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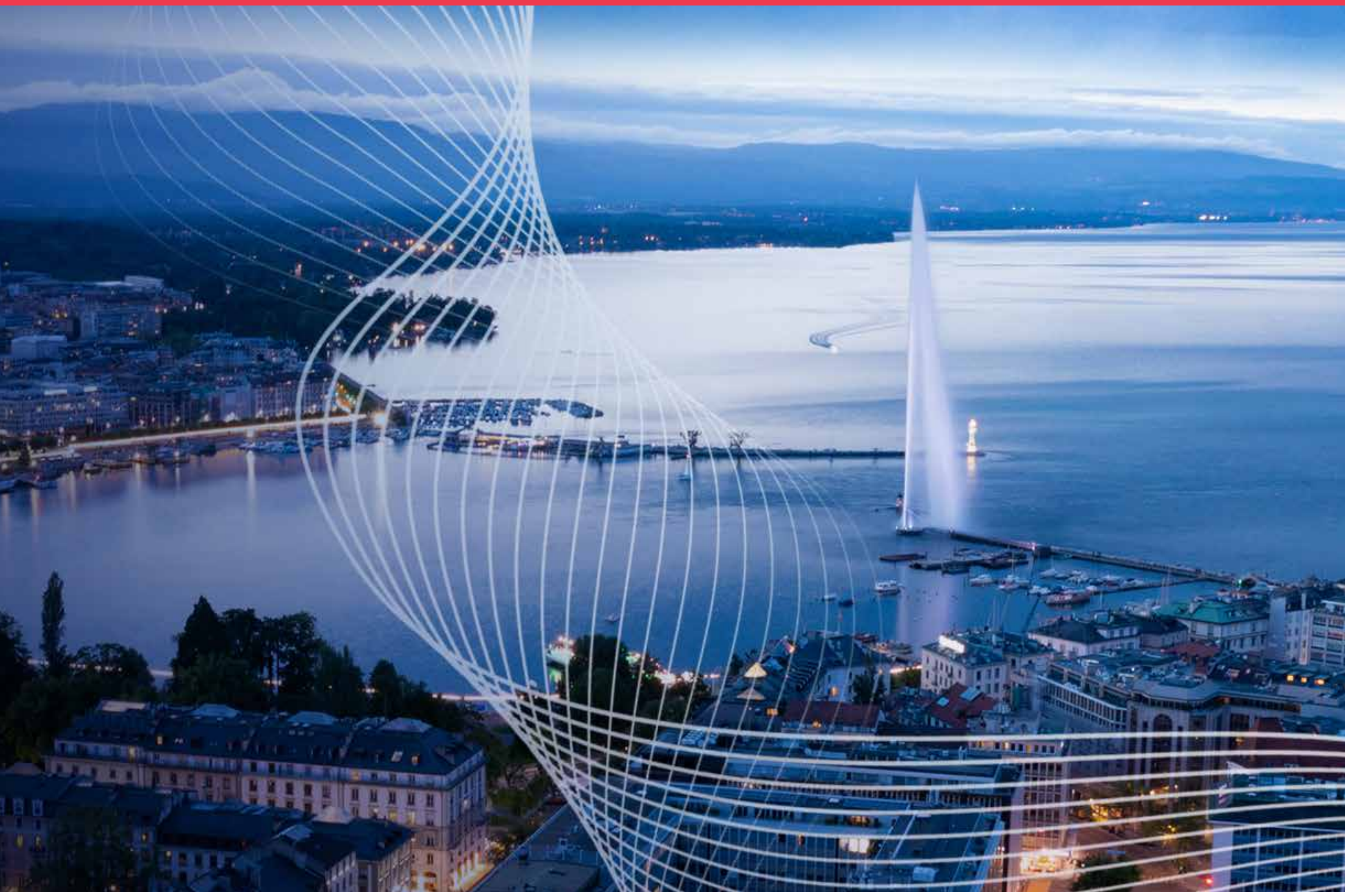
International Telecommunication Union
Radiocommunication Bureau

Report of the CPM
on technical, operational and regulatory/procedural matters to be considered by the
World Radiocommunication Conference 2023



ITUWRC
DUBAI2023
20 November – 15 December 2023
Dubai, United Arab Emirates

International Telecommunication Union

2nd Session of the Conference Preparatory Meeting for WRC-23

Report of the CPM on technical, operational and regulatory/ procedural matters to be considered by the World Radiocommunication Conference 2023

Radiocommunication Sector

Preface

This Report of the CPM to the World Radiocommunication Conference 2023 (WRC-23) was prepared in response to Resolution 1399 (C20) of the ITU Council to assist those who will be involved in the preparations for and deliberations at WRC-23. The Report was prepared and approved by the Conference Preparatory Meeting (CPM) at its Second Session held in Geneva from 27 March to 6 April 2023. The Report is structured to follow the topics of the WRC-23 Agenda and its content follows the outline approved by the First Session of the CPM, which was held during the week following WRC-19. A cross-reference list is provided to facilitate finding specific topics within the framework of the WRC-23 Agenda. This Report comprises five Chapters and two Annexes.

The Report represents the most up-to-date information on technical, operational and regulatory/procedural issues relevant to the WRC-23 Agenda available at the time of its preparation and should provide a good basis for the discussions at the Conference.

Mario Maniewicz
Director, Radiocommunication Bureau

Cross-reference between the WRC-23 agenda items and the Chapters and Annex 1 of the CPM Report

WRC-23 agenda item		Part of the CPM Report to WRC-23
1	on the basis of proposals from administrations, taking account of the results of WRC-19 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:	-
1.1	to consider, based on the results of ITU-R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the power flux-density criteria in No. **5.441B** in accordance with Resolution **223 (Rev.WRC-19)**;	Chapter 1
1.2	to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution **245 (WRC-19)**;	Chapter 1
1.3	to consider primary allocation of the frequency band 3 600-3 800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with Resolution **246 (WRC-19)**;	Chapter 1
1.4	to consider, in accordance with Resolution **247 (WRC-19)**, the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;	Chapter 1
1.5	to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review, in accordance with Resolution **235 (WRC-15)**;	Chapter 1
1.6	to consider, in accordance with Resolution **772 (WRC-19)**, regulatory provisions to facilitate radiocommunications for sub-orbital vehicles;	Chapter 2
1.7	to consider a new aeronautical mobile-satellite (R) service allocation in accordance with Resolution **428 (WRC-19)** for both the Earth-to-space and space-to-Earth directions of aeronautical VHF communications in all or part of the frequency band 117.975-137 MHz, while preventing any undue constraints on existing VHF systems operating in the aeronautical mobile (R) service, in the aeronautical radionavigation service, and in adjacent frequency bands;	Chapter 2
1.8	to consider, on the basis of ITU-R studies in accordance with Resolution **171 (WRC-19)**, appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution **155 (Rev.WRC-19)** and No. **5.484B** to accommodate the use of fixed-satellite service networks by control and non-payload communications of unmanned aircraft systems;	Chapter 2
1.9	to review Appendix **27** of the Radio Regulations and consider appropriate regulatory actions and updates based on ITU-R studies, in order to accommodate digital technologies for commercial aviation safety-of-life applications in existing HF bands allocated to the aeronautical mobile (R) service and ensure coexistence of current HF systems alongside modernized HF systems, in accordance with Resolution **429 (WRC-19)**;	Chapter 2
1.10	to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with Resolution **430 (WRC-19)**;	Chapter 2

	WRC-23 agenda item	Part of the CPM Report to WRC-23
1.11	to consider possible regulatory actions to support the modernization of the Global Maritime Distress and Safety System (GMDSS) and the implementation of e-navigation, in accordance with Resolution **361 (Rev.WRC-19)**;	Chapter 2
1.12	to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution **656 (Rev.WRC-19)**;	Chapter 3
1.13	to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with Resolution **661 (WRC-19)**;	Chapter 3
1.14	to review and consider possible adjustments of the existing frequency allocations or possible new primary frequency allocations to the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution **662 (WRC-19)**;	Chapter 3
1.15	to harmonize the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally, in accordance with Resolution **172 (WRC-19)**;	Chapter 4
1.16	to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-geostationary fixed-satellite service earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with Resolution **173 (WRC-19)**;	Chapter 4
1.17	to determine and carry out, on the basis of ITU-R studies in accordance with Resolution **773 (WRC-19)**, the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate;	Chapter 4
1.18	to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution **248 (WRC-19)**;	Chapter 4
1.19	to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with Resolution **174 (WRC-19)**;	Chapter 4
2	to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with *further resolves* of Resolution **27 (Rev.WRC-19)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in *resolves* of that Resolution;	Chapter 5
3	to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;	Not in scope of CPM
4	in accordance with Resolution **95 (Rev.WRC-19)**, to review the Resolutions and Recommendations of previous conferences with a view to their possible revision, replacement or abrogation;	Chapter 5
5	to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the ITU Convention;	Not in scope of CPM
6	to identify those items requiring urgent action by the radiocommunication study groups in preparation for the next world radiocommunication conference;	Not in scope of CPM

WRC-23 agenda item		Part of the CPM Report to WRC-23
7	to consider possible changes, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution **86 (Rev.WRC-07)**, in order to facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;	Chapter 4
8	to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev.WRC-19)**;	Not in scope of CPM
9	to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the ITU Convention;	-
9.1	on the activities of the ITU Radiocommunication Sector since WRC-19:	-
9.1-a) *	– In accordance with Resolution **657 (Rev.WRC-19)**, review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services;	Chapter 5
9.1-b) *	– Review the amateur service and the amateur-satellite service allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the radionavigation-satellite service (space-to-Earth) operating in the same band in accordance with Resolution **774 (WRC-19)**;	Chapter 5
9.1-c) *	– Study the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis, in accordance with Resolution **175 (WRC-19)**;	Chapter 5
9.1-d) **	– Protection of EESS (passive) in the frequency band 36-37 GHz from non-GSO FSS space stations;**	Chapter 5
9.2	on any difficulties or inconsistencies encountered in the application of the Radio Regulations;[1] and	-
9.3	on action in response to Resolution **80 (Rev.WRC-07)**;	-
10	to recommend to the ITU Council items for inclusion in the agenda for the next world radiocommunication conference, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the ITU Convention and Resolution **804 (Rev.WRC-19)**,	Annex 1

* Provisional topic number given at CPM23-1 (see CA/251).

** Additional topic identified at CPM23-1 (see CA/251).

[1] This agenda sub-item is strictly limited to the Report of the Director on any difficulties or inconsistencies encountered in the application of the Radio Regulations and the comments from administrations. Administrations are invited to inform the Director of the Radiocommunication Bureau of any difficulties or inconsistencies encountered in the Radio Regulations.

CPM Report to WRC-23

CONTENTS

I Introduction to the CPM Report to WRC-23

This CPM Report to WRC-23 is provided to assist the ITU Member States and the Radiocommunication Sector Members who will be involved in preparation for the World Radiocommunication Conference 2023. It represents the most updated information on the technical, operational and regulatory/procedural issues relevant to the WRC-23 agenda items and topics available at the time of its preparation.

I.1 Origin and purpose of CPM-23

The World Radiocommunication Conference (WRC-23) will be held in Dubai (United Arab Emirates) from 20 November to 15 December 2023, immediately following the Radiocommunication Assembly (RA-23) (see Council Resolution 1399).

The conditions for invitation and admission to the World Radiocommunication Conference are specified in Article 24 of the Convention and in accordance with the relevant Plenipotentiary Conference resolutions.

The agenda for WRC-23 is contained in Council Resolution 1399 (see Annex I-1), on the basis of Resolution **811 (WRC-19)**.

The 2019 Radiocommunication Assembly, by its Resolution ITU-R 2-8, reconfirmed that preparatory studies for the WRC are to be carried out by a Conference Preparatory Meeting (CPM) and appointed Ms Cindy-Lee Cook (Canada) as the Chairperson of CPM-23 as well as Dr Michel Audrey Abaga Abessolo (Gabon), Dr Mohamed A. El-Moghazi (Egypt), Mr Alexander Kühn (Germany), Dr Jaewoo Lim (Korea (Rep. of)), Mr Sergey Pastukh (Russian Federation) and Ms Keer Zhu (China) as the Vice-Chairpersons.

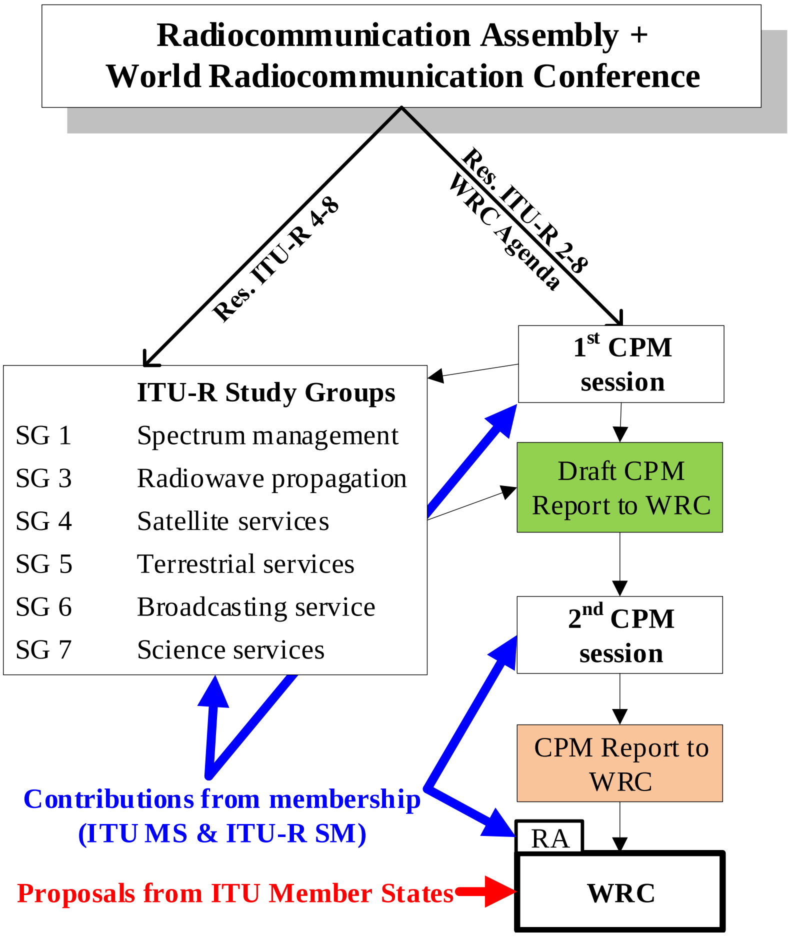
All administrations of the ITU Member States as well as the Radiocommunication Sector Members were invited to participate in the preparation of the CPM Report to WRC-23.

I.2 Organization of the ITU-R preparation for the conference

The organization of the conference preparatory work is shown in Figure I-1.

FIGURE I-1

Organization of the ITU-R conference preparatory work



On the basis of contributions from the membership of the ITU and inputs from the Radiocommunication Study Groups, concerning the technical, operational, regulatory and procedural matters to be considered by world radiocommunication conferences, the CPM prepares a consolidated report for such conferences (see Resolution ITU-R 2-8).

The first session of the 2023 Conference Preparatory Meeting (CPM23-1) was held in Sharm el-Sheikh (Egypt) on 25-26 November 2019 and organized the preparatory studies for WRC-23. It also identified studies in preparation for the following WRC. A structure for the CPM Report to WRC-23 was agreed together with a preparatory process, working procedures and a chapter structure. The meeting appointed a Rapporteur or Co-Rapporteurs for each chapter to assist the Chairman in managing the development and flow of draft report contributions. The results of CPM23-1 were published in Administrative Circular CA/251 of the Radiocommunication Bureau dated 19 December 2019.

The ITU-R preparations for WRC-23 were concentrated in the following responsible groups (listed in the order of the Study Groups):

Study Group 4 chaired by Mr V. Strelets (Russian Federation), **WP 4A** chaired by Mr J. Wengryniuk (United States of America) and **WP 4C** chaired by Mr N. Kawai (Japan);

Study Group 5 chaired by Mr M. Fenton (United Kingdom), **WP 5A** chaired by Mr J. Costa (Canada), **WP 5B** chaired by Mr J. Mettrop (United Kingdom), **WP 5C** chaired by Mr P. Nava (China) and **WP 5D** chaired by Mr S. Blust (United States of America);

Study Group 6 chaired by Dr Y. Nishida (Japan) and **TG 6/1** chaired by Mr S. Pastukh (Russian Federation);

Study Group 7 chaired by Mr J.E. Zuzek (United States of America), **WP 7B** chaired by Ms C. Sham (United States of America) and **WP 7C** chaired by Mr M. Dreis (Germany).

I.3 Preparation of the CPM Report to WRC-23

Texts for the draft CPM Report have been prepared by the responsible groups identified by CPM23-1 and provided by the Chairpersons of these groups to the CPM-23 Chapter Rapporteurs.

The work was coordinated by the Chairperson of CPM-23, in consultation with the CPM-23 Management Team, as defined in Sections A1.5 and A1.6 of Annex 1 to Resolution ITU-R 2-8.

In accordance with Section A1.6 of Annex 1 to Resolution ITU-R 2-8, the CPM-23 Management Team meeting was held in Geneva on 9 and 10 November 2022. It consolidated the draft CPM Report which was distributed to all Member States and Radiocommunication Sector Members as Document CPM23-2/1.

The Radiocommunication Bureau provided the required assistance in the above-mentioned meetings.

The second session of CPM-23 (CPM23-2) met in Geneva from 27 March to 6 April 2023 under the chairmanship of Ms Cindy-Lee Cook (Canada) to consider the draft CPM Report, contributions from the ITU membership and additional material submitted by the Radiocommunication Bureau.

About 1 950 participants, including 1 297 attending in person, representing 127 Member States and 117 Radiocommunication Sector Members and 3 UN agencies, including international organizations attended the CPM.

CPM23-2 considered 236 input contributions including the draft CPM Report and the documents from the Director of the Radiocommunication Bureau.

At CPM23-2, the contributions were assigned for preparation of the final CPM Report to WRC-23 according to the following adopted structure:

Chairperson, CPM-23	Ms C.H. Cook (CAN)
Vice-Chairperson, CPM-23	Dr M.A. Abaga Abessolo (GAB)
Vice-Chairperson, CPM-23	Dr M.A. El-Moghazi (EGY)
Vice-Chairperson, CPM-23	Mr A. Kühn (D)
Vice-Chairperson, CPM-23	Dr J. Lim (KOR)
Vice-Chairperson, CPM-23	Mr S. Pastukh (RUS)
Vice-Chairperson, CPM-23	Ms K. Zhu (CHN)
Rapporteur of the Plenary	Mr B. Montgomery (AUS)
Secretary of the Plenary	Mr Ph. Aubineau (ITU BR, Counsellor for the CPM)

CPM23-2 Groups	Topic (WRC-23 agenda items)	(Co-) Chairperson(s)	ITU BR (Co-) Secretary(ies)
Working Group 1	Chapter 1: fixed, mobile and broadcasting issues (1.1, 1.2, 1.3, 1.4, 1.5)	Dr H. Atarashi (J) Mr U.A. Mahmud (NIG)	Mr U. Loewenstein Mr D. Botha
Working Group 2	Chapter 2: aeronautical and maritime issues (1.6, 1.7, 1.8, 1.9, 1.10, 1.11)	Mr M. Alhassani (UAE)	Mr K. Bogens with Mr N. Sinanis and Mr X. Zhou
Working Group 3	Chapter 3: science issues (1.12, 1.13, 1.14)	Mr T.A. Bakaus (B)	Mr V. Nozdrin
Working Group 4	Chapter 4: satellite issues (1.15, 1.16, 1.17, 1.18, 1.19, 7 Topics A to K)	Ms L. Ferreira (B) Mr G. Kwizera (RRW)	Mr N. Malaguti with Ms C. Karina and Mr D. Tham
Working Group 5	Chapter 5: general issues (2, 4, 9.1 Topics a), b), c) and d))	Mr J. Huang (CHN)	Mr R. Chang with Ms A. Soto Romero
Drafting Group of the Plenary	Annex 1 (10)	Mr A. Kühn (D)	Mr J.A. Ciccorossi

In the Resolutions supporting various WRC-23 agenda items, it has been clearly and specifically resolved that the existing services to which the frequency band(s) under consideration are allocated need to be protected, sometimes in the in-band and other times in both the in-band and adjacent bands. Consequently, the protection of existing services should be taken into account when considering methods and conditions thereto by WRC-23.

The informative nature of the tables in section 3 of the CPM Report for various WRC-23 agenda items is based on the fact that the assumptions, input parameters, interference scenarios and protection criteria including the use of ITU-R Recommendations and Reports in force, are decided by the submitting member of those studies and may not be identical and consequently there may not be common conclusions from results of those studies.

Membership is invited to assess the results of studies and draw their own conclusions.

The meeting was successful in approving the CPM Report to WRC-23.

I.4 Presentation and structure of the Report

The Report is structured to follow the items and topics of the WRC-23 agenda, taking into account the outline developed and approved by the first session of CPM-23.

The Report comprises five chapters and two annexes, defined in accordance with the adopted structure described in section I.3 above.

A cross-reference list between the Chapters of this Report and the WRC-23 agenda items and topics is provided at the beginning of this Report to facilitate the identification of specific topics within the framework of the WRC-23 agenda. A list of abbreviations is also provided at the beginning of this Report. Squared brackets (i.e. '[' and ']') have been used in the Report around values (e.g. frequencies, limits, etc.) and around names (e.g. future number of draft new WRC Resolutions or draft new ITU-R Recommendations or Reports, future list of country names, etc.), to indicate the provisional nature of this information.

The Report also contains in Annex 2 a list of the ITU-R Recommendations including certain draft new and revised Recommendations which are referred to in the text of the Report. The final version of this list reflecting the decisions of the 2023 Radiocommunication Assembly will be made available to the World Radiocommunication Conference 2023.

ANNEX I-1

RESOLUTION 1399 (C20)

Agenda of the World Radiocommunication Conference (WRC-23)

The ITU Council,

noting

that Resolution **811** of the World Radiocommunication Conference (Sharm el-Sheikh, 2019):

a) resolved to recommend to the Council that a world radiocommunication conference be held in 2023 for a maximum period of four weeks;

b) recommended its agenda, and invited the Council to finalize the agenda and arrange for the convening of WRC-23 and to initiate as soon as possible the necessary consultation with Member States,

resolves

to convene a World Radiocommunication Conference (WRC-23) in 2023, preceded by the Radiocommunication Assembly, with the following agenda:

1 on the basis of proposals from administrations, taking account of the results of WRC-19 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:

1.1 to consider, based on the results of ITU-R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the power flux-density criteria in No. **5.441B** in accordance with Resolution **223 (Rev.WRC-19)**;

1.2 to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution **245 (WRC-19)**;

1.3 to consider primary allocation of the frequency band 3 600-3 800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with Resolution **246 (WRC-19)**;

1.4 to consider, in accordance with Resolution **247 (WRC-19)**, the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;

1.5 to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review, in accordance with Resolution **235 (WRC-15)**;

1.6 to consider, in accordance with Resolution **772 (WRC-19)**, regulatory provisions to facilitate radiocommunications for sub-orbital vehicles;

1.7 to consider a new aeronautical mobile-satellite (R) service allocation in accordance with Resolution **428 (WRC-19)** for both the Earth-to-space and space-to-Earth directions of aeronautical VHF communications in all or part of the frequency band 117.975-137 MHz, while preventing any undue constraints on existing VHF systems operating in the aeronautical mobile (R) service, in the aeronautical radionavigation service, and in adjacent frequency bands;

1.8 to consider, on the basis of ITU-R studies in accordance with Resolution **171 (WRC-19)**, appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution **155 (Rev.WRC-19)** and No. **5.484B** to accommodate the use of fixed-satellite service networks by control and non-payload communications of unmanned aircraft systems;

1.9 to review Appendix **27** of the Radio Regulations and consider appropriate regulatory actions and updates based on ITU-R studies, in order to accommodate digital technologies for commercial aviation safety-of-life applications in existing HF bands allocated to the aeronautical mobile (R) service and ensure coexistence of current HF systems alongside modernized HF systems, in accordance with Resolution **429 (WRC-19)**;

1.10 to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with Resolution **430 (WRC-19)**;

1.11 to consider possible regulatory actions to support the modernization of the Global Maritime Distress and Safety System (GMDSS) and the implementation of e-navigation, in accordance with Resolution **361 (Rev.WRC-19)**;

1.12 to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution **656 (Rev.WRC-19)**;

1.13 to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with Resolution **661 (WRC-19)**;

1.14 to review and consider possible adjustments of the existing frequency allocations or possible new primary frequency allocations to the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution **662 (WRC-19)**;

1.15 to harmonize the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally, in accordance with Resolution **172 (WRC-19)**;

1.16 to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-geostationary fixed-satellite service earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with Resolution **173 (WRC-19)**;

1.17 to determine and carry out, on the basis of ITU-R studies in accordance with Resolution **773 (WRC-19)**, the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate;

1.18 to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution **248 (WRC-19)**;

1.19 to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with Resolution **174 (WRC-19)**;

2 to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with *further resolves* of Resolution **27 (Rev.WRC-19)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in *resolves* of that Resolution;

3 to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;

4 in accordance with Resolution **95 (Rev.WRC-19)**, to review the Resolutions and Recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

5 to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the ITU Convention;

6 to identify those items requiring urgent action by the radiocommunication study groups in preparation for the next world radiocommunication conference;

7 to consider possible changes, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution **86 (Rev.WRC-07)**, in order to facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;

8 to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev.WRC-19)**;

9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the ITU Convention;

9.1 on the activities of the ITU Radiocommunication Sector since WRC-19:

– In accordance with Resolution **657 (Rev.WRC-19)**, review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services;

– Review the amateur service and the amateur-satellite service allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the radionavigation-satellite service (space-to-Earth) operating in the same band in accordance with Resolution **774 (WRC-19)**;

– Study the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis, in accordance with Resolution **175 (WRC-19)**;

9.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations;[1] and

9.3 on action in response to Resolution **80 (Rev.WRC-07)**;

10 to recommend to the ITU Council items for inclusion in the agenda for the next world radiocommunication conference, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the ITU Convention and Resolution **804 (Rev.WRC-19)**.

[1] This agenda sub-item is strictly limited to the Report of the Director on any difficulties or inconsistencies encountered in the application of the Radio Regulations and the comments from administrations. Administrations are invited to inform the Director of the Radiocommunication Bureau of any difficulties or inconsistencies encountered in the Radio Regulations.

CHAPTER 1

Fixed, mobile and broadcasting issues

(Agenda items 1.1, 1.2, 1.3, 1.4, 1.5)

CONTENTS

Agenda item 1.1

1.1 to consider, based on the results of ITU-R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the power flux-density criteria in No. ***5.441B*** *in accordance with Resolution* ***223 (Rev.WRC-19)****;*

Resolution **223 (Rev.WRC-19)** – *Additional frequency bands identified for International Mobile Telecommunications*

1/1.1/1 Executive summary

Resolution **223 (Rev.WRC-19)** invites ITU-R to study the technical and regulatory conditions for the protection of stations of the aeronautical mobile service (AMS) and the maritime mobile service (MMS) located in international airspace or waters (i.e. outside national territories) and operated in the frequency band 4 800-4 990 MHz. Accordingly, ITU-R conducted the studies and presents the results herein.

Section 1/1.1/2 provides background information on the subject matter for WRC-23 agenda item (AI) 1.1 including key decisions taken by WRC-15 and WRC-19.

Section 1/1.1/3 provides an analysis and summary of the results of regulatory and technical studies conducted by the ITU-R pursuant to WRC-23 AI 1.1.

Six (6) methods, which are described in section 1/1.1/4, were developed to satisfy AI 1.1 of WRC-23.

Finally, the regulatory and procedural considerations are available in section 1/1.1/5.

1/1.1/2 Background

Situation at WRC-15

WRC-15 established No. **5.441B** of the Radio Regulations (RR) which provided International Mobile Telecommunications (IMT) identification for three Region 3 countries in the 4 800-4 990 MHz frequency band, already allocated to the mobile service (MS) on a primary basis, and introduced, *inter alia*, additional criterion consisting of a limit on the pfd produced by IMT station up to 19 km above sea level at 20 km from the coast in order to protect AMS. This criterion was subject to review at WRC-19.

Due to diverging views with regards to the relevance of pfd criterion to protect AMS, its value, conditions and frequency band for its application, noting that preparatory work was not finalized, WRC-15 invited ITU-R to study the technical and regulatory conditions for the use of IMT in this band in order to protect AMS and review pfd criterion in RR No. **5.441B** at WRC-19.

Situation at WRC-19

As invited by WRC-15, in accordance with Resolution **223 (Rev.WRC-15)**, ITU-R carried out but did not finalize studies mentioned above. The report on the above-mentioned ITU-R studies were submitted to WRC-19 for its consideration and necessary action, as appropriate.

WRC-19 updated RR No. **5.441B** and Resolution **223 (Rev.WRC-19)** and as a result additional countries were included in the IMT identification in RR No. **5.441B** (now the footnote includes 40 countries) and for 11 of these countries the pfd criterion in footnote RR No. **5.441B** was deactivated. However, due to diverging views on whether or not to apply a pfd criterion, WRC-23 was invited, in accordance with Resolution **223 (Rev.WRC-19)**, to consider possible measures to address protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the pfd criterion in RR No. **5.441B**.

WRC-19 therefore adopted WRC-23 AI 1.1 referred to above.

1/1.1/3 Summary and analysis of the results of ITU-R studies

1/1.1/3.1 Applicable ITU-R Recommendations and Reports

Recommendation ITU-R M.2116	Technical characteristics and protection criteria for the aeronautical mobile service systems operating within the 4 400-4 990 MHz frequency range

1/1.1/3.2 System characteristics

1/1.1/3.2.1 IMT systems

IMT systems characteristics are described in section 5.3 of the supporting material document in Annex 4.8 of Document 5D/1555.

1/1.1/3.2.2 Maritime systems

Maritime systems characteristics are described in section 5.2 of the supporting material document in Annex 4.8 of Document 5D/1555.

1/1.1/3.2.3 Aeronautical systems

Aeronautical systems characteristics are described in section 5.1 of the supporting material document in Annex 4.8 of Document 5D/1555.

The following views were expressed with regard to technical characteristics of AMS and MMS used in the studies.

View 1:

It should be noted that during the study cycle, the operational characteristics of these systems were not fully available (frequency plan, required spectrum volume for missions in international airspace and waters, duration of missions, as well as the purposes of using these systems in international airspace and waters), which did not allow determining the actual requirements for protecting these systems when they are located in international airspace and waters. Moreover, the characteristics of the systems are not registered in the MIFR in the form of frequency assignments for the AMS/MMS stations located in international airspace waters.

In addition, the technical criteria for the protection of these systems were not fully agreed by WP 5B (e.g. the percentage of time during which protection should be provided was not agreed upon) while these systems are not standardized by ICAO and IMO and the 4 800-4 990 MHz frequency band is not used for civil missions.

In addition, the presented characteristics indicate a wide tuning range of 4 400-4 950/4 990 MHz of the AMS/MMS systems, which makes it possible to exclude the use of the 4 800-4 990 MHz range in specific areas of the use of AMS/MMS systems without negative impact on their operation.

View 2:

The characteristics of aeronautical systems have been provided from the beginning of the WRC-23 cycle by WP 5B to WP 5D, including details of the operation/mission carried out by these systems *and networks which use broadband datalinks including aircraft-to-aircraft to support various applications, such as remote sensing for earth sciences, and energy distribution system monitoring. Many systems and parameters used in studies are in the original version of Rec. ITU-R M.2116. The revision of Rec. ITU-R M.2116 was not yet finalized due to the desire from some administrations to include consideration about UNCLOS in this recommendation, outside the mandate of ITU.*

Base stations of AMS and MMS operating in airspace and waters outside national territories are not stationary and therefore cannot be notified in the MIFR. Usage of these systems is described in the document "Supporting Material for WRC-23 AI 1.1" and the tuning range is a characteristic of the operating systems in the frequency band.

1/1.1/3.3 Summary of the results of studies

In preparation for WRC-15, ITU-R carried out sharing and compatibility studies between aeronautical mobile/ground mobile applications and potential IMT systems in the frequency band 4 400-4 990 MHz that resulted in PDN Report ITU-R M.[AERO-IMT.SHARING.C-BAND] (see Annex 33 of the Chairman's Report of the final meeting of JTG-4-5-6-7 – Document 4-5-6-7/715) and in section 1/1.1/4.1.9.1 of the CPM Report to the 2015 World Radiocommunication Conference.

These technical studies considered co-channel and adjacent channel sharing scenarios.

WRC-15 adopted RR No. **5.441B** and identified the frequency band 4 800-4 990 MHz, or portions thereof, for use by administrations wishing to implement IMT and established, among other things, the pfd limit for use of IMT in that frequency band as an additional measure to provide protection to AMS outside the territorial water of coastal States. This pfd criterion was subject to review at WRC-19, see Resolution **223 (Rev.WRC-15)**. It also decided that this identification shall be effective after WRC-19.

The pfd criterion as in RR No. **5.441B** was not resulting from ITU-R studies in preparation of WRC-15 but from discussions at WRC-15 since for co-channel scenario the above-mentioned technical studies concluded that sharing between aeronautical mobile applications and IMT systems in 4 400-4 990 MHz is not practical.

The pfd value of -155 dB(W/(m^2 · 1 MHz)) was derived based on simplified assumptions during WRC-15. This pfd value was based on IMT indoor small cells deployment and one specific AMS system.

WRC-19 attempted to review that criterion without any definitive outcome. It therefore adopted the WRC-23 agenda item 1.1 by which it invited the ITU Radiocommunication Sector to study the technical and regulatory conditions for the protection of stations of the AMS and the MMS located in "international airspace or waters" (i.e. outside national territories) and operated in the frequency band 4 800-4 990 MHz; and invited the 2023 World Radiocommunication Conference to consider, based on the results of the studies referred to in *invites the ITU Radiocommunication Sector*, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the AMS and MMS located in international airspace and waters from other stations located within national territories and to review the pfd criteria in RR No. **5.441B**.

To that effect, ITU-R carried out necessary regulatory studies and technical studies in preparation for WRC-23, as detailed in section 1/1.1/3.3.1.

1/1.1/3.3.1 Summary of the results of studies in preparation for WRC-23

The term operation of vessels and aircraft in *international waters* and *international airspace*, respectively, referred to in WRC-23 agenda item 1.1, is understood to mean that such operation would take place in an area which is outside the territory under the jurisdiction of any administration.

There is a common understanding that no country has jurisdiction over the use of spectrum in international airspace/waters.

Regulatory studies were based on the analysis of various regulatory aspects such as:

– the analysis of the regulatory conditions for the protection of stations of the AMS, including analysis of mobile service allocations and their use for AMS applications in the frequency band 4 800-4 990 MHz and the use of this band for aeronautical mobile telemetry (AMT);

– analysis of existing practice to protect stations in AMS in the *international airspace*;

– the analysis of the regulatory conditions for the protection of stations of the MMS.

Technical studies focused on the protection of the AMS/MSS in *international airspace and waters*.

The supporting material document in Annex 4.8 of Document 5D/1555 contains the details of these regulatory and technical studies.

Some administrations referred to the "exclusive economic zone" of the United Nations Convention on the Law of the Sea (the UNCLOS) in the development of the draft CPM text, e.g. regarding the distance from the coast in the context of the discussion on AI 1.1 of WRC-23. Diverging views on relevance of the UNCLOS to the subject of AI 1.1 of WRC-23 were expressed (see section 1/1.1/4).

The following views were expressed with regard to the conducted studies:

View 1:

*In accordance with Article **8** of the Radio Regulations, as well as Resolution COM5-1 of the Plenipotentiary Conference 2022, AMS and MMS stations located in international airspace and international waters whose frequency assignments are not registered in the MIFR do not obtain international recognition and the right for protection. The application of measures, such as a hard pfd limit at the border of the territorial sea of Member States, in order to protect AMS and MMS stations non-registered in the MIFR, would restrict the rights of Member States to use IMT stations on their national territories, lead to unfair, unequal and inefficient use of the radio frequency spectrum, which would in turn contradict the provisions of the Constitution, the Convention, Resolutions of the Plenipotentiary Conference and the Radio Regulations.*

View 2:

*While it is not possible to protect individual assignments outside territorial waters, there are examples of RR footnotes, in addition to RR No. **5.441B**, providing protection for services in international airspace and waters, such as RR No. **5.502** and RR No. **5.509D**. WRC-15, taking into account that the conclusion of the CPM-15 Report concluded that the sharing with AMS was not feasible, accepted the request from 3 countries to have an IMT identification with the conditions of a stringent pfd limit to protect AMS. This attempt to remove measures such as pfd limit are in contradiction with the principle that when one application is introduced in the RR, it has to protect the incumbent.*

*An analysis of regulatory provisions such as RR No. **8.1** is provided in section 1/1.1/3.4.1. A pfd limit is an appropriate method to mitigate interference between systems that cannot be coordinated because they are not stationary, or to protect systems operating in an area. It is a gross mischaracterization to describe application of pfd limits, which were agreed to at the previous conferences, as restricting the rights of Member States. Limits are not applied to limit the rights of Member States but to facilitate sharing among systems or services using the same frequency bands.*

1/1.1/3.4 Analysis of the results of studies

1/1.1/3.4.1 Analysis of regulatory aspects

The studies revealed the variety of the regulatory situations which could be considered relevant to the discussion under this agenda item and which are addressed by the various regulatory provisions of the RR and other relevant regulations. Based on the above-mentioned studies, the following aspects should be taken into account when making a decision on WRC-23 AI 1.1.

a) Based on the AMS allocations in the RR the question of potential protection of aeronautical stations in international airspace may only be discussed for the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and not for the whole frequency band 4 800-4 990 MHz (except in Region 2 (other than Brazil, Cuba, Guatemala, Mexico, Paraguay, Uruguay and Venezuela), and in Australia, where the frequency band 4 825-4 835 MHz is also allocated to the AMS, limited to aeronautical mobile telemetry for flight testing by aircraft stations).

b) According to the provision in RR No. **8.1**, "The international rights and obligations of administrations in respect of their own and other administrations' frequency assignments shall be derived from the recording of those assignments in the Master International Frequency Register (the Master Register) or from their conformity, where appropriate, with a plan. Such rights shall be conditioned by the provisions of these Regulations and those of any relevant frequency allotment or assignment plan."

However, there is no specific notification and registration procedure in international airspace and waters for frequency assignments of AMS and MMS stations in this frequency band pursuant to RR No. **11.14**. Such a situation does not provide the possibility to obtain international rights recognition in respect to frequency assignments of AMS and MMS stations in international airspace and waters and to claim protection against subsequent assignments from another country, taking into account RR No. **8.1**, taking also into account that there is no frequency allotment or assignment Plan in the frequency band 4 800-4 990 MHz for the AMS nor for the MMS service.

Therefore, protection of AMS/MMS stations in international airspace/waters on the basis of registration of frequency assignments is not feasible. At the same time, it should be noted that AMS/MMS frequency assignments for coast and aeronautical stations can cover a service area which overlaps with international airspace/waters. For this case (such as in Figure 1 of Report ITU-R M.2119), application of RR No. **9.21** would enable the protection of AMS/MMS stations in the international airspace covered by the service area.

The inability to address protection of AMS/MMS stations in international airspace/waters via the registration procedure in accordance with RR No. **11.14** does not exclude the possibility of applying other mechanisms, through current and future provisions in the RR.

c) It is observed that:

– there are examples of RR footnotes providing protection for services in international airspaces and waters, such as RR Nos. **5.502** and **5.509D**;

– there are cases where no specific measures are provided to protect mobile service systems operated in international airspace or waters (e.g. all the frequency bands identified for IMT except for the frequency band 4 800-4 990 MHz which is currently being studied under WRC-23 AI 1.1);

– there are cases wherein mobile service systems operated in international airspace or waters protect authorized stations operating within national territories (e.g. ESV, IMT onboard vessels and aircraft).

In several frequency bands with IMT identification and aeronautical mobile service allocation in the RR, some administrations operate AMS systems in accordance with the relevant Recommendations (ITU-R M.2114, ITU-R M.2115, etc.) and it is not clear whether the situations with the use of such frequency bands may differ from one another.

This variety of situations is likely to reflect the differences of circumstances under which WRC have decided a new allocation or identification, based on the principle that incumbent services and applications have to be protected. In keeping with this principle, WRC-15 adopted RR No. **5.441B** and identified the frequency band 4 800-4 990 MHz, or portions thereof, for use by administrations wishing to implement IMT. RR No. **5.441B** establishes, among other conditions, a pfd limit applied to IMT in that frequency band as an additional measure to provide protection of AMS stations operating outside territorial waters of coastal States. Due to diverging views with respect to the relevance of the pfd criterion for the protection of the AMS, its value, conditions of use and the frequency band within which the pfd limit would apply, WRC-15 invited ITU-R to conduct studies for technical and regulatory conditions for the use of this frequency band for IMT, in order to protect the AMS and review the pfd criterion in RR No. **5.441B** at WRC-19.

d) RR No. **5.441B** provides a pfd limit, which is subject to review by WRC-23, applicable in the frequency band 4 800-4 990 MHz based on assumptions relevant to the AMS. In practice, the existing provisions of RR No. **5.441B** protect MMS operations in international waters. However, it should be confirmed, based on the studies under WRC-23 agenda item 1.1, whether specific measures are required for the protection of the MMS in international waters, if any, also taking into account allocations in the various portions of the frequency band.

The use of the frequency band 4 800-4 990 MHz for the MMS was not considered until WRC-19. No studies with regard to compatibility between IMT and MMS had been conducted and MMS characteristics were not available. Some administrations informed they had MMS systems in operation but focused on studies for the protection of AMS, more sensitive to interference than MMS due to larger line-of-sight distances.

1/1.1/3.4.2 Analysis of the results of technical studies

Two studies have estimated the single-entry pfd required to protect AMS and MMS systems for omnidirectional antennas and directional antennas.

Study 1 considered the maximum antenna gain, i.e. the antenna of the AMS and MMS points towards IMT.

Study 2 considered the scenario where an airborne station at 22 km communicates with ships at a farther distance and is not applicable when the receiver is at a larger distance, communicating with airborne or shipborne transmitters with no or limited antenna discrimination in the direction of IMT.

Results[1] are included in Tables 1/1.1/3-1 and 1/1.1/3-2.

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[1] The pfd limits in Tables 1/1.1/3-1 and 1/1.1/3-2 are derived using feeder loss of zero dB for Study 1 and 2 dB for Study 2.

TABLE 1/1.1/3-1

Calculated pfd required to protect AMS systems

Parameter (unit)	Maximum AMS receiver antenna gain (dBi)		Study 1: on power flux-density for maximum receiving and antenna gain direction (dB(W/(m^2 · MHz)))		Study 2 on power flux-density (dB(W/(m^2 · MHz)))	
System 1 Airborne	3		−114.07		−112.07	
System 2 Airborne	3		−114.07		−112.07	
System 3 Airborne	3.5 (omni)	16 (directional)	−115.57 (omni)	−128.07 (directional)	−113.57 (omni)	−107.88 (directional)
System 3 Shipborne	3 (omni)	30 (directional)	−111.57 (omni)	−138.57 (directional)	−109.57 (omni)	−112.44 (directional)
System 4 Airborne	4.5 (omni)	16 (directional)	−116.57 (omni)	−128.07 (directional)	−114.57 (omni)	−107.88 (directional)
System 5 Airborne	3 (omni)	19 (directional)	−114.07 (omni)	−130.07 (directional)	−112.07 (omni)	−109.24 (directional)
System 5 Shipborne	3 (omni)	31 (directional)	−111.57 (omni)	−139.57 (directional)	−109.57 (omni)	−101.44/-113.44 (directional)
System 6 Airborne 1	4.7		−113.27		−111.27	
System 6 Airborne 2	4.7		−113.27		−111.27	
System 6 Shipborne	6 (omni)	11.8 (directional)	−114.57 (omni)	−120.37 (directional)	−112.57 (omni)	−99.54 (directional)
System 7 Airborne 1	14		−122.57		−102.38	
System 7 Airborne 2	14		−122.57		−102.38	
System 8 Airborne	0		−105.57		−103.57	
System 8 Shipborne	15		−124.57		−111.25	

TABLE 1/1.1/3-2

Calculated pfd required to protect MMS systems for maximum receiving antenna gain direction

Parameter (unit)	Maximum MMS receiver antenna gain (dBi)	Power flux-density (dB(W/(m^2 · MHz)))
System 1 Shipborne	6	−114.57
System 2 Shipborne	15	−124.57

Given that the values derived in Tables 1/1.1/3-1 and 1/1.1/3-2 are based on the total interference power allowable at the victim receiver, some other studies have assessed the aggregation factor to be applied to derive a pfd limit per station in the case of an omnidirectional antenna. The aggregation factor derived for the AMS is 13.5 dB and for the MMS is 10 dB, based on the assumption of 22 simultaneous and equivalent sources of interference for the AMS and 10 for the MMS. The various IMT deployment assumptions used in the studies could result in different representations of the equivalent sources of interference.

One contribution was submitted to CPM 23-2 (see Doc. CPM23-2/195) regarding the derived aggregation factor. This contribution provided an updated aggregation factor with a higher value.

This contribution was not submitted to the relevant expert group for review, however CPM23-2 discussed it, but did not draw any conclusion on the matter.

Another study showed that the aggregated factor for the AMS is 8.1 dB at the distance of 82 km from the coast considering the randomly located IMT base stations within the area, calculated according to the beamwidth of AMS antenna station.

In a study on basic transmission loss between an airborne station of the AMS and a terrestrial base station, it is observed that at specific separation distances between an airborne station and a terrestrial station, and at up to specific altitudes of the airborne station, the basic transmission loss can be high enough to meet the isolation needed to mitigate interference to the airborne station.

One study presented a simulation of interference from an IMT base station with AAS to the AMS within the frequency band 4 800-4 990 MHz and estimated whether the required protection criterion of $I/N = -6$ dB for 20% of the time is met when the AMS and the MMS operate at the distances of 12, 80 and 200 nautical miles from the coast. Based on the obtained results, it can be summarized that I/N threshold of AMS and MMS receivers will not be exceeded when interfered by IMT stations deployed in urban areas.

For an AMS receiver with omnidirectional antenna the protection criterion is met more than 97% of the time even in the worst-case scenario when the AMS receiver is located at 12 nautical miles from the coastline. For the AMS with directional antenna receiver the I/N margin for the worst-case scenario is 6 dB. The study assumed that, in practice, the AMS receiver would be located much farther from the coastline, the results show that under this assumption the I/N margins are more than 14 dB. For MMS System 1 within a worst-case scenario when the MMS receiver is located at 12 nautical miles from the coastline, the margin is 7 dB. For MMS System 2 receiver with directional antenna the I/N margin for the worst-case scenario is 16 dB. The study further assumed that, in practice, the AMS receiver would be located much farther from the coastline, the results show that under this assumption the I/N margins are very significant and equal more than 90 dB.

Additionally for 80 and 200 nautical miles, which under this study were assumed to be more likely distances between IMT networks and AMS/MMS receivers, the margins are more than 15 dB for both omnidirectional and directional antennas.

Taking into account high margins of I/N, this study concluded that protection of AMS and MMS receivers operating close to the borders of territorial seas would be excessive and unnecessary since no interference problems would occur in practice.

Another study also presented a simulation of interference from IMT with AAS to the AMS within the 4 800-4 990 MHz frequency band and estimated whether the required protection criterion of $I/N = -6$ dB is met when the AMS and the MMS operate at the distances of 12 nautical miles from the coast, together with a sensitivity analysis in order to evaluate the effect of various parameters, in particular:

– the density and number of base stations (from 5 cities with 19 base stations per city to Ra_urban/Ra_suburban/Rb parameters as agreed in baseline assumptions from the ITU-R Working Party in charge of IMT);

– the clutter layer (from a clutter used on 100% of sites to a clutter used on 50% of urban sites considering the agreed baseline assumptions on BS antenna height and clutter height).

This study also highlights the dynamics of I/N depending on the location of the AMS/MMS victim. Based on the obtained results, it can be summarized that I/N threshold of AMS and MMS receivers will be significantly exceeded (by 17 dB more than 95% of results for AMS, and by 24 dB more than 95% of results for MMS) when using baseline assumption instead of ad-hoc assumptions.

One study also assessed the effect of the single-entry interference. This static analysis shows that even a single IMT base station interference could exceed the −6 dB *I/N* protection criterion by more than 10 dB, and that the protection criterion could be exceeded up to large distances (more than 100 km for 10° IMT downtilt, more than 200 km for 6° IMT downtilt).

One contribution was submitted to CPM 23-2 (see Doc. CPM 23-2/195) providing sensitivity analysis of interference from IMT to AMS and MMS within the 4 800-4 990 MHz frequency band with various values for TRP and single-entry pfd. This contribution was not submitted to the relevant expert group for review. However, CPM23-2 discussed it, but did not draw any conclusion on the matter.

1/1.1/4 Methods to satisfy the agenda item

Concerning the possibility for countries to add their names to the list of countries in RR No. **5.441B**, see Resolution **26 (Rev.WRC-19)**.

1/1.1/4.1 Method A – NOC to RR except for consequential changes as reflected in section 1/1.1/5

Under this method, the current regulatory conditions are considered sufficient "to address, in the frequency band 4 800-4 990 MHz, protection of the aeronautical mobile and maritime mobile services located in international airspace and waters" from IMT stations. The sentences in RR No. **5.441B** subjecting the pfd value to "review at WRC-23" and stipulating that "identification shall be effective after WRC-19" are deleted. Consequential modifications are made to Resolution **223 (Rev.WRC-19)** to remove the reference to studies in preparation for WRC-23.

The following views were expressed on Method A.

View 1:

This method is not in line with the scope of agenda item 1.1 which is intended to review the existing pfd criteria. Keeping the existing pfd limit would also contradict the results of all presented technical studies.

This method also does not address the differences in allocation status for AMS and MMS within the band 4 800-4 990 MHz and propose keeping a single pfd limit for the entire frequency band based on the protection of AMS only. Such a pfd would place undue constraints on IMT stations operating in national territories.

It should also be clarified that the two measures, i.e. RR No. ***9.21*** *and a pfd limit could be applied without contradicting each other. It could be assumed that in the case when the distance from an IMT station to the border of another country is less than 450 km, RR No.* ***9.21*** *should apply while in the case the distance from an IMT station to the border of another country is more than 450 km, a pfd limit should apply. The same view is also related to Methods B, C, D and E.*

View 2:

The existing pfd limit is not specific to AMS or MMS but is a general limit. It was decided by WRC-15 to protect both AMS and MMS, taking into account that the pfd limit for the protection of AMS also provides protection to MMS. Furthermore, combining RR No. ***9.21*** *with pfd limits is usual in other frequency bands (e.g. IMT in 3.4-3.6 GHz).*

1/1.1/4.2 Method B – NOC to RR except for modification of Resolution 223 to apply the existing pfd value to all countries listed in RR No. 5.441B, as well as other consequential changes as reflected in section 1/1.1/5

Under this method the current regulatory conditions are considered sufficient "to address, in the frequency band 4 800-4 990 MHz, protection of the aeronautical mobile and maritime mobile services located in international airspace and waters" from IMT stations. The sentences in RR No. **5.441B** subjecting the pfd value to "review at WRC-23" and stipulating that "identification shall be effective after WRC-19" are deleted. Consequential modifications are made to Resolution **223 (Rev.WRC-19)** to remove the reference to studies in preparation for WRC-23.

Under this method, *resolves* 5 of Resolution **223 (Rev.WRC-19)** is deleted thereby applying the pfd limit(s) to all countries listed in RR No. **5.441B**.

The following views were expressed on Method B.

View 1:

This method is not in line with the scope of agenda item 1.1 which is intended to review the existing pfd criteria. Keeping the existing pfd limit would also contradict the results of all presented technical studies.

This method also does not address the differences in allocation status for AMS and MMS within the band 4 800-4 990 MHz and proposes keeping a single pfd limit for the entire frequency band based on the protection of AMS only. Such a pfd would place undue constraints on IMT stations operating in national territories.

Moreover a deletion of resolves *5 of Resolution **223 (Rev.WRC-19)** would also be out of the scope of agenda item 1.1 and would create significant problems for administrations which have already implemented or are in the process of implementation of IMT systems in accordance with Resolution **223 (Rev.WRC-19)**. It is also related to Method D below.*

View 2:

The existing pfd limit is not specific to AMS or MMS but is a general limit. It was decided by WRC-15 to protect both AMS and MMS, taking into account that the pfd limit for the protection of AMS also provides protection to MMS.

This agenda item covers possible measures to protect AMS/MMS in international airspace and waters, and the deletion of resolves *5 would enable such protection also in coastal areas of countries listed in* resolves *5, also ensuring a fair application of the technical conditions to all countries listed in RR No. **5.441B**.*

1/1.1/4.3 Method C – Modification of the existing pfd criterion in RR No. 5.441B, as well as other consequential changes as reflected in section 1/1.1/5

Under this method, while considering that both the regulatory mechanisms (i.e. i) an appropriate pfd criteria on IMT stations, and ii) application of RR No. **9.21**) are required to address protection of stations in the AMS and MMS located in international airspace and waters in the frequency band 4 800-4 990 MHz, from IMT stations, based on the results of studies, the current pfd criterion is reviewed and replaced, with new pfd criteria. Administrations currently exempt from the pfd criterion would continue to remain exempt. The sentences in RR No. **5.441B** stating that "this pfd criterion is subject to review at WRC-23" and stipulating that "identification shall be effective after WRC-19" are deleted.

The current pfd value of "−155 dB(W/(m^2 · 1 MHz)), produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State", in RR No. **5.441B**, is replaced with a new pfd value(s) for the protection of AMS/MMS:

Alternative 1: −134 dB(W/(m^2 · 1 MHz)) produced up to 30 m above sea level for the protection of MMS in the frequency band 4 800-4 990 MHz, and −138 dB(W/(m^2 · 1 MHz)) produced from 30 m up to 19 km above sea level for the protection of AMS in the frequency band 4 800-4 950 MHz, at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State.

View 1:

*The distance of 22 km, in Alternative 1 above and Alternatives 2, 3*bis *and 4 below, presented as a reference point for establishing a pfd limit is not justified and does not correspond to the actual use of AMS/MMS stations which typically operate well beyond this distance.*

View 2:

*The distance of 20/22 km is the distance which was decided at WRC-15 and also appears as the distance to apply pfd limits for the protection of ships in some other Article **5** footnote. This distance is the breadth of the territorial sea where the coastal State has full jurisdiction and sovereignty. Any larger distance would suggest that the coastal State extends its sovereignty on ships and aircraft outside territorial seas.*

Alternative 2: −140 dB(W/(m^2 · 1 MHz)) produced up to 19 km above sea level at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State, for the protection of AMS in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and −134 dB(W/(m^2 · 1 MHz)) produced up to 30 m above sea level at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State, for the protection of MMS in the frequency band 4 800-4 990 MHz.

Alternative 3: −122 dB(W/(m^2 · 1 MHz)), produced up to 19 km above sea level at 82 km from the coast defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the band 4 800-4 950 MHz.

Views were expressed on Alternative 3:

View 1:

Views were expressed that setting the pfd value at 82 km from the coast was not justified. 82 km was calculated based on the operating distance of AMT transmitters to protect FS receivers. FS and its associated protection are outside the scope of this agenda item, and, in addition, there are many applications under the AMS allocations which are not AMT (see Recommendation ITU-R M.2116). Furthermore, it is flawed to calculate a distance based primarily on a regulatory condition for a transmitter and apply that distance for the protection of a receiver. On the other hand, 22 km reflects the boundary of national territories and directly satisfies the invites *of the AI 1.1 in Resolution **223 (Rev.WRC-19)**.*

View 2:

Views were expressed that the distance of 82 km is obtained based on simulation considering the protection of FS in the national territories, which is a distance to strike a balance between interfering with other services and being protected from interference. Although the interference is from the transmitter and the interference protection is for the receiver, it is appropriate to apply such distance when an AMS system usually has both transmitter and receiver. The pfd value varies according to the distance and in Alternative 3 is based on the distance of 82 km as derived from the technical study. The frequency band 4 800-4 950 MHz is allocated to AMS, in which 4 825-

4 835 MHz can be used for AMT only. Considering that the characteristics and protection criteria along with the pfd limit for AMS and AMT are the same, it would be appropriate to set the pfd limit for AMS in 4 800-4 950 MHz frequency band as a whole.

*Alternative 3*bis*:* −122 dB(W/(m² · 1 MHz)), produced up to 19 km above sea level at 22 km from the coast defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the band 4 800-4 950 MHz.

View 1:

See View 2 of Alternative 3 above.

Alternative 4: −117 dB(W/(m² · 1 MHz)) produced up to 19 km above sea level at 22 km from the coast for the protection of AMS in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and −115 dB(W/(m² · 1 MHz)) produced up to 30 m above sea level at 22 km from the coast for the protection of MMS in the frequency band 4 800-4 990 MHz.

Alternative 5: −117 dB(W/(m² · 1 MHz)) produced up to 19 km above sea level at the external boundary of the exclusive economic zone, as officially recognized by the coastal State, for the protection of AMS in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and −115 dB(W/(m² · 1 MHz)) produced up to 30 m above sea level at the external boundary of the exclusive economic zone, as officially recognized by the coastal State, for the protection of MMS in the frequency band 4 800-4 990 MHz.

Different views were expressed regarding Alternative 5.

View 1:

Alternative 5 is based on the assumption that AMS/MMS stations typically operate well beyond 22 km from the low-water mark of any coastal State as well as that in the exclusive economic zone, the coastal State has exclusive jurisdiction and sovereign rights for the various activities, including building artificial islands, installations and structures.

In accordance with UNCLOS coastal States have jurisdiction and sovereign rights in their so called "exclusive economic zones", i.e. within 200 nautical miles from the border of the territorial sea, for the various activities related to the economic exploitation and exploration of these zones. These activities may include establishing artificial islands, building installations and structures, establishing safety zones with a special regulatory regime and others. In exercising their rights and performing their duties under this Convention in the exclusive economic zone, States shall have due regard to the rights and duties of the coastal State and shall comply with the laws and regulations adopted by the coastal State. Such regulations may be related to installation and maintenance of radio stations installed by coastal States within their respective exclusive economic zones. Although UNCLOS does not address the use of radio spectrum directly, it is a basis today in the RR for defining geographical areas where a radio station can be deployed.

It was agreed in the course of the ITU-R work on AI 1.1 of WRC-23 that the term "operation of vessels and aircraft in international waters and international airspace", respectively, referred to in WRC-23 agenda item 1.1, is understood to mean that such operation would take place in an area which is outside the territory under jurisdiction of any administration. So it can be concluded that "international airspace" and "international waters" in the context of agenda item 1.1 starts at the external boundary of the exclusive economic zone of a coastal State.

View 2:

The reference to the exclusive economic zone, as defined in Article 56 of the UNCLOS, which is reproduced below, does not grant a right of jurisdiction regarding radio-frequency spectrum to the coastal State and does not limit the right of other States to use spectrum onboard ships or aircraft in exclusive economic zone. Therefore, exclusive economic zone should not be used to develop regulatory provisions in the Radio Regulations and to define where AMS/MMS have the right for protection.

“

Article 56

Rights, jurisdiction and duties of the coastal State in the exclusive economic zone

1. In the exclusive economic zone, the coastal State has:

(a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds;

(b) jurisdiction as provided for in the relevant provisions of this Convention with regard to:

(i) the establishment and use of artificial islands, installations and structures;

(ii) marine scientific research;

(iii) the protection and preservation of the marine environment;

(c) other rights and duties provided for in this Convention.

2. In exercising its rights and performing its duties under this Convention in the exclusive economic zone, the coastal State shall have due regard to the rights and duties of other States and shall act in a manner compatible with the provisions of this Convention.

3. The rights set out in this article with respect to the seabed and subsoil shall be exercised in accordance with Part VI.

”

A boundary that reflects the sovereignty of a coastal State based on Article 3 is appropriate for the application of a pfd limit in the context of this agenda item.

“

SECTION 1. GENERAL PROVISIONS

Article 2

Legal status of the territorial sea, of the air space over the territorial sea and of its bed and subsoil

1. The sovereignty of a coastal State extends, beyond its land territory and internal waters and, in the case of an archipelagic State, its archipelagic waters, to an adjacent belt of sea, described as the territorial sea.

2. This sovereignty extends to the air space over the territorial sea as well as to its bed and subsoil.

3. The sovereignty over the territorial sea is exercised subject to this Convention and to other rules of international law.

SECTION 2. LIMITS OF THE TERRITORIAL SEA

Article 3

Breadth of the territorial sea

Every State has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with this Convention.
"

Consequential modifications are made to Resolution **223 (Rev.WRC-19)** to remove the reference to studies in preparation of WRC-23.

1/1.1/4.4 Method D - Modification of the existing pfd criterion in RR No. 5.441B and applying it to all countries listed in RR No. 5.441B, as well as other consequential changes as reflected in section 1/1.1/5

Under this method, while considering that both the regulatory mechanisms (i.e. i) an appropriate pfd criteria on IMT stations and ii) application of RR No. **9.21**) are required to address protection of stations in the AMS and MMS located in international airspace and waters in the frequency band 4 800-4 990 MHz, from IMT stations. Therefore, based on the results of studies, the current pfd criterion is reviewed and replaced, with a new pfd value(s). The sentences in RR No. **5.441B** stating that "this pfd criterion is subject to review at WRC-23" and stipulating that "identification shall be effective after WRC-19" are deleted.

The current pfd value of "−155 dB(W/(m^2 · 1 MHz)), produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State", in RR No. **5.441B**, is replaced with a new pfd value(s) with all alternatives considered under Method C.

Consequential modifications are made to Resolution **223 (Rev.WRC-19)** to remove the reference to studies in preparation of WRC-23.

Under this method, *resolves* 5 of Resolution **223 (Rev.WRC-19)** is deleted, thereby applying pfd limit(s) to all countries listed in RR No. **5.441B**.

Different views were expressed regarding the alternatives under this method (for details, see Method C).

1/1.1/4.5 Method E – Applying a pfd criterion and extension of list of countries where it is not applied through separate regulatory measures

Under this method, either regulatory protection mechanisms of i) a pfd criterion imposed on IMT stations together with RR No. **9.21** or, ii) only the application of No. **9.21** can be considered sufficient "to address, in the frequency band 4 800-4 990 MHz, protection of the aeronautical mobile and maritime mobile services located in international airspace and waters" from IMT stations.

Countries currently listed in RR No. **5.441B** and new countries wishing to identify the band for IMT would be able to freely elect to do so through joining one of the two footnotes on the basis of such administrations' willingness to apply a pfd limit on IMT stations together with RR No. **9.21** or on the basis of such administrations deeming the application of RR No. **9.21** only, as sufficient.

The countries electing to remain in RR No. **5.441B** or add their names to this footnote at WRC-23 will comply to a pfd criterion in RR No. **5.441B**, as revised by WRC-23, along with the application of RR No. **9.21**. The current pfd criterion in RR No. **5.441B** would be revised with one alternative of Methods C related to the update of the pfd criterion (see 1/1.1/5.3).

The countries listed in RR No. **5.441B** exempt from the pfd criterion via *resolves* 5 of Resolution **223 (WRC-19)** and new countries willing to identify the band for IMT for which, only the application of RR No. **9.21** would be deemed sufficient, would add their names to a new footnote exempt from any pfd criterion. The sentence "This pfd criterion is subject to review at WRC-23" and the sentence in RR No. **5.441B** stipulating that "identification shall be effective after WRC-19" are deleted from RR No. **5.441B**.

Consequential modifications are made to Resolution **223 (Rev.WRC-19)** to remove the reference to studies in preparation for WRC-23. It is also clarified in RR No. **5.441B** that "and IMT stations shall not claim protection from stations of the aeronautical mobile service and land mobile service" instead of "other applications of the mobile service".

Resolves 5 of Resolution **223 (Rev.WRC-19)** listing the countries exempt from the pfd criterion would be deleted.

The following views were expressed on Method E.

View 1:

Measure ii) of Method E does not enable the protection of AMS/MMS stations in the international airspace and waters, which is the objective of agenda item 1.1. This measure limits the protection to those AMS/MMS stations in the coverage area of ground stations, i.e. excluding communications between aircraft, between ships or between ships and aircraft outside this coverage area. This method does not respond to this agenda item calling for possible measures to address the protection of AMS/MMS located in international airspace and waters from other stations located in national territories. Furthermore, due to the unpredictable location and timing of the operations of AMS/MMS stations in international airspace and waters, it is impossible for administrations implementing IMT to identify administrations operating AMS/MMS in international airspace and waters. In addition, there is no ITU framework for such coordination. Therefore, this method is in contradiction with this agenda item calling for possible measures to address the protection of AMS/MMS in international airspace and waters. This method is effectively the opposite of the objective of AI 1.1.

In addition, by allowing IMT administrations to freely and unilaterally decide whether a pfd criterion would be necessary to protect AMS and MMS operating in international airspace and waters, this method assumes that the protection of incumbent services and applications used by other administrations would be optional. Considering that measures to protect other administrations are at the discretion of administrations would violate the principles of the RR, in particular preamble RR 0.4.

This method also excludes arbitrarily the maritime mobile service from the "non claiming protection" provision.

View 2:

Under Method E, to respond to the objective of AI 1.1, it is emphasized that no country has jurisdiction over the use of spectrum in international airspace and waters, and that protection of AMS/MMS stations in international airspace waters respectively can be implemented on the basis of RR No. ***9.21*** *only or, in addition to RR No.* ***9.21****, on a pfd criterion, should countries deem it necessary to comply with it.*

To implement this approach, a clear regulatory mechanism with two footnotes, one with a pfd value (RR No. ***5.441B****, as revised by WRC-23) and the other one without a pfd value (a new footnote) is* *proposed under this Method. Countries would be free to join one or the other, based on their own assessment on whether the application of the revised pfd criterion would unreasonably restrict their national IMT deployments.*

Such a mechanism would provide an opportunity, especially for developing countries, to benefit from economies of scale for IMT deployments while maintaining the option of enhanced protection of AMS/MMS stations in international airspace and waters through a pfd criterion in RR No. ***5.441B****, as revised by WRC-23.*

1/1.1/4.6 Method F – Application of RR No. 9.21 and bilateral/multilateral coordination agreements with coastal States for the protection of AMS/MMS stations in international airspace and international waters

Under this method, no additional measures such as pfd limit are imposed on IMT stations for the protection of AMS/MMS stations in international airspace/waters. However, RR No. **9.21** would continue to apply, providing a mechanism for protection of AMS operations from IMT in areas up to 450 km around respective ground stations located in countries which authorized the use of AMS applications in question. This method corresponds to the existing regulatory practice implemented in the RR in other IMT frequency bands and is considered to be sufficient.

This method also suggests that the protection of AMS/MMS stations is limited to the areas of national territories of countries using these stations. The use of AMS/MMS stations outside of national territories shall not claim protection from mobile and other services deployed within national territories. Therefore the pfd criterion is proposed to be deleted in RR No. **5.441B**.

The sentences stating that "this pfd criterion is subject to review at WRC-23" and stipulating that "identification shall be effective after WRC-19" are also deleted.

Under this method, it is clarified in RR No. **5.441B** that "and IMT stations shall not claim protection from stations of the aeronautical mobile service" instead of "from stations of other applications of the mobile service".

An option under this method envisages bi- or multilateral agreements between administrations willing to implement specific technical or regulatory measures such as a pfd limit on IMT stations or frequency planning (e.g. possible frequency band segmentation between IMT and AMS/MMS systems respectively) aimed at facilitating sharing between terrestrial IMT systems of coastal States and AMS/MMS located within the "exclusive economic zones" of coastal States as well as in international airspace or waters (i.e. outside national territories).

The Conference would invite ITU-R to develop appropriate ITU-R Recommendation(s) in order to assist negotiations between administrations willing to implement such measures.

Consequential modifications are made to Resolution **223 (Rev.WRC-19)** and RR No. **5.441B**.

The following views were expressed on Method F.

View 1:

This Method F does not enable the protection of AMS/MMS stations in the international airspace and waters, which is the objective of agenda item 1.1. Method F limits the protection to those AMS/MMS stations in the coverage area of ground stations, i.e. excluding communications between aircraft, between ships or between ships and aircraft outside this coverage area. This method does not respond to this agenda item calling for possible measures to address the protection of AMS/MMS located in international airspace and waters from other stations located within national territories. Furthermore, due to the unpredictable location and timing of the operations of AMS/MMS stations in international airspace and waters, it is impossible for administrations *implementing IMT to identify administrations operating AMS/MMS in international airspace and waters. In addition, there is no ITU framework for such coordination.*

Therefore, this method is in contradiction with this agenda item calling for possible measures to address the protection of AMS/MMS in international airspace and waters. This method is effectively the opposite of the objective of AI 1.1.

This method also excludes arbitrarily the maritime mobile service from the "not claiming protection" provision.

View 2:

*Under Method F, to respond to the objective of AI 1.1, it is emphasized that no country has jurisdiction over the use of spectrum in international airspace and waters. Based on the provisions on Article **8** of the RR, AMS and MMS stations located in international airspace and international waters whose frequency assignments are not registered in the MIFR do not obtain international recognition and the right for protection. The lack of registration procedures in the territories outside the jurisdiction of any countries should not be the cause for creating excessive constraints to other services and applications used on national territories.*

*Under this method, the application of RR No. **9.21** would be sufficient for the continued operation of AMS/MMS stations in international airspace and waters while countries will also have the option to enter into bi-/multilateral agreements to enhance the protection of AMS/MMS provided under RR No. **9.21**. In order to assist countries, ITU-R would be invited to develop relevant ITU-R Recommendations or Reports providing various mitigation measures.*

Such a mechanism would provide an opportunity, especially for developing countries, to benefit from economies of scale for IMT deployments while maintaining the option of enhanced protection of AMS/MMS stations in international airspace and waters through e.g. bi-/multilateral agreements between countries and/or other mitigation measures.

1/1.1/5 Regulatory and procedural considerations

1/1.1/5.1 For all methods except Method E

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

4 800-5 250 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
4 800-4 990	FIXED MOBILE 5.440A 5.441A MOD 5.441B 5.442 Radio astronomy 5.149 5.339 5.443	

1/1.1/5.1.1 For Method E

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

4 800-5 250 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
4 800-4 990	FIXED MOBILE 5.440A 5.441A MOD 5.441B ADD 5.A11 5.442 Radio astronomy 5.149 5.339 5.443	

1/1.1/5.2 For Methods A and B

MOD

5.441B In Angola, Armenia, Azerbaijan, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, China, Côte d'Ivoire, Djibouti, Eswatini, Russian Federation, Gambia, Guinea, Iran (Islamic Republic of), Kazakhstan, Kenya, Lao P.D.R., Lesotho, Liberia, Malawi, Mauritius, Mongolia, Mozambique, Nigeria, Uganda, Uzbekistan, the Dem. Rep. of the Congo, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, South Africa, Tanzania, Togo, Viet Nam, Zambia and Zimbabwe, the frequency band 4 800-4 990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. **9.21** with concerned administrations, and IMT stations shall not claim protection from stations of other applications of the mobile service. In addition, before an administration brings into use an IMT station in the mobile service, it shall ensure that the power flux-density (pfd) produced by this station does not exceed -155 dB(W/(m^2 · 1 MHz)) produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State. ~~This pfd criterion is subject to review at WRC-23.~~ Resolution **223 (Rev.WRC-~~19~~23)** applies. ~~This identification shall be effective after WRC-19.~~ (WRC-~~19~~23)

1/1.1/5.3 For Methods C and D

MOD

5.441B In Angola, Armenia, Azerbaijan, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, China, Côte d'Ivoire, Djibouti, Eswatini, Russian Federation, Gambia, Guinea, Iran (Islamic Republic of), Kazakhstan, Kenya, Lao P.D.R., Lesotho, Liberia, Malawi, Mauritius, Mongolia, Mozambique, Nigeria, Uganda, Uzbekistan, the Dem. Rep. of the Congo, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, South Africa, Tanzania, Togo, Viet Nam, Zambia and Zimbabwe, the frequency band 4 800-4 990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. **9.21** with concerned administrations, and IMT stations shall not claim protection from stations of other applications of the mobile service. In addition, before an administration brings into use an IMT station in the mobile service, it shall ensure that the power flux-density (pfd) produced by this station does not exceed ~~−155 dB(W/(m² · 1 MHz)) produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State.~~:

Alternative 1: −134 dB(W/(m^2 · 1 MHz)) produced up to 30 m above sea level for the protection of the maritime mobile service in the frequency band 4 800-4 990 MHz, and −138 dB(W/(m^2 · 1 MHz)) produced from 30 m up to 19 km above sea level, for the protection of the aeronautical mobile service in the frequency band 4 800-4 950 MHz, at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State.

Alternative 2: −140 dB(W/(m^2 · 1 MHz)) produced up to 19 km above sea level at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and −134 dB(W/(m^2 · 1 MHz)) produced up to 30 m above sea level at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State, for the protection of the maritime mobile service in the frequency band 4 800-4 990 MHz.

Alternative 3: −122 dB(W/(m^2 · 1 MHz)), produced up to 19 km above sea level at 82 km from the coast defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the band 4 800-4 950 MHz.

Alternative 3bis: −122 dB(W/(m^2 · 1 MHz)), produced up to 19 km above sea level at 22 km from the coast defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the band 4 800-4 950 MHz.

Alternative 4: −117 dB(W/(m^2 · 1 MHz)) for the protection of the aeronautical mobile service produced up to 19 km above sea level at 22 km from the coast in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and −115 dB(W/(m^2 · 1 MHz)) for the protection of the maritime mobile service produced up to 30 m above sea level at 22 km from the coast in the frequency band 4 800-4 990 MHz.

Alternative 5: −117 dB(W/(m^2 · 1 MHz)) produced up to 19 km above sea level at the external boundary of exclusive economic zone, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and −115 dB(W/(m^2 · 1 MHz)) produced up to 30 m above sea level at the external boundary of exclusive economic zone, as officially recognized by the coastal State, for the protection of the maritime mobile service in the frequency band 4 800-4 990 MHz.

~~This pfd criterion is subject to review at WRC-23.~~ Resolution **223 (Rev.WRC-~~19~~23)** applies. ~~This identification shall be effective after WRC-19.~~ (WRC-~~19~~23)

1/1.1/5.4 For Method E

MOD

5.441B In Angola, [~~Armenia~~], Azerbaijan, Benin, Botswana, [~~Brazil~~], Burkina Faso, Burundi, [~~Cambodia~~], Cameroon, [~~China~~], Côte d'Ivoire, Djibouti, Eswatini, [~~Russian Federation~~], Gambia, Guinea, Iran (Islamic Republic of), [~~Kazakhstan~~], Kenya, [~~Lao P.D.R.~~], Lesotho, Liberia, Malawi, Mauritius, Mongolia, Mozambique, Nigeria, Uganda, [~~Uzbekistan~~], the Dem. Rep. of the Congo, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, [~~South Africa~~], Tanzania, Togo~~,~~ [~~Viet Nam~~]~~,~~ and Zambia [~~and Zimbabwe~~], the frequency band 4 800-4 990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. **9.21** with concerned administrations, and IMT stations shall not claim protection from stations of ~~other applications of the~~ aeronautical mobile service and land mobile service. In addition, before an administration brings into use an IMT station in the mobile service, it shall ensure that the power flux-density (pfd) produced by this station does not exceed *[The existing power flux-density criterion is to be replaced with an alternative from Method C, to be decided by WRC-23]*[~~−155 dB(W/(m² · 1 MHz)) produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State.~~] ~~This pfd criterion is subject to review at WRC-23~~. Resolution **223 (Rev.WRC-~~19~~23)** applies. ~~This identification shall be effective after WRC-19.~~ (WRC-~~19~~23)

Note: Countries currently listed and new countries can choose at WRC-23 which footnote they want to apply in their country based on their willingness to apply a pfd limit on IMT stations together with RR No. ***9.21*** *or on the basis of such administrations deeming the application of RR No.* ***9.21*** *only, as sufficient. Deleted country names in [] in this example are those currently listed in resolves 5 of Resolution* ***223 (Rev.WRC-19)*** *and its deletion is an example.*

Note: The value of the pfd limit and the distance from the coast at which it will be applied in this case is given as a placeholder, and shall be agreed upon by all interested countries at WRC-23 based on the results of studies reflected in alternatives of Method C or D.

ADD

5.A11 In [Armenia], [Brazil], [Cambodia], [China], [Russian Federation], [Kazakhstan], [Lao P.D.R], [Uzbekistan], [South Africa], [Viet Nam], [Zimbabwe], *[add other country names]* the frequency band 4 800-4 990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. **9.21** with concerned administrations, and IMT stations shall not claim protection from stations of aeronautical mobile service and land mobile service. Resolution **223 (Rev.WRC-23)** applies. (WRC-23)

Note: Examples listed above are the countries currently in *resolves* 5 of Resolution **223 (Rev.WRC-19)**. Those countries currently listed in new RR No. **5.A11** and new countries can choose at WRC-23 which footnote they want to apply in their country based on their willingness to apply a pfd limit on IMT stations together with RR No. **9.21** or on the basis of such administrations deeming the application of RR No. **9.21** only, as sufficient. The countries listed in RR No. **5.441B** exempt from the pfd criterion via *resolves* 5 of Resolution **223 (WRC-19)** and new countries willing to identify the band for IMT for which, only the application of RR No. **9.21** would be deemed sufficient, would add their names to a new footnote exempt from any pfd criterion.

1/1.1/5.5 For Method F

MOD

5.441B In Angola, Armenia, Azerbaijan, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, China, Côte d'Ivoire, Djibouti, Eswatini, Russian Federation, Gambia, Guinea, Iran (Islamic Republic of), Kazakhstan, Kenya, Lao P.D.R., Lesotho, Liberia, Malawi, Mauritius, Mongolia, Mozambique, Nigeria, Uganda, Uzbekistan, the Dem. Rep. of the Congo, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, South Africa, Tanzania, Togo, Viet Nam, Zambia and Zimbabwe, the frequency band 4 800-4 990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. **9.21** with concerned administrations, and IMT stations shall not claim protection from stations of the aeronautical ~~other applications of the~~ mobile service. ~~In addition, before an administration brings into use an IMT station in the mobile service, it shall ensure that the power flux-density (pfd) produced by this station does not exceed −155 dB(W/(m² · 1 MHz)) produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State. This pfd criterion is subject to review at WRC-23.~~ Resolution **223 (Rev.WRC-~~19~~23)** applies. ~~This identification shall be effective after WRC-19.~~ (WRC-~~19~~23)

1/1.1/5.6 For Methods A, B, C and D

MOD

RESOLUTION 223 (REV.WRC-~~19~~23)

Additional frequency bands identified for International Mobile Telecommunications

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

1 to invite administrations planning to implement IMT to make available, based on user demand and other national considerations, additional frequency bands or portions of the frequency bands above 1 GHz identified in Nos. **5.341B**, **5.384A**, **5.429B**, **5.429D**, **5.429F**, **5.441A** and **5.441B** for the terrestrial component of IMT; due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the services to which the frequency band is currently allocated;

2 to acknowledge that the differences in the texts of Nos. **5.341B**, **5.384A** and **5.388** do not confer differences in regulatory status;

3 that in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz, in order to identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** by IMT stations in relation to aircraft stations, a coordination distance from an IMT station to the border of another country equal to 300 km (for land path)/450 km (for sea path) applies;

4 that in the frequency band 4 800-4 990 MHz, in order to identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** by IMT stations in relation to fixed-service stations or other ground-based stations of the mobile service, a coordination distance from an IMT station to the border of another country equal to 70 km applies;

[*For Method A:*

5 that the power flux-density (pfd) limits in No. **5.441B**~~, which is subject to review at WRC-23,~~ shall not apply to the following countries: Armenia, Brazil, Cambodia, China, Russian Federation, Kazakhstan, Lao P.D.R., Uzbekistan, South Africa, Viet Nam and Zimbabwe,]

[*For Method C:*

5 that the power flux-density (pfd) ~~limits~~criteria in No. **5.441B**~~, which is subject to review at WRC-23~~ for protection of stations in the AMS or the maritime mobile service (MMS), shall not apply to~~ the following countries~~: Armenia, Brazil, Cambodia, China, Russian Federation, Kazakhstan, Lao P.D.R., Uzbekistan, South Africa, Viet Nam and Zimbabwe,]

[*For Methods B and D:*

~~5 that the power flux-density (pfd) limits in No. **5.441B**, which is subject to review at WRC-23, shall not apply to the following countries: Armenia, Brazil, Cambodia, China, Russian Federation, Kazakhstan, Lao P.D.R., Uzbekistan, South Africa, Viet Nam and Zimbabwe~~;]

invites the ITU Radiocommunication Sector

1 to conduct compatibility studies in order to provide technical measures to ensure coexistence between the MSS in the frequency band 1 518-1 525 MHz and IMT in the frequency band 1 492-1 518 MHz, including guidance on the implementation of frequency arrangements for IMT deployment in the frequency band 1 427-1 518 MHz, taking into account the results of these studies;

~~2 to study the technical and regulatory conditions for the protection of stations of the AMS and the maritime mobile service (MMS) located in international airspace or waters (i.e. outside national territories) and operated in the frequency band 4 800-4 990 MHz;~~

~~3~~2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries and rural areas;

~~4~~3 to include the results of the studies mentioned in *invites the ITU Radiocommunication Sector* above in one or more ITU-R Recommendations and Reports, as appropriate~~,~~.

~~*invites the 2023 World Radiocommunication Conference*~~

~~to consider, based on the results of the studies referred to in *invites the ITU Radiocommunication Sector* above, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the AMS and MMS located in international airspace and waters from other stations located within national territories and to review the pfd criteria in No. **5.441B**.~~

1/1.1/5.7 For Methods E and F

MOD

RESOLUTION 223 (REV.WRC-~~19~~23)

Additional frequency bands identified for International Mobile Telecommunications

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

recognizing

a) that for some administrations the only way of implementing IMT would be spectrum refarming, requiring significant financial investment~~,~~;

b) that the rights to international recognition and protection of any frequency assignments are derived from the recording of those frequency assignments in the Master International Frequency Register and conditioned by the provisions of the Radio Regulations,

resolves

[*For Method E:*

1 to invite administrations planning to implement IMT to make available, based on user demand and other national considerations, additional frequency bands or portions of the frequency bands above 1 GHz identified in Nos. **5.341B**, **5.384A**, **5.429B**, **5.429D**, **5.429F**, **5.441A**, ~~and~~ **5.441B** and **5.A11** for the terrestrial component of IMT; due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the services to which the frequency band is currently allocated;]

[*For Method F:*

1 to invite administrations planning to implement IMT to make available, based on user demand and other national considerations, additional frequency bands or portions of the frequency bands above 1 GHz identified in Nos. **5.341B**, **5.384A**, **5.429B**, **5.429D**, **5.429F**, **5.441A** and **5.441B** for the terrestrial component of IMT; due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the services to which the frequency band is currently allocated;]

2 to acknowledge that the differences in the texts of Nos. **5.341B**, **5.384A** and **5.388** do not confer differences in regulatory status;

3 that in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz, in order to identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** by IMT stations in relation to aircraft stations, a coordination distance from an IMT station to the border of another country equal to 300 km (for land path)/450 km (for sea path) applies;

4 that in the frequency band 4 800-4 990 MHz, in order to identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** by IMT stations in relation to fixed-service stations or other ground-based stations of the mobile service, a coordination distance from an IMT station to the border of another country equal to 70 km applies~~;~~,

[*For Methods E and F:*

~~5 that the power flux-density (pfd) limits in No. **5.441B**, which is subject to review at WRC-23, shall not apply to the following countries: Armenia, Brazil, Cambodia, China, Russian Federation, Kazakhstan, Lao P.D.R., Uzbekistan, South Africa, Viet Nam and Zimbabwe,~~]

invites the ITU Radiocommunication Sector

1 to conduct compatibility studies in order to provide technical measures to ensure coexistence between the MSS in the frequency band 1 518-1 525 MHz and IMT in the frequency band 1 492-1 518 MHz, including guidance on the implementation of frequency arrangements for IMT deployment in the frequency band 1 427-1 518 MHz, taking into account the results of these studies;

[*For Method E:*

~~2 to study the technical and regulatory conditions for the protection of stations of the AMS and the maritime mobile service (MMS) located in international airspace or waters (i.e. outside national territories) and operated in the frequency band 4 800-4 990 MHz;~~

~~3~~2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries and rural areas;

~~4~~3 to include the results of the studies mentioned in *invites the ITU Radiocommunication Sector* above in one or more ITU-R Recommendations and Reports, as appropriate~~,~~.]

[*For Method F:*

2 to study the technical and regulatory ~~conditions~~measures for ~~the protection of~~facilitating sharing between terrestrial IMT stations of coastal States and stations of the AMS and the maritime mobile service (MMS) located ~~in international airspace or waters (i.e.~~ outside the national territories of any country~~)~~ and operated in the frequency band 4 800-4 990 MHz, including measures based on frequency planning, and, on the basis of these studies, to develop ITU-R Recommendations and/or Reports, as appropriate, to assist administrations willing to implement such measures;

3 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries and rural areas;

4 to include the results of the studies mentioned in *invites the ITU Radiocommunication Sector* above in one or more ITU-R Recommendations and Reports, as appropriate~~,~~.]

~~*invites the 2023 World Radiocommunication Conference*~~

~~to consider, based on the results of the studies referred to in *invites the ITU Radiocommunication Sector* above, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the AMS and MMS located in international airspace and waters from other stations located within national territories and to review the pfd criteria in No. **5.441B**.~~

Agenda item 1.2

*1.2 to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution **245 (WRC-19)**;*

Resolution **245 (WRC-19)** – *Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications identification in the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz, and 10.0-10.5 GHz*

resolves to invite the ITU Radiocommunication Sector

2 to conduct and complete in time for WRC-23 the sharing and compatibility studies[1], with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and also, as appropriate, on services in adjacent bands, for the frequency bands:

– 3 600-3 800 MHz and 3 300-3 400 MHz (Region 2);
– 3 300-3 400 MHz (amend footnote in Region 1);
– 7 025-7 125 MHz (globally);
– 6 425-7 025 MHz (Region 1);
– 10.0-10.5 GHz (Region 2),

1/1.2/1 Executive summary

WRC-23 agenda item 1.2 considers International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis for certain frequency bands, in accordance with Resolution **245 (WRC-19)**.

Section 1/1.2/3 contains a summary and analysis of the results of studies including sharing and compatibility studies that have been conducted in the current cycle under WRC-23 agenda item 1.2.

There are six frequency bands addressed under this agenda item (AI) as follows: Band 1 (3 300-3 400 MHz (amend footnote in Region 1)), Band 2 (3 300-3 400 MHz (Region 2)), Band 3 (3 600-3 800 MHz (Region 2)), Band 4 (6 425-7 025 MHz (Region 1)), Band 5 (7 025-7 125 MHz (globally)) and Band 6 (10.0-10.5 GHz (Region 2)).

A number of methods to satisfy this agenda item are proposed in section 1/1.2/4 and are summarized below:

Band 1 – 3 300-3 400 MHz (amend footnote in Region 1)

– Method 1A: No change.
– Method 1B: Modification of RR No. **5.429A** and RR No. **5.429B** to add interested Region 1 countries south of 30° parallel north to allocate the frequency band 3 300-3 400 MHz to the mobile service (except aeronautical mobile) on a primary basis and to identify it for IMT in those countries.
– Method 1C: Modification of RR No. **5.429A** and RR No. **5.429B**, including the revision of conditions and to add interested Region 1 countries to allocate the frequency band

[1] Including studies with respect to services in adjacent bands, as appropriate.

3 300-3 400 MHz to the mobile service (except aeronautical mobile) on a primary basis and to identify it for IMT in those countries.

– Method 1D: Primary allocation to the mobile (except aeronautical mobile) service in the frequency band 3 300-3 400 MHz in interested Region 1 countries and identification of IMT.

– Method 1E: Primary allocation to the mobile (except aeronautical mobile) service in the frequency band 3 300-3 400 MHz in the Table of Allocations and identification to IMT in Region 1.

– Method 1F: Primary allocation to the mobile service in the frequency band 3 300-3 400 MHz in the Table of Frequency Allocations and identification to IMT in Region 1.

Band 2 – 3 300-3 400 MHz (Region 2)

– Method 2A: No change.

– Method 2B: Allocation of the frequency band 3 300-3 400 MHz to the mobile service on a primary basis and identification of IMT in Region 2.

– Method 2C: Allocation of the frequency band 3 300-3 400 MHz to the mobile (except aeronautical) service on a primary basis and identification of IMT in Region 2.

Band 3 – 3 600-3 800 MHz (Region 2)

– Method 3A: No change.

– Method 3B: Identification of the frequency band 3 600-3 800 MHz for IMT in Region 2 with conditions (RR Table **21-4**).

– Method 3C: Identification of the frequency band 3 600-3 800 MHz for IMT in Region 2 with conditions (RR Table **21-4**, pfd limit and RR Nos. **9.17**, **9.18**).

– Method 3D: Identification of the frequency band 3 600-3 800 MHz for IMT in Region 2 with conditions (RR Table **21-4**, pfd limit (short-term criteria) and RR Nos. **9.17**, **9.18**).

– Method 3E: Identifications of the frequency band 3 600-3 700 MHz for IMT in additional countries in Region 2 in RR No. **5.434** while maintaining all existing conditions.

– Method 3F: Identification of the frequency band 3 600-3 700 MHz for IMT in Region 2 by modifying RR No. **5.434** while maintaining all existing conditions.

Band 4 – 6 425-7 025 MHz (Region 1)

– Method 4A: No change.

– Method 4B: Identification of the frequency band 6 425-7 025 MHz in Region 1 for IMT without any additional conditions or constraints to the IMT deployment other than those existing in the RRs.

– Method 4C: Identification of the frequency band 6 425-7 025 MHz in Region 1 for IMT with conditions contained in a draft new WRC Resolution.

– Method 4D: Identification of the frequency band 6 425-7 025 MHz in Region 1 for IMT with conditions contained in a draft new WRC Resolution, applied only within a portion of the band.

– Method 4E: Identification of the frequency band 6 425-7 025 MHz in Region 1 for IMT with conditions contained in a draft new WRC Resolution, with use expected as of 2030.

Band 5 – 7 025-7 125 MHz (globally)

– Method 5A: No change.

– Method 5B: Identification of the frequency band 7 025-7 125 MHz for IMT without any additional conditions or constraints to the IMT deployment other than those existing in the RRs.

– Method 5C: Identification of the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote with conditions contained in a draft new WRC Resolution.

– Method 5D: Identification of the frequency band 7 025-7 100 MHz for IMT by creating a new RR footnote with a requirement to implement technical and regulatory measures to protect and not impose constraints on existing services in the band above 7 100-7 155 MHz.

– Method 5E: Identification of the frequency band 7 025-7 125 MHz for IMT with conditions contained in a draft new WRC Resolution, with use expected as of 2030.

Band 6 – 10.0-10.5 GHz (Region 2)

– Method 6A: No change.

– Method 6B: Allocation of the frequency band 10-10.5 GHz to the mobile service on a primary basis in Region 2 and identification for IMT with conditions contained in a draft new WRC Resolution.

– Method 6C: Allocation of the frequency band 10-10.5 GHz to the mobile (except aeronautical) service on a primary basis in Region 2 and identification for IMT with conditions contained in a draft new WRC Resolution, and protection of the radiolocation service.

All methods propose to suppress Resolution **245 (WRC-19)**.

The regulatory and procedural considerations for the methods are contained in section 1/1.2/5.

See the introduction to the CPM Report to WRC-23.

1/1.2/2 Background

Information and communication technologies (ICTs) emerging technologies play an important role in supporting socio-economic development. IMT systems are able to support various usage scenarios including enhanced mobile broadband (eMBB), massive machine-type communications (mMTC) and ultra-reliable low-latency communications (URLLC).

With demand for IMT applications continuing to increase, additional IMT spectrum identifications in the mid-range frequency bands need to be considered in order to enable future deployments, where these applications and services might be difficult to implement using lower or higher frequency bands.

However, when considering potential candidate frequency bands for IMT identification there is a need to ensure the protection of services already allocated in these frequency bands and in adjacent bands (as appropriate) on a primary basis.

1/1.2/3 Summary and analysis of the results of ITU-R studies

1/1.2/3.1 Relevant ITU-R Recommendations and Reports

Recommendations ITU-R: M.2101, M.2083, RS.2017, RS.2065, RS.2105, RA.769, SM.1132-2, M.1461, M.1465, M.1796.

Reports ITU-R: M.2320, M.2370, M.2376, M.2410, M.2481, RS.2313, RS.2178, RS.2096.

1/1.2/3.2 Sharing and compatibility studies

The following subsections present results of the sharing and compatibility studies for each frequency band.

In order to facilitate the review of the results of various studies carried out in various frequency bands subject to WRC-23 agenda item 1.2 without necessarily a detailed review of those results, it was felt helpful to provide a summary of the results of those studies in a comparison tabular form.

It is to be emphasized and acknowledged that the information and materials in the comparison tables below are merely for information purposes enabling the reader to glance at the summaries of the study results.

The informative nature of the table is based on the fact that the assumptions, input parameters and interference criteria including the use of ITU-R Recommendations and Reports in force are generally neither identical nor representative and, in particular, not agreed by ITU-R despite RAG and CVC decisions but just decided by the submitting member of those studies.

In view of the above arguments and explanations, no firm or general conclusions are therefore expected to be reached on the results of studies displayed in various columns of the tables.

Individual membership and regional telecommunication organizations are invited to make their own analysis of studies and draw their own conclusions, taking into account prevailing circumstances and interference environment as well as other conditions in their countries/regions as they find appropriate and valid.

1/1.2/3.2.1 Frequency range 3 300-3 400 MHz

The frequency range 3 300-3 400 MHz is allocated to the RLS on a primary basis. The frequency bands adjacent to this frequency range are allocated to the FS, FSS, MS (except aeronautical) and RLS. The details of these allocations and those of the adjacent frequency bands can be found in the Radio Regulations.

With respect to sharing between different applications within the mobile service, no contribution was received in the preparation of the draft CPM text.

1/1.2/3.2.1.1 RLS

Report ITU-R M.2481 contains in-band and adjacent band coexistence studies between IMT systems in the frequency band 3 300-3 400 MHz and land and maritime radiolocation systems in the frequency band 3 100-3 400 MHz.

In addition, four new studies were performed this cycle to assess the sharing between IMT operating in the frequency range 3 300-3 400 MHz and incumbent radiolocation service operations. The IMT network with IMT base stations is located in both suburban and urban scenarios considering non-AAS and/or AAS antennas separately.

Ship-based radars

The results of one study shows that the protection criteria are exceeded at a maximum of 120 km, and exceeded by 0.07 of samples in the range of 100 km to 150 km when considering Recommendation ITU-R P.452 with a time percentage of p = 10%.

Land-based radars

For Radars D and E, the results of one study shows that the protection criteria are exceeded at a maximum of 85 km, and exceeded by 0.07% of samples in the range of 50 km to 100 km when considering Recommendation ITU-R P.452 with a time percentage of p = 10%.

For Radars G and F, the results of one study shows that the protection criteria are exceeded at a maximum of 130 km, and exceeded by 0.86% of samples in the range of 100 km to 150 km, when using Recommendation ITU-R P.452 with a percentage of time p = 10%. With a percentage of time p = 20%, the maximum distance drops to 70 km, and protection criteria is exceeded by 1.17% of samples in the range of 50 km to 100 km. The results also show that Radar G requires a little more protection than Radar F due to its higher antenna gain.

Airborne radars

One study assumed the azimuth of radar antenna is randomly pointing. The results of aggregate interference integrated over all scanned angles show that considering 40 MHz IMT channel bandwidth, the separation distance is 335 km from the edge of IMT deployment for both non-AAS and AAS antennas. For 100 MHz channel bandwidth of IMT BS with AAS antenna, the separation distance drops to 310 km.

Another study (Study D) assumed that the radar antenna is pointing towards the direction of IMT as proposed by the relevant ITU-R contributing group, enabling protection of radar per scanned angle. For 100 MHz channel bandwidth of IMT BS with AAS antenna, the results showed a larger separation distance in 450-548 km range for the aircraft to be protected. The distance ranges result from different assumptions in radiation pattern of radar, propagation model, clutter-loss model, etc.

View 1:

WP 5B, in a liaison statement, asked WP 5D "to take into account the interference received by the radar only when pointing in the direction of the IMT deployment" in order to cover the protection of the radar system per scanning angle, in particular for those in direction of the sources of interference. In many other studies, the results were based on such assumptions, at previous WRC as well as in the preparation of WRC-23 (e.g. radionavigation radar in 2.7-2.9 GHz under agenda item 1.4, meteorological radar in 2.7-2.9 GHz under agenda item 1.4).

View 2:

This proposed approach in Study D reflects the worst-case scenario, does not reflect the followed approach for coexistence studies in ITU-R and is not in line with the practical deployment for coexistence studies.

View 3:

There was no need to conduct additional studies in this study cycle (2019-2023) either for the co-channel coexistence between IMT and RLS within 3 300-3 400 MHz or within the adjacent bands. Report ITU-R M.2481-0 included studies on the coexistence of mobile (IMT) and radiolocation services in the frequency band 3 300-3 400 MHz that showed feasibility of the identification of the band 3 300-3 400 MHz to IMT. Other four new studies submitted to this study cycle under WRC-23 AI 1.2 considered worst-case assumptions and scenarios which do not reflect the actual practical deployment scenarios.

Report ITU-R M.2481 considered the co-channel sharing coexistence scenario and adjacent-band coexistence scenario. Co-channel scenario: Some studies examined the impact of interference from an IMT BS with advanced antenna system (AAS) for macro and micro urban BSs operating co-channel with shipborne radar type D at four different world locations. The probability of *interference exceeding the* I/N *threshold is found to be lower than 8% for the outdoor small cell case within 20 km distance between IMT and radar systems. This does not change across different locations, as the influence of the propagation model is small at such a short distance. The probability of interference is found to vary between 7% and 20%, depending on the location. For indoor small cells, the probability of interference is found to be lower than 5% within 20 km distance between IMT and radar stations.*

The adjacent-channel scenario considered different frequency offset between the two systems operating in the same allocated band: The results of adjacent studies showed much less separation distances between IMT and radar systems, which were found to be within a few kilometres, in comparison with co-channel scenario.

Some other studies examined the impact of IMT (with and without considering Advanced Antenna System) into land-based radars type B, D and I, for the macro urban scenario operating in an adjacent channel. These studies showed that distances between the IMT network and the radar are found to be between 3 km and 10 km to ensure not exceeding the I/N threshold assumed at the radar receiver.

For AAS systems within distances of 3 km, the OOB limits vary between −31.7 and −39.5 dBm/MHz TRP depending on the scenario that ensure a 90% probability that the interference is below the assumed protection threshold. For AAS systems at distances within 10 km, the OOB limits are found to vary between −26.1 and −38.3 dBm/MHz TRP depending on the scenario that ensure a 90% probability that the interference is below the protection threshold.

These studies considered AAS system based on 3GPP parameters (TR 37.840) which is similar to IMT parameters for WRC-23 AI 1.2, which are also valid for macro BS between AAS parameters used in Report ITU-R M.2481-0 and those used in WRC-23 studies, since the results of using WRC-23 AI 1.2 parameters should be better than the parameters of Report ITU-R M.2481 that confirms feasibility for IMT identification in the band 3 300-3 400 MHz. For example, negligible differences in antenna array size should not have any considerable impact, however the Tx power assumptions in Report ITU-R M.2481 for the AAS BS is 10 dB, which is higher than the one assumed for WRC 23 IMT parameters. This suggests that studies with WRC-23 IMT parameters would lead to better results for the macro BS case compared with Report ITU-R M.2481. In addition, antenna gain in Report ITU-R M.2481 (8 dBi element) provided higher e.i.r.p. with 1.6 dB difference.

For outdoor small cell, AAS parameters shared by the responsible group for AI 1.2 are similar to Report ITU-R M.2481. While Tx power is 3 dB higher for WRC-23 IMT parameters, antenna element gain is 1.6 dB lower. For Indoor small cell, there is no AAS parameter provided and accordingly the results of Report ITU-R M.2481 studies can be a good reference.

View 4:

Since Report ITU-R M.2481 does not address the protection of airborne radars, there was a need to conduct additional studies in this study cycle (2019-2023) to cover this use case scenario.

Moreover, Report ITU-R M.2481 shows that the feasibility of co-channel sharing with radar can only be envisaged for small-cell IMT. All results for macro cells are showing a large distance, even for the single-entry case. And the summary of technical studies concluded:

One study considers scenarios of micro urban, macro urban, indoor small cell IMT BS interfering with shipborne radar type D at four different world locations. This is a single-entry Monte Carlo study where the radar antenna points to a random azimuth direction that is uniformly distributed between 0 and 360 degrees. At 20 km separation distance and for the outdoor small cell *deployment, the probability of exceeding the interference criteria is lower than 8%, and the probability of exceeding the interference criteria is lower than 42% for the urban macro cell case.*

At 50 km separation distance, the probability of harmful interference is lower than 1%-5% for the outdoor small cell case, and the probability of harmful interference is lower than 7%-20%, depending on the location, for urban macro cells.

At 100 km separation distance, the probability of harmful interference is lower than 3% for the outdoor small cell case the probability of interference is below 2%-14% in all locations for urban macro cells. For indoor small cells, the probability of harmful interference is lower than 5% at 20 km separation distance in all locations.

Another study analyses co-channel aggregation-based interference into the radar. In this study, the first scenario is a coastal urban macro IMT deployment with 25 AAS BSs and ship-based Radars A and D standing 22 km from the shoreline at the edge of the territorial waters. Interference from IMT (with a 20 MHz bandwidth) is assessed to be 82.25-93.48 dB above the radar protection criteria of I/N *= −6 dB, for an assumption of 99.999% CDF and depending on the radar type.*

In addition, the second part of this study looks at the separation distances using the same IMT deployment as above. Under the assumption of 99.999% of the CDF, these distances vary between 477-544 km, 354-421 km and 240-352 km depending on the radar type for ITU-R P.452 propagation model with p *= 1%, 10% and 20% respectively.*

1/1.2/3.2.2 Frequency range 3 600-3 800 MHz

The frequency range 3 600-3 800 MHz is allocated to the FS, FSS and MS in Region 2. The frequency bands adjacent to this frequency range are allocated to the FS, FSS and MS (except aeronautical). The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

With respect to sharing between different applications within the mobile service, no contribution was received in the preparation of the draft CPM text.

1/1.2/3.2.2.1 FSS

Five studies were performed in relation to co-channel coexistence between the FSS and IMT systems in the frequency band 3 600-3 800 MHz. The required separation distances to protect FSS receiving earth stations are summarized as below.

Four studies assumed no terrain profile. Three studies resulted in a separation distance ranging from 14 km to 46 km when clutter loss is applied at one path endpoint (at either IMT BSs or FSS earth station). One study showed that the separation distance is in the range of 11 km to 21 km when clutter loss is applied at the earth station side and to 50% of urban IMT BSs. Three studies showed that the separation distance ranges from less than 1 km to 27 km when clutter loss is applied at both IMT BSs side and FSS earth station side. One study showed that the separation distance ranged from less than 1 km to 16 km when IMT is seen in the back lobe of the FSS ES antenna. The above studies used 3 dB polarization discrimination. The range of separation distances above mainly arise from variations of assumptions regarding earth station elevation angle, earth station antenna height, earth station antenna diameter, the application of time percentage in the propagation model, and IMT network loading factor.

One study showed separation distances of 150 km for urban scenarios and 190 km for suburban scenarios when clutter loss is applied to 50% of urban IMT BSs, but not applied to the FSS earth station nor to suburban IMT BSs. In addition to that, polarization loss was not considered in this study. The main difference in results between this study and the other studies resides in the clutter and polarization loss assumptions.

In addition, this study also assumed a short-term protection criterion which led to separation distances of 460 km for urban and 495 km for suburban scenarios. However, it is noted that the ITU-R Working Party in charge of the FSS indicated work in developing short-term protection criteria is not completed and the value may evolve in the future. While some members believe this additional scenario is a sensitivity analysis rather than a baseline, some other members believe this is part of the baseline parameters.

One study using site-specific terrain data showed that the protection criteria can be met when the separation distance is 30 km, 50 km or 70 km. However, one of the results for a separation distance of 60 km shows that the probabilities of exceedance could be higher than 20% because of the particular terrain data used.

The actual separation distances vary from one earth station to another and need to be determined on a case-by-case basis through bilateral agreement.

Report ITU-R S.2368-0 includes studies on the coexistence of IMT-Advanced and the fixed-satellite service in the frequency band 3 400-4 200 MHz.

1/1.2/3.2.2.2 FS

One sharing study was presented. It provides the results of the aggregated interference from IMT urban macro and suburban macro-BSs using AAS to FS station in the frequency band 3 600-3 800 MHz. Propagation model in Recommendation ITU-R P.452 with smooth Earth profile is used. The clutter-loss model in Recommendation ITU-R P.2108-1 with random location percentage is used. For the cases of 20 m FS antenna height, clutter loss is applied to both IMT side and FS side. For the case of 60 m FS antenna height, clutter loss is only applied to the IMT side.

The separation distance between IMT and FS station to meet long-term protection criteria are as follows. When clutter loss is applied to both sides, in case of FS main beam pointing towards the IMT network, the separation distances are 26-31.2 km, in case of the FS back lobe pointing towards the IMT network, the separation distances are less than 1 km. When one side clutter loss is applied, in case of FS main beam pointing towards the IMT network, the separation distances are 65-66.2 km, if case of the FS back lobe pointing towards the IMT network, the separation distances are 1-2 km.

1/1.2/3.2.3 Frequency range 6 425-7 125 MHz

The frequency range 6 425-7 125 MHz is allocated to the FS, FSS, MS and SOS on a primary basis. The frequency bands adjacent to this frequency range are allocated to the FS, FSS, MS, SOS and SRS (deep space). The details of these allocations and those of the adjacent frequency bands can be found in the Radio Regulations, in particular RR Appendix **30B** (RR No. **5.441**) for the frequency band 6 725-7 025 MHz taking into account that this is a worldwide plan in all Regions.

RR Nos. **5.149** and **5.458** refer to RAS and EESS/SRS (passive) usage in this frequency band. However, this frequency band is not allocated to these services and, therefore, studies were not carried out under WRC-23 agenda item 1.2.

View 1: The bands 6 425-7 075 MHz and 7 075-7 250 MHz are used by passive EESS (RR No. ***5.458****) in order to perform sea surface temperature (SST) measurements. There is a significant relationship between overall SST and tropical storms/typhoon/hurricane intensity. RR No.* ***5.458*** *states that "administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz". However, ongoing studies in ITU-R have shown that there may be a high level of interference from mass-market mobile systems such as IMT or WiFi, which will result in making it impossible to predict and follow climate changes and severe weather events.*

ITU-R is studying alternative bands for SST which would exhibit better coexistence opportunities. WRC-23 may consider, under agenda item 1.2, an extension of the bands in RR No. ***5.458*** *as a consequence of the IMT identification of the bands 6 425-7 075 MHz and 7 075-7 125 MHz.*

View 2: The frequency range 6 650-6 675.2 MHz (RR No. ***5.149****) is used for observations of the methanol spectral line and is of utmost importance to radio astronomers around the world. Experience with existing IMT networks shows that cross-border coordination is required to prevent harmful interference in RAS receivers. It is noted that owing to the physical nature of spectral lines, the observing band cannot be shifted.*

View 3: ITU-R Working Party 5D is the responsible group for performing the requisite studies and developing the draft CPM text for WRC-23 agenda item 1.2. Impact studies performed by ITU-R Working Party 7C between the primary mobile service/IMT and Earth exploration-satellite (passive) and space research (passive) services in 6 425-7 075 MHz and 7 075-7 250 MHz; operating under RR No. ***5.458****, was deemed by WP 5D to be outside of the scope of WRC-23 agenda item 1.2 and Resolution* ***245 (WRC-19)****. As such, the inclusion of any text from these EESS/SRS impact studies that propose or imply WRC-23 action regarding new alternative frequency bands for the EESS/SRS is not appropriate for inclusion in the draft CPM text for WRC-23 agenda item 1.2.*

With respect to sharing between different applications within the mobile service, no contribution was received in the preparation of the draft CPM text.

With respect to sharing between FSS transmitting earth stations and receiving IMT base stations, no contribution was received in preparation of the CPM text and it has not been studied by the ITU-R.

1/1.2/3.2.3.1 FSS

1/1.2/3.2.3.1.1 FSS uplink (6 425-7 075 MHz)

1/1.2/3.2.3.1.1.1 Studies

In total, 20 studies have assessed the potential aggregate interference from IMT stations into FSS space stations at various positions in a geostationary orbit for global, hemi, zone and spot beams.

Table 1/1.2/3-1 summarizes the various studies highlighting the following differences in the methodologies and key assumptions identified as influencing the results:

– The choice of *Ra* and *Rb* options, which determines the number of IMT base stations for different deployment environments on the landmass of the Earth.
– Modelling of the FSS receiver antenna pattern and efficiency.
– Modelling of clutter losses in the propagation mechanism.
– Apportionment of the interference criterion that apply to other co-primary services.
– The area covered on the surface of the Earth by the satellite footprint, and whether IMT BS stations are considered in the full visibility area or within the 3 dB contour, with or without maximum antenna gain; and
– Boresight direction of the satellite space station antenna towards the surface of the Earth.

View 1: Based on technical studies submitted to the ITU-R, even taking into account the different assumptions in each study, some of the studies fail a simple validation test.

View 2: There is no "validation" methodology agreed in ITU-R otherwise such a methodology should have been used to validate all technical studies results obtained for all items on the WRC-23 agenda. In addition, we believe that verification of Monte-Carlo studies requires verification of various platforms used to perform simulations. Such verification has been carried out and some of *the studies cannot be reproduced precisely while reproduction of other studies demonstrate very similar results.*

View 3: The "simple validation test" is not mathematically correct for validating Monte-Carlo studies and therefore, not appropriate/agreed.

TABLE 1/1.2/3-1 (see also section 1/1.2/3.2)

Summary of key differences in assumptions and results of the studies

Study	**IMT BS deployment parameters for large areas (Ra/Rb)**	**Rural scenario (optional)**	**Area of study**	**Adjust-ment of Rb**	**Clutter-loss model******	**Satellite carriers***	**Adjustment for FSS antenna pattern****	**Appor-tionment of FSS protection criterion**	**Study results**		**Sharing feasible**
									***I*/*N* levels with respect to the FSS criterion, dB**	**Interference margin*****	
A	Ra1Rb3 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	#7 (G) and #8 (Z) Within 3 dB contour; AP**30B** allotments for Cameroon and Nigeria: Full visible area excluding R2/3	#7 (G): Yes, removal of area of Sahara desert where the population density is 1 person per km^2 or less; #8 (Z) and AP**30B** allotments for Cameroon and Nigeria: No	Annex 6 to Doc. 3K/178, urban and suburban	#7 (G) (noise temp = 900 K) #8 (Z) (noise temp = 900 K) AP**30B** allotments for Cameroon (CME00000) and Nigeria (NIG00000)	No	No	#7 (G): −26.69 #8 (Z): −29.14 – −22.3 AP**30B** allotment for Cameroon (CME00000): −28.8 AP**30B** allotment for Nigeria (NIG00000): −16.1	#7 (G): 16.19 #8 (Z): 11.80-18.64 AP**30B** allotment for Cameroon (CME00000): 18.3 AP**30B** allotment for Nigeria (NIG00000): 5.6	Yes
B	Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	Within 3 dB contour / Full visibility	Yes, excluded sand area (up to 3.2% of the landmass among all the cases)	Annex 6 to Doc. 3K/178, urban and suburban	#1(G), #2(H), #3(Z)	Both studies without and with TIG correction factor (#1(G): −2.7 dB #2(H): −2.7 dB #3(Z): −2.9 dB) were conducted.	No	Without TIG correction factor (G): −25.53 to −19.24 (H): −20.41 to −13.89 (Z): −19.54 to −13.25 with TIG correction factor (G): −28.23 to −21.94 (H): −23.11 to −16.59 (Z): −22.44 to −16.15	without TIG correction factor (G): 8.74 to 15.03 (H): 3.39 to 9.91 (Z): 2.75 to 9.04 with TIG correction factor (G): 11.44 to 17.73 (H): 6.09 to 12.61 (Z): 5.65 to 11.94	Yes

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									***I/N* levels with respect to the FSS criterion, dB**	**Interference margin*****	
C	Rb=5% inside 3 dB footprint, 3% outside. Ra_Suburban = 20% Ra_Urban = 45%	No	Within 3 dB contour and Full visibility (Scenario 5)	No	Annex 6 to Doc. 3K/178	#4	No	Yes	IMT BSs inside 3 dB footprint only: *I/N* −1.9 dB at 80% IMT BSs in whole visibility: *I/N* −0.4 dB at 80%	IMT BSs inside 3 dB footprint only: −11.5 dB IMT BSs in whole visibility: −13.1 dB	No
D	Ra1Rb1 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	Satellite visible area	No	Annex 6 to Doc. 3K/178, urban and suburban	#1 (G)	Yes (−2.7 dB)	No	#1 (G): −20.8 dB, −19.2 dB and −21.9 dB for 25E, 64E and 143.5E.	#1 (G): 10.3 dB, 8.7 dB, 11.4 dB for 25E, 64E and 143.5E.	Yes
E	Case 1: (Rb = 1% Ra_Sub = 5%, Ra_Urb = 10%) Case 2: (Rb = 3% Ra_Sub = 20%, Ra_Urb = 45%)	Yes, (0.003 BS sectors per km^2)	Full visibility (> 0 deg elev)	No	Rec. ITU-R P.2108 for suburban and urban stations below rooftop	#12(G), #2(H), # AP**30B** (BFA00000, CTI00000, GHA00000, GUI00000, MLI00000, NGR00000, SEN00000)	None	Yes, 3 dB reduction	Case 1: (G) −2.3 dB; (H) −0.5 dB (AP**30B**) −13.4 to +1.6 dB. Case 2: (G) +6.6 dB; (H) +8.8 dB.	Case 1: (G) −11.2 dB; (H) −13 dB (AP**30B**) −0.1 to −15.1 dB. Case 2: (G) −20.1 dB; (H) −22.3 dB.	No
F	Case 1: (Rb = 1% Ra_Sub = 5%, Ra_Urb = 10%) Case 2: (Rb = 3%, Ra_Sub = 20%, Ra_Urb = 45%)	Yes (0.003 BS sectors per km^2)	Full visibility	No	Rec. ITU-R P.2108 for suburban and urban stations below rooftop	#12(G), #2(H), #4(S) # INDA00000 (AP**30B**)	No	Yes, 3 dB reduction	Case 1: (G) −2.5 dB; (H) −1 dB; (S) −6 dB. (AP**30B**) −4 dB. Case 2: (G) +6.5 dB; (H) +9 dB; (S) +3 dB. (AP**30B**) +5 dB.	Case 1: (G) −11 dB; (H) −12.5 dB; (S) −7.5 dB. (AP**30B**) −9.5 dB. Case 2: (G) −20 dB; (H) −22.5 dB; (S) −16.5 dB. (AP**30B**) −18.5 dB.	No

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									I/*N* levels with respect to the FSS criterion, dB	Interference margin***	
G	Case 1: (Rb = 1% Ra_Sub = 5%, Ra_Urb = 10%); Case 2: (Rb = 3% Ra_Sub = 20%, Ra_Urb = 45%)	Yes (0.003 BS sectors per km²)	Full visibility (> 0 deg elev), including Region 3.	No	Rec. ITU-R P.2108 for suburban and urban stations below rooftop	#12(G), #2(H), #4(S)	None	Yes, 3 dB reduction	Case 1: (G) −2.5 dB; (H) +0.2 dB; (S) +1.5 dB. Case 2: (G) +7.5 dB; (H) +10.4 dB; (S) +11.8 dB	Case 1: (G) −11 dB; (H) −13.7 dB; (S) −15 dB. Case 2: (G) −21 dB; (H) −23.9 dB; (S) −25.3 dB	No
H	Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	3 dB contour with peak FSS antenna gain within the 3 dB contour and Full visibility area.	No	Annex 6 to Doc. 3K/178, urban and suburban / Full clutter loss applied to all BSs	#1(G) #2(H) #8(Z) (noise temp = 900K)	Yes (G –3.3 dB) (H –3.5 dB) (Z –4.1 dB)	No	(G): *I/N* (dB) (Full visibility −21.84 (H): *I/N* (Full visibility) −19.66 (Z): *I/N* (dB) (3 dB contour + peak gain – beam pointing to 11°E, 7°N, 77.44°) −33.90 (Z): *I/N* (dB) (3 dB contour + peak gain - beam pointing to 38°E, 0°, 49.27°) −23.90 With sub-array IMT BS antenna (sensitivity analysis) (G): *I/N* (dB) (Full visibility) −21.34 (H): *I/N* (Full visibility) −24.23	(G): margin (dB) (Full visibility) +11.34 (H): margin (dB) (Full visibility) +9.16 (Z): margin(dB) (3 dB contour + peak gain – beam pointing to 11°E, 7°N, 77.44°) +23.40 (Z): margin(dB) (3 dB contour + peak gain - beam pointing to 38°E, 0°, 49.27°) +13.40 With sub-array IMT BS antenna (sensitivity analysis) (G): margin (dB) (Full visibility) +10.84 (H): margin(dB) (Full visibility) +13.73	Yes

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									I/*N* levels with respect to the FSS criterion, dB	Interference margin***	
									(Z): *I/N* (dB) (3 dB contour + peak gain – beam pointing to 11°E, 7°N, 77.44°) −36.50 (Z): *I/N* (dB) (3 dB contour + peak gain – beam pointing to 38°E, 0°, 49.27°) −21.90	(Z): margin (dB) (3 dB contour + peak gain – beam pointing to 11°E, 7°N, 77.44°) +26 (Z): margin(dB) (3 dB contour + peak gain – beam pointing to 38°E, 0°, 49.27°) +11.4	
I	Ra2Rb1 Rb=1% Ra_Suburban= 20% Ra_Urban= 45%	No	Full visible area excluding R2 and R3	Yes. Removal of areas with population density lower than 1 person/km^2	Annex 6 to Document 3K/178, urban and suburban Case 1: urban: Doc. 3K/178 Annex 6 model applied to all urban BS; suburban: no clutter was assumed. Case 2: urban: Doc. 3K/178 Annex 6 model applied to all urban BS; suburban: Doc. 3K/178 Annex 6 model applied to suburban IMT BSs for which the satellite is observed at elevations of 5° or less above the horizon	Carrier #1 (Global)	Yes (Taylor window with a 3 dB beamwidth of 13.6° and peak gain of 22 dBi)	No	Case 1: the level of aggregate interference observed on the I_{agg}/N 80th percentile of −13.0 dB, −14.3 dB and −12.6 dB when GSO satellite operates at 15.5°W, 25°E and 64°E longitude respectively Case 2: the level of aggregate interference observed on the I_{agg}/N 80th percentile of −13.7 dB, −15.2 dB and −13.0 dB when GSO satellite operates at 15.5°W, 25°E and 64°E longitude respectively	Case 1: 2.5 dB, 3.8 dB and 2.1 dB when GSO satellite operates at 15.5°W, 25°E and 64°E longitude respectively Case 2: 3.2 dB, 4.7 dB and 2.5 dB when GSO satellite operates at 15.5°W, 25°E and 64°E longitude respectively	Yes

<table>
<tr><th rowspan="2">Study</th><th rowspan="2">IMT BS deployment parameters for large areas (Ra/Rb)</th><th rowspan="2">Rural scenario (optional)</th><th rowspan="2">Area of study</th><th rowspan="2">Adjust-ment of Rb</th><th rowspan="2">Clutter-loss model****</th><th rowspan="2">Satellite carriers*</th><th rowspan="2">Adjustment for FSS antenna pattern**</th><th rowspan="2">Appor-tionment of FSS protection criterion</th><th colspan="2">Study results</th><th rowspan="2">Sharing feasible</th></tr>
<tr><th>I/N levels with respect to the FSS criterion, dB</th><th>Interference margin***</th></tr>
<tr><td>J</td><td>Rb = 1%
Ra_Suburban = 5%
Ra_Urban = 10%</td><td>Yes (0.003 BS sectors per sq km in 21% of the area)</td><td>Within 3 dB contour with space station peak receive antenna gain over the entire contour</td><td>No</td><td>Urban: Rec. ITU-R P.2108, extrapolated downward in frequency applied to all IMT BSs
Suburban: No clutter loss
Rural: No clutter loss</td><td>#7(G) (noise temp = 900 K); #8(Z) (noise temp = 500 K)

<u>AP30B</u> allotment RUS00002</td><td>No</td><td>No</td><td>(G): I/N = −21.87 dB
(Z): I/N = −14.33 dB to −13.63 dB
AP30B allotment RUS00002:
I/N = −17.55 dB</td><td>Scenario 1 (Carrier #8, 183°E):
+3.83 dB

Scenario 2 (Carrier #8, 90°E):
+3.13 dB

Scenario 3 (Carrier #7, 140°E):
+11.37

AP30B allotment RUS00002: +7.05 dB</td><td>Yes</td></tr>
<tr><td>K</td><td>Ra1 Rb3

Ra (Suburban) = 5%
Ra (Urban) = 10%
Rb = 1%</td><td>No</td><td>Method 1:
3 dB satellite footprint with peak FSS antenna gain.

Method 2:
Full visible land area (i.e. without sea/ocean) with FSS antenna model

Excluding R2/R3</td><td>No</td><td>Clutter model according to Rec. ITU-R P.2108

Case 1:
Urban with 65% in clutter & suburban with 15% in clutter

Case 2:
Urban with 100% in clutter & suburban with 15% in clutter</td><td>Carrier #1 (Global)</td><td>Yes (−2 dB)</td><td>No</td><td>Method 1
Case 1: −20.1 dB
Case 2: −21 dB

Method 2
Case 1: −18.8 dB
Case 2: −21.6 dB</td><td>Method 1
Case 1: +9.6 dB
Case 2: +10.5 dB

Method 2
Case 1: +8.3 dB
Case 2: +11.1 dB</td><td>Yes</td></tr>
</table>

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									***I/N* levels with respect to the FSS criterion, dB**	**Interference margin*****	
L	Ra1Rb1 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	Full visible area	No	Annex 6 to Doc. 3K/178, urban and suburban Scenario 1: clutter loss is applied to both urban and suburban IMT base stations Scenario 2: clutter loss is applied to urban base station, but no clutter loss was applied for suburban base stations with elevation angles higher than 5°.	#12 (G) #12 (S)	Yes (−2.2 dB)	No	#12 (G) Scenario 1: −17.76 dB Scenario 2: −16.71 dB #12 (S) Scenario 1: −18.1 dB Scenario 2: −17.5 dB	#12 (G) Scenario 1: 7.26 dB Scenario 2: 6.21 dB #12 (S) Scenario 1: −7.6 dB Scenario 2: 7.0 dB	Yes
M	Ra1Rb1 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	#12 (G): full visible area #12 (G): full visible area excluding R3 #2 (H): full visible area #3 (Z): full visible area #4 (S): full visible area Indian AP**30B** (INDA00000: full visible area	No	Annex 6 to Doc. 3K/178, urban and suburban	#12 (G) #2 (H) #3 (Z) #4 (S) Indian AP**30B** (INDA00000)	Yes (−3 dB)	No	#12 (G): −19.9 to −18.5 dB #2 (H): −16.0 dB #3 (Z): −18.6 dB #4 (S): −26.3 dB Indian AP**30B** (INDA00000: −24.2 dB	#12 (G): 8.0 to 9.4 dB #2 (H): 5.5 dB #3 (Z): 8.1 dB #4 (S): 15.8 dB Indian AP**30B** (INDA00000: 13.7 dB	Yes
N	Ra1 Rb3 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	Visible area	No	Annex 6 to Doc. 3K/178, urban and suburban	AP**30B** MLI00000& GUI00000	No	No	MLI00000: *I/N*=−23.1 dB GUI00000: *I/N*=−18.2 dB 80% time	MLI00000: 12.6 dB GUI00000: 7.7 dB	Yes

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									I/*N* levels with respect to the FSS criterion, dB	Interference margin***	
O	Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	Yes	Within 3 dB contour with space station peak receive antenna gain over the entire contour	No	Urban: Rec. ITU-R P.2108, extrapolated downward in frequency applied to all IMT BSs Suburban: No clutter loss Rural: No clutter loss	#7(G) (noise temp=900 K); #8(Z) (noise temp=500 K)	No	No		For end-to-end transparent transponders of #7(G) and #8(Z) carriers: *C*/*N* degradation is 0.1 dB BER is less than 10^{-6}	Yes
P	Ra1Rb3 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	Full visible area excluding R2/3	No	Annex 6 to Doc. 3K/178, urban and suburban	AP**30B** for South Africa (AFS00000); AP**30B** for Zimbabwe (ZWE00000)	Yes (AFS00000 −4.6 dB) (ZWE00000 −5.5 dB)	No	AP**30B** for South Africa (AFS00000): *I*/*N* = −22.7 dB @ 80% AP**30B** for Zimbabwe (ZWE00000): *I*/*N* = −21.6 dB @ 80%	AP**30B** for South Africa (AFS00000): 12.2 dB AP**30B** for Zimbabwe (ZWE00000): 11.1 dB	Yes
Q	Ra1 Rb3 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	Yes (0.003 BS sectors per sq km in 5% of the area)	Visible area	No	Doc. 3K/178 Annex 6 model, clutter-loss model is applied to all urban BSs, and for suburban BSs it is applied only for satellite elevation angles lower than 5 degrees. Rural: no clutter loss	#1 (G), #2(H), #4(S), AP**30B** NGR00000, BFA00000, GHA00000, CTI00000	Yes (#1 (G) −3.3 dB, #2 (H) −3.5 dB, #4 (S) −0.5 dB, NGR00000 −3.4 dB, BFA00000 −3.6 dB, GHA00000 −3.7 dB, CTI00000 −3.7 dB)	No	*I*/*N* at 80th percentile #1 (G) pointing at Nadir: −20.52 dB #2 (H) pointing at Africa: −15.93 dB #2 (H) pointing at Europe: −15.98 dB #4 (S) pointing at Africa: −21.13 dB #4 (S) pointing at Europe: −13.02 dB NGR00000: −14.6 dB BFA00000: −26.54 dB GHA00000: −26.66 dB CTI00000: −28.19 dB	#1 (G) pointing at Nadir: 10.02 dB #2 (H) pointing at Africa: 5.43 dB #2 (H) pointing at Europe: 5.48 dB #4 (S) pointing at Africa: 10.63 dB #4 (S) pointing at Europe: 2.52 dB NGR00000: 4.1 dB BFA00000: 16.04 dB GHA00000: 16.16 dB CTI00000: 17.69 dB	Yes

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									***I*/*N* levels with respect to the FSS criterion, dB**	**Interference margin*****	
R	Ra1 Rb1 Rb = 1% Ra_Suburban = 5% Ra_Urban = 10%	No	Visible area	No	Annex 6 to Doc. 3K/178, applied to 100% urban base station and only to suburban base stations <5° elevation	#12 (G), #2(H), SEN00000	No	No	SEN00000: *I/N* < −16.8 dB @ 80% #12(G): *I/N* < −16.2 dB @ 80% #2(H): *I/N* < −12.5 dB @ 80%	SEN00000: 6.3 dB #12(G): 5.7 dB #2(H):2 dB	Yes
S	Case 1: Rb = 1% Ra_Suburban = 5% Ra_Urban = 10% Case 2: Rb = 3% Ra_Suburban = 20% Ra_Urban = 45%	Yes (0.003 BS sectors per km^2)	Full visible area	No	Rec. ITU-R P.2108 for all base stations below rooftop	#1(G)	No	Yes (3 dB)	Case 1: −6.5 to −3.4 dB Case 2: +4 to +7.1 dB	Case 1: −7 to −10.1 dB Case 2: −17.5 to −20.6 dB	No
T	Case 1: Rb = 1% Ra_Sub = 5% Ra_Urb = 10% Case 2: Rb = 3% Ra_Sub = 20% Ra_Urb = 45%	Yes (0.003 BS sectors per km^2)	Full visible area. Excludes BSs in Region 3.	No	Rec. ITU-R P.2108 for all base stations below rooftop	#12(G) # MWI00000 (AP**30B**)	No	No	(G): Case 1: −6 dB Case 2: +4.6 dB (AP**30B**): Case 1: −8.5 dB Case 2: +2 dB	(G): Case 1: − 4.5 dB Case 2: −15.1 dB (AP**30B**): Case 1: −2 dB Case 2: −12.5 dB	No

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjust-ment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Appor-tionment of FSS protection criterion	Study results		Sharing feasible
									I/N levels with respect to the FSS criterion, dB	Interference margin***	

* Beam designators: G: Global, H: Hemispherical (Hemi), Z: Zone, S: Spot

** The total integrated gain (TIG) of an antenna represents the integration of the antenna gain over the entire radiated sphere and is equal to unity for a loss-less antenna for the conservation of energy.

*** Positive margin indicates interference is lower than the protection criterion.

**** Two interim clutter loss models were used in studies:

- Some of them implemented Recommendation ITU-R P.2108 clutter model with extrapolation to frequencies below 10 GHz.
- Some other implemented the clutter loss model in “Annex 6 to Doc. 3K/178”.

ITU-R continues to complete the clutter loss model.

Note: Terms ‘1 BS sector’ and ‘1 BS’ are the same.

The FSS protection criteria (corresponding to the total *I*/*N* contributions present at the satellite station receiver) in this frequency band are, for the long-term, −10.5 dB *I*/*N* (exceeded up to 20% of time) and, for the short-term[2], −6 dB *I*/*N* exceeded 0.03% and −2.33 dB *I*/*N* exceeded 0.001% of time.

There are a total of 17 studies assessing the interference from IMT stations into FSS space stations in a geostationary orbit and using satellite carriers and protection criteria specified by the responsible ITU-R group. These studies cover the different satellite carriers classified as global beam, hemi beam, zone beam and spot beam.

Studies have shown that long-term interference is the limiting case, and therefore those results are used for the summary and comparison of the studies.

The main assumptions for these studies are identified in Table 1/1.2/3-1.

Global beam

Among the 16 studies assessing the global beam (carrier #1, #7 and #12):

– Studies A, B, D, H, I, J, K, L, M, Q, R found that the long-term protection criterion is met with *I*/*N* values and interference margins as provided in Table 1/1.2/3-1.

– Studies E, F, G, S, T found that the long-term protection criterion is not met with *I*/*N* values and interference margins as provided in Table 1/1.2/3-1.

Hemi beam

Among the 8 studies assessing the hemi beam (carrier #2):

– Studies B, H, M, Q, R found that the long-term protection criterion is met with *I/N* values and interference margins as provided in Table 1/1.2/3-1.

– Studies E, F, G found that the long-term protection criterion is not met with *I/N* values and interference margins as provided in Table 1/1.2/3-1.

Zone beam

Among the 5 studies assessing the zone beam (carrier #3 and #8), Studies A, B, H, J, M found that the long-term protection criterion is met with *I/N* values and interference margins as provided in Table 1/1.2/3-1.

Spot beam

Among the 6 studies assessing the spot beam (carrier #4 and #12)

– Studies M, Q, L found that the long-term protection criterion is met with *I/N* values and interference margins as provided in Table 1/1.2/3-1.

– Studies C, F, G found that the long-term protection criterion is not met with *I/N* values and interference margins as provided in Table 1/1.2/3-1.

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[2] It is noted that the short-term FSS protection values were put forward by the ITU-R Working Party in charge of the FSS to facilitate the work for WRC-23 agenda item 1.2 as it had not completed its work in developing short-term protection criteria and these values may evolve prior to or after WRC-23.

Appendix 30B

Ten studies evaluated the interference to 14 FSS allotments from Appendix **30B** of the Radio Regulations. These carriers were not directly provided by the ITU-R Working Party in charge of the FSS and were considered from the RR. Among these studies:

– Studies A, J, M, N, P, Q, R found that the long-term protection criterion is met with *I*/*N* values and interference margins as provided in Table 1/1.2/3-1.

– Studies E, F, T found that the long-term protection criterion is not met with *I*/*N* values and interference margins as provided in Table 1/1.2/3-1.

1/1.2/3.2.3.1.1.2 Additional study submitted to CPM23-2

One additional study (Study U) was submitted to CPM23-2 (see Doc. CPM23-2/215) and was not fully reviewed. Using the Ra Rb method, Study U concluded that, for the Global beam Carrier #12, the long-term protection criterion is met when IMT network density is based on Ra1Rb1, and not met otherwise**.** For Hemi beam Carrier #2 and for Spot beam Carriers #4 and #12, it found that the long-term protection criterion is not met. *I/N* values and interference margins are provided in Table 1/1.2/3-1.

Different views were expressed regarding the summary of this study.

View 1: This study presents balanced results on sharing feasibility. It shows sharing is possible under certain assumptions and not possible under others. This study considered 432 parameter combinations (18 orbital slots, 4 satellite carriers, 6 IMT densities) and demonstrated the sensitivity of interference to these parameters.

View 2: The new study was based on arbitrary assumptions and their results were not reviewed or verified during the ITU-R CPM23-2. A number of assumptions in the study are not in line with the IMT parameters agreed by the expert group. These include high proportions of IMT base stations deployed in rural areas (uncharacteristic of IMT deployments at 6 GHz), macro-cell sizes which are considerably greater than agreed (inconsistent with IMT performance at 6 GHz), and a number of considered spot and multi-spot satellite orbital slots which correspond to very low elevation angles of the satellite when viewed from the centre of the footprint on the Earth (inconsistent with FSS service provision in practice). This new study may not provide sufficient basis for regulatory methods.

TABLE 1/1.2/3-1 (see also section 1/1.2/3.2)

Summary of key differences in assumptions and results of the studies

Study	IMT BS deployment parameters for large areas (Ra/Rb)	Rural scenario (optional)	Area of study	Adjustment of Rb	Clutter-loss model****	Satellite carriers*	Adjustment for FSS antenna pattern**	Apportionment of FSS protection criterion	Study results		Sharing feasible
									I/*N* levels with respect to the FSS criterion, dB	Interference margin***	
U	Ra1Rb1: Ra_urb = 10% Ra_sub = 5% Rb = 1% Ra1Rb2: Ra_urb = 10% Ra_sub = 5% Rb = 3% Ra2Rb1: Ra_urb = 45% Ra_sub = 20% Rb = 1% Ra2Rb2: Ra_urb = 45% Ra_sub = 20% Rb = 3%	No	Full visible area excluding R2 and R3	No	Rec. ITU-R P.2108	#2 #4 #12 (global) #12 (spot)	Yes (applied outside the HPBW to simulate efficiency of –2.6 dB (55%) for hemi/ spot and 1.5 dB (70 %) for global beam antennas)	No	Ra1Rb1: Global: −15.7 to −12 dB Hemi: −13.1 to −6.6 dB Spot: −15.4 to −2.3 dB Ra1Rb2: Global: −10.9 to −7.3 dB Hemi: −8.3 to −2 dB Spot: −10.9 to 2.3 dB Ra2Rb1: Global: −9.4 to −5.6 dB Hemi: −6.7 to −0.3 dB Spot: −9.3 to 4 dB Ra2Rb2: Global: −4.6 to −0.8 dB Hemi: −1.9 to 4.4 dB Spot: −4.6 to 8.7 dB	Ra1Rb1: Global: 1.5 to 5.2 dB Hemi: −3.9 to 2.6 dB Spot: −8.2 to 4.9 dB Ra1Rb2: Global: −3.2 to 0.4 dB Hemi: −8.5 to −2.2 dB Spot: −12.8 to 0.4 dB Ra2Rb1: Global: −4.9 to −1.1 dB Hemi: −10.2 to −3.8 dB Spot: −14.5 to −1.2 dB Ra2Rb2: Global: −14.5 to −6.1 dB Hemi: −14.9 to −8.6 dB Spot: −19.2 to−5.9 dB	Depends

* Beam designators: G: Global, H: Hemispherical (Hemi), Z: Zone, S: Spot

** The total integrated gain (TIG) of an antenna represents the integration of the antenna gain over the entire radiated sphere and is equal to unity for a loss-less antenna for the conservation of energy.

*** Positive margin indicates interference is lower than the protection criterion.

**** Two interim clutter loss models were used in studies.

- Some of them implemented Recommendation ITU-R P.2108 clutter model with extrapolation to frequencies below 10 GHz.
- Some other implemented the clutter loss model in “Annex 6 to Doc. 3K/178”.

ITU-R continues to complete the clutter loss model.

Note: Terms ‘1 BS sector’ and ‘1 BS’ are the same.

Sensitivity analysis

Study H additionally considered a sub-array configuration for the IMT base station antenna. Comparison of coexistence between the baseline single element and the sub-array model shows that while there is a reduction in margin in some cases, in other cases the margin slightly increases in comparison with the single element configuration. Specifically, for the cases where the footprint area corresponding to low elevation angles are large, the sub-array configuration provides additional margin as compared to the baseline single element case.

Study O examined the $E_b/(N_o+I_o)$ and $C/(N + I)$ criteria for the global beam carrier #7 and the zone beam carrier #8 of end-to-end transparent transponders link taking into account the wanted signal, modulation, and code rate. For the worst-case scenario of the GSO transponder links with minimum output powers and the earth stations located on the borders of the footprint the degradation of the signal-to-noise ratio of a wanted link is less than 0.1 dB and the bit error rate (BER) of different links is less than 10^{-6} for QPSK modulation. Therefore, this study concluded that the deployment of IMT-2020 systems will not have any negative impact on the real performance of the FSS (Earth-to-space) network.

Study U studied, in addition to the Ra Rb method, IMT deployment density using a BS distribution based on population density using data from networks in one country. In this additional method to model deployment density rural IMT deployments are considered, and the results confirmed the findings from the baseline studies using the Ra Rb method.

1/1.2/3.2.3.1.2 FSS downlink (6 700-7 075 MHz)

All studies carried out indicated that separation distances are required in order to protect the operation of non-GSO FSS earth stations. These separation distances range between a few kilometres to tens of kilometres. These protection distances are site specific and depend on several elements such as the propagation parameters, local terrain topography, surrounding clutter (including vegetation losses as appropriate e.g. during the seasonal changes) station and orbital parameters of the non-GSO system, and satellite selection strategy.

The minimum elevation angle should be treated with care to distinguish between the acquisition phase and communication phase taking into account the FSS DL receiver characteristics for each phase.

1/1.2/3.2.3.2 FS

Several sharing and compatibility studies between the FS and IMT in the frequency band 6 425-7 125 MHz were performed in ITU-R as detailed below.

Studies found that the separation distance is necessary for the coexistence between two systems.

1) Four studies used Monte-Carlo approach using the typical parameters considering a cluster of IMT cells found that:
   - For the FS antenna main lobe interference scenario, the required separation distance ranged from 10 to 68 km, while the required separation distance ranged from 1 to 10 km in the FS side lobe interference scenario.
   - Two sensitivity analyses using a C/I criterion found that the separation distances will be from 1.5 to 43 km for the main lobe scenario and less than 1.5 km for the side lobe scenario.
   - One sensitivity analysis considered an IMT antenna with sub-array configuration resulting in separation distances of 44 to 58 km for the main lobe scenario and less than 3 km for the side lobe scenario.

2) One study used deterministic calculation and found that separation distance is 59 km when the IMT BS is placed inside the clutter, but increasing up to 122 km for the worst-case scenario when IMT BS is located above clutter using example of typical values for FS point-point system parameters provided by the responsible ITU-R group. Further analysis without clutter using worst-case FS system parameters provided in Recommendation ITU-R F.758-7 indicate that the separation distance can go up to 200 km. The worst-case parameters include FS antennas with 46/47.4/48.6 dBi antenna gain that are rarely used in actual deployment. Usage of the long-term criteria of −10 dB (no more than 20% of the time) in a deterministic calculation study is not agreed by all administrations.

All the separation distances above mainly depended on the coexistence scenario, ways to account for clutter losses and propagation losses. The separation distance might be further reduced in actual deployment by considering mutual positioning of the elements (back lobe vs main lobe scenario) and locating the IMT BS within the clutter.

The studies summarized above showed that co-channel coexistence between IMT and the fixed service can be achieved but would require site-by-site coordination if IMT and FS are deployed in the same or in adjacent geographical areas.

1/1.2/3.2.3.3 SOS (7 100-7 155 MHz)

Three studies carried out aggregate interference calculations into non-GSO SOS satellite network (System C) from IMT network.

Study A comprising of macro urban base stations, micro urban base stations, macro suburban base stations, macro rural base stations, results in maximum C/I 11 and 12.3 dB for Mode 1 and Mode 2. Based on assumptions of the study negative C/I margin may exceed 1% of time, when the SOS link is operational, which does not satisfy SOS protection criteria.

Study C has repeated Study A and demonstrated that C/I would exceed 20 dB meeting the protection criteria with margins of larger than 9 dB for Mode 1 and Mode 2, respectively. The study considered maximum power at the transmitting earth station, longest slant path, Ra1Rb3 parameters to calculate the number of transmitting BSs in the service areas for Mode 1 and Mode 2. Clutter loss has been applied to all IMT BSs in the urban and suburban area.

Study B carried out Monte-Carlo simulations to assess aggregate interference into GSO SOS satellite system (System D) from IMT urban/suburban/rural macro-BS deployment results resulted in minimum C/I = 22 dB for 45 dBi and minimum C/I = 27 dB for 50 dBi SOS ES antenna gain respectively. In this study Ra1Rb1 combination of parameters is considered to calculate the number of active IMT BSs in the simulation area.

Study D models potential interference from IMT into an SOS space station in orbit around the Earth, using Monte Carlo simulation. Based on assumptions of the study it is shown that for all of the 20 000 snapshots, a C/I = 20 dB is achievable for non-GSO SOS satellite network (System C) with the use of power control to increase e.i.r.p. in order to maintain an adequate signal-to-interference ratio, and that therefore there is no coexistence problem.

In addition, one of the studies mentioned that as allocation to SOS is only for an administration specified in RR No. **5.459** and where the communicating earth station is on the administration’s territory, it is therefore necessary to note that protection criteria should be applied during the time periods when the satellite is in operation and can be seen from the administration’s territory.

1/1.2/3.2.3.4 SRS (7 145-7 190 MHz)

Three sharing and compatibility studies between the SRS and IMT in the frequency band 6 425-7 125 MHz were performed in ITU-R as detailed below.

Studies A and B calculate the potential for interference from IMT deployments on the surface of the Earth into an SRS space station receiver, which is assumed to be in deep space in Study A and in early/return mission phase/orbit around the Earth in Study B. These studies demonstrate that there is no compatibility problem in both of these cases, with margins of around 48 dB and 44 dB between the aggregate interference and interference protection criteria for Studies A and B respectively.

Study C has assessed the potential impact from the unwanted emission of SRS (deep space) earth station into IMT receivers, assuming an unwanted emissions attenuation of 60 dBc (in a 4 kHz reference bandwidth) for the SRS transmitters, in accordance with RR Appendix **3**. The study results show that coordination distances, ranging from tens of kilometres up to 400 km, may be required to ensure the protection of IMT BS receivers below 7 125 MHz from unwanted emissions of SRS (deep space) earth station transmitters operating above 7 145 MHz.

The exact value of the required separation distances would have to be assessed, on a case-by-case basis, taking into account the specific parameters of the SRS earth station.

1/1.2/3.2.4 Frequency range 10-10.5 GHz

The frequency range 10-10.5 GHz is allocated to the EESS (active) FS, MS and RLS on a primary basis. The frequency bands adjacent to this frequency range are allocated to the EESS (active), EESS (passive), FS, MS, RAS and RLS. The details of these allocations and those of the adjacent frequency bands can be found in the Radio Regulations. See also Resolution **751 (WRC-07)** and Report ITU-R RS.2096, where applicable.

With respect to sharing between different applications within the mobile service, no contribution was received in the preparation of the draft CPM text.

1/1.2/3.2.4.1 RLS

Table 1/1.2/3-2 summarizes the parameters and assumptions used in the RLS-IMT sharing and compatibility studies.

All studies are statistical simulation using multiple entry (aggregated), and the IMT network modelling in all studies is based on Recommendation ITU-R M.2101 with variations between number of snapshots. An urban/suburban micro (outdoor) scenario was used with deployment density of 30 BSs/km^2 urban / 10 BSs/km^2 suburban, and a 20% network loading factor.

Ground-based and shipborne RLS

Some studies suggest that co-channel operation of IMT and ground-based RLS, and of IMT and shipborne RLS, operating in 10-10.5 GHz is feasible, considering the separation distance between systems.

Airborne RLS

Some studies (Studies A, B and F) assumed that the antenna of the aircraft points toward the IMT network, the exceedance of the protection criterion (0-35.57 dB) depends on several factors such as the considered radar system, separation distance of the aircraft from the IMT network or the percentile of the aggregate interference statistical distribution. It has to be noted that for Study A, the aircraft location is randomized over the IMT network within a radius of 10 km to simulate the imaging function of the airborne radar.

Some other studies (Studies A, E, G) assumed that the antenna of the aircraft can point anywhere within its scanning angles. Study A concluded on 200 km separation distance from the edge of the IMT network to meet the protection criterion. Studies A and E combined the statistics of aggregate interference for all scanning angles, while the other one (G) processed the statistics of aggregate interference per scanning angle, resulting in different exceedance of the protection criterion (e.g. more than 20 dB for specific pointing angles for 99th percentile of the radar antenna for Study G, 0-7.92 dB for Study E presents that when combining all scanning angles the probability of interference is less than 0.3% of the cases when the aircraft is 22 km away and presents that there is no interference when the aircraft is flying parallel to the coast in a typical scenario of operation).

Additional studies performed sensitivity analysis using technical and operational parameters that were not developed by contributing groups.

Some proponents used the suppression side lobe (SSL) technique in their studies, as described in document 3GPP TR 38.921 V17.1.0 (2022-03). SSL is a technique that mitigates the skyward emissions and does not mitigate the emission on the horizon. The performance and regulatory implementation aspects of this technique require further study.

Studies E and G implemented suppression side lobe of 30 dB. Study E shows that no additional isolation loss is required for some scenarios including the aircraft on the horizon of the IMT network. Study G assumed that the aircraft is only on the horizon of the IMT network.

Study H considered a moving aircraft with a rotating antenna (scanning mode) or towards the IMT network (tracking mode). In this study, the antenna pattern is based on available information from the proponent and not the mathematical model from Recommendation ITU-R M.1851 and uses the antenna characteristics from Recommendation ITU-R M.1796. Under the scenario studied, an 8 dB isolation would be required when the aircraft is in the horizon of the IMT network.

Study I assumed macro cell deployments in the frequency band. This study showed a 27.6-37.6 dB exceedance of the protection criterion when the aircraft is 165 km (horizontal distance) away from the edge of the IMT network.

View 1: The macro cell IMT deployment scenario used in Study I is not a scenario expected to be typically deployed in the 10 GHz band. Other studies that applied micro cell IMT deployments in the 10 GHz band studies are fully consistent with the deployment scenario and technical characteristics provided by the ITU-R contributing group.

View 2: WP 5B, in a liaison statement, asked WP 5D "to take into account the interference received by the radar only when pointing in the direction of the IMT deployment" in order to cover the protection of the radar system per scanning angle, in particular for those in direction of the sources of interference. In many other studies, the results were based on such an assumption, at the previous WRC as well as in the preparation of WRC-23 (e.g. radionavigation radar in 2.7-2.9 GHz under agenda item 1.4, meteorological radar in 2.7-2.9 GHz under agenda item 1.4).

View 3: When the aircraft is located close to the horizon of the IMT network, the aggregate emissions level of IMT stations is dominated by the main lobe of some BSs antenna. Thus, the Sidelobe Suppression Level (SSL) technique would not mitigate the aggregate interference from BS towards the airborne receiver. Consequently, under this configuration, any excess of interference affecting the radar cannot be accommodated by SSL as a mitigation technique, if proved to be practicable.

View 4: Although Working Party 5D agreed on deployment parameters on 10-10.5 GHz not to include macro BS as a typical one, inconsistencies among:

– *the fact that according to the objectives of such topology (providing both capacity and coverage), the deployment cannot be anything else than a typical one;*

– *the mobile industry regarding the expected IMT deployment (macro scenario was* ***the only one*** *to be addressed in a 3GPP Technical Report TR 38.921 dealing, among other, with the frequency range 10-10.5 GHz);*

– *ITU-R through CPM text regarding any alternative in one Method (6B) not limiting any Total Radiated Power (TRP) or e.i.r.p. of the BS to exclude any macro deployment,*

draw uncertainties about the future deployment expected in this frequency range. This leads the need to undertake a sharing analysis between a deployment of macro-BSs and airborne radar on a co-channel basis in 10-10.5 GHz.

View 5: The baseline studies present that when the aircraft is far from the IMT deployment or located close to the horizon of the IMT network, the sharing is feasible considering a separation distance. Furthermore, other studies show that the sidelobe suppression level (SSL) technique is applied, considering the same low elevation angle close to the horizon of the IMT network the spectrum sharing is also feasible. Therefore, there is no risk of interference in those radars considering the baseline or SSL assumption in the low elevation or close-to-the-horizon scenario. SSL provides a mitigation technique that is consistent with Recommendation ITU-R SM.1132-2, that states "… Improved side-lobe control over current antenna designs can be a technique for further facilitating sharing".

TABLE 1/1.2/3-2 (see also section 1/1.2/3.2)

	Study A	Study B	Study E	Study C	Study D	Study F	Study I	Study H	Study G
Interfering system and victim system	Micro cell IMT stations interfering with airborne radar (A12)	Hotspot (outdoor) stations interfering with following radar systems: ground-based radars (G3 and G4), other radars (G10, G11 and G12), shipborne radars (S2 and S3), airborne radars (A1, A3, A4 and A12).	Hotspot (outdoor) stations interfering with co-channel airborne radar (A12)	Hotspot (outdoor) stations interfering with co-channel ground-based radars (G4 and G11)	Hotspot (outdoor) stations interfering with co-channel shipborne radar (S2)	Micro IMT stations interfering with co-channel airborne radar (A12)	Macro cell IMT stations interfering with airborne radar (A12)	Micro IMT stations interfering with co-channel airborne radar (A12)	Hotspot (outdoor) stations interfering with co-channel airborne radar (A12)
Methodology	aggregated interferes from IMT BS stations	aggregated interferes from IMT BS and UE stations	aggregated interferes from IMT BS and UE stations	aggregated interferes from IMT BS and UE stations	aggregated interferes from IMT BS and UE stations	aggregated interferes from IMT BS stations	aggregated interferes from IMT BS stations	aggregated interferes from IMT BS stations	aggregated interferes from IMT BS stations
Number of snapshots	100 000	500 000	10 000	10 000	10 000	100 0000	100 000	Nb samples × Nb aircraft positions = 200 × 5 420 = 1 084 000	10 000
Topology of IMT network	Scenario A: One IMT cluster with 19 sites. Scenario B: IMT hotspot base stations are randomly distributed in 200 km × 200 km = 40 000 km^2, Each base station serves 3 UEs simultaneously.	Ground-based radars and shipborne radars: IMT hotspot base stations are randomly distributed in 50 km^2. Airborne radars: IMT hotspot base stations are randomly distributed within 50 km^2, 300 km^2 Each base station serves 3 UEs simultaneously.	IMT hotspot base stations are randomly distributed within 50 km^2. Each base station serves 3 UEs simultaneously. Scenario A: aircraft is positioned towards the continent at a distance of 22 km from the IMT topology border.	IMT hotspot base stations are randomly distributed within 50 km^2. Each base station serves 3 UEs simultaneously. Scenario: the fixed radar position with main beam towards the IMT topology.	IMT hotspot base stations are randomly distributed within 50 km^2. Each base station serves 3 UEs simultaneously. Scenario: the fixed radar position with main beam towards the IMT topology.	IMT hotspot base stations use population density criterion to distribute within 1 138.4 km^2 including 200 km^2 of urban, 67.8 km^2 of suburban R_b= 100%, 870.6 km^2 with R_b= 5%. Each base station serves 3 UEs simultaneously.	IMT macro base stations use population density criterion to distribute within 1 138.4 km^2 including 200 km^2 of urban, 67.8 km^2 of suburban R_b=100%, 870.6 km^2 with R_b=5%. Each base station serves 3 UEs simultaneously.	IMT hotspot base stations use population density 14 500, 7 000, 100 inhabitants/km^2 for urban (R_b= 100%), suburban (R_b= 100%), suburban (R_b= 5%). Surface urban ∈ 627.3 ... 718.4 km Surface suburban (R_b= 100%)	IMT hotspot base stations are randomly distributed within 100 km^2. Each base station serves 3 UEs simultaneously. Aircraft is positioned towards the continent at a distance of 22 km from the IMT topology border.

	Study A	Study B	Study E	Study C	Study D	Study F	Study I	Study H	Study G
			Scenario B: aircraft is flying parallel to the continent. Scenario E: Aircraft positioned in 5 different distances pointing the radar antenna towards the IMT topology			Scenario: radar is located at (43.75°W, 23.55°S).	Scenario: radar is located at (43.75°W, 23.55°S).	∈ 1 380 ... 1 604 km Surface suburban (R_b = 5%) ∈ 16 480 ... 20 180 km Each base station serves 3 UEs simultaneously. Scenario: radar is moving	
Ra	Scenario B: 7% Urban 3% Suburban	7% Urban 3% Suburban	7% Urban 3% Suburban	7% Urban 3% Suburban	7% Urban 3% Suburban	7% Urban 3% Suburban	45% Urban 20% Suburban	7% Urban 3% Suburban	7% Urban
Rb	Scenario B: 2.5% (option 2)	100%	100%	100%	100%	100%	100% for 200 km^2 of urban, 67.8 km^2 of suburban 5% for 870.6 km^2 of suburban	100% for 627.3 ... 718.4 km 100% for 1 380 ... 1 604 km Surface suburban: 5% for 16 480 ... 20 180 km	100%
TDD activity factor	75% BS 25% UE	75% BS 25% UE	75% BS	75% BS	75% BS	75% BS	75% BS	75% BS	75% BS
Radar antenna height	10 000 m for airborne radars.	15 m for ground-based radars. 20 m for shipborne radars. 12 000 m for airborne radars.	10 000 m for airborne radar	6 m for ground-based radars.	15 m for shipborne radar.	9 000 m for airborne radar.	9 000 m for airborne radars.	9 000 m for airborne radars.	10 000 m for airborne radar
Antenna side-lobe (SL) levels (1st SLs and remote SLs)	14-19 dB below peak gain	A12:14-19 dB below peak gain	A12: 14-19 dB below peak gain	G11: 22 dBi at 3 degrees	S2: 23 dBi at 3 degrees	A12: 14-19 dB below peak gain	A12: 14-19 dB below peak gain	A12: 14-19 dB below peak gain	A12: 14-19 dB below peak gain

	Study A	Study B	Study E	Study C	Study D	Study F	Study I	Study H	Study G
Predict transmission loss between stations on the surface of the Earth		Rec. ITU-R P.2001. Time percentage: 50%, 10%		Rec. ITU-R P.452. Time percentage: 20%	Rec. ITU-R P.452. Time percentage: 20%				
Predict transmission loss between airborne stations and stations on the Earth's surface	Rec. ITU-R P.528. Time percentage: 5%, 10%.	Rec. ITU-R P.528 Time percentage: 50%, 10%	Rec. ITU-R P.528. Time percentage: 50%, 10%			Basic loss: Free space ITU-R P.525. / Rec. ITU-R P.528. Time percentage: 5%, 10%.	Basic loss: Free space ITU-R P.525. /Rec ITU-R P.528. Time percentage: 5%, 10%.	**Scanning mode:** Basic loss: free space ITU-R P.525. /Rec ITU-R P.528. Time percentage: 5%, 10%. **Tracking mode:** Rec ITU-R P.528. Time percentage: 10%.	Recommendation ITU-R P.528. Time percentage: ~~50%~~, 10%
Prediction of clutter loss	Rec. ITU-R P.2108 model with the percentage of locations value of 50%	Rec. ITU-R P.2108-1 for slant path model. Location percentage: range of 0% <p<100%.	Rec. ITU-R P.2108 model and 3K/178 model with the location percentage range of 0%<p<100%	Rec. ITU-R P.2108 (updated document 3/41) model with the location percentage range of 0%<p<100%	Rec. ITU-R P.2108 (updated document 3/41) model with the location percentage range of 0%<p<100%	Rec. ITU-R P.2108 model and 3K/178 model	Rec. ITU-R P.2108 model and 3K/178 model with random percentage of locations 0% <p<100%.	**Scanning mode:** Rec. ITU-R P.2108 model and 3K/178 model with random percentage of locations 0% <p<100%. **Tracking mode:** 3K/178 model with random percentage of locations 0% <p<100%.	Rec. ITU-R P.2108 model percentage of locations: Scenario 1: p = 50% Scenarios 2, 3, 4: 0% < p < 100%.

	Study A	Study B	Study E	Study C	Study D	Study F	Study I	Study H	Study G
Antenna pattern	M.1851 Uniform distribution	Antenna pattern for both digital beamforming antennas and uniform antennas with 42 dBi peak gain (see Rec. ITU-R M.1851) are considered for A12.	Rec. ITU-R M.1851 (Beamforming antenna pattern: 42 dBi of gain for Radar A12)	Rec. ITU-R M.1851 (Parabolic antenna pattern: 42.2 dBi of gain for system G4 and 42 dBi for system G11)	Rec. ITU-R M.1851 (Parabolic antenna pattern: 43 dBi of gain for System S2)	3 dB contour of the main lobe of 42 dBi	3 dB contour of the main lobe of 42 dBi	Whole pattern 35 dBi peak gain $\varphi_{3dB} = \theta_{3dB} =$ 2.8°	Whole pattern 35 dBi peak gain $\varphi_{3dB} = \theta_{3dB} =$ 2.8°

1/1.2/3.2.4.2 EESS (active) (10-10.4 GHz)

Table 1/1.2/3-3 summarizes the parameters and assumptions used in the EESS (active)-IMT sharing and compatibility studies.

TABLE 1/1.2/3-3 (see also section 1/1.2/3.2)

	Study A	Study B	Study C	Study D	Study E
SAR antenna gain	The real satellite gain calculated by Rec. ITU-R RS.2043	The real satellite gain calculated by Rec. ITU-R RS.2043	The real satellite gain calculated by Rec. ITU-R RS.2043	The real satellite gain calculated by Rec. ITU-R RS.2043	Antenna peak gain in main beam area and the real satellite gain for each BS in the visibility area.
SAR antenna efficiency factor	0 dB within main beam 1.77 dB outside of main beam	0 within main beam 1.77 outside of main beam	1.77	1.8	2 dB but already taken is the gain of element gain
IMT deployment	Micro and macro cell as sensitivity analysis[1]	Micro cell	Micro cell	Micro cell	Micro cell and macro cell as sensitivity analysis[1]
IMT antenna normalization	Yes, depending on the pointing direction	No	No	No	No
SAR look angle	50°, 35° and 18°	**Methodology A:** 50° **Methodology B:** At each iteration the SAR beam will be randomly pointing within 18 to 50°.	18° and 50° respectively.	**Methodology 1:** 18°, 35° and 50° **Methodology 2:** randomly 18 to 50°	**From 18° to 50°**
Study area	Area of 2 000 km^2 centred around satellite main beam footprint	3 dB SAR satellite beamwidth	**Area 1:** Spot area of 50 km² and 340.7 km² for 18° and 50° respectively. **Area 2:** The area of 8 510 345.358 km²	Swath area of 455 km².	Study 1 – Main beam of the EESS Satellite Study 2 – Satellite visibility area (higher than 0° elevation)
R_b in the study area	100% for dense urban and suburban areas 1% for areas larger than 1 000 km^2	100%	1% in visibility area and 100% in spot beam area.	100%	**Area 1:** 100% **Area 2:** 100% in main beam and 1% in other area.
Nb of BS in the study area	**4 operators** **Micro deployment:** 63*4 urban BS are transmitting simultaneously co-frequency in Z1 36*4 suburban BS in Z2 and 4*4 urban and suburban BS in Z3 (considering a	**4 operators** 264 co-frequency BS (232 urban BS and 64 suburban BS) for a 20% network load factor	**4 operators** 420 and 1 849 hotspots deployed in the spot area for 18° and 50° respectively.	**4 operators** 63*4 urban BS are transmitting simultaneously co-frequency in a dense urban area and 11*4 suburban BS in a dense suburban area (considering a 20% loading factor).	**1 operator** **Area 1:** 20 to 84.6 BSs **Area 2:** 200 000 BSs

	Study A	Study B	Study C	Study D	Study E
	20% loading factor). **Macro deployment:** 63*4 urban BS are transmitting simultaneously co-frequency in Z1 26*4 suburban BS in Z2 and 3*4 urban and suburban BS in Z3 (considering a 20% loading factor).				
UEs	No	No	Yes	YES	Yes
Clutter-loss model	P.2108	P.2108	P.2108 3K/178 as sensitivity analysis[1]	P.2108 3K/178 as sensitivity analysis[1]	P.2108
Protection criteria	−6.22 dB	−6.22 dB	−6 dB	−6 dB	−6 dB

The aggregate interference into an EESS (active) satellite hosting a synthetic aperture radar (SAR) by IMT-2020 BS deployment within the main beam of that SAR satellite when pointing towards a dense area such big cities has been estimated.

Five studies evaluated the sharing and compatibility between IMT and EESS (active) operating in 10-10.4 GHz.

Studies A and C have been evaluating the static aggregate interference whereas Studies B, D and E have been evaluating both static aggregate interference and dynamic interference. The following Table provides a summary of the conclusion of these studies with regards to baseline scenario.

Study	Exceedance of protection criteria		
	Static aggregate interference		Dynamic interference (dynamic look angle)
	look angle fixed to 18°	look angle fixed to 50°	
Study A	5.31 dB	11.5 dB	N/A
Study B	N/A	11.22 dB	10.55 dB
Study C	0.96 dB	8.15 dB	N/A
Study D	2.56 dB	8.03 dB	5.29 dB
Study E	5 dB	11 dB	8.6 dB

Various studies show that for the baseline scenario the interference from IMT into EESS (active) service exceeds the required protection criteria by 0.96 to 5.31 dB and 8.03 to 11.5 dB for the fixed beam look angle of 18 and 50 degrees, respectively. The interference exceeds the required protection criteria by 5.29 to 10.55 dB, if a dynamic beam look angle is taken into account. No aeronautical mobile stations deployments are foreseen in that band.

The impact of user equipment emission into the SAR satellite receiver is negligible.

It is noticed that EESS active RF bandwidth is 1 200 MHz (i.e. 9.2-10.4 GHz) according to Recommendation ITU-R RS.2043, all studies evaluated the interference into EESS active operations in the frequency band 10-10.4 GHz.

Taking into account the baseline scenario, the results of all studies show that there is a high risk of interference into EESS active operations in the frequency band 10-10.4 GHz from Region 2 IMT-2020 deployments and therefore sharing is not feasible.

Note: Additional studies performed sensitivity analysis using technical and operational parameters that were not developed by contributing groups.

Study D performed sensitivity analysis using Document 3K/178 model, the results show that the protection criteria of EEES (active) would be exceeded by −0.41 dB and 5.31 dB for the fixed look angle of 18° and 50° respectively, and 2.06 dB for the dynamic look angle from 18° to 50°.

Studies A and E performed additional sensitivity analysis assuming macro cell deployments in the band. These two studies show that the protection criteria of EESS (active) would be exceeded by 10.5 to 20 dB depending on the satellite beam look angle (respectively 18° to 45°).

Studies A and C also developed sensitivity analysis implementing suppression side lobe of 30 dB showing that sharing could be feasible if this mitigation technique is implemented. This technique is described in the document 3GPP TR 38.921 V17.1.0 (2022-03) for the next IMT networks, based on the industry perspective. The performance and regulatory implementation aspects of this technique requires further studies.

View 1: The macro cell IMT deployment scenario used in EESS (active) Studies A and E is not a scenario expected to be typically deployed in the 10 GHz band. Other studies that applied micro cell IMT deployments in the 10 GHz band studies are fully consistent with the deployment scenario and technical characteristics provided by the ITU-R contributing group.

View 2: Although Working Party 5D agreed on deployment parameters on 10-10.5 GHz not to include macro-BS as a typical one, inconsistencies among:

– *the fact that according to the objectives of such topology (providing both capacity and coverage), the deployment cannot be anything else than a typical one;*

– *the mobile industry regarding the expected IMT deployment (macro scenario was the only one to be addressed in a 3GPP Technical Report TR 38.921 dealing, among other, with the frequency range 10-10.5 GHz);*

– *ITU-R through CPM Text regarding any alternative in one Method (6B) not limiting any Total Radiated Power (TRP) or e.i.r.p. of the BS to exclude any macro deployment,*

draw uncertainties about the future deployment expected in this frequency range. This leads the need to undertake a sharing analysis between a deployment of macro BSs and airborne radar on a co-channel basis in 10-10.5 GHz.

1/1.2/3.2.4.3 EESS (passive) (10.6-10.7 GHz)

Four different studies have been developed to address the compatibility between IMT in the frequency band 10-10.5 GHz and EESS (passive) in the frequency band 10.6-10.7 GHz. Table 1/1.2/3-4 summarizes all known differences in study assumptions.

TABLE 1/1.2/3-4 (see also section 1/1.2/3.2)

	Study A	**Study B**	**Study C**	**Study D**
Study area	Three different 10 million km^2 areas in Region 2	Two different 10 million km^2 areas in Region 2	Footprint size area	Footprint size area
Deployment density	Does not exceed 30 total BS in any km^2 designated as urban; does not exceed 10 total BS in any km^2 designated as suburban	Ra/Rb calculations over the study area and population based distributed in Urban and suburban areas	Ra/Rb calculations over the study area and population based distributed in urban and suburban areas	Followed the urban and suburban density of 30 and 10 BS/km^2
R_b (%)	1	1	1	If study area < 1 000 km^2, Rb=100; If study area > 1 000 km^2, Rb=5
Number of BS cells in the study area operating simultaneously \#	36 000	Total number of BS additionally considering network activity and TDD factors.	Total number of BS considering the network activity factor of 20% Total number of BS: C5: 598 C7: 488 C8: 345 C9: 506 C11: 557	C1: 140 C4: 411 C5: 120 C6: 248 C7: 97 C8: 69 C9: 101 C10: 206 C11: 111
Channel aggregation factor (dB)	0	2	0	0
EESS (passive) sensors considered by study	All sensors provided in Tables 5 and 6 in Rec. ITU-R RS.1861-1 (In-force version)	Sensor C8 from Rec. ITU-R RS.1861-1	Sensors C5, C7, C8, C9, C11 from Rec. ITU-R RS.1861-1 Remark: C8 is a planned sensor, but so far, there is no defined radiation pattern	All sensors provided in Tables 5 and 6 in Rec. ITU-R RS.1861-1 (In-force version)
Simulation dynamics	Satellite propagation and conical scanning is parameterized as a function of simulation time	Satellite propagation and conical scanning is parameterized as a function of simulation time	Accordingly Rec. ITU-R RS.1861-1	/
Limits account for simultaneous BS and UE operation?	Yes (leading to a 2.6 dB factor)	Yes (leading to a 5.5 dB factor)	No	No

Table 1/1.2/3-5 below provides the corresponding results for all studies.

TABLE 1/1.2/3-5 (see also section 1/1.2/3.2)

Study results – Unwanted TRP limits for BS (baseline) (Note 1)					
		Study A	**Study B** (Note 3)	**Study C**	**Study D**
Full array	dBW per 100 MHz	−43.0	−50.2	−44	−39.6
Single element		—	−58.9	—	−48.1
Study results – Unwanted TRP limits for BS (sensitivity analysis)					
Full array + 3K/178 clutter loss	dBW per 100 MHz	—	—	−41.6	−36.7
Single element + 3K/178 clutter loss		—	—	—	−44.8
Full array + SSL		−36.0	—	−36.5	—
Full array + 3K/178 clutter loss + SSL		—	—	−34.1	—
Study results – Unwanted TRP limits for UE (baseline) (Note 1)					
With full array BS antenna model	dBW per 100 MHz	−41.0	−46.2	−36.7	−36.3
With single element BS antenna model		—	−54.9 (Note 2)	—	—
Study results – Unwanted TRP limits for UE (sensitivity analysis)					
3K/178 clutter loss	dBW per 100 MHz	—	—	-34	-32.8

Note 1: While Recommendation ITU-R M.2101-0 states that out-of-band patterns “can be assumed to have a similar antenna pattern as a single antenna element”, the ITU-R Working Party in charge of IMT determined that for small fractional frequency offsets from the AAS operating band border (e.g. 1-2%), the best assumption is the beamformed radiation pattern as per the model in Recommendation ITU-R M.2101, with adjustment of d/λ. Further work would be necessary to model the transient radiation from beamformed to non-beamformed (single element).

Note 2: It will have to be further considered if this limit should or should not be dependent on BS OOB pattern.

Note 3: Study B uses channel aggregation factor and a factor to account for simultaneous BS and UE operation.

Per the guidance from the responsible ITU-R group, all four studies consider the beamformed radiation pattern given in Recommendation ITU-R M.2101 with adjustment of d/λ, and the resulting base station unwanted TRP limit ranges from −39.6 dBW to −50.2 dBW per 100 MHz. Additionally, the baseline results for the study of user equipment indicate that the unwanted TRP limit ranges from −36.3 dBW to −46.2/−54.9 dBW per 100 MHz.

Studies B and D further considered the single element radiation pattern given in Recommendation ITU-R M.2101 for base stations, and the resulting base station unwanted TRP limit ranges from −48.1 dBW to −58.9 dBW per 100 MHz.

Additional studies performed sensitivity analysis using technical and operational parameters that were not developed by contributing groups.

Study D used a new clutter-loss model being developed by the ITU-R contributing group, but not yet finalized, and the results show that the unwanted TRP limits relax by approximately 3 dB for both base stations and user equipment, as shown in Table 1/1.2/3-5.

Study C considered a simulation suggesting that sharing between IMT operating in the 10-10.5 frequency range and EESS (passive) service operating in 10.6-10.7 GHz (adjacent-channel) is also feasible, if the suppression side lobe mitigation technique is considered combined with the proposed spurious emissions limit of −34.1 dB(W/100 MHz). Study A determined that a base station unwanted TRP limit of −36.0 dBW per 100 MHz is needed when using the SSL technique. This technique is described in the document 3GPP TR 38.921 V17.1.0 (2022-03) for the next IMT networks, based on the industry perspective. The performance and regulatory implementation aspects of this technique requires further studies.

View: Noting:

– *that Recommendation ITU-R M.2101 states "In an adjacent frequency band situation with IMT as the interfering system, the antenna pattern for the unwanted emission can be assumed to have a similar antenna pattern as a single antenna element";*

– *that the results of the sharing studies with the single element model for the AAS show more stringent levels of unwanted emissions compared to the beamforming model;*

– *that SSL only applies for a beamforming model of the AAS.*

It is therefore not sure whether SSL can mitigate or not the emissions level of BSs in the unwanted domain as the behaviour of the real BS antenna is unknown.

1/1.2/3.2.4.4 RAS

Table 1/1.2/3-6 summarizes the parameters and assumptions used in the RAS-IMT compatibility studies.

TABLE 1/1.2/3-6 (see section 1/1.2/3.2)

	Study A	**Study B**
IMT characteristics		
BS antenna pattern	Rec. ITU-R M.2101	Rec. ITU-R M.2101
	16 × 8 and 8 × 8 with adjustment of d/λ	8 × 8 with adjustment of d/λ
BS/cells operating simultaneously	1	105
BS downtilt	6°	10°
BS height above local ground	6 m	6 m
Elevation	Varied with respect to RAS	
OOB emission	−30 dBm/MHz	−13, −30 dBm/MHz
RAS characteristics		
Gain	0 dBi	0 dBi
Reference height above local ground	25 m	25 m
Elevation	2 213 m (7 000’)	–
Protection threshold	Rec. ITU-R RA.769: −202 dB(W/100 MHz) −160 dB(W/(m^2 · Hz))	Rec. ITU-R RA.769: −202 dB(W/100 MHz) −160 dB(W/(m^2 · Hz))
Propagation		
Propagation	Line of sight Atmospheric attenuation integrated over path Recs. ITU-R P.619, P.676, P.835	Rec. ITU-R P.452, 20%

	Study A	Study B
IMT characteristics		
Clutter loss	none	Rec. ITU-R P.2108-1

Two studies were conducted. Study B considered all the parameters provided by the ITU-R contributing groups, including propagation effects, and considered a full IMT deployment over an area of 50 km^2 using 8 × 8 BS AAS antennas. The separation distance between the perimeter of the IMT deployment and a radio telescope was varied at the same geographic elevation as the radio telescope. In this case, compatibility is feasible considering the separation distance between systems IMT BS remained in direct line-of-sight.

Study A did not use all the parameters provided by the ITU-R expert group. It considered one unobstructed IMT BS 6 m above local ground using 8 × 8 and 16 × 8 AAS antennas. The geographic elevation difference between the BS and a radio telescope was varied to allow the BS to remain visible at large separation distances. Propagation was included by integrating the atmospheric attenuation along the slant path line of sight: diffraction and other effects were ignored. The IMT BS beam was electrically steered away from the azimuth of the telescope. The study identified separation distances and OOB IMT BS power densities for compatible operations under the considered conditions.

1/1.2/3.2.4.5 FS

One study was submitted for sharing of FS and IMT systems in the frequency band 10-10.5 GHz. The results suggest that sharing between IMT and fixed services (FS) operating in 10-10.5 GHz (co-channel) is feasible considering the separation distance of 28 km between systems.

1/1.2/4 Methods to satisfy the agenda item

Band (based on Res. 245 (WRC-19))	Section
1 / 3 300-3 400 MHz in Region 1	1/1.2/4.1
2 / 3 300-3 400 MHz in Region 2	1/1.2/4.2
3 / 3 600-3 800 MHz in Region 2	1/1.2/4.3
4 / 6 425-7 025 MHz in Region 1	1/1.2/4.4
5 / 7 025-7 125 MHz globally	1/1.2/4.5
6 / 10.0-10.5 GHz in Region 2	1/1.2/4.6

All methods propose suppression of Resolution **245 (WRC-19)**.

1/1.2/4.1 Band 1 – 3 300-3 400 MHz (amend footnote in Region 1)

1/1.2/4.1.1 Method 1A

This method proposes no change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**.

1/1.2/4.1.2 Method 1B

This method proposes to modify existing footnotes RR No. **5.429A** and RR No. **5.429B** to add interested Region 1 countries that are in the area defined in RR No. **5.429B** (south of 30° parallel north) to allocate the frequency band 3 300-3 400 MHz to the mobile service (except aeronautical mobile) on a primary basis and to identify it for IMT in those countries.

1/1.2/4.1.3 Method 1C

This method proposes to modify existing footnotes RR No. **5.429A** and RR No. **5.429B** including the revision of given conditions and to add interested Region 1 countries to allocate the frequency band 3 300-3 400 MHz to the mobile service (except aeronautical mobile) on a primary basis (RR No. **5.429A**) and to identify it for IMT in those countries (RR No. **5.429B**).

1/1.2/4.1.4 Method 1D

This method proposes a primary allocation to the mobile service (except aeronautical mobile) in the frequency band 3 300-3 400 MHz in interested Region 1 countries and identification of IMT through a new footnote.

Note: Resolution **245 (WRC-19)** refers only to amending an existing footnote for the frequency band 3 300-3 400 MHz in Region 1, but this method was included according to contributions of some administrations.

*View: This method does not take into account the coexistence with the radiolocation service and the results of studies showing interference issues. It contradicts the objective of Resolution **245 (WRC-19)** to ensure "the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services".*

1/1.2/4.1.5 Method 1E

This method proposes a primary allocation to the mobile service (except aeronautical mobile) in the frequency band 3 300-3 400 MHz by adding the band in the Table of Frequency Allocations for Region 1 and identification to IMT by modification of RR No. **5.429B** to apply to Region 1, and any consequent modifications to RR No. **5429A**.

Note: Resolution **245 (WRC-19)** refers only to amending an existing footnote for the frequency band 3 300-3 400 MHz in Region 1, but this method was included according to contributions of some administrations.

1/1.2/4.1.6 Method 1F

This method proposes a primary allocation to the mobile service in the frequency band 3 300-3 400 MHz by adding the band in the Table of Frequency Allocations for Region 1 and identification to IMT without any condition by adding a new footnote.

Note: Resolution **245 (WRC-19)** refers only to amending an existing footnote for the frequency band 3 300-3 400 MHz in Region 1, but this method was included according to contributions of some administrations.

*View: This method does not take into account the coexistence with the radiolocation service and the results of studies showing interference issues. It contradicts the objective of Resolution **245 (WRC-19)** to ensure "the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services".*

1/1.2/4.2 Band 2 – 3 300-3 400 MHz (Region 2)

1/1.2/4.2.1 Method 2A

This method proposes no change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**.

1/1.2/4.2.2 Method 2B

This method proposes to allocate the frequency band 3 300-3 400 MHz to the mobile service on a primary basis in Region 2 and identify it for IMT, by:

– upgrading the existing secondary mobile allocation on the Table of Frequency Allocations;

– modifying the existing RR footnote (RR No. **5.429C**) applying it only to the fixed service;

– modifying the existing RR footnote (RR No. **5.429D**) for IMT identification in Region 2, specifying that stations in the MS operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to or claim protection from systems in the RLS.

View 1: This method leads to the harmful interference of services in Region 1. This method assumes an upgrade of the existing secondary allocation of the frequency band 3 300-3 400 MHz to primary for the aeronautical mobile service in countries of Region 2 having borders with countries of Region 1, but sharing and compatibility studies of the AMS stations with the stations of other primary services of Region 1 have not been carried out by ITU-R. As a result there is no technical basis for determining the conditions for compatibility of the AMS in countries of Region 2 having borders with countries of Region 1 and incumbent services of Region 1. In addition, the agenda item aims to identify a frequency band 3 300-3 400 GHz for IMT that is used in the land mobile service and not in the aeronautical mobile service, therefore upgrade of allocation of the band 3 300-3 400 GHz to the AMS is not required, is outside of the scope of AI 1.2 and lead to the harmful interference for incumbent services of Region 1.

*View 2: Method 2B is proposed on the basis of ITU-R sharing and compatibility studies submitted in accordance with Resolution **245 (WRC-19)** that would support a primary mobile allocation and IMT identification for Region 2 while protecting those existing services that operate within that region. Relevant studies to address concerns related to a primary mobile allocation/IMT identification and protection of existing services operating for Region 1 for the 3 300-3 400 MHz are contained in Methods 1A to 1E.*

1/1.2/4.2.3 Method 2C

This method proposes to allocate the frequency band 3 300-3 400 MHz to the mobile, except aeronautical mobile, service on a primary basis in Region 2 and identify it for IMT, by:

– upgrading the existing secondary mobile allocation, except aeronautical mobile, on the Table of Frequency Allocations;

– modifying the existing RR footnote (RR No. **5.429C**) applying it only to the fixed service;

– modifying the existing RR footnote for IMT (RR No. **5.429D**) identification in Region 2, specifying that stations in the MS operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to or claim protection from systems in the RLS.

1/1.2/4.3 Band 3 – 3 600-3 800 MHz (Region 2)

1/1.2/4.3.1 Method 3A

This method proposes no change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**.

1/1.2/4.3.2 Method 3B

This method proposes to identify the frequency band 3 600-3 800 MHz for IMT in Region 2 by modifying RR No **5.434** to list the following condition:

– IMT systems shall not claim more protection from space stations than that provided in RR Table **21-4**.

In addition, conditions applicable to the MS in the frequency band equally apply to IMT.

View 1: This method does not provide protection for FSS earth stations of Region 1 countries from interference of MS/IMT stations of Region 2 countries bordering with Region 1 as this method does not propose any conditions for MS/IMT ensuring protection of FSS earth stations for long-term and short-term protection criteria.

*View 2: Method 3B is proposed on the basis of ITU-R sharing and compatibility studies submitted in accordance with Resolution **245 (WRC-19)** that would support an IMT identification for Region 2 while protecting those existing services that operate within that region. The majority of the studies have shown that the separation distances to protect FSS earth stations are small, and their protection could be considered a national matter. Issues related to the operation of radiocommunication services that are allocated and operate in accordance with the Radio Regulations in adjacent cross-border areas should be addressed bilaterally between those concerned administrations.*

1/1.2/4.3.3 Method 3C

This method proposes to identify the frequency band 3 600-3 800 MHz for IMT in Region 2 by modifying RR No. **5.434** to list the following conditions:

– pfd limit used in RR No. **5.431B** for the MS/IMT;

– IMT systems shall not claim more protection from space stations than that provided in RR Table **21-4**;

– RR Nos. **9.17**, **9.18**.

*View: This method does not provide protection for FSS earth stations of Region 1 countries from interference of MS/IMT stations of Region 2 countries bordering with Region 1 as this method proposes conditions for MS/IMT to protect FSS earth stations based only on a long-term protection criteria and does not take into account short-term protection criteria which require a much more stringent pfd limit than in RR No. **5.431B**.*

1/1.2/4.3.4 Method 3D

This method proposes to identify the frequency band 3 600-3 800 MHz for IMT in Region 2 by modifying RR No. **5.434** listing the following conditions:

– RR Nos. **9.17**, **9.18**;

– RR No. **9.21**;

– IMT systems shall not claim more protection from space stations than that provided in RR Table **21-4**;

– revised pfd limit for the MS/IMT.

*View: This method includes a proposal to replace the existing FSS long-term protection criteria condition in RR No. **5.434** with a more stringent short-term protection criteria condition that has neither been validated nor agreed to by the ITU-R contributing group.*

1/1.2/4.3.5 Method 3E

This method proposes to identify the frequency band 3 600-3 700 MHz for IMT in additional countries in Region 2 by adding names of countries to RR No. **5.434** while maintaining all existing conditions.

View: This method does not provide protection for FSS earth stations of Region 1 countries from interference of MS/IMT stations of Region 2 countries bordering with Region 1 as this method proposes conditions for MS/IMT to protect FSS earth stations based only on a long-term protection criteria and does not take into account short-term protection criteria which require a much more stringent pfd limit than in RR No. ***5.434****.*

1/1.2/4.3.6 Method 3F

This method proposes to identify the frequency band 3 600-3 700 MHz for IMT in Region 2 by modifying RR No. **5.434** while maintaining all existing conditions.

View: This method does not provide protection for FSS earth stations of Region 1 countries from interference of MS/IMT stations of Region 2 countries bordering with Region 1 as this method proposes conditions for MS/IMT to protect FSS earth stations based only on a long-term protection criteria and does not take into account short-term protection criteria which require a much more stringent pfd limit than in RR No. ***5.434****.*

1/1.2/4.4 Band 4 – 6 425-7 025 MHz (Region 1)

1/1.2/4.4.1 Method 4A

This method proposes no change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**.

Reasons: The proponents of this method believe that no change would ensure the protection of incumbent services from harmful interference due to IMT as shown in some studies. Furthermore, some administrations are planning to use this band for other applications, including planned (AP**30B**) and unplanned FSS, FS and other mobile applications.

View 1: Majority of studies done in ITU-R show that there is no risk of harmful interference to incumbent services. Plans to use the band for other applications is not a valid reason for NOC, since IMT identification has never precluded the use of any IMT identified frequency band by any application of the services to which it is allocated, and identification does not establish any priority for IMT in the Radio Regulations.

View 2: There is no agreement with the term "majority of studies" and the term "there is no risk of harmful interference to incumbent services". Consequently, use the terms "a number of studies" and "harmful interference to incumbent services is unlikely".

View 3: For the frequency band 6 425-7 025 MHz, some administrations propose NOC to the RR and suppression of Resolution ***245 (WRC-19)*** *based on the outcome of a number of ITU-R studies indicating that an IMT identification would cause harmful interference to those existing services in this band. Furthermore, some administrations are planning to use this band for other applications including RLANs. Given the extensive use of this band by existing services and applications including RLANs, and the need to protect these services/applications from harmful interference, a Region 1 IMT identification in the frequency band 6 425-7 025 MHz is not justified.*

View 4: The associated reasons with this proposed method are not correct and contradict with the results of most conducted studies under AI 1.2 for this band, which confirmed the feasibility of coexistence between IMT and other systems of incumbent services allocated within the frequency band on primary basis without any harmful interference impact. Furthermore, the use of any specific application under the services allocated in this frequency band is a national issue and is outside of the scope of this AI 1.2 and outside the mandate of ITU. It should be noted that IMT identification does not preclude the use of the band by other applications. IMT technologies can also support RLAN application under mobile service and accordingly decisions on technology or application selection are an absolute national issue.

View 5: A number of ITU-R studies have concluded that an IMT identification would cause harmful interference to the incumbent services to which this band is already allocated. Further, many administrations are already using this band for RLANs. Therefore, an IMT identification in Region 1 would cause harmful interference to the extensive use of this band by various incumbent services including RLANs.

View 6: A number of ITU-R studies indicate that an IMT identification would cause harmful interference to existing services in this band. Furthermore, some administrations are using and/or planning to use this band for other applications including RLANs. Given the extensive use of this band by existing services including RLANs, there is a need to protect these services from harmful interference. An IMT identification in Region 1 in the frequency band 6 425-7 025 MHz is not justified.

View 7: Some administrations are of the view that given the uncertainty on the outcome of the sharing studies, the co-existence of FS/FSS and RLANs services is far more critical to bridging the digital divide and providing the community-based Wi-Fi hotspot nationwide, especially for the developing world.

*View 8: A number of ITU-R technical studies indicate that an IMT implementation would cause harmful interference to existing services in this band. Even by considering a case-by-case coordination scenario between the incumbent services and IMT, there is no certainty of protection. Moreover, a case-by-case coordination scenario would result in the imposition of additional regulatory or technical constraints on the incumbent services, which would preclude their future development, as the case of the AP**30B**.*

View 9: Regarding Method A, this method is not necessary since the studies conducted in WP 5D have shown that coexistence of IMT with the incumbent services is possible.

1/1.2/4.4.2 Method 4B

This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote associated with a new Resolution without any additional conditions or constraints to the IMT deployment other than those existing in the Radio Regulations.

View 1: This method reflects the results of the majority of studies done in ITU-R which indicated that there is NO harmful interference to incumbent services and does not require any coordination or exclusions zones. Accordingly, the results of the studies confirmed that there is no need for imposing any additional regulatory or technical constraints on the mobile service, in particular IMT, which would not impact or preclude current deployments or future development of incumbent services.

*View 2: The proposed Method 4B is not consistent with Resolution **245 (WRC-19)** which recognizes that any identification of frequency bands for IMT should take into account the use of the frequency bands by other services and the evolving needs of these services, and resolves to conduct sharing and compatibility studies with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis. Hence, an identification for IMT without any conditions will not ensure the protection of the incumbent services since it is neither taking into consideration the result of the technical studies nor the evolving needs of these services. Furthermore, all studies have shown a need for protection distances for FSS (downlink) and FS, neither of which are captured in this method. In consequence, this method should be deleted.*

View 3: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the resolution should contain some recognition of these other applications in the mobile service.

View 4: This method does not recognize the need to contain conditions for protection of incumbent services. This view is based on the text of Resolution ***245 (WRC-19)****, which recognizes the need to consider protection of the incumbent services, and in the divergence in the results of the studies presented during the study cycle.*

The conditions to protect the incumbent services contained in Article ***21*** *may not be sufficient to guarantee operation of those services under the deployment scenarios and conditions considered in this agenda item.*

Therefore, the method should not be considered during WRC.

View 5: Resolution ***245 (WRC-19)*** *is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution* ***245 (WRC-19)****. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other applications of the mobile service at national level.*

1/1.2/4.4.3 Method 4C

This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution.

Concerning the protection of FSS uplink, there are several alternatives for regulatory conditions under this method.

Alternative 1: Pointing restrictions and power or TRP restriction (see Example 1 in *resolves* 2, of the draft new Resolution [A12-6 GHz])

In this alternative, IMT stations would be subject to pointing restrictions to avoid any pointing above the horizon or towards the GSO. In addition, the power or the TRP would be limited to 13 dBW, which is the value of Article **21.5**, which is consistent with the ITU-R studies (Study I) carried out with intermediate assumption for base station density (Ra_suburban = 20%; Ra_urban = 45%; Rb = 1%).

Alternative 2: Limit on the expected e.i.r.p. (see Example 2, 3, 4 in *resolves* 2 of the draft new Resolution [A12-6 GHz])

The technical conditions are expressed as limits on expected equivalent isotropically radiated power (e.i.r.p.), in dBm/MHz or dBm/100 MHz, emitted by an IMT base station as a function of vertical angle above the horizon. Expected e.i.r.p. is the relevant and correct metric for technical conditions on IMT base stations when considering aggregate interference towards the satellite and is in-line with the sharing studies conducted by the responsible ITU-R working group. Since this is a limit on the emissions above the horizon, there is no need for any limits on TRP.

Three examples are provided with limits based on the expected e.i.r.p. The proposed limits are derived based on Study Q for Example 2, Study K for Example 3 and Study J for Example 4 outlined in the section "Summary and analysis of the results of ITU-R studies" of the draft CPM Report to WRC-23. All the three studies of Q, K and J use (Ra_suburban = 5%; Ra_urban = 10%; Rb = 1%).

Alternative 3: Maximum e.i.r.p. mask and base station density limit (see Example 5 in *resolves* 2 of the draft new Resolution [A12-6 GHz])

Example 5 proposes a limit on the maximum e.i.r.p. of the IMT base station, for angles above the horizontal, and a limit on the density of IMT base stations. Both technical conditions would be necessary to ensure that the aggregate interference at the FSS space stations is maintained to an acceptable level. It is proposed to limit the *maximum* (rather than average) e.i.r.p. radiated by the base station, since that allows for the checking of compliance from an operational base station, which would not be possible with an average limit. The limits are based on the results for Study G (Ra_suburban = 20%; Ra_urban =45%; Rb = 3%).

The proposed base station density limit applies to the *average* density throughout the territory of the administration. A limit consistent with the assumptions made in the ITU-R studies (Ra_suburban = 5%; Ra_urban =10%; Rb = 1%) leads to a density limit of 0.0037 BSs/sq km (which is equal to 0.0112 BS sector/sq km). As an example, a country of area of 1 m sq km would be limited to 3 700 base stations (11 000 base station sectors) per 100 MHz bandwidth, deployed anywhere throughout their territory.

*View 1: This method does not reflect the results of some ITU-R studies that have indicated that an IMT identification would cause harmful interference to existing services in this band, or requires coordination and exclusions zones that would result in the imposition of additional regulatory or technical constraints on incumbent services, which would preclude their future development, as the case of the AP**30B**.*

*View 2: This method reflects the results of the majority of studies done in ITU-R which indicated that there is NO harmful interference to incumbent services and does not require any coordination or exclusions zones. Accordingly, the results of the studies confirmed that there is no need for imposing any additional regulatory or technical constraints on the mobile service, in particular IMT, which would not impact or preclude current deployments or future development of incumbent services, including those in the AP**30B**.*

View 3: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the Resolution should contain some recognition of these other applications in the mobile service.

View 4: There was a proposal to identify the frequency band 6 425-7 025 MHz for countries in Region 3 for IMT at WRC-23 during CPM23-2. Identification of 6 425-7 025 MHz for IMT at WRC-23 is essential for countries in Region 3 to support the future development of IMT. The existing ITU-R sharing and compatibility studies provide a good justification for identifying 6 425-7 075 MHz for IMT for countries in Region 3 at WRC-23. The sharing studies were conducted based on service allocation covering both 6 425-7 025 MHz and 7 025-7 125 MHz. Take FSS uplink (7 025-7 125 MHz) for example, the sharing studies for FSS uplink are conducted for 6 425-7 075 MHz for all Regions, rather than separating sharing studies for FSS uplink for 6 425-7 025 MHz for Region 1 and 7 025-7 075 MHz for global. For FSS uplink (6 425-7 075 MHz), a majority of studies have demonstrated that sharing with IMT system is feasible; within these studies, most have assumed IMT deployments in Region 3, and some studies in particular have assumed satellite orbital locations and satellite antennas pointing at Region 3. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service; however, the countries concerned should not limit the opportunity for other countries to consider this band for IMT identification and deployment. Consideration of 6 425-7 025 MHz for IMT identification for Region 3 at WRC-23 will also contribute to harmonization and economics of scale and be of benefit to other regions.

*View 5: Resolution **245 (WRC-19)** is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution **245 (WRC-19)**. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT* *identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

Views on Alternative 1

View 1-1: The proposed technical conditions would not constrain IMT base station characteristics compared with those assumed in the ITU studies, and some studies showed excessive interference based on those characteristics. There is also no proposed limitation on the number of base stations that could be deployed. Hence the limit would not provide adequate protection to FSS uplinks.

View 1-2: A limitation on TRP is difficult to apply and control in practice condition which restrict radiated power in all directions.

View 1-3: A limitation on TRP is a blunt instrument as it restricts radiated power in directions which are not relevant regarding interference towards satellites, and is therefore over-restrictive for IMT deployments.

View 1-4: The restrictions on pointing direction and output power or TRP is the easiest way to enforce protection of satellite, given the complexity of defining and controlling e.i.r.p. mask, and is based on the deployment assumptions provided for IMT.

View 1-5: In Alternative 1, some administrations did not agree to the conclusion that RR No. ***21.5*** *applies as a TRP limitation on terrestrial services, which implies a modification of the current notification process for terrestrial stations.*

Views on Alternative 2

View 2-1: There are a number of issues with the examples based on Alternative 2 and Example 2, 3, 4, as described below:

1 When deriving an e.i.r.p. mask for IMT BSs as a protection measure, it is necessary to assess the impact of aggregate interference on FSS space stations from BSs which conform to the masks. This evaluation has not been provided and hence the limit values presented in the examples have not been validated or agreed.

2 For the protection of space station receivers to be adequate, it is critical that the number of IMT BSs assumed (incorporated in the sharing studies via a density of IMT BSs) is also provided together with the e.i.r.p. 3 mask. The protection conditions proposed do not contain information or constraints on the density levels or numbers of IMT BSs that correspond to the e.i.r.p. mask that they propose.

3 The masks using “average”, “mean” or “expected” e.i.r.p. values represent the e.i.r.p. of IMT BSs in the range of 0-5 degree elevation by a single average value. This is an inaccurate representation of the actual IMT BS e.i.r.p. for IMT BSs at low elevation angle. The interference from IMT BSs at low elevation typically dominates the aggregate interference and the e.i.r.p. varies significantly with elevation angle in this range. Therefore, the granularity of the range of vertical angles should be lower than 5 degrees up to 30 degrees.

4 The use of average or mean e.i.r.p. creates ambiguity with respect to how the average power is obtained, given that the average transmitter power depends on the data traffic/resource blocks, TDD ratio, power setting of the IMT BS, among others. Furthermore, the time over which averaging is carried out is not defined, which could lead to different results for the same BS. This ambiguity could lead to false compliance for BSs which during operations would exceed the limit.

5 The proposed horizontal scanning range (+/–180 deg) may not be appropriate, considering that it is the power transmitted within the sector that dominates the *interference (typically +/–60 deg). Radiated power outside of the sector has relatively little impact and might contribute to reduce the overall average value considered for the e.i.r.p.*

6 The distribution of vertical scan angles within the vertical scan angle range is not linear – angles close to 0 deg elevation are more common than lower elevation angles. Also, the range of vertical scan angles varies depending on whether the base station is deployed in an urban or suburban environment. How is a realistic vertical scan angle distribution obtained and applied during compliance testing? How can it be assured that operation in the field will follow the same assumptions? Should a new ITU-R Recommendation dealing with appropriate procedures for compliance testing be developed?

7 The power radiated varies depending on the number of beams created by the BS, when serving multiple users simultaneously. It is not apparent how this is taken into account.

8 How is the mechanical down tilting taken into account in these proposals?

9 The average/mean/expected e.i.r.p. mask concept does not provide to regulators a clear means to develop compliance checks on operational base stations. There is no practical way for regulators to check the compliance of an operational IMT BS against the limits. Given that it would not be practical to test all possible operational configurations of a base station and all possible pointing scenarios in order to verify compliance before installation and start of operations, it would not be possible to use compliance testing as a means to guarantee protection of the incumbent FSS service.

10 Variation of e.i.r.p., the likelihood of exceedance of the mask limits, and the variance associated to that exceedance, are also parameters that may influence the impact of one or a group of base stations over a given area and at a given time. The order of magnitude of such variance, or its limit are also not clearly defined.

View 2-2: Limits applying to the expected e.i.r.p. is a new concept which needs to be more precisely detailed, e.g. in an annex of the resolution, with the objective of ensuring that administration will be able to check the conformity of an IMT station. In particular, two elements would need further considerations:

– *The averaging over beamforming direction: it is necessary to explain the assumption regarding the distribution of the beamforming direction. According to the explanation provided in Doc. 229 of CPM23-2, only discrete beamforming direction (i.e. predefined beamset) are considered and the averaging is based on a uniform distribution of the beamforming direction. This assumption may need to be confirmed.*

– *The mechanical tilting: what is important for protecting satellites is the compliance with the expected e.i.r.p. mask, which may not be the case if the antenna has upward tilting. The underlying assumption is therefore that the mechanical tilt can only be downwards or 0°.*

In addition, the mask which is proposed is based on Ra/Rb assumption which may not cover massive long term IMT deployment, and any expected e.i.r.p. mask should enable the protection of satellite taking into account more worst-case assumption such as (Ra_suburban = 20%; Ra_urban = 45%; Rb = 1%) for global beam really implemented on satellites.

View 2-3: The following points are in relation to the concerns expressed in View 2-1:

1 The metric expected e.i.r.p. is defined for a single base station. The aggregation factor considering interference from multiple base stations is taken into account when deriving the limit on the expected e.i.r.p. of a single IMT base station. The proposed limits are derived by starting from the maximum permitted aggregate interference at the satellite *receiver, and then working backwards, accounting for the contribution of various parameters including FSS antenna gain, radio propagation losses (including clutter loss), number of IMT base stations, network loading and TDD activity factor, in order to arrive at the permitted expected e.i.r.p. as a function of vertical angle above the horizon for each IMT base station. In this way, the limits are technology neutral in the sense that their derivation is not subject to any assumptions regarding the antenna configuration of the IMT base station or deployment considerations such as cell radius, and geographic distribution of IMT user equipment within the cells, etc.*

2 *The proposed limits on expected e.i.r.p. are derived based on Study Q for Example 2, Study K for Example 3 and Study J for Example 4, as outlined in the section "Summary and analysis of the results of ITU-R studies" of the draft CPM Report to WRC-23. All three studies use (Ra_suburban = 5%; Ra_urban =10%; Rb = 1%).*

3 *Plugging the proposed limits on expected e.i.r.p. back into the Monte-Carlo simulations of the relevant sharing studies indicates that the averages over vertical angle bins, e.g. the range 0-5 degrees, do not materially impact the aggregate levels of interference to the FSS uplink. This is because the values of relevant parameters, such as radio propagation losses and the satellite antenna gain, do not vary substantially within each vertical angle bin. In particular, the higher the elevation angle the lower the variability of such relevant parameters. Finally, it is the average value of the emissions within each bin which affects the aggregate interference, and in any case, the values of the limits are selected to ensure that the agreed criterion for the protection of FSS uplink is fulfilled.*

4 *The nature of averaging over horizontal angles, beamforming directions and vertical angle measurement windows is clearly set out in the description of the limits on expected e.i.r.p. and no other averaging is intended or implied. An IMT base station must comply with the limits on expected e.i.r.p., as well-understood for the case of any limits on radiated power (including e.i.r.p. and TRP).*

5 *To be clear, the horizontal scanning range is not +/−180 degrees. It is the averaging that is performed over horizontal angles between 180 to +180 degrees, and this is correct, as it represents the range of horizontal orientations of IMT base stations with respect to the satellite.*

6 *It is correct that the distribution of vertical tilt angles within the steering range is not uniform considering the assumptions used in the sharing studies. However, the derivation of the proposed limits on expected e.i.r.p. are independent of this (see response to item 1). As for compliance testing, the beamforming directions used must cover beamforming directions within the steering range of the IMT base station that would be observed in practice and would provide an accurate measure of the radiation for comparison with the specified limits. This would apply for the case of any limits on radiated power (including e.i.r.p. and TRP).*

7 *An IMT base station must comply with the limits on expected e.i.r.p., as well-understood for the case of any limits on radiated power (including e.i.r.p. and TRP). Furthermore, since the expected e.i.r.p. incorporates averaging over the entire range of horizontal angles (+/−180 degrees) and over beamforming directions, the impact of beamforming is taken into account in the expected e.i.r.p. of an IMT base station.*

8 *The limits on expected e.i.r.p. are specified as a function of vertical angle above the horizon. The specified limits on expected e.i.r.p. shall be satisfied by the IMT base station for all mechanical downtilts that the IMT base station can be deployed with.*

9 Conformance to the limits on expected e.i.r.p. can be verified by testing IMT base stations following well-established test procedures that are very similar to conformance test procedures for TRP, but simply involve different post processing of the measurements.

10 Considering aggregate interference towards a satellite receiver, the relevant and correct metric is the expected e.i.r.p. of each IMT base station. An IMT base station must comply with the limits on expected e.i.r.p. as well-understood for the case of any limits on radiated power (including e.i.r.p. and TRP).

Views on Alternative 3

View 3-1: The protection of satellite should be based on reasonable worst-case assumptions. However, the e.i.r.p. mask under alternative 3 is based on unrealistic Rb assumption, where the base station density would considerably exceed base station density in all other frequency bands identified for IMT in densely populated countries, and assumes deployment also in unpopulated areas. In addition, it assumes beams different from those implemented in practice in this frequency band.

The condition applying to BS density is unfair since it applies the same constraint for a densely populated area and for a country with low density population. It is also unrealistic to envisage that administrations would limit the number of base stations that an operator could deploy, thus also limiting the coverage of their population.

The alternative 3 is also inconsistent since the mask is based on the higher Ra/Rb assumption while the density of base stations is based on the lower Ra/Rb assumption.

View 3-2: Alternative 3 proposes a limit on the maximum e.i.r.p. for angles above horizon. This is an incorrect condition for IMT base stations (BS) to protect satellite reception. The maximum e.i.r.p. limits for IMT BS with an active antenna system have not been discussed or verified in ITU-R. All compatibility studies and the comparison of results obtained therefrom have been based on average (mean) gain of IMT BS in the direction of the satellite for each elevation angle. Therefore mean/expected e.i.r.p. limits is the only correct condition for IMT BSs. The regulatory example for Alternative 3 proposes decrease IMT BS maximum e.i.r.p. by 21 dB down from operational value and will restrict the performance of IMT networks and possibility to operate overall. Therefore this example is equal to "No change" method.

In addition to the limit on the maximum e.i.r.p. for angles above horizon Alternative 3 also proposes a base station density limit on the territory of a sovereign state. This will limit the right of administrations on their own territory and therefore is absolutely unacceptable and shall not be included in RR.

View 3-3: Alternative 3 proposes a limit on the 'maximum' e.i.r.p. for angles above horizon. This is an inappropriate/incorrect condition when considering aggregate interference from multiple IMT base stations towards the satellite. This is because in practice each IMT base station will have a different horizontal orientation with respect to any satellite, and will be forming beams in different horizontal and vertical directions. Therefore, assertion that any satellite would experience interference caused by the 'maximum' e.i.r.p. of each of hundreds of thousands of IMT base stations is evidently incorrect. A requirement on 'maximum' e.i.r.p. would also be overly restrictive on IMT, besides not being the relevant metric for aggregate interference. Hence any conditions on the 'maximum' e.i.r.p. is not in-line with the methodology or conclusions from sharing studies.

Alternative 3 also proposes a base station density limit, to be applied together with the limit on the 'maximum' e.i.r.p. for angles above horizon. There are critical issues with this approach:

– *The specified limit on the density of base stations is based on the lowest density of base stations agreed by WP 5D for purposes of simulations (Ra option 1, Rb option 1 in the WP 5D methodology), whereas the accompanying limits on maximum e.i.r.p. are based on the highest (Ra option 2, Rb option 2 in the WP 5D methodology) density of base stations agreed by WP 5D for purposes of simulations. Furthermore, this specified base station density limit does not take into account the number of rural base stations, whereas the accompanying limits on 'maximum' e.i.r.p. considers rural base stations in 100% of the area. These lead to an inconsistency within the proposed method itself and a double penalty to IMT base stations, and consequently to IMT deployments.*

– *Such limits would unduly penalize some administrations, given that different national jurisdictions have different geographic topographies and national circumstances.*

– *The proposed base station density limit would apply throughout the territory of the Administration. However, this base station density limit is based on the IMT parameters Ra and Rb used in the sharing studies developed for very large areas (significantly larger than many countries) and hence it is inappropriate. The proposed limit of 0.0037 base stations per square km would mean that certain countries whose land area is small would only be able to deploy a handful of base stations. For instance, a country with a land area of less than 270 square km would not be allowed to deploy even one base station. Such countries are often heavily populated and urban.*

View 3-4: The following points are in relation to the concerns expressed in View 3-1 and 3-2:

Based on the results of current studies and the use of agreed deployment density values, it is not possible to develop a combination of base station power limits and base station deployment density limits that would adequately protect FSS receiving space stations while allowing for usable deployment of outdoor IMT systems in multiple countries. This is because of the fundamental incompatibility between IMT and FSS receiving space stations, a situation consistent with previous ITU-R studies in Report ITU-R S.2367 and some of the current study results.

View 3-5: Alternative 3 proposes a maximum e.i.r.p. mask and a limitation on the number of BS per country. A maximum e.i.r.p. mask is not an appropriate measure to ensure coexistence in the scenario of IMT to FSS uplink coexistence in the 6 GHz band. This is because the IMT emissions are of statistical, random nature. IMT base stations in this band will operate with Advanced Antenna Systems and beamforming. This means that the BS points a beam to the locations of the terminals. The beam is changes continuously, rapidly and randomly. The radiation pattern and the unwanted radiation toward satellites also change randomly, and the maximum radiation towards satellites may occur in a very small percentage of time. Therefore, maximum e.i.r.p. it is not the relevant metric for protection. Instead, the mean e.i.r.p. should be used.

Furthermore, alternative 3 restricts the number of BSs that a country can deploy. The restriction is proportional to the area of the country. This means that countries of small area are only allowed to deploy one BS (or even none). This is not acceptable for a number of African countries whose area is small and would therefore be precluded from deploying IMT in this band.

1/1.2/4.4.4 Method 4D

This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution and which are applied only within portion of the frequency band 6 425-7 025 MHz.

Concerning the protection of FSS uplink, see the various alternatives under Method 4C and related views.

*View 1: This method does not reflect the results of some ITU-R studies that have indicated that an IMT identification would cause harmful interference to existing services in this band, or requires coordination and exclusions zones that would result in the imposition of additional regulatory or technical constraints on incumbent services, which would preclude their future development, as the case of the AP**30B**.*

*View 2: This method reflects the results of the majority of studies done in ITU-R which indicated that there is NO harmful interference to incumbent services and does not require any coordination or exclusions zones. Accordingly, the results of the studies confirmed that there is no need for imposing any additional regulatory or technical constraints on the mobile service, in particular IMT, which would not impact or preclude current deployments or future development of incumbent services, including those in the AP**30B**.*

*View 3: Resolution **245 (WRC-19)** is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution **245 (WRC-19)**. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

1/1.2/4.4.5 Method 4E

This method proposes to identify the frequency band 6 425-7 025 MHz in Region 1 for IMT by creating a new RR footnote, specifying the use is expected from 2030* onwards, in due time for launching IMT-2030 and in order to provide time for identifying solutions for users of the spectrum which may be affected (e.g. fixed links and EESS, with sea surface temperature measurements), with conditions which are contained in a new WRC Resolution.

* This date was proposed by the proponents of the method.

Concerning the protection of FSS uplink, see the various alternatives under Method 4C and related views.

View 1: This method was developed in order to provide time for identifying solutions with conditions which are contained in a new Resolution, for users of the spectrum which may be affected (e.g. fixed links and EESS, with sea surface temperature measurements). Any solution not dealing with a delay of the IMT deployment (this method proposes 2030) could not ensure the continuity of SST measurements performed by satellite sensors because of the global nature of these measurements. It has to be noted that the global coverage of satellite measurements is not compatible with any national or regional solution.

*View 2: The implementation of IMT identification (including any possible delays) as well as the IMT-technology generation to be used/deployed is a regional or a national issue not to be restricted in the RR. The consideration of solutions for fixed and EESS applications in the frequency band 6 425-7 025 MHz is not within the scope of WRC-23 agenda item 1.2 and Resolution **245 (WRC-19)** and should not be included in the draft CPM text. Furthermore, IMT-2030 has not been defined by the ITU-R yet and the inclusion of launch dates of IMT-2030 use is not appropriate.*

*View 3: This method does not reflect the results of some ITU-R studies that have indicated that an IMT identification would cause harmful interference to existing services in this band, or requires coordination and exclusions zones that would result in the imposition of additional regulatory or technical constraints on incumbent services, which would preclude their future development, as the case of the AP**30B**. Moreover, this method is not consistent with Resolution **245 (WRC-19)** which resolves to conduct and complete in time for WRC-23 the sharing and compatibility studies in order* *to ensure the protection of services allocated in the band. By considering this method, the technical and operational characteristics of terrestrial IMT systems would remain uncertain. Therefore, it will be necessary to conduct new technical studies to ensure protection to the incumbent services operating in the band as such systems will keep evolving and, in consequence, the technical parameters considered during this study cycle will be different by 2030.*

*View 4: The results of the majority of studies done in ITU-R indicated that there is NO harmful interference to incumbent services and does not require any coordination or exclusions zones. Accordingly, the results of the studies confirmed that there is no need for imposing any additional regulatory or technical constraints on the mobile service in particular IMT, which would not impact or preclude current deployments or future development of incumbent services, including those in the AP**30B**.*

View 5: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the Resolution should contain some recognition of these other applications in the mobile service.

*View 6: Resolution **245 (WRC-19)** is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution **245 (WRC-19)**. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

1/1.2/4.5 Band 5 – 7 025-7 125 MHz (globally)

1/1.2/4.5.1 Method 5A

Reasons: This method proposes no change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**. The proponents of this method believe that no change would ensure the protection of incumbent services from harmful interference due to IMT as shown in some studies. Furthermore, some administrations are planning to use this band for other applications, including planned (AP**30B**) and unplanned FSS, FS and other mobile applications.

View 1: Majority of studies done in ITU-R show that there is no risk of harmful interference to incumbent services. Plans to use the band for other applications is not a valid reason for NOC, since IMT identification has never precluded the use of any IMT identified frequency band by any application of the services to which it is allocated, and identification does not establish any priority for IMT in the Radio Regulations.

View 2: There is no agreement with the term "majority of studies" and the term "there is no risk of harmful interference to incumbent services". Consequently, use the terms "a number of studies" and "harmful interference to incumbent services is unlikely".

*View 3: For the frequency band 7 025-7 125 MHz, some administrations propose NOC to the RR and suppression of Resolution **245 (WRC-19)** based on the outcome of a number of ITU-R studies indicating that an IMT identification would cause harmful interference to those existing services in this band. Furthermore, some administrations are planning to use this band for other applications including RLANs. Given the extensive use of this band by existing services and applications including RLANs, and the need to protect these services/applications from harmful interference, a global IMT identification in the frequency band 7 025-7 125 MHz is not justified.*

View 4: The associated reasons with this proposed method are not correct and contradict with the results of most conducted studies under AI 1.2 for this band, which confirmed the feasibility of *coexistence between IMT and other systems of incumbent services allocated within the frequency band on primary basis without any harmful interference impact. Furthermore, the use of any specific application under the services allocated in this frequency band is a national issue and is outside of the scope of this AI 1.2 and outside the mandate of ITU. It should be noted that IMT identification doesn't preclude the use of the band by other applications. IMT technologies can also support RLAN application under mobile service and accordingly decisions on technology or application selection are an absolute national issue.*

View 5: A number of ITU-R studies have concluded that an IMT identification would cause harmful interference to the incumbent services to which this band is already allocated. Further, many administrations are already using this band for RLANs. Therefore, an IMT identification in Region 1 would cause harmful interference to the extensive use of this band by various incumbent services including RLANs.

View 6: For the frequency band 7 025-7 125 MHz, some administrations propose NOC to the RR and suppression of Resolution ***245 (WRC-19)*** *based on the outcome of a number of ITU-R studies indicating that an IMT identification would cause harmful interference to those existing services in this band. Furthermore, some administrations are planning to use this band for other applications including RLANs. Given the extensive use of this band by existing services including RLAN applications, and the need to protect these services and applications from harmful interference, a global IMT identification in the frequency band 7 025-7 125 MHz is not justified.*

View 7: A number of ITU-R technical studies indicate that an IMT implementation would cause harmful interference to existing services in this band. Even by considering a case-by-case coordination scenario between the incumbent services and IMT, there is no certainty of protection. Moreover, a case-by-case coordination scenario would result in the imposition of additional regulatory or technical constraints on the incumbent services, which would preclude their future development.

1/1.2/4.5.2 Method 5B

This method proposes to identify the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote associated with a new Resolution without any additional conditions or constraints to the IMT deployment other than those existing in the RRs.

View 1: This method does not provide protection for non-GSO SOS stations, operating in the band 7 100-7 155 MHz under RR No. ***5.459*** *from interference of IMT-2020 stations and may impose additional regulatory and technical constraints on the SOS service.*

View 2: This method reflects the results of the majority of studies done in ITU-R which indicated that there is NO harmful interference to incumbent services and does not require any coordination or exclusions zones. Accordingly, the results of the studies confirmed that there is no need for imposing any additional regulatory or technical constraints on the mobile service, in particular IMT, which would not impact or preclude current deployments or future development of incumbent services.

View 3: The proposed Method 5B is not consistent with Resolution ***245 (WRC-19)*** *which recognizes that any identification of frequency bands for IMT should take into account the use of the frequency bands by other services and the evolving needs of these services, and resolves to conduct sharing and compatibility studies with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis. Hence, an identification for IMT without any conditions will not ensure the protection of the incumbent services since it is neither taking into consideration the result of the technical studies nor the evolving needs of these services. Furthermore, all studies* *have shown a need for protection distances for FSS (downlink) and FS, neither of which are captured in this method. In consequence, this method should be deleted.*

View 4: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the Resolution should contain some recognition of these other applications in the mobile service.

View 5: This method does not recognize the need to contain conditions for protection of incumbent services. This view is based on the text of Resolution ***245 (WRC-19)****, which recognizes the need to consider protection of the incumbent services, and in the divergence in the results of the studies presented during the study cycle. The conditions to protect the incumbent services contained in Article* ***21*** *may not be sufficient to guarantee operation of those services under the deployment scenarios and conditions considered in this agenda item. Therefore, the method should not be considered during WRC.*

View 6: Resolution ***245 (WRC-19)*** *is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution* ***245 (WRC-19)****. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

1/1.2/4.5.3 Method 5C

This method proposes to identify the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution.

Concerning the protection of FSS uplink, see the various alternatives under Method 4C and related views.

View: This method does not provide protection for non-GSO SOS stations, operating in the band 7 100-7 155 MHz under RR No. ***5.459*** *from interference of IMT-2020 stations and may impose additional regulatory and technical constraints on the SOS service.*

*View 1: This method does not reflect the results of some ITU-R studies that have indicated that an IMT identification would cause harmful interference to existing services in this band, or requires coordination and exclusions zones that would result in the imposition of additional regulatory or technical constraints on incumbent services, which would preclude their future development, as the case of the AP****30B*** *adjacent band.*

*View 2: This method reflects the results of the majority of studies done in ITU-R which indicated that there is NO harmful interference to incumbent services and does not require any coordination. or exclusions zones. Accordingly, the results of the studies confirmed that there is no need for imposing any additional regulatory or technical constraints on the mobile service, in particular IMT, which would not impact or preclude current deployments or future development of incumbent services, including those in the AP****30B****.*

View 3: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the Resolution should contain some recognition of these other applications in the mobile service.

View 4: Resolution ***245 (WRC-19)*** *is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution* ***245 (WRC-19)****. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent* *services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

1/1.2/4.5.4 Method 5D

This method proposes to identify the frequency band 7 025-7 100 MHz for IMT by creating a new RR footnote with a requirement to implement technical and regulatory measures to protect and not impose constraints on existing services in the band above 7 100 MHz.

Concerning the protection of FSS uplink, see the various alternatives under Method 4C and related views.

*View 1: This method does not reflect the results of some ITU-R studies that have indicated that an IMT identification would cause harmful interference to existing services in this band, or requires coordination and exclusions zones that would result in the imposition of additional regulatory or technical constraints on incumbent services, which would preclude their future development, as the case of the AP**30B** adjacent band.*

View 2: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the Resolution should contain some recognition of these other applications in the mobile service.

*View 3: Resolution **245 (WRC-19)** is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution **245 (WRC-19)**. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

1/1.2/4.5.5 Method 5E

This method proposes to identify the frequency band 7 025-7 125 MHz for IMT by creating a new RR footnote, clarifying that the use is expected from 2030* onwards, in due time for launching IMT-2030 and in order to provide time for identifying solutions for users of the spectrum which may be affected (e.g. fixed links at a national level and EESS, with sea-surface temperature measurements), with conditions which are contained in a draft new WRC Resolution.

* This date was proposed by the proponents of the method.

Concerning the protection of FSS uplink, see the various alternatives under Method 4C and related views.

View 1: The implementation of IMT identification (including any possible delays) as well as the IMT-technology generation to be used/deployed is a regional or a national issue not to be restricted in the RR.

*View 2: This method does not provide protection for non-GSO SOS stations, operating in the band 7 100-7 155 MHz under RR No. **5.459** from interference of IMT-2020 stations and may impose additional regulatory and technical constraints on the SOS service.*

*View 3: The consideration of solutions for fixed and EESS applications in the frequency band 7 025-7 125 MHz is not within the scope of WRC-23 agenda item 1.2 and Resolution **245 (WRC-19)** and should not be included in the draft CPM text. Furthermore, IMT-2030 has not been defined by the ITU-R yet and the inclusion of launch dates of IMT-2030 use not appropriate.*

*View 4: This method does not reflect the results of some ITU-R studies that have indicated that an IMT identification would cause harmful interference to existing services in this band, or requires coordination and exclusions zones that would result in the imposition of additional regulatory or technical constraints on incumbent services, which would preclude their future development, as the case of the AP**30B**. Moreover, this method is not consistent with Resolution **245 (WRC-19)** which resolves to conduct and complete in time for WRC-23 the sharing and compatibility studies in order to ensure the protection of services allocated in the band. By considering this Method, the technical and operational characteristics of terrestrial IMT systems would remain uncertain. Therefore, it will be necessary to conduct new technical studies to ensure protection to the incumbent services operating in the band as such systems will keep evolving and, in consequence, the technical parameters considered during this study cycle will be different by 2030.*

View 5: Some administrations are considering use of the band 6 425-7 125 MHz by other applications in the mobile services (e.g. WAS/RLAN). Therefore, the resolution should contain some recognition of these other applications in the mobile service.

*View 6: Resolution **245 (WRC-19)** is to consider identification of the frequency bands for International Mobile Telecommunications (IMT). Consideration of other applications in the mobile services (e.g. WAS/RLAN) is not in line with Resolution **245 (WRC-19)**. ITU-R has not conducted studies in this frequency band to assess the sharing and compatibility between the incumbent services and other broadband applications including WAS/RLAN. Consideration for IMT identification does not preclude the concerned countries using this band for other application of the mobile service at national level.*

1/1.2/4.6 Band 6 – 10.0-10.5 GHz (Region 2)

1/1.2/4.6.1 Method 6A

This method proposes no change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**.

Reasons: Studies between IMT, operating under the mobile service, and EESS (active) in the frequency band 10-10.4 GHz show that the protection criteria for EESS (active) is exceeded by an amount in the range of 5 to 11 dB when no mitigation techniques were considered. Studies submitted to the ITU-R included a theoretical mitigation technique in order to achieve sharing and compatibility with the EESS (active). However, the proponents understand that the degree of the theoretical sidelobe suppression used in the sharing study is not achievable in practice.

The proponents of this method believe that no change would ensure the continued development of the incumbent services.

1/1.2/4.6.2 Method 6B

This method proposes to allocate the frequency band 10-10.5 GHz to the mobile service on a primary basis in the Frequency Allocation Table in Region 2, modify RR Nos. **5.480** and **5.481**, and identify the frequency band for IMT by creating a new RR footnote with conditions which are contained in a draft new WRC Resolution. Various examples of *resolves* are included in the draft Resolution for conditions that may be considered when developing proposals, as appropriate.

View 1: This method leads to the harmful interference of services in Region 1. This method assumes a new allocation of the frequency band 10-10.5 GHz to the aeronautical mobile service on a primary basis in countries of Region 2 having borders with countries of Region 1, but sharing and compatibility studies of the AMS stations with the stations of other primary services of Region 1 have not been carried out by ITU-R. As a result, there is no technical basis for determining the conditions for compatibility of the AMS in countries of Region 2 having borders with countries of

Region 1 and incumbent services of Region 1. In addition, the agenda item aims to identify a frequency band 10-10.5 GHz for IMT that is used in the land mobile service and not in the aeronautical mobile service, therefore allocation of the band 10-10.5 GHz to the AMS is not required, is outside of the scope of WRC-23 agenda item 1.2 and leads to the harmful interference for incumbent services of Region 1.

View 2: The alternative 1 of Method 6B plan to deploy macro cells in the band 10-10.5 GHz and is not in line with baseline assumptions of WP 5D. Moreover, the capability of SSL to mitigate the interferences on incumbent services will be conditioned by its real implementation (not ensured by the way it is introduced today) on equipment. It should be noticed that even if the SSL is really implemented, every manufacturer will provide its own method to perform SSL that cannot guarantee a uniform decrease of emission towards sky.

View 3: Method 6B is proposed on the basis of ITU-R sharing and compatibility studies submitted in accordance with Resolution ***245 (WRC-19)*** *that would support a primary mobile allocation and IMT identification for Region 2 while protecting those existing services that operate within that region. Additionally, there is an existing primary mobile service allocation in Regions 1 and 3 that already permits aeronautical mobile service (AMS) for the frequency band 10-10.45 GHz. As such, there should be no reason to prohibit Region 2 from having the same primary mobile service allocation including AMS for the frequency band 10-10.45 GHz. To further spectrum harmonization within Region 2, the band 10.45-10.5 GHz should be afforded the same allocation status as the adjacent band 10-10.45 GHz for the primary mobile service under this agenda item.*

View 4: The alternative 1 of Method 6B used the deployment parameters provided by the ITU-R study groups and in line with baseline assumptions of WP 5D. Furthermore, SSL provides a mitigation technique that is consistent with Recommendation ITU-R SM.1132-2, that states "… Improved side-lobe control over current antenna designs can be a technique for further facilitating sharing".

1/1.2/4.6.3 Method 6C

This method proposes to allocate the frequency band 10-10.5 GHz to the mobile, except aeronautical mobile, service on a primary basis in the Frequency Allocation Table in Region 2, and modify RR Nos. **5.480** and **5.481**. In making the mobile service primary in Region 2, two RR footnotes are provided through two examples shown in Section 5 to ensure the protection of the radiolocation service, including those stations of the radiolocation service in 10.45-10.5 GHz in Regions 1 and 3.

Additionally, a new footnote identifies the frequency band for IMT with conditions, which are contained in a draft new WRC Resolution.

Various examples of *resolves* are included in the draft Resolution for conditions that may be considered when developing proposals, as appropriate.

View: The Method 6C proponents have proposed a primary mobile allocation except aeronautical allocation for the 10-10.45 GHz and 10.45-10.5 GHz bands for Region 2. Such a proposal is not balanced or consistent with other existing primary mobile service allocations that include aeronautical for Regions 1 and 3 in portions of this frequency range; and unnecessarily creates regulatory burdens to those Region 2 countries regarding their use of the primary mobile service allocation.

1/1.2/5 Regulatory and procedural considerations

1/1.2/5.1 For Methods 1A, 2A, 3A, 4A, 5A and 6A

No change to the Radio Regulations, except for suppression of Resolution **245 (WRC-19)**.

NOC

ARTICLES

NOC

APPENDICES

NOC

RECOMMENDATIONS

1/1.2/5.2 Band 1 – 3 300-3 400 MHz (amend footnote in Region 1)

1/1.2/5.2.1 For Methods 1B and 1C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

2 700-3 600 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 300-3 400 RADIOLOCATION 5.149 5.429 MOD 5.429A MOD 5.429B 5.430	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149 5.429C 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F

1/1.2/5.2.2 For Method 1B

MOD

5.429A *Additional allocation*: in [country name for countries of Region 1 south of 30° parallel north] Angola, Benin, Botswana, Burkina Faso, Burundi, Djibouti, Eswatini, Ghana, Guinea, Guinea-Bissau, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Zambia and Zimbabwe, the frequency band 3 300-3 400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. Stations in the mobile service operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-~~19~~23)

MOD

5.429B In the following countries of Region 1 south of 30° parallel north: [country name] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo (Rep. of the), Côte d'Ivoire, Egypt, Eswatini, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Uganda, the Dem. Rep. of the Congo, Rwanda, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Zambia and Zimbabwe, the frequency band 3 300-3 400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). The use of this frequency band shall be in accordance with Resolution **223 (Rev.WRC-19)**. The use of the frequency band 3 300-3 400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

1/1.2/5.2.3 For Method 1C

MOD

5.429A *Additional allocation*: in [country name] Angola, Benin, Botswana, Burkina Faso, Burundi, Djibouti, Eswatini, Ghana, Guinea, Guinea-Bissau, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Zambia and Zimbabwe, the frequency band 3 300-3 400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. Stations in the mobile service operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-~~19~~23)

MOD

5.429B In ~~the following countries of Region 1 south of 30° parallel north:~~ [country name] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo (Rep. of the), Côte d'Ivoire, Egypt, Eswatini, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Uganda, the Dem. Rep. of the Congo, Rwanda, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Zambia and Zimbabwe, The frequency band 3 300-3 400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). The use of this frequency band shall be in accordance with Resolution **223 (Rev.WRC-19)**.

The use of the frequency band 3 300-3 400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

1/1.2/5.2.4 For Method 1D

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

2 700-3 600 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 300-3 400 RADIOLOCATION 5.149 5.429 5.429A 5.429B 5.430 ADD 5.A12-1D	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149 5.429C 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F

ADD

5.A12-1D *Additional allocation:* in [country name] the frequency band 3 300-3 400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, and is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of this frequency band shall be in accordance with Resolution **223 (Rev.WRC-19)**. (WRC-23)

1/1.2/5.2.5 For Method 1E

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

2 700-3 600 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 300-3 400 MOBILE except aeronautical mobile RADIOLOCATION 5.149 5.429 ~~5.429A~~ MOD 5.429B 5.430	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149 5.429C 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F

SUP

5.429A

MOD

5.429B In Region 1~~the following countries of Region 1 south of 30° parallel north: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo (Rep. of the), Côte d'Ivoire, Egypt, Eswatini, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Uganda, the Dem. Rep. of the Congo, Rwanda, Sudan, South Sudan, South Africa, Tanzania, Chad, Togo, Zambia and Zimbabwe~~, the frequency band 3 300-3 400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). The use of this frequency band shall be in accordance with Resolution **223 (Rev.WRC-19)**. The use of the frequency band 3 300-3 400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

1/1.2/5.2.6 For Method 1F

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

2 700-3 600 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 300-3 400 MOBILE RADIOLOCATION 5.149 5.429 ~~5.429A~~ 5.429B 5.430 ADD 5.A12-1F	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149 5.429C 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F

SUP

5.429A

ADD

5.A12-1F In Region 1, the frequency band 3 300-3 400 MHz is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of this frequency band shall be in accordance with Resolution **223 (Rev.WRC-19)**. (WRC-23)

1/1.2/5.3 Band 2 – 3 300-3 400 MHz (Region 2)

1/1.2/5.3.1 For Method 2B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

2 700-3 600 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 300-3 400 RADIOLOCATION 5.149 5.429 5.429A 5.429B 5.430	**3 300-3 400** MOBILE RADIOLOCATION Amateur Fixed ~~Mobile~~ 5.149 MOD 5.429C MOD 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F

MOD

5.429C *Different category of service*: ~~in Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, El Salvador, Ecuador, Guatemala, Mexico, Paraguay and Uruguay, the frequency band 3 300-3 400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. I~~in Argentina, Brazil, the Dominican Republic, Guatemala, Mexico, Paraguay and Uruguay, the frequency band 3 300-3 400 MHz is also allocated to the fixed service on a primary basis. Stations in the fixed ~~and mobile~~ service~~s~~ operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-~~19~~23)

MOD

5.429D In ~~the following countries in~~ Region 2~~: Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, El Salvador, Ecuador, Guatemala, Mexico, Paraguay and Uruguay~~, the use of the frequency band 3 300-3 400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). ~~Such use shall be in accordance with Resolution **223 (Rev.WRC-19)**. This use in Argentina, Paraguay and Uruguay is subject to the application of No. **9.21**. The use of the frequency band 3 300-3 400 MHz by IMT s~~Stations in the mobile service operating in the frequency band 3 300-3 400 MHz in Region 2 shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

1/1.2/5.3.2 For Method 2C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

2 700-3 600 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 300-3 400 RADIOLOCATION	**3 300-3 400** MOBILE except aeronautical mobile RADIOLOCATION Amateur Fixed ~~Mobile~~	**3 300-3 400** RADIOLOCATION Amateur
5.149 5.429 5.429A 5.429B 5.430	5.149 MOD 5.429C MOD 5.429D	5.149 5.429 5.429E 5.429F

MOD

5.429C *Different category of service*: in Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, El Salvador, Ecuador, Guatemala, Mexico, Paraguay and Uruguay, the frequency band 3 300-3 400 MHz is allocated to the ~~mobile, except~~ aeronautical mobile~~,~~ service on a primary basis. In Argentina, Brazil, the Dominican Republic, Guatemala, Mexico, Paraguay and Uruguay, the frequency band 3 300-3 400 MHz is also allocated to the fixed service on a primary basis. Stations in the fixed and aeronautical mobile services operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-~~19~~23)

MOD

5.429D In ~~the following countries in~~ Region 2~~: Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, El Salvador, Ecuador, Guatemala, Mexico, Paraguay and Uruguay~~, the use of the frequency band 3 300-3 400 MHz is identified for the implementation of

International Mobile Telecommunications (IMT).~~ Such use shall be in accordance with Resolution **223 (Rev.WRC-19)**. This use in Argentina, Paraguay and Uruguay is subject to the application of No. **9.21**. The use of the frequency band 3 300-3 400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, ~~Stations in the mobile, except aeronautical mobile, service operating in the frequency band 3 300-3 400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. ~~and~~ A~~a~~dministrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

1/1.2/5.4 Band 3 – 3 600-3 800 MHz (Region 2)

1/1.2/5.4.1 For Methods 3B, 3C and 3D

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

3 600-4 800 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">3 600-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
Mobile</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile MOD 5.434
Radiolocation 5.433</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td></tr>
<tr><td>3 700-~~4 200~~3 800
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile MOD 5.434</td><td>3 700-~~4 200~~3 800
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td></tr>
<tr><td colspan="2">~~3 700~~3 800-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td></tr>
</table>

1/1.2/5.4.2 For Method 3B

MOD

5.434 In Region 2, ~~Canada, Chile, Colombia, Costa Rica, El Salvador, the United States and Paraguay,~~ the frequency band 3 600-~~3 700~~3 800 MHz, or portions thereof, is identified for use by ~~these~~ administrations wishing to implement International Mobile Telecommunications (IMT). ~~This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall seek agreement under No. **9.21** with other administrations and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m² · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above.~~ Stations of the mobile service, including IMT systems, in the frequency band 3 600-~~3 700~~3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations~~ (Edition of 2004)~~. (WRC-~~19~~23)

1/1.2/5.4.3 For Method 3C

MOD

5.434 In Region 2~~Canada, Chile, Colombia, Costa Rica, El Salvador, the United States and Paraguay~~, the frequency band 3 600-~~3 700~~3 800 MHz, or portions thereof, is identified for use by ~~these~~ administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall ~~seek agreement under No. **9.21** with other administrations and~~ ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m² · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service, including IMT systems, in the frequency band 3 600-~~3 700~~3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations~~ (Edition of 2004)~~. (WRC-~~19~~23)

1/1.2/5.4.4 For Method 3D

MOD

5.434 In Region 2~~Canada, Chile, Colombia, Costa Rica, El Salvador, the United States and Paraguay~~, the frequency band 3 600-~~3 700~~3 800 MHz, or portions thereof, is identified for use by ~~these~~ administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall seek agreement under No. **9.21** with other administrations and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed [−154.5] dB(W/(m^2 · 4 kHz)) for more than 0.005~~20~~% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service, including IMT systems, in the frequency band 3 600-~~3 700~~3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of ~~2004~~2020). (WRC-~~19~~23)

NOTE: When preparing the text for a proposal to modify RR No. ***5.434*** *under this method, the pfd value in square brackets in the regulatory example above should be modified to correspond to the revised time percentage in that footnote.*

1/1.2/5.4.5 For Methods 3E and 3F

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

3 600-4 800 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">3 600-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
Mobile</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile MOD 5.434
Radiolocation 5.433</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td></tr>
<tr><td colspan="2">3 700-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td></tr>
</table>

1/1.2/5.4.6 For Method 3E

MOD

5.434 In Canada, Chile, Colombia, Costa Rica, El Salvador, the United States and Paraguay, [add names of countries], the frequency band 3 600-3 700 MHz, or portions thereof, is identified for use by these administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall seek agreement under No. **9.21** with other administrations and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed -154.5 dB(W/(m$^2 \cdot 4$ kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service, including IMT systems, in the frequency band 3 600-

3 700 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of ~~2004~~2020). (WRC-~~19~~23)

1/1.2/5.4.7 For Method 3F

MOD

5.434 In ~~Canada, Chile, Colombia, Costa Rica, El Salvador, the United States and Paraguay~~Region 2, the frequency band 3 600-3 700 MHz, or portions thereof, is identified for use by ~~these~~ administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall seek agreement under No. **9.21** with other administrations and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service, including IMT systems, in the frequency band 3 600-3 700 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of ~~2004~~2020). (WRC-~~19~~23)

1/1.2/5.5 Band 4 – 6 425-7 025 MHz (Region 1)

There was a proposal to identify the frequency band 6 425-7 025 MHz for some countries in Region 3 for IMT by creating a new RR footnote with appropriate conditions.

1/1.2/5.5.1 For Methods 4B, 4C, 4D, 4E

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

5 570-6 700 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
5 925-6 700	FIXED 5.457 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C ADD 5.B12 5.149 5.440 5.458	

MOD

6 700-7 250 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
6 700-7 075	FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE ADD 5.B12 5.458 5.458A 5.458B	

1/1.2/5.5.2 For Method 4B

ADD

5.B12-4B In Region 1, the frequency band 6 425-7 025 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.5.3 For Method 4C

ADD

5.B12-4C In Region 1, the frequency band 6 425-7 025 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.5.4 For Method 4D

ADD

5.B12-4D In Region 1, the frequency band 6 425-7 025 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[B12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.5.5 For Method 4E

1/1.2/5.5.5.1 For Method 4E, Example 1

ADD

5.B12-4E In Region 1, the frequency band 6 425-7 025 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). The use is expected as of 2030, taking into account the need for transition time for some existing users of the spectrum. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.5.5.2 For Method 4E, Example 2

ADD

5.B12-4E In Region 1, the frequency band 6 425-7 025 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

Note: For Example 2, the transition date would be specified in the Resolution.

1/1.2/5.5.6 For Methods 4B, 4C, 4E, as well as Methods 5B, 5C, 5D, 5E

NOTE: This Resolution covers both 6 425-7 025 MHz in Region 1 (Band 4) and 7 025-7 125 MHz in all Regions (Band 5). Depending on the decision of the WRC to identify these bands for IMT or not, further analysis should be made whether to have separate Resolutions for Band 4 and Band 5 or not.

A proposal was made to add additional *considering*, *recognizing* and *resolves* to this Resolution to address coexistence with other services and applications (including applications of the mobile service).

ADD

DRAFT NEW RESOLUTION [A12-6GHz] (WRC-23)

(*the text also includes the frequency band 7 025-7 125 MHz covered in section 5.6.2*)

Terrestrial component of International Mobile Telecommunications in the frequency band 6 425-7 025 MHz in Region 1 and 7 025-7 125 MHz in all Regions

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision of global mobile access, and is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;

b) that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;

c) that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;

d) that the ITU Radiocommunication Sector (ITU-R) has studied, in preparation for WRC-23, sharing and compatibility with services allocated in the frequency band 6 425-7 025 MHz and 7 025-7 125 MHz, and its adjacent band, as appropriate, based on characteristics available at that time, and results may change if these characteristics change;

[For Methods 4C, 4E, 5C, 5D and 5E]

e) that it is assumed that a very limited number of IMT base stations will be communicating with a positive elevation angle towards IMT indoor mobile stations;

or

e) that it is assumed that IMT base stations would be communicating with a negative elevation angle towards IMT mobile stations;

f) that the frequency band 6 425-7 125 MHz, or part thereof, is allocated on a primary basis to the fixed, mobile, fixed-satellite (Earth-to-space and space-to-Earth) and space operation services (Earth-to-space);

[For Methods 4C, 4E, 5C, 5D and 5E]

g) that, under No. **5.458**, passive microwave sensor measurements are carried out over the oceans in the frequency band 6 425-7 075 MHz, and passive microwave sensor measurements are carried out in the band 7 075-7 250 MHz;

[For Methods 4C, 4E, 5C, 5D and 5E]

h) that, in the frequency band 6 650-6 675.2 MHz, radio astronomy observations are carried out under No. **5.149**, *noting*

a) Resolutions **223 (Rev.WRC-19)**, **224 (Rev.WRC-19)**, **225 (Rev.WRC-12)**, **241 (WRC-19)**, **242 (WRC-19)** and **243 (WRC-19)**, which also relate to IMT;

b) that the IMT terrestrial radio interfaces as defined in Recommendations ITU-R M.1457, ITU-R M.2012 and ITU-R M.2150 are expected to evolve within the framework of ITU-R beyond those initially specified, to provide enhanced services and services beyond those envisaged in the initial implementation;

c) that ITU-R has developed its vision defining the framework and overall objectives of IMT towards 2030 and beyond to drive the future developments for IMT;

[For Methods 4C, 4E, 5C and 5E]

d) that ITU-R is studying the application of No. **21.5** to IMT stations that use an antenna that consists of an array of active elements,

recognizing

a) that the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band by any application of the services to which it is allocated;

[For Methods 4C, 4E, 5C and 5E]

b) that studies have shown that the protection of feeder links for the non-geostationary-satellite orbit (non-GSO) fixed-satellite service (FSS) (space-to-Earth) requires the determination of protection distances ranging between a few kilometres to tens of kilometres. These protection distances are site-specific and depend on several elements, such as the propagation parameters, local terrain topography, station and orbital parameters of the feeder links for non-GSO FSS (space-to-Earth);

[For Methods 4E and 5E]

c) that the frequency band 6 425-7 125 MHz is expected to be implemented as of 1 January 2030 in time to help meet the spectrum requirement of future systems for 2030 and beyond and to enable the migration of some other services and applications to other bands, e.g. surface sea temperature satellite observations (see No. **5.458**) or fixed links in areas where IMT would be deployed, if considered necessary by national administrations,

[For Methods 4C and 5C]

d) that the frequency band 6 425-7 125 MHz is expected to be implemented as of 1 January 2024, in time to help meet the spectrum requirement of IMT-2020 systems and beyond,

[For Method 5D]

e) that the frequency band 7 100-7 155 MHz is allocated on a primary basis to the SOS (Earth-to-space),

resolves

1 that administrations wishing to implement IMT consider use of the frequency band 6 425-7 025 MHz identified for IMT in No. **5.B12** in Region 1 and 7 025-7 125 MHz identified for IMT in all Regions in No. **5.C12**, taking into account the latest relevant ITU-R Recommendations;

[For Methods 4B and 5B]

2 not used;

[For Methods 4C, 4E and 5C, 5D and 5E]

2 that administrations wishing to implement IMT in the frequency band 6 425-7 075 MHz shall apply the following conditions to IMT to ensure the protection, continued use and future development of the fixed-satellite service (Earth-to-space):

[Example 1]

2.1 take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon when deploying IMT base stations within the frequency band 6 425-7 075 MHz; the mechanical pointing needs to be at or below the horizon;

2.2 that, in the frequency band 6 425-7 075 MHz, the power delivered by a transmitter to the antenna of an IMT station not using active antenna system (AAS) or the total radiated power (TRP) for an IMT station using active antenna system (AAS), shall not exceed 13 dBW;

[Example 2]

2.1 the level of expected equivalent isotropically radiated power (e.i.r.p.) emitted by an IMT base station as a function of vertical angle above the horizon in the frequency band 6 425-7 025 MHz or part thereof shall not exceed the following values:

Vertical angle measurement window **$\theta_L \leq \theta < \theta_H$** **(vertical angle θ above horizon)**	**Expected e.i.r.p.** **(dBm/MHz)** **(NOTE 1)**
$0° \leq \theta < 5°$	31.5
$5° \leq \theta < 10°$	26.5
$10° \leq \theta < 15°$	22.5
$15° \leq \theta < 20°$	21.5
$20° \leq \theta < 30°$	19.5
$30° \leq \theta < 60°$	18.5
$60° \leq \theta \leq 90°$	18.5

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

– over horizontal angles between −180° to +180°, and the IMT base station beamforming in a specific direction within its steering range,

– over different beamforming directions within the IMT base station steering range, and

– over the specified vertical angle measurement window $\theta_L \leq \theta < \theta_H$.

2.2 (not used)

[Example 3]

2.1 the level of expected equivalent isotropically radiated power (e.i.r.p.) emitted by an IMT base station as a function of vertical angle above the horizon in the frequency band 6 425-7 025 MHz or parts thereof shall not exceed the following values:

Vertical angle measurement window **$\theta_L \leq \theta < \theta_H$** **(vertical angle θ above horizon)**	**Expected e.i.r.p.** **(dBm/MHz)** **(NOTE 1)**
$0° \leq \theta < 5°$	32
$5° \leq \theta < 10°$	28
$10° \leq \theta < 15°$	24
$15° \leq \theta < 20°$	24
$20° \leq \theta < 30°$	20
$30° \leq \theta < 60°$	18
$60° \leq \theta \leq 90°$	17

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

– over horizontal angles between −180° to +180°, and the IMT base station beamforming in a specific direction within its steering range,

– over different beamforming directions within the IMT base station steering range, and

– over the specified vertical angle measurement window ($\theta_L \leq \theta < \theta_H$).

2.2 (not used)

[Example 4]

2.1 that, in the frequency band 6 425-6 525 MHz, IMT base stations with an active antenna system shall comply with a limit on expected e.i.r.p. as a function of vertical (elevation) angle.

Expected e.i.r.p. limits for IMT base stations

Elevation angle	**e.i.r.p,** **dBm/100 MHz**
$0 \leq \theta \leq 5$	56.9
$5 < \theta \leq 10$	$-2.346 \cdot \theta + 68.63$
$10 < \theta \leq 30$	$-0.5904 \cdot \theta + 50.94$
$30 < \theta \leq 60$	33.36
$60 < \theta \leq 80$	29.13

2.2 (not used)

[Example 5]

2.1 The following limit to the e.i.r.p. radiated by each IMT base station, in any bandwidth of 100 MHz, for a given elevation angle above the horizontal applies:

e.i.r.p. limits for IMT base stations

Elevation angle (θ) **degrees**	**Maximum e.i.r.p.** **dBW/100 MHz**
$0 \leq \theta \leq 1$	20.7
$1 < \theta \leq 10$	$20.7 - 1.777(\theta - 1)$
$10 < \theta \leq 90$	$4.7 - 0.239(\theta - 10)$

2.2 The average density of base stations operating in the territory of any administration, in any bandwidth of 100 MHz, not to exceed 0.0037 base stations per square kilometre;

[[For Methods 4B and 5B]]

3 (not used);

[For Methods 4C, 4E and 5C, 5D and 5E]

[Example 1]

3 that administrations wishing to implement IMT in the frequency band 6 700-7 075 MHz shall ensure the protection, continued use and future development of the fixed-satellite service (space-to-Earth) through the adoption of site-specific coordination;

3*bis* that IMT within the frequency range 6 700-7 075 MHz shall not be used by aeronautical applications,

[Example 2]

3 (not used);

3*bis* (not used),

encourages administrations

[For Methods 4C and 4E]

1 to ensure that provisions for the implementation of IMT does not adversely affect the operation of FSS earth stations and their future development;

[For Method 4C and 4E]

2 to keep the antenna pattern of IMT base stations within the limits of the approximation envelope according to Recommendation ITU-R M.2101 and to implement suppression side lobe mitigation techniques;

[For Method 4C and 4E]

3 to take all practicable steps to protect the radio astronomy service from harmful interference in the frequency band 6 650-6 675.2 MHz, which covers spectral lines of importance for current astronomical investigations, in accordance with No. **5.149**,

invites administrations

to take into account the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT,

invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment in the frequency band 6 425-7 025 MHz in Region 1 and 7 025-7 125 MHz in all Regions;

2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries;

[For Methods 4C and 4E]

3 to develop a recommendation to address methods for the determination of the protection area around a non-GSO earth station in the frequency band 6 700-7 075 MHz, from an IMT base station;

[For Methods 4C and 4E]

4 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) on sharing and compatibility with space services, and to take into account the results of these reviews in the development and/or revision of ITU-R Recommendations/Reports addressing, *inter alia*, if necessary, applicable measures to mitigate the risk of interference into space services;

[For Methods 4C and 4E]

5 to develop a recommendation to address methods for the determination of the protection area around existing radio astronomy service stations from IMT stations in the frequency band 6 650-6 675.2 MHz;

6 to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations, as appropriate, to provide information and assistance to the concerned administrations on possible coordination of FS stations with IMT stations in the frequency band 6 425-7 125 MHz,

NOTE: WRC-23 may consider extending this *invites ITU-R* to 3 600-3 800 MHz and 10-10.5 GHz.

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

1/1.2/5.5.7 For Method 4D

ADD

DRAFT NEW RESOLUTION [B12-6GHz] (WRC-23)

Conditions for the terrestrial component of International Mobile Telecommunications in the frequency band 6 425-6 525/6 575 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that identification of frequency bands allocated to the mobile service for International Mobile Telecommunications (IMT) may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;

b) that, in Region 1, the frequency band 6 425-6 525/6 575 MHz (Earth-to-space) is extensively used by the existing satellite networks/systems of the fixed-satellite service (FSS) with characteristics that may evolve in the future;

c) that the ITU Radiocommunication Sector (ITU-R) has studied compatibility of IMT with applications of other services allocated in the frequency band 6 425-7 025 MHz in Region 1, including FSS, based on characteristics available at that time, and results may change if these characteristics change;

d) that Article **21** of the Radio Regulations establishes power limits for terrestrial stations in order to ensure an interference-free environment for terrestrial and space services sharing frequency bands above 1 GHz that were developed for non-advanced antenna system (non-AAS) stations of mobile and fixed services,

recognizing

that, the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band by any application of the services to which it is allocated,

resolves

[Example 1]

1 that, in the frequency band 6 425-6 525 MHz, IMT base stations with an active antenna system shall comply with a limit on expected e.i.r.p. as a function of vertical (elevation) angle:

Expected e.i.r.p. limits for IMT base stations

Elevation angle	e.i.r.p, dBm/100 MHz
$0 \leq \theta \leq 5$	56.9
$5 < \theta \leq 10$	$-2.346 \cdot \theta + 68.63$
$10 < \theta \leq 30$	$-0.5904 \cdot \theta + 50.94$
$30 < \theta \leq 60$	33.36
$60 < \theta \leq 80$	29.13

2 that the e.i.r.p. limits mentioned in *resolves* 1 shall remain in force unless Article **21** of the Radio Regulations be revised by a future competent WRC with respect to the mobile stations with an active antenna system for the band mentioned in *resolves* 1.

[Example 2]

1 that, the level of expected equivalent isotropically radiated power (e.i.r.p.) emitted by an IMT base station as a function of vertical angle above the horizon in the frequency band 6 425-6 525 MHz or part thereof shall not exceed the following values:

Vertical angle measurement window $\theta_L \leq \theta < \theta_H$ (vertical angle θ above horizon)	Expected e.i.r.p. (dBm/MHz) (NOTE 1)
$0° \leq \theta < 5°$	31.5
$5° \leq \theta < 10°$	26.5
$10° \leq \theta < 15°$	22.5
$15° \leq \theta < 20°$	21.5
$20° \leq \theta < 30°$	19.5
$30° \leq \theta < 60°$	18.5
$60° \leq \theta \leq 90°$	18.5

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

– over horizontal angles between −180° to +180°, and the IMT base station beamforming in a specific direction within its steering range,

– over different beamforming directions within the IMT base station steering range, and

– over the specified vertical angle measurement window $\theta_L \leq \theta < \theta_H$.

2 (not used);

[Example 3]

1 the level of expected equivalent isotropically radiated power (e.i.r.p.) emitted by an IMT base station as a function of vertical angle above the horizon in the frequency band 6 425-6 525 MHz or parts thereof shall not exceed the following values:

Vertical angle measurement window $\theta_L \leq \theta < \theta_H$ **(vertical angle θ above horizon)**	**Expected e.i.r.p.** **(dBm/MHz)** **(NOTE 1)**
$0° \leq \theta < 5°$	32
$5° \leq \theta < 10°$	28
$10° \leq \theta < 15°$	24
$15° \leq \theta < 20°$	24
$20° \leq \theta < 30°$	20
$30° \leq \theta < 60°$	18
$60° \leq \theta \leq 90°$	17

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

– over horizontal angles between −180° to +180°, and the IMT base station beamforming in a specific direction within its steering range,

– over different beamforming directions within the IMT base station steering range, and

– over the specified vertical angle measurement window ($\theta_L \leq \theta < \theta_H$).

2 (not used);

[Example 4]

1 the following limit to the e.i.r.p. radiated by each IMT base station, in any bandwidth of 100 MHz, for a given elevation angle above the horizontal applies:

e.i.r.p. limits for IMT base stations

Elevation angle (θ) **degrees**	**Maximum e.i.r.p.** **dBW/100 MHz**
$0 \leq \theta \leq 1$	20.7
$1 < \theta \leq 10$	$20.7 - 1.777(\theta - 1)$
$10 < \theta \leq 90$	$4.7 - 0.239(\theta - 10)$

2 the average density of base stations operating in the territory of any administration, in any bandwidth of 100 MHz, not to exceed 0.0037 base stations per square kilometre,

invites the ITU Radiocommunication Sector

to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations, as appropriate, to provide information and assistance to the concerned administrations on possible coordination of FS stations with IMT stations in the frequency band 6 425-7 125 MHz.

NOTE: WRC-23 may consider extending this *invites ITU-R* to 3 600-3 800 MHz and 10.10.5 GHz.

1/1.2/5.6 Band 5 – 7 025-7 125 MHz (globally)

1/1.2/5.6.1 For Methods 5B, 5C, 5D, 5E

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

6 700-7 250 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
6 700-7 075	FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE ADD 5.C12 5.458 5.458A 5.458B	
7 075-7 145	FIXED MOBILE ADD 5.C12 5.458 5.459	

1/1.2/5.6.2 For Method 5B

ADD

5.C12-5B The frequency band 7 025-7 125 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.6.3 For Method 5C

ADD

5.C12-5C The frequency band 7 025-7 125 MHz, or portions thereof, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.6.4 For Method 5D

ADD

5.C12-5D The frequency band 7 025-7 100 MHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.6.5 For Method 5E

1/1.2/5.6.5.1 For Method 5E, Example 1

ADD

5.C12-5E The frequency band 7 025-7 125 MHz, or portions thereof, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). The use is expected as of 2030, taking into account the need for transition time for existing users of the spectrum. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

1/1.2/5.6.5.2 For Method 5E, Example 2

ADD

5.C12-5E The frequency band 7 025-7 125 MHz, or portions thereof, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A12-6GHz] (WRC-23)** applies. (WRC-23)

Note: For Example 2, the transition date would be specified in the Resolution.

1/1.2/5.6.6 For Methods 5B, 5C, 5D and 5E

See draft new Resolution **[A12-6GHz] (WRC-23)** proposed in section 1/1.2/5.5.6.

1/1.2/5.7 Band 6 – 10.0-10.5 GHz (Region 2)

1/1.2/5.7.1 For Method 6B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

10-10.7 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
10-10.4 EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C FIXED MOBILE RADIOLOCATION Amateur 5.474D 5.479	**10-10.4** EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474CA MOBILE RADIOLOCATION Amateur 5.474D 5.479 MOD 5.480 ADD 5.D12-6B	**10-10.4** EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C FIXED MOBILE RADIOLOCATION Amateur 5.474D 5.479
10.4-10.45 FIXED MOBILE RADIOLOCATION Amateur	**10.4-10.45** MOBILE RADIOLOCATION Amateur MOD 5.480 ADD 5.D12-6B	**10.4-10.45** FIXED MOBILE RADIOLOCATION Amateur
10.45-10.5 RADIOLOCATION Amateur Amateur-satellite 5.481	**10.45-10.5** MOBILE RADIOLOCATION Amateur Amateur-satellite MOD 5.481 ADD 5.D12-6B	**10.45-10.5** RADIOLOCATION Amateur Amateur-satellite 5.481

MOD

5.480 *Additional allocation:* in Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, El Salvador, Ecuador, Guatemala, Honduras, Mexico, Paraguay, the overseas countries and territories within the Kingdom of the Netherlands in Region 2, Peru, ~~and~~ Uruguay and Venezuela, the frequency band 10-10.45 GHz is also allocated to the fixed ~~and mobile~~ service~~s~~ on a primary basis. ~~In Colombia, Costa Rica, Mexico and Venezuela, the frequency band 10-10.45 GHz is also allocated to the fixed service on a primary basis.~~ (WRC-~~19~~23)

MOD

5.481 *Additional allocation:* in Algeria, Germany, Angola, ~~Brazil,~~ China, Côte d'Ivoire, Egypt, ~~El Salvador, Ecuador,~~ Spain, ~~Guatemala,~~ Hungary, Japan, Kenya, Morocco, Nigeria, Oman, Uzbekistan, Pakistan, ~~Paraguay, Peru,~~ the Dem. People's Rep. of Korea, Romania~~,~~ and Tunisia ~~and Uruguay~~, the frequency band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis. In Brazil, Costa Rica, El Salvador, Ecuador, Guatemala, Paraguay, Peru and

Uruguay, the frequency band 10.45-10.5 GHz is also allocated to the fixed service on a primary basis. (WRC-~~19~~23)

ADD

5.D12-6B In Region 2, the frequency band 10-10.5 GHz, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[C12-10GHz] (WRC-23)** shall apply. (WRC-23)

1/1.2/5.7.2 For Method 6C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

10-10.7 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
10-10.4 EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C FIXED MOBILE RADIOLOCATION Amateur 5.474D 5.479	**10-10.4** EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C MOBILE except aeronautical mobile ADD 5.E12 RADIOLOCATION Amateur 5.474D 5.479 MOD 5.480 ADD 5.F12	**10-10.4** EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C FIXED MOBILE RADIOLOCATION Amateur 5.474D 5.479
10.4-10.45 FIXED MOBILE RADIOLOCATION Amateur	**10.4-10.45** MOBILE except aeronautical mobile ADD 5.E12 RADIOLOCATION Amateur MOD 5.480 ADD 5.F12	**10.4-10.45** FIXED MOBILE RADIOLOCATION Amateur

10.45-10.5	10.45-10.5	10.45-10.5
RADIOLOCATION Amateur Amateur-satellite	MOBILE except aeronautical mobile ADD 5.E12 RADIOLOCATION Amateur Amateur-satellite	RADIOLOCATION Amateur Amateur-satellite
5.481	MOD 5.481 ADD 5.F12*bis*	5.481

MOD

5.480 *Additional allocation:* in Argentina, Brazil, Chile, Cuba, El Salvador, Ecuador, Guatemala, Honduras, Paraguay, the overseas countries and territories within the Kingdom of the Netherlands in Region 2, Peru and Uruguay, the frequency band 10-10.45 GHz is also allocated to the fixed and aeronautical mobile services on a primary basis. In Colombia, Costa Rica, Mexico and Venezuela, the frequency band 10-10.45 GHz is also allocated to the fixed service on a primary basis. (WRC-~~19~~23)

MOD

5.481 *Additional allocation:* in Algeria, Germany, Angola, ~~Brazil,~~ China, Côte d'Ivoire, Egypt, ~~El Salvador, Ecuador,~~ Spain, ~~Guatemala,~~ Hungary, Japan, Kenya, Morocco, Nigeria, Oman, Uzbekistan, Pakistan, ~~Paraguay, Peru,~~ the Dem. People's Rep. of Korea, Romania~~,~~ and Tunisia ~~and Uruguay~~, the frequency band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis. In Brazil, Costa Rica, El Salvador, Ecuador, Guatemala, Paraguay, Peru and Uruguay, the frequency band 10.45-10.5 GHz is also allocated to the fixed and aeronautical mobile services on a primary basis. (WRC-~~19~~23)

ADD

5.E12 In Region 2, the frequency band 10-10.5 GHz, is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[C12-10GHz] (WRC-23)** applies. (WRC-23)

Example 1:

ADD

5.F12 Stations of the mobile service in Region 2 countries not listed in No. **5.480** in the frequency band 10-10.45 GHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-23)

ADD

5.F12*bis* Stations of the mobile service in Region 2 countries not listed in No. **5.481** in the frequency band 10.45-10.5 GHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service in all Regions. (WRC-23)

Example 2:

ADD

5.F12 In the frequency band 10-10.45 GHz, IMT stations in Region 2 and stations of the mobile service in Region 2 countries not listed in No. **5.480** shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. Administrations wishing to implement IMT in Region 2 shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. (WRC-23)

ADD

5.F12*bis* In the frequency band 10.45-10.5 GHz, IMT stations in Region 2 and stations of the mobile service in Region 2 countries not listed in No. **5.481** shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service in all Regions. Administrations wishing to implement IMT in Region 2 shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service in all Regions. (WRC-23)

1/1.2/5.7.3 For Methods 6B and 6C

ADD

DRAFT NEW RESOLUTION [C12-10GHz] (WRC-23)

Terrestrial component of International Mobile Telecommunications in the frequency band 10-10.5 GHz in Region 2

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, are intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;

b) that adequate and timely availability of spectrum and supporting regulatory provisions are essential to realize the objectives in Recommendation ITU-R M.2083;

c) that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;

d) that IMT systems are now being evolved to provide diverse usage scenarios and applications, such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications,

recognizing

a) that timely availability of wide and contiguous blocks of spectrum is important to support the development of IMT;

b) that the frequency band 10.6-10.68 GHz is allocated on a primary basis to both active and passive services with specific conditions outlined in Resolution **751 (WRC-07)**, based on the conclusion of studies contained in Report ITU-R RS.2096, that allow for sharing with the Earth exploration-satellite service (EESS) (passive);

c) that the frequency band 10.68-10.7 GHz is globally allocated to passive services, and No. **5.340** applies;

[For Method 6C]

d) that the frequency band 10-10.4 GHz is allocated to the EESS (active) service, whose capability to perform very high-resolution cloud-free imaging, offers a multitude of benefits to society, such as topographic and cadastral mapping, urban planning, emergency management, climate change and enhanced maritime monitoring;

e) that the use of the frequency band 10-10.5 GHz for IMT is only intended for microcell base stations,

resolves

1 that administrations wishing to implement IMT consider use of the frequency band 10-10.5 GHz identified for IMT in No. **5.D12-6B/5.E12-6C** in Region 2, taking into account the latest relevant ITU-R Recommendations;

2 that administrations shall take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon when deploying IMT base stations within the frequency band 10-10.5 GHz; the mechanical pointing needs to be at or below the horizon;

[Examples for the protection of radiolocation and EESS (active)]

[Example 1]

3 that administrations shall consider suppression side lobe techniques providing 16 dB additional attenuation for angles above 30°, considering the main beam at boresight, compared to the approximation envelope according to Recommendation ITU-R M.2101;

Note: Further discussions are needed whether this resolves *applies to in-band and adjacent band.*

[Example 2]

3 [TBD: development of a defined constraint (gain and/or e.i.r.p.) on IMT station skyward emissions];

Note: When preparing the text for a proposal for resolves *3 under Example 2, the TBD value in square brackets in the regulatory example above should be proposed.*

[Example 3]

3 that the power delivered by a transmitter to the antenna of a station, or the total radiated power (TRP) of IMT stations that use an antenna that consists of an array of active elements, shall not exceed −1 dBW;

3*bis* that the maximum e.i.r.p. of the IMT base stations antenna shall not exceed −5 dBW for all elevation angles above 34 degrees;

Note: If/once constraints are developed in Examples 1, 2 and/or 3 for resolves *3 (and 3*bis *for Example 3) above, then the level provided in* resolves *4 on IMT base stations to protect EESS (passive) should be adjusted accordingly.*

[Example for the protection of EESS (passive)]

4 that, for the purposes of protecting the EESS (passive), the unwanted emission level per IMT base station shall not exceed −43/TBD (see note above) dBW in the frequency band 10.6-10.7 GHz;

5 that, for the purposes of protecting the EESS (passive), the unwanted emission level per IMT user equipment shall not exceed −41/TBD (see note above) dBW in the frequency band 10.6-10.7 GHz;

[Example for the protection of RAS and/or invites *3 below]*

6 that the power flux-density from IMT stations operating in the frequency band 10-10.5 GHz shall not exceed −167 dB(W/m^2) at radio astronomy stations operating in the frequency band 10.68-10.7 GHz,

invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment in the frequency band 10-10.5 GHz, taking into account the results of sharing and compatibility studies conducted in preparation for WRC-23;

2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of the developing countries;

3 to develop an ITU-R Report and/or Recommendation on methodologies for calculating coordination zones around radio astronomy stations operating in the frequency band 10.6-10.7 GHz in order to avoid harmful interference from IMT systems operating in the frequency band 10-10.5 GHz;

4 to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations, as appropriate, to provide information and assistance to the concerned administrations on possible coordination of FS stations with IMT stations in the frequency band 10-10.5 GHz,

NOTE: WRC-23 may consider extending this invites ITU-R *to 3 600-3 800 MHz and 6 425-7 125 MHz.*

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

1/1.2/5.8 For all Methods: Suppression of Resolution 245 (WRC-19)

SUP

RESOLUTION 245 (WRC-19)

Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications identification in the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz

Agenda item 1.3

1.3 to consider primary allocation of the band 3 600-3 800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with Resolution ***246 (WRC-19)****;*

Resolution **246 (WRC-19)** – *Studies to consider possible allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1.*

Different views have been expressed regarding the *invites WRC-23* of Resolution **246 (WRC-19)** "to consider possible upgrade of the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1, and to take appropriate regulatory actions".

The following two views are expressed concerning Methods D and E:

View 1:

With regard to Methods D and E (a possible IMT identification under this agenda item), several administrations raised the following points:

a) Identification of the band, if upgraded to primary, for IMT is not in the scope of WRC-23 agenda item 1.3.

b) There is no specific reference to identification of the band, if upgraded to primary, to IMT and the interpretation of the term "Regulatory Action" to mean identification is not supported.

c) ITU-R is not eligible to interpret the language used in title of agenda item 1.3 or in its supporting Resolution.

d) More importantly, Method D does not have any provision to protect incumbent services and their future development.

e) The upgrading to primary for the aeronautical mobile service is not in the scope of WRC-23 agenda item 1.3. All the studies were conducted only with respect to the land mobile service.

Moreover, these administrations, after consultation with BR, are of the view that, while the framework of Resolution ***246 (WRC-19)*** *does not explicitly exclude <u>studies on IMT</u> from other studies on mobile service applications under the purview of WP 5A, <u>it does not address the possibility of an IMT identification of the band under consideration</u>. WP 5A may include IMT applications in its studies under AI 1.3 based on input information, e.g. from WP 5D, but cannot propose an IMT identification because this task was not decided by WRC-19 when establishing AI 1.3. In this regard, it has to be noted that CPM23-1 followed the clear differentiation of WRC-19 between agenda items 1.2 and 1.3 and consequently assigned both to different groups with dedicated expertise. WP 5A, when developing and concluding on this draft CPM text, must respect the above.*

In addition, the above administrations object to make any reference to considering d) *of Resolution* ***246 (WRC-19)*** *as reproduced below: "*considering d)*"*

> *"*d) *that some administrations in Region 1 are currently using the frequency band 3 600-3 800 MHz, or part of that frequency band, for the mobile service (for example International Mobile Telecommunications (IMT) implementation);".*

The above objection is based on the fact that considering d) *only indicates the use of spectrum for IMT as a national policy of administrations wishing to use IMT for that band under RR No.* ***4.4****.*

In view of the above these administrations therefore strongly object to making any reference to identification of IMT under this agenda item.

View 2:

Some other administrations have the view that the framework of Resolution ***246 (WRC-19)*** *include the studies on IMT systems as part of mobile service applications as well as IMT identification within the scope of AI 1.3 considered under the purview of WP 5A. Resolution* ***246 (WRC-19)*** *invites the 2023 World Radiocommunication Conference:*

" … to consider possible upgrade of the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1, and to take appropriate regulatory actions".

It is crystal clear from Resolution ***246 (WRC-19)*** *that IMT studies and consequently potential for IMT identification in WRC-23 is part of the AI 1.3 scope as follows:*

1) IMT identification is included within the scope of Resolution ***246 (WRC-19)*** *by clearly calling WRC-23 to consider taking appropriate regulatory actions in addition to upgrading the allocation to mobile service on a primary basis.*

2) IMT is part of the mobile service since Resolution ***246 (WRC-19)*** *resolves to invite the ITU Radiocommunication Sector … to conduct sharing and compatibility studies in time for WRC-23 between the mobile service and other services allocated on a primary basis within the frequency band 3 600-3 800 MHz ….*

3) In accordance with Administrative Circular CA/251, CPM23-1 decided that WP 5D is contributing group in the AI 1.3, which is responsible for IMT aspects to be considered in the WP 5A studies on this AI 1.3.

4) It is necessary to refer to considering d) *of Resolution* ***246 (WRC-19)*** *as reproduced below: "*considering d)*"*

> *"d) that some administrations in Region 1 are currently using the frequency band 3 600-3 800 MHz, or part of that frequency band, for the mobile service (for example International Mobile Telecommunications (IMT) implementation);".*

Accordingly, this agenda item was intended to upgrade the mobile allocation to primary and to identify the 3 600-3 800 MHz frequency band for IMT, since IMT is already implemented in many countries of Region 1 as well as other regions.

The following two views are expressed concerning Method C, Alternative C5:

View 3:

Some administrations are of the view that the pfd limit of −154.5 dB(W/(m² · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time does not ensure the respect of the short-term criteria for the FSS receiver. Therefore, Method C alternative C5 proposes a regulatory approach based on a pfd limit to ensure protection of the uncoordinated typical FSS earth stations. The proposed value for a limit is based on the short-term protection criterion for FSS stations (I/N −1.3 not to be exceeded for 0.005% of time), a minimal elevation angle of 5 degrees, a system noise temperature of 120 K and an FSS earth station antenna gain pattern from Recommendation ITU-R S.465, as provided by WP 4A.

View 4:

Concerning Method C alternative C5, some administrations raised concerns regarding the applicability of the short-term criteria for the following reasons:

1) The proposed pfd limit of −154.5 dB (W/(m² · 4 kHz)) was defined for the protection of uncoordinated VSAT (for worst-case scenario) and the use of such short-term criteria would lead to unrealistic protection distances.

2) For large stations, for which the short-term interference criteria are important, the provision of RR No. ***9.17*** *also applies in the coordination phase, and the coordination distance is based on the short-term interference criteria.*

3) If the coordination does not apply, it is because it is not a large station and WRC-07 considered that it was not necessary to update the short-term criteria.

4) The pfd value of [−154.5 dB (W/(m² · 4 kHz))] has been previously proposed as the long-term protection threshold at 3 m above ground for 20% of the time at the border of other administrations. Method C alternative C5 considers the same long-term pfd value but for 0.005% of time, which is the time % used in the short-term protection criterion. The resulting protection criterion from combining elements of both long- and short-term criteria has not been technically justified in the studies and will result in unrealistic and unnecessary separation distances.

The following view is expressed concerning Method A:

View 5:

With regard to Method A, analysis of the results of studies performed before WRC-19 indicate that the same regulatory and technical provisions could be considered applicable to a primary allocation of this frequency band as applied for the frequency band 3 400-3 600 MHz. Several sharing and compatibility studies submitted during this study period show reasonable separation distances indicating that the upgrade of the allocation to the mobile, except aeronautical mobile, service on a primary basis is feasible without imposing undue constraints on the existing services and their future development.

The following view is expressed concerning Method B:

View 6:

With regard to Method B, this method will not protect incumbent services in the 3 600-3 800 MHz band and adjacent bands since it has not any provision to protect them.

The following three views are expressed concerning Method D:

View 7:

Some administrations have expressed serious concerns with the deletion of the exclusion of aeronautical mobile in the update of Method D contained in the proposal of some countries received at the CPM23-2 meeting. Indeed, the aeronautical mobile service is clearly excluded from the scope of the agenda item 1.3 by the Resolution ***246 (WRC-19)*** *both in its title as well as in the section “*invites the 2023 World Radiocommunication Conference*”.*

It should be noted that ***no*** *studies, nor any characteristics have been submitted, neither to the responsible WP 5A nor to CPM23-2, addressing the compatibility of the aeronautical mobile service with incumbent services. The conclusions of the studies provided in this cycle are not applicable to the aeronautical mobile service.*

Considering further the above elements, not connected to the content of Method D itself as it was initially in the draft CPM text, the new version of this method raises procedural issues. Finally, Method D appears to be no longer in accordance with the working methods of the CPM, contained in Resolution ITU-R 2-8 (see for example sections A1.2.8 and A2.4.3) and should therefore be deleted.

View 8:

Some other administrations are of the view that the deletion of the exclusion of the aeronautical mobile service in the update of Method D is within the scope of agenda item 1.3. It should be noted that IMT systems are widely used for serving many applications in the air such as air-to-ground applications for serving aircraft in the sky, applications of unmanned aerial vehicles (UAV) and unmanned aircraft systems (UAS) including drones and flying air taxis, etc. Accordingly, the IMT related agenda items need to consider such growing demands in most of countries by deleting any reference to "exception of aeronautical mobile service" from the primary allocation to the mobile service, without proper technical and regulatory justifications.

Although this proposal was discussed over multiple occasions, there were no studies submitted from those other concerned administrations which show clearly that there is no real impact and such exclusion should be deleted.

Hence, Method D is fully in line with the working methods of the CPM, contained in Resolution ITU-R 2-8.

View 9:

Some administrations are of the view that agenda item 1.3 does not relate to any action directly or indirectly to unmanned aircraft.

1/1.3/1 Executive summary

Section 1/1.3/3 contains a summary of the compatibility and sharing studies between the MS and the FSS and FS that were conducted before the current study cycle. It also summarizes seven studies that have been conducted in the current cycle under WRC-23 agenda item 1.3.

Five methods to satisfy this agenda item are proposed in section 1/1.3/4:

– Method A: No change;

– Method B: Upgrade of the allocation of 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1 without conditions;

– Method C: Upgrade of the allocation of 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1 with regulatory and/or technical conditions. This method includes five alternatives for the conditions;

– Method D: Upgrade of the allocation of 3 600-3 800 MHz to the mobile service on a primary basis within Region 1 without conditions, and identification for IMT.

– Method E: Upgrade of the allocation to the mobile, except aeronautical mobile, service on a primary basis within Region 1 with regulatory and/or technical conditions, and identification for IMT in Region 1 in the band 3 600-3 800 MHz or parts thereof.

All five methods also propose to suppress Resolution **246 (WRC-19)**.

The regulatory and procedural considerations for the methods and alternatives are contained in section 1/1.3/5.

1/1.3/2 Background

Further to Resolution **246 (WRC-19)**, efficient implementation of broadband connectivity, *inter alia*, could play an important role in development of telecommunications services in many countries.

1/1.3/3 Summary and analysis of the results of ITU-R studies

1/1.3/3.1 Applicable ITU-R Recommendations and Reports

ITU-R Recommendations: P.452, P.1238, P.2040, P.2001, M.2150, F.1336

ITU-R Reports: S.2368, M.2109, S.2199, M.2111, M.2116, F.2328

1/1.3/3.2 Summary of the results of studies

Sharing and compatibility studies in the frequency band 3 300-4 200 MHz, including frequency band 3 600-3 800 MHz, between the land mobile service (including IMT) and other existing services have been carried out in preparation of previous World Radiocommunication Conferences, including WRC-07 and WRC-15.

The frequency range 3 400-4 200 MHz, or parts thereof, is allocated to the FS, FSS, ARS, MS and RLS. The frequency bands adjacent to this frequency range are allocated to the RLS, ARS, FS, MS, RNS and ARNS. The details of these allocations and those of the adjacent frequency bands can be found in RR Article **5**.

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 300-3 400
RADIOLOCATION

5.149 5.429 5.429A 5.429B
5.430</td><td>3 300-3 400
RADIOLOCATION
Amateur
Fixed
Mobile
5.149 5.429C 5.429D</td><td>3 300-3 400
RADIOLOCATION
Amateur

5.149 5.429 5.429E 5.429F</td></tr>
<tr><td rowspan="2">3 400-3 600
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.430A
Radiolocation

5.431</td><td>3 400-3 500
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.431A 5.431B
Amateur
Radiolocation 5.433
5.282</td><td>3 400-3 500
FIXED
FIXED-SATELLITE (space-to-Earth)
Amateur
Mobile 5.432 5.432B
Radiolocation 5.433

5.282 5.432A</td></tr>
<tr><td>3 500-3 600
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.431B
Radiolocation 5.433</td><td>3 500-3 600
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.433A
Radiolocation 5.433</td></tr>
<tr><td>3 600-4 200
FIXED
FIXED-SATELLITE
(space-to-Earth)
Mobile</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.434
Radiolocation 5.433</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td></tr>
</table>

	3 700-4 200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile

1/1.3/3.2.1 Studies from previous cycles (before WRC-19)

Notwithstanding the studies performed under WRC-23 agenda item 1.3, the results provided in Reports ITU-R S.2368, ITU-R S.2199, ITU-R F.2328 reflected in this section remain valid taking into account the parameters, assumptions and conditions based on which these Reports were adopted. However, the relevance of the studies in these Reports depend on current and future deployments of radiocommunication services including the land mobile service.

1/1.3/3.2.1.1 Compatibility and sharing studies with FSS system

Report ITU-R S.2368 assessed compatibility and sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service in the frequency range 3 400-4 200 MHz. Section 7 of the Report contains the Summary of the results including the assumptions and interference mechanisms considered, and Section 9 provides the overall summary. For co-channel sharing, the following separation distance requirements were found, to protect the long-term interference criterion of FSS receiving earth stations:

– for suburban/urban macro-cell deployment scenarios: some studies resulted in distances as low as around 10 km, and other studies showed distances as large as around 100 km;

– for small-cell outdoor deployment scenarios: some studies resulted in distances as low as around 0.5 km, and other studies showed distances as large as around 80 km;

– for small-cell indoor deployment scenarios: some studies resulted in distances as low as around 0.5 km, and other studies showed distances as large as around 60 km.

Report ITU-R S.2368 also provides studies which indicated that for co-channel configurations the separation distances when considering the short-term protection criterion, as presented in the report, for FSS receiving earth stations could be as low as around 0.2 km and as large as around 400 km, depending on assumptions of the studies.

Report ITU-R S.2368 also provides studies which indicated that for adjacent channel configurations, the separation distances when considering the long-term protection criterion for FSS receiving earth stations could be less than 0.3 km and as large as around 49 km, depending on the assumptions of the studies including guardbands of between 0 MHz and 20 MHz.

Report ITU-R S.2199 examined the compatibility of Broadband Wireless Access systems (BWA) with FSS systems also in the frequency range 3 400-4 200 MHz. Section 6 of the Report contains the summary of the results including the assumptions and interference mechanisms considered, and Section 8 provides the overall summary. The separation distance requirements to facilitate sharing were found to be:

– co-frequency: several tens to in excess of 100 km;

– out-of-band emissions: a few km; and

– FSS receiver saturation: a few to several km.

Study A in Attachment 1 to Annex B of Report ITU-R S.2199 states that the minimum required distance can be smaller than 100 m. However, this was not reflected in the conclusions of Report ITU-R S.2199.

1/1.3/3.2.1.2 Compatibility and sharing studies with FS system

Report ITU-R F.2328 examined the sharing and compatibility of IMT and FS systems operating in the frequency range 3 400-4 200 MHz. Table 6 of the Report contains the summary of the results including the assumptions and interference mechanisms considered, and the conclusions section provides the overall summary. The separation distance requirements between the IMT BS and the FS receiver to facilitate sharing were found to be:

– co-frequency: 50.4-92.0 km (Macro Suburban), 41.7-81.0 km (Macro Urban), 13.4-45.0 km (Small Cell Outdoor) and 1-10 km (Small Cell Indoor), depending on the interference scenario and deployment environment; and

– the adjacent channel: between 1 km (for a frequency separation of 27.7 MHz) and 30 km (for a frequency separation of 9 MHz).

1/1.3/3.2.1.3 Analysis of the results of studies (before WRC-19)

Report ITU-R S.2368 contains conclusions on the sharing and compatibility studies between IMT-Advanced and the FSS in the frequency band 3 400-4 200 MHz, indicating that sharing is feasible when FSS earth stations are at known, specific locations, and deployment of IMT-Advanced is outside the minimum required distances for each azimuth to protect these specific FSS earth stations. When FSS earth stations are deployed in a typical ubiquitous manner or with no individual licensing, sharing between IMT-Advanced and the FSS may not be feasible in the same geographical area since no minimum separation distance can be guaranteed.

In the frequency band 3 400-3 600 MHz regulatory and technical conditions to protect existing services contain, a power flux-density (pfd) limit, applicable to stations of the mobile service, of -154.5 dB(W/(m^2 · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time at the border of the territory of any other administration.

Compatibility and sharing studies in Report ITU-R S.2368, Report ITU-R M.2109 and Report ITU-R F.2328, do not differentiate between frequency bands 3.4-3.6 GHz and 3.6-3.8 GHz.

Therefore, the same regulatory and technical provisions could be considered in the frequency bands 3.6-3.8 GHz for a possible primary allocation of the frequency band 3.6-3.8 GHz to the mobile service.

1/1.3/3.2.2 WRC-23 study cycle summary of studies

1/1.3/3.2.2.1 Compatibility and sharing studies with FSS systems

1/1.3/3.2.2.1.1 Parameters and assumptions of the studies

The table below summarizes the parameters and assumptions used in the FSS-MS compatibility studies. The rest of this section summarizes the results of the studies.

	Study A	Study B	Study C	Study D	Study E	Study	Study G
Scenario	In-band	In-band	In-band	In-band	In-band	In-band and adjacent band	In-band
Methodology	Statistical	Statistical	Statistical study	Statistical study	Statistical study	statistical	Deterministic (single entry) and statistical
MS characteristics							
Deployment scenarios	Urban, suburban macro	Urban macro	Urban macro	Urban macro	Urban, suburban macro	Urban, suburban, rural macro	Urban, suburban, rural macro
BS antenna	AAS	AAS	AAS	AAS	AAS	AAS	non-AAS
Parameter source	See Doc. 5A/378	See Doc. 5A/378	See Doc. 5A/378	See Doc. 5A/378	See Doc. 5A/378	See Doc. 5A/378	See Doc. 5A/378
FSS characteristics							
Antenna diameter (metres)	1.2 m, 3 m, 32 m	3 m & 32 m	5 m to 7.3 m	3 m	3 m	AAS: 1.2-32 m	Non-AAS: 2.4-12 m,
Elevation angle (degrees)	10	26 to 55	24.8 to 50	30 and 68	10°, 15° and 48°	10 degrees AAS	17-77 degrees non-AAS
Antenna height (metres)	10 m & 17 m	5 m & 18 m	1.8 m	1.8 m	5 m	10 m	10 m
Azimuth angle between FSS boresight & IMT network (degrees)	0 and 180	0	0 and 180	0	0	0 degrees for AAS	Full circle for non-AAS
Parameter source	See Doc. 5A/395	See Doc. 5A/395 3 dB scale factor in the antenna pattern	See Doc. 5A/395	See Doc. 5A/395	See Doc. 5A/395	See Doc. 5A/395	See Doc. 5A/395
Propagation and clutter models							
Model source	See Doc. 5A/384	See Doc. 5A/384	See Doc. 5A/384	See Doc. 5A/384	See Doc. 5A/384	See Doc. 5A/384	See Doc. 5A/384
Propagation model	Rec. ITU-R P.452 with 50%, 20% and random time %, no terrain data	Rec. ITU-R P.2001 random time %, no terrain data	Rec. ITU-R P.452 with 20% time, no terrain data	Rec. ITU-R P.452 with random time %, terrain data	Rec. ITU-R P.2001 with random time %, no terrain data	AAS: Rec. ITU-R P.452 with random time %	Non-AAS: Rec. ITU-R P.452 with 20% for long-term and 0.005% for short term, terrain data

	Study A	Study B	Study C	Study D	Study E	Study	Study G
Clutter model	Rec. ITU-R P.2108 at mobile BSs & ES / mobile BSs only, random distribution	Rec. ITU-R P.2108 at mobile BSs / mobile BS & ES, random distribution	Rec. ITU-R P.2108 at mobile BSs and ES, random distribution	Rec. ITU-R P.2108 at mobile BSs, random distribution	Rec. ITU-R P.2108 at mobile urban BSs, (two cases: 100% of urban BSs, 50% of urban BSs), random distribution	AAS: Rec. ITU-R P.2108 at 50% of mobile BSs, random distribution	Non-AAS: Rec. ITU-R P.452

NOTE: The above table provides an overview of the main assumptions for each of the sharing and compatibility studies that are summarized in this section and indicates the main parameters used in each study. Since the various studies have used different assumptions for various parameters, the corresponding summary is shown at the end of each study to indicate the results of that study. The overall summary of all studies, to the extent practicable, is also shown at the end of this section. It is evident that it would be difficult or impractical to properly reflect such overall results in the section “Methods to satisfy agenda the item” taking into account that some of the input parameters merely reflect the conditions and circumstances based on which the study was carried out. Consequently, no single unified overall conclusion can be drawn from these studies. The appropriate conclusions for sharing and compatibility depend on which parameter assumptions are considered most relevant by each administration.

1/1.3/3.2.2.1.2 Results of the studies

1/1.3/3.2.2.1.2.1 Study A

Simulation results provide the required separation distances in urban and suburban scenarios. Different assumptions on the percentage of time were used to evaluate the interference (50%, 20% and random time %). When considering clutter loss on both sides, the range of distances are from < 1 km to 11.7 km to meet the long-term criteria, and from 1.5 km to 58 km to meet the short-term criteria. When considering only MS side clutter loss, the range of distances are from 8.1 km to 39.3 km to meet the long-term criteria, and from 6.9 km to 98 km to meet the short-term criteria.

1/1.3/3.2.2.1.2.2 Study B

The results show that the aggregated interference in urban scenarios from MS BSs to a FSS ES is able to satisfy the FSS long-term protection criterion for all considered cases at a separation distance of 20 km for FSS ESs with a small antenna diameter (3 m) and at a separation distance of 30 km for FSS ESs with a large antenna diameter (32 m). Additional results show that, if the FSS ES has natural and/or artificial shielding, the separation distances required are below 1 km.

1/1.3/3.2.2.1.2.3 Study C

The results show separation distances of between 4.5 km and 7.5 km for different ES, azimuth distance, and protection criteria (long-term and short-term criteria).

1/1.3/3.2.2.1.2.4 Study D

The study presents results in the form of CCDFs showing the probability that the aggregate interference-to-noise ratio exceeds different $\Sigma\, I/N$ values for a number of different scenarios. The probability that an example $\Sigma\, I/N$ value of −10 dB is exceeded is < 0.01 for all scenarios modelled in the study. The study illustrates that the probability of exceedance of interference was below 1% with at most a few tens of kms, with results dependent on specific scenarios on a case-by-case basis.

1/1.3/3.2.2.1.2.5 Study E

The results indicate that distances of up to 24 km between FSS ES and urban mobile service base stations were sufficient to meet the interference criteria, while distances of up to 30 km between FSS ES and suburban mobile service base stations were sufficient to meet the interference criteria when no clutter was considered at the MS base station.

1/1.3/3.2.2.1.2.6 Study F

A single-entry study calculates separation distances to protect operational FSS ES in some countries in Africa. The study concludes on required separation distance of 79.5 km to 149 km to meet the long-term interference criteria and from 248 km to 420 km to meet the short-term interference criteria depending on the FSS ES location, terrain and characteristics.

Another aggregate interference study shows the I/N aggregate impact at the Niamey FSS ES for urban and suburban deployment cases around the ES. The results corroborate the single-entry sharing study by showing a large exceedance of the FSS ES protection criteria even for small MS deployment around the FSS ES.

These studies have only addressed protection of FSS ES at a known location.

1/1.3/3.2.2.1.2.7 Study G

For the in-band case the results lead to separation distances of 150-218 km to meet the long-term interference criteria and of 460-505 km to meet the short-term interference criteria. Further, for the out-of-band case, the results show:

– that the FSS ES LNB would be driven into saturation without filtering consideration and;

– the mobile OOB emissions falling into the FSS ES receiving band would have an impact on the FSS ES receiving performances even when the two services are separated by several tens of km.

1/1.3/3.2.2.2 Compatibility and sharing studies with FS systems

One sharing study was presented. It provides the preliminary results of the interference from MS BSs to FS station in the frequency band 3 600-3 800 MHz. Recommendations ITU-R P.452 and ITU-R P.2108 are applied as propagation model and clutter loss model separately. For clutter loss model, the cases of both MS side and FS side (with 20 m FS antenna height) and only MS side (with 60 m FS antenna height) are considered. In the simulation, the MS BSs are aside the FS station at a given distance. Monte Carlo simulation method is used in the study to evaluate the aggregated interference. The long-term protection criteria are considered when assessing the interference level from the MS to the FS.

Simulation results provide the required separation distances in urban and suburban scenarios. To meet the protection criteria in urban scenario, the required separation distances in the direction where FS main-lobe points towards the MS are 65 km (with 60~76 m FS antenna height) and 20~30.5 km (with 20 m FS antenna height), and in the direction where FS back-lobe points towards the MS are 1~4.5 km (with 60 m FS antenna height) and 0.6~3 km (with 20 m FS antenna height). In addition, to meet the protection criteria in a suburban scenario, the required separation distances in the direction where FS main-lobe points towards the MS are 66.2~76.5 km (with 60 m FS antenna height) and 29.8~31.2 km (with 20 m FS antenna height), and in the direction where FS back-lobe points towards the MS are 2~3 km (with 60 m FS antenna height) and 1~3 km (with 20 m FS antenna height).

1/1.3/4 Methods to satisfy the agenda item

The following methods reflect the views of administration(s) proposing any of these methods:

1/1.3/4.1 Method A: No change to the RR except suppression of Resolution 246 (WRC-19)

Reason/justification:

Sharing and compatibility studies are not convincing enough to protect incumbent services therefore upgrading the allocation to primary is not supported.

1/1.3/4.2 Method B: Upgrade the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1 without conditions and suppression of Resolution 246 (WRC-19)

This method proposes to upgrade the allocation of the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations for the frequency band 3 600-3 800 MHz in Region 1 without any conditions. This method also proposes suppression of Resolution **246 (WRC-19)**.

1/1.3/4.3 Method C: Upgrade of the allocation to the mobile, except aeronautical mobile, service on a primary basis within Region 1 with regulatory and/or technical conditions and suppression of Resolution 246 (WRC-19)

This method contains five Alternatives. They are self-contained so if chosen by administrations when preparing proposals for WRC-23 the whole method is clearly presented.

All the Alternatives propose the suppression of Resolution **246 (WRC-19)**. To this effect there may be a need for a new Resolution in this regard yet to be decided, if necessary.

1/1.3/4.3.1 Alternative C1

Alternative C1 of Method C recognizes the need of upgrading the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis in Region 1, subject to agreement to be obtained under RR No. **9.21**. This Alternative proposes the same technical and regulatory conditions as for the frequency band 3 400-3 600 MHz (except IMT identification). This upgrade to be done while ensuring the protection of existing primary services. This objective could be reached by adopting the same technical and regulatory conditions applicable to the frequency band 3 400-3 600 MHz, in particular the pfd limit of -154.5 dB(W/(m^2 · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time at the border.

1/1.3/4.3.2 Alternative C2

Alternative C2 of Method C recognizes the need of upgrading the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis in Region 1. This upgrade to be done while ensuring the protection of existing primary services. This objective could be reached by adopting particular conditions in a footnote to the RR, in particular the pfd limit of -154.5 dB(W/(m^2 · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time at the border.

1/1.3/4.3.3 Alternative C3

Alternative C3 of Method C supports the upgrade to the mobile, except aeronautical mobile, service on a primary basis in the frequency band 3 600-3 800 MHz, or parts thereof, in Region 1, while recognizing the need of the appropriate protection of the FSS at the border of each country (specifically with the implementation of a pfd limit, applicable to stations of the mobile service, of -154.5 dB(W/(m^2 · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time at the border of the territory of any other administration).

1/1.3/4.3.4 Alternative C4

Alternative C4 of Method C proposes to upgrade the allocation of the mobile, except aeronautical mobile, service on a primary basis in the Frequency Allocation Table for the frequency band 3 600-3 800 MHz in Region 1, reaching agreement with other administrations according to RR No. **9.21**.

1/1.3/4.3.5 Alternative C5: Upgrading the mobile allocation with power flux-density (pfd) protection limits based on short-term protection criterion

Alternative C5 of Method C proposes alternative pfd protection limits, to include a pfd limit of [-154.5] dB(W/(m^2 · 4 kHz)) at 3 m above ground not to be exceeded for more than 0.005% of the time at the border of the territory.

Note: This Alternative C5 was included in accordance with View 3.

With regard to Method C Alternative C5, see also Views 3 and 4 before section 1/1.3/1.

1/1.3/4.4 Method D: Upgrade of the allocation of the frequency band 3 600-3 800 MHz to the mobile service on a primary basis within Region 1 without conditions, and identification for IMT – Suppression of Resolution 246 (WRC-19)

This method proposes to upgrade the allocation of the mobile service on a primary basis in the Frequency Allocation Table for the frequency band 3 600-3 800 MHz in Region 1 without any conditions, and identification of the band for IMT.

Note: This method was included in accordance with View 2.

With regard to Method D, see also Views 1, 2, 7, 8 and 9 before section 1/1.3/1.

1/1.3/4.5 Method E: Upgrade of the allocation of the band 3 600-3 800 MHz or parts thereof to the mobile, except aeronautical mobile, service on a primary basis in Region 1 with regulatory and/or technical conditions, and identification for IMT. Suppression of Resolution 246 (WRC-19)

1/1.3/4.5.1 Alternative E1

This alternative proposes to upgrade the allocation of the frequency band 3 600-3 800 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations, and identification of the band for IMT. The use of this band by MS is subject to agreement to be obtained under RR No. **9.21**. The provisions of RR Nos. **9.17** and **9.18** shall also apply in the coordination phase. This upgrade is to be done, recognizing the need of the appropriate protection of FSS at the border of each country by adopting a pfd limit of −154.5 dB(W/(m² · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time at the border of the territory of any other administration applicable to stations of the mobile service.

In addition, this method grants the flexibility for administrations to limit the use of IMT to the band 3 600-3 700 MHz by adding their name to the footnote.

1/1.3/4.5.2 Alternative E2

This alternative supports the upgrade of the allocation of the frequency band 3 600-3 700 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations, and identifies the band for IMT. The use of this band by MS is subject to agreement to be obtained under RR No. **9.21**. The provisions of RR Nos. **9.17** and **9.18** shall also apply in the coordination phase. This upgrade is to be done, recognizing the need of the appropriate protection of FSS at the border of each country by adopting a pfd limit of −154.5 dB(W/(m² · 4 kHz)) at 3 m above ground not to be exceeded for more than 20% of time at the border of the territory of any other administration applicable to stations of the mobile service.

In addition, this method also grants the flexibility for administrations to extend the use of IMT in the band 3 700-3 800 MHz by adding their name to a new footnote, which would apply the same technical and regulatory conditions that apply in the band 3 600-3 700 MHz to 3 700-3 800 MHz.

The method also proposes the suppression of the Resolution **246 (WRC-19)**.

With regard to Method E, see also Views 1 and 2 before section 1/1.3/1.

1/1.3/5 Regulatory and procedural considerations

NOTE: For some of the methods presented, regulatory and procedural considerations are subject to further studies and related decisions by administrations in Region 1 and may be added at a later stage in accordance with § A2.4.5 of Resolution ITU-R 2-8.

1/1.3/5.1 For Method A: No Change

NOC

ARTICLES

1/1.3/5.2 For Method B: Upgrade to a primary basis of the allocation of 3 600-3 800 MHz to the mobile service without conditions

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

3 600-4 800 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 600-~~4 200~~3 800 FIXED FIXED-SATELLITE (space-to-Earth) ~~Mobile~~ MOBILE except aeronautical mobile	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.434 Radiolocation 5.433	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.435
~~3 600~~3 800-4 200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile	**3 700-4 200** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	

1/1.3/5.3 For Method C: Upgrade of the allocation to the mobile, except aeronautical mobile, service on a primary basis within Region 1 with particular regulatory and/or technical conditions

1/1.3/5.3.1 For Method C, Alternative C1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

3 600-4 800 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 600-<s>4 200</s>3 800
FIXED
FIXED-SATELLITE (space-to-Earth)
<s>Mobile</s>
MOBILE except aeronautical mobile ADD 5.A13-C1</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.434
Radiolocation 5.433</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td></tr>
<tr><td><s>3 600</s>3 800-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
Mobile</td><td colspan="2">3 700-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td></tr>
</table>

ADD

5.A13-C1 The allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service is subject to agreement obtained under No. **9.21**. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band, it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed -154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) and with the assistance of the Bureau if so requested. In case of disagreement, calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service systems operating in the frequency band 3 600-3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-23)

1/1.3/5.3.2 For Method C, Alternative C2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

3 600-4 800 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 600-~~4 200~~3 800 FIXED FIXED-SATELLITE (space-to-Earth) ~~Mobile~~ MOBILE except aeronautical mobile ADD 5.B13-C2	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.434 Radiolocation 5.433	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.435
~~3 600~~3 800-4 200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile	**3 700-4 200** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	

ADD

5.B13-C2 Before an administration in Region 1 brings into use a (base or mobile) station of the mobile service in the frequency band 3 600-3 800 MHz, it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) and with the assistance of the Bureau if so requested. In case of disagreement, calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service systems operating in the frequency band 3 600-3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-23)

1/1.3/5.3.3 For Method C, Alternative C3

[TBD - Example(s) of regulatory text for this alternative to satisfy the agenda item may follow in dedicated proposals to WRC-23 directly, to give more time for national consideration and studies.]

1/1.3/5.3.4 For Method C, Alternative C4

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

3 600-4 800 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td>3 600-~~4 200~~3 800
FIXED
FIXED-SATELLITE (space-to-Earth)
~~Mobile~~
MOBILE except aeronautical mobile ADD 5.C13-C4</td>
<td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.434
Radiolocation 5.433</td>
<td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td>
</tr>
<tr>
<td>~~3 600~~3 800-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
Mobile</td>
<td colspan="2">3 700-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td>
</tr>
</table>

ADD

5.C13-C4 In Region 1, the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis is subject to agreements with the other administrations obtained under No. **9.21**. Stations of the mobile service in the frequency band 3 600-3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4**. (WRC-23)

1/1.3/5.3.5 For Method C, Alternative C5

[TBD - Example(s) of regulatory text for this alternative to satisfy the agenda item may follow in dedicated proposals to or WRC-23 directly, to give more time for national consideration.]

1/1.3/5.4 For Method D: An allocation to the mobile service on a primary basis in Region 1 and identification for International Mobile Telecommunications (IMT)

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

3 600-4 800 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 600-~~4 200~~3 800
FIXED
FIXED-SATELLITE (space-to-Earth)
~~Mobile~~
MOBILE ADD 5.D13-D</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.434
Radiolocation 5.433</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td></tr>
<tr><td>~~3 600~~3 800-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
Mobile</td><td colspan="2">3 700-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td></tr>
</table>

ADD

5.D13-D The frequency band 3 600-3 800 MHz, or portions thereof, are identified for use by administrations in Region 1 wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-23)

1/1.3/5.5 For Method E, Alternative E1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

3 600-4 800 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 600-~~4 200~~3 800
FIXED
FIXED-SATELLITE
(space-to-Earth)
~~Mobile~~MOBILE except
aeronautical mobile ADD 5.X13</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile 5.434
Radiolocation 5.433</td><td>3 600-3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation
5.435</td></tr>
<tr><td>~~3 600~~3 800-4 200
FIXED
FIXED-SATELLITE
(space-to-Earth)
Mobile</td><td colspan="2">3 700-4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile</td></tr>
</table>

ADD

5.X13 The allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations for the frequency band 3 600-3 800 MHz in Region 1, is subject to agreement obtained under No. **9.21**. This frequency band is identified for International Mobile Telecommunications (IMT), with the exception of [country A], [country B], [country C], […] where only the 3 600-3 700 MHz frequency band is identified for IMT. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The provisions of Nos. **9.17** and **9.18** shall also apply in the coordination phase. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band, it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20% of the time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) and with the assistance of the Bureau if so requested. In case of disagreement, calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band 3 600-3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of 2004). (WRC-23)

1/1.3/5.6 For Method E, Alternative E2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

3 600-4 800 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 600-3 700~~4 200~~ FIXED FIXED-SATELLITE (space-to-Earth) ~~Mobile~~ MOBILE except aeronautical mobile ADD 5.Y13-1	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.434 Radiolocation 5.433	**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.435
~~3 600~~3 700-4 200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile ADD 5.Y13-2	**3 700-4 200** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	

ADD

5.Y13-1 The allocation of the frequency band 3 600-3 700 MHz to the mobile, except aeronautical mobile, service is subject to agreement obtained under No. **9.21**. This frequency band is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The provisions of Nos. **9.17** and **9.18** shall also apply in the coordination phase. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band, it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed −154.5 dB(W/(m^2 · 4 kHz)) for more than 20 per cent of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) and with the assistance of the Bureau if so requested. In case of disagreement, calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service systems operating in the frequency band 3 600-3 700 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-23)

ADD

5.Y13-2 *Different category of service:* in [country A], [country B], [country C], […], the frequency band 3 700-3 800 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. **9.21** with other administrations and is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination, the provisions of Nos. **9.17** and **9.18** also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed -154.5 dB(W/(m^2 · 4 kHz)) for more than 20 per cent of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band 3 700-3 800 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations. (WRC-23)

1/1.3/5.7 For all Methods: Suppression of Resolution 246 (WRC-19)

SUP

RESOLUTION 246 (WRC-19)

Studies to consider possible allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1

Agenda item 1.4

1.4 to consider, in accordance with Resolution ***247 (WRC-19)****, the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;*

Resolution **247 (WRC-19)** – *Facilitating mobile connectivity in certain frequency bands below 2.7 GHz using high-altitude platform stations as International Mobile Telecommunications base stations*

1/1.4/1 Executive summary

WRC-23 agenda item 1.4 considers the use of high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level pursuant to Resolution **247 (WRC-19)**.

Section 1/1.4/3 contains a summary and analysis of the results of studies including sharing and compatibility studies that have been conducted under WRC-23 agenda item 1.4.

For each of the different issues identified, up to four methods are proposed to satisfy this agenda item in section 1/1.4/4, as summarized below:

Issues - Frequency band(s)	Methods			
	No change to the Radio Regulations (RR)	Use by HIBS in single footnote	Use by HIBS in single footnote not claiming protection	Use by HIBS in regional footnotes
A - 694-960 MHz	A1	A2	A3	A4
B - 1 710-1 885 MHz	B1	B2	B3	B4
C - 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz	C1	C2	C3	-
D - 2 500-2 690 MHz	D1	D2	D3	D4

The regulatory and procedural considerations for the methods are contained in section 1/1.4/5. All methods propose to suppress Resolution **247 (WRC-19)**.

1/1.4/2 Background

HIBS are located in the stratosphere, providing both uplink and downlink mobile connectivity to the ground-based IMT mobile stations. HIBS are intended to be used as part of terrestrial IMT networks, as an application of the mobile service, and may use the same frequency bands with ground-based IMT base stations. The IMT mobile stations to be served by HIBS are proposed to be the same as the ground-based IMT base stations. Currently, the IMT mobile stations support a variety of frequency bands identified for IMT, including frequency bands below 2.7 GHz.

WRC-2000 identified through RR No. **5.388A** the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 that may be used by high-altitude platform stations as base stations to provide IMT, in accordance with Resolution **221 (Rev.WRC-07)**. Furthermore, Resolution **221 (Rev.WRC-07)** provides the technical conditions that need to be met by these high-altitude platform stations to ensure that emissions to neighbouring countries do not cause co-channel harmful interference to the other services and applications allocated in these frequency bands, including terrestrial IMT-2000 stations.

The work under WRC-23 agenda item 1.4 includes studying sharing and compatibility in the frequency bands 694-960 MHz, 1 710-1 885 MHz and 2 500-2 690 MHz, as well as appropriate modifications to the existing RR No. **5.388A** and associated Resolution **221 (Rev.WRC-07)**. These studies are intended to allow the use of such frequency bands by HIBS. This would allow HIBS to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas, while ensuring the protection of existing primary services in the same and adjacent frequency bands.

1/1.4/3 Summary and analysis of the results of ITU-R studies

1/1.4/3.1 Usage and deployment scenarios, spectrum needs, and technical and operational characteristics

HIBS enhances terrestrial IMT networks as so-called "super macro cells" that may complement the existing ground-based deployment methods (e.g. macro cell, micro cell, indoor), and provides low latency mobile connectivity to non-coverage areas of ground-based IMT base stations, over a large footprint.

The service-link communicates between HIBS and IMT mobile stations utilizing frequency bands identified for IMT. HIBS will use multi-beam operation to provide mobile connectivity over a wide area, and certain measures to maintain the footprints (e.g. beamforming, mechanical tilt) would be implemented to ensure stable mobile connectivity.

In certain cases where HIBS is deployed in remote areas, where ground-based IMT base stations are yet to be deployed, HIBS could play a role to bridge the digital divide across the rural and remote areas, as well as to provide an equivalent and consistent user experience with existing ground-based IMT systems and to support various applications and use cases such as Internet of Things, Event services and others.

The detailed information on usage and deployment scenarios, spectrum needs, and technical and operational characteristics including deployment and system parameters that are used for sharing and compatibility studies of HIBS, are contained in WDPDN Report ITU-R M.[HIBS-CHARACTERISTICS][3] and working document on the spectrum needs for HIBS in some scenarios, which is attached in Annex 4.12 of the 43rd meeting of the Working Party 5D Chairman's Report (Document 5D/1668).

1/1.4/3.2 Summary of studies of HIBS in the frequency band 694-960 MHz

1/1.4/3.2.1 Sharing studies between the land mobile service excluding IMT and HIBS operating in the frequency range 694-960 MHz

The applications of the land mobile service in the frequency range 694-960 MHz include:

– trunk systems in the frequency range 869-960 MHz;

– Public Protection and Disaster Relief (PPDR) in the frequency range 694-894 MHz;

– digital dispatch systems in different bands in the frequency range 746-940 MHz;

– systems for public mobile communications with aircraft in Region 2 in the frequency ranges 849-851 MHz and 894-896 MHz.

3 If such document is approved by ITU-R Study Group 5 before WRC-23.

It is important to note that several of these frequency ranges would fall in the proposed HIBS uplink arrangement (i.e. 698-748 MHz, 824-862 MHz and 880-915 MHz), and thus the sharing and compatibility would not differ from the existing conditions for ground-based terrestrial IMT networks.

For example, the PPDR broadband applications in the sub-frequency ranges 694-791 MHz and 791-862 MHz in Region 1, and 703-803 MHz in Region 2 are mostly aligned with the channel arrangements proposed for IMT in Recommendation ITU-R M.1036, which would therefore align with the proposed channel arrangements for HIBS in the same geographical area. In this case, the operation of HIBS and PPDR in the same geographical area is equivalent to that of terrestrial IMT and PPDR, including in its capabilities to support such applications. As such, the HIBS base stations transmission will not be different from terrestrial IMT base stations in terms of compatibility with broadband PPDR in this frequency range. The channel arrangements for PPDR in the frequency range 806-869 MHz in Region 2 do not coincide with that of IMT, and thus do not coincide with that of HIBS in the same Region.

1/1.4/3.2.2 Sharing studies between the ground component of IMT and HIBS operating in the frequency range 694-960 MHz

Studies conducted between proposed HIBS systems and IMT terrestrial systems operating within the frequency band 694-960 MHz show that co-frequency compatibility between HIBS and IMT systems in the same geographical area is only feasible if a range of separation distances at the border or pfd limits are introduced to ensure the protection of IMT terrestrial systems, particularly for non-synchronized cross-border IMT terrestrial networks.

Additionally, one adjacent channel study (Study D) indicated that compatibility between proposed HIBS systems and the IMT terrestrial system in a cross-border scenario may be feasible if the channels of the proposed HIBS systems and the IMT terrestrial systems do not overlap.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.2.3 Sharing studies between the aeronautical radionavigation service and HIBS operating in the frequency range 694-960 MHz

1/1.4/3.2.3.1 Sharing studies between the aeronautical radionavigation service and HIBS operating in the frequency range 694-862 MHz

One study indicates that sharing between aeronautical radionavigation service (ARNS) and HIBS operating in the frequency range 694-960 MHz may be feasible under certain circumstances, such as a minimum distance between the HIBS nadir and the ARNS system in the frequency range 694-862 MHz which varies between 19 km and 597 km depending on the ARNS type.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

It should be noted that the influence of IMT mobile stations to the ARNS stations is out of the scope of WRC-23 agenda item (AI) 1.4 based on the understanding that HIBS will operate with the same IMT mobile stations. It is noted that studies were carried out on WRC-12 AI 1.17 and WRC-15 AI 1.2 concerning the impact of IMT mobile stations on the ARNS stations and the results were reflected in Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.

1/1.4/3.2.3.2 Sharing studies between the aeronautical radionavigation service and HIBS operating in the frequency range 862-960 MHz

In accordance with RR No. **5.323**, the frequency band 862-960 MHz or part of it is allocated to the ARNS on a primary basis in a number of countries. However, there was no study for the frequency band since the characteristics were not provided by the contributing group. At the same time, the contributing group indicated that additional information might be available in the Master International Frequency Register.

1/1.4/3.2.4 Sharing and compatibility studies between broadcasting services in the frequency band 470-960 MHz and HIBS operating in the frequency range 694-960 MHz

It is recognized that the use of the frequency band 470-862 MHz is governed by the provisions of the GE06 Agreement. The operation of the broadcasting service in this frequency band, *inter alia*, with the frequency band 694-960 MHz, should be protected and not be negatively impacted by the operation of HIBS.

Some studies indicate that sharing and compatibility between broadcasting services in the frequency band 470-960 MHz and HIBS operating in the frequency range 694-960 MHz may be feasible if the interference issue is resolved through cross-border agreement between the concerned countries (i.e. one country deploying HIBS and another operating broadcasting service), under certain circumstances, such as the definition of a HIBS pfd limit.

Another study indicates that sharing and compatibility between broadcasting services in the frequency band 470-960 MHz and HIBS operating in the frequency range 694-960 MHz may not be feasible. This study indicates that operating HIBS adjacent to areas where DTTB is still used above 694/698 MHz could result in co-channel interference from DTTB to the HIBS uplink or from HIBS downlink to DTTB.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.2.5 Compatibility studies between the aeronautical radionavigation service in the adjacent frequency band and HIBS operating in the frequency range 694-960 MHz

One study, considering a TACAN system (not others), indicates that compatibility between the ARNS in the adjacent frequency band and HIBS operating in the frequency range 694-960 MHz may be feasible if fuselage loss effect is considered. In addition, the study provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

1/1.4/3.2.6 Compatibility studies between the aeronautical mobile (route) service in the adjacent frequency band and HIBS operating in the frequency range 694-960 MHz

One study shows that for HIBS operating in the frequency range 694-960 MHz, the compatibility with aircraft and ground AM(R)S stations in the adjacent channel may be feasible if the fuselage loss effect is considered in the airborne scenario. Furthermore, in the I/N interference metric, there is a margin to meet the protection criteria in all cases assessed. Additionally, the sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km has shown that the protection criteria continue to be met with a margin of protection in both cases.

1/1.4/3.2.7 Study between 2nd harmonics of the HIBS base station operating in the frequency range 694-960 MHz and radio astronomy service in the frequency band 1 610.6-1 613.8 MHz

NOTE: Different views were expressed on whether this impact study is outside of the scope of WRC-23 agenda item 1.4, as per Resolution **247 (WRC-19)**. The study below was not agreed to by some administrations.

This study indicates that the impact to the RAS in the frequency band 1 610.6-1 613.8 MHz from HIBS base station operating in the frequency range 694-960 MHz could be mitigated under certain circumstances, such as with antenna pointing, RF filters, and geographical separation.

When considering the FDD arrangements of Recommendation ITU-R M.1036 (A4-A11), most of the possible harmonics listed to fall under the RAS frequency bands would come from the HIBS uplink in the 700 MHz band. As such, considering that the mobile station from HIBS and ground-based IMT networks are the same, no studies would be necessary in this case. In the case when the FDD arrangement A3 (also known as 800 MHz band) is used, which has a reverse duplexer (base station in the lower part, mobile station in the upper part), there could be a possibility that the second harmonics of this arrangement would fall into the RAS frequency band 1 610.6-1 613.8 MHz.

1/1.4/3.3 Summary of studies of HIBS in the frequency band 1 710-1 885 MHz

1/1.4/3.3.1 Sharing studies between the land mobile service excluding IMT and HIBS operating in the frequency range 1 710-1 885 MHz

The applications of the land mobile service in the frequency range 1 710-1 885 MHz include digital dispatch systems in the frequency bands 1 785-1 805 MHz and 1 850-1 910 MHz. The frequency range 1 710-1 885 MHz would fall in the proposed HIBS uplink arrangement, and thus the sharing and compatibility conditions between HIBS and the applications of the land mobile service do not differ from the existing conditions for ground-based terrestrial IMT networks.

1/1.4/3.3.2 Sharing studies between the ground component of IMT and HIBS operating in the frequency range 1 710-1 885 MHz

Studies conducted between proposed HIBS systems and IMT terrestrial systems operating within the frequency band 1 710-1 885 MHz show that co-frequency compatibility between HIBS and IMT systems in the same geographical area is only feasible if a range of separation distances at the border or pfd limits are introduced to ensure the protection of IMT terrestrial systems, particularly for non-synchronized cross-border IMT terrestrial networks.

Additionally, one adjacent channel study (Study D) indicated that compatibility between proposed HIBS systems and the IMT terrestrial system in a cross-border scenario may be feasible if the channels of the proposed HIBS systems and the IMT terrestrial systems do not overlap.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.3.3 Sharing studies between the fixed service and HIBS operating in the frequency range 1 710-1 885 MHz

All studies indicate that sharing between the fixed service (FS) and HIBS operating in the frequency range 1 710-1 885 MHz may be feasible under certain circumstances, such as the definition of a HIBS pfd limit.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.3.4 Sharing studies between the space research service (Earth-to-space) and the space operation service (Earth-to-space) in the frequency band 1 750-1 850 MHz and HIBS operating in the frequency range 1 710-1 885 MHz

One study indicates that sharing between the space research service (Earth-to-space) and the space operation service (Earth-to-space) in the frequency band 1 750-1 850 MHz and HIBS operating in the frequency range 1 710-1 885 MHz may be feasible.

In addition, the study provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.3.5 Sharing studies between the aeronautical mobile service and HIBS operating in the frequency range 1 780-1 850 MHz

Studies conducted between proposed HIBS systems and aeronautical mobile service (AMS) systems operating within the frequency band 1 780-1 850 MHz show that co-frequency sharing between HIBS and AMS systems in the same geographical area is only feasible with the introduction of large separation distances to ensure the protection of AMS systems. Fuselage loss was not considered in most of the sharing studies as the fuselage loss for the frequency band 1 780-1 850 MHz was not identified by the contributing group nor in any of the ITU-R Recommendations/Reports.

Study A indicates that sharing between the AMS and HIBS operating in the frequency range 1 780-1 850 MHz requires a minimum separation distance between the proposed HIBS and airborne AMS systems which varies between 725 km and 1 135 km, depending on the airborne AMS system. The required separation distance between the proposed HIBS nadir and the ground-based AMS systems varies between 135 km and 490 km depending on the ground-based AMS system. Fuselage loss was not considered in the sharing studies as the fuselage loss for the frequency band 1 780-1 850 MHz was not identified by the contributing group nor in any of the ITU-R Recommendations/Reports.

One study (Study B) indicates that sharing between the AMS and HIBS operating in the frequency range 1 780-1 850 MHz is feasible for one system (System-1) when additional fuselage loss (0-33 dB) is considered.

Study C indicates that sharing between the AMS and HIBS operating in the frequency range 1 780-1 850 MHz requires a minimum distance between the HIBS nadir and the airborne AMS system which varies between 150 km and 800 km depending on the AMS type. The required separation distance between the HIBS nadir and the ground-based AMS system varies between 200 km and 600 km depending on the AMS type. Fuselage loss was not considered in the sharing studies as the fuselage loss for the frequency band 1 780-1 850 MHz was not identified by the contributing group nor in any of the ITU-R Recommendations/Reports.

1/1.4/3.3.6 Compatibility studies between the meteorological satellite service in the adjacent frequency band 1 670-1 710 MHz and HIBS operating in the frequency range 1 710-1 885 MHz

As HIBS are intended to be used as a part of, and complement to, terrestrial IMT networks, they will use the same frequency bands as ground-based IMT base stations. Since *resolves* 1 of Resolution **223 (Rev.WRC-19)** invites administration for implementation of IMT above 1 GHz to consider "the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the services to which the frequency band is currently allocated", it would be expected that administrations who deploy HIBS in the frequency range 1 710-1 885 MHz will employ the same band plans as those used by ground-based IMT networks described in section 5 of Recommendation ITU-R M.1036, in which only the uplink directions of frequency arrangements based on FDD duplex mode are recommended in the frequency band 1 710-1 785 MHz.

Based on the above considerations, HIBS would only use the frequency band 1 710-1 785 MHz in the uplink direction. As a HIBS base station will not transmit in the frequency band adjacent to meteorological satellite (MetSat) operations in the frequency band 1 670-1 710 MHz, it could be considered that interference is unlikely to be from HIBS in the uplink direction to MetSat earth stations operating in adjacent frequency bands. However, it is noted that the limitation of HIBS in the uplink direction is not based on regulatory conditions but only on Recommendation ITU-R M.1036. It would be necessary to consider possible regulatory measures/action on how such uplink limitation could be ensured.

1/1.4/3.4 Summary of studies of HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz

1/1.4/3.4.1 Sharing studies between the land mobile service excluding IMT and HIBS operating in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz

The applications of the land mobile service in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz include digital dispatch systems in the frequency bands 1 850-1 910/1 930-1 990 MHz and 1 920-1 980/2 110-2 170 MHz. Currently, HIBS may use the bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz as per RR No. **5.388A**, and in accordance with Resolution **221 (Rev.WRC-07)**, which does not include any additional regulatory or technical measures in relation to the land mobile service.

1/1.4/3.4.2 Sharing studies between the ground component of IMT and HIBS operating in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz

Studies conducted between proposed HIBS systems and IMT terrestrial systems operating within the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz show that co-frequency compatibility between HIBS and IMT systems in the same geographical area is only feasible if a range of separation distances at the border or pfd limits are introduced to ensure the protection of IMT terrestrial systems, particularly for non-synchronized cross-border IMT terrestrial networks.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.4.3 Sharing studies between the fixed service and HIBS operating in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz

All studies indicate that sharing between the FS and HIBS operating in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz may be feasible under certain circumstances, such as the definition of a HIBS pfd limit.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.4.4 Sharing studies between the space research service (deep space) (Earth-to-space) in the frequency band 2 110-2 120 MHz and HIBS operating in the frequency range 2 110-2 170 MHz

Currently, HIBS may use the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz as per RR No. **5.388A**, and in accordance with Resolution **221 (Rev.WRC-07)**, which does not include any additional regulatory or technical measures in relation to SRS (deep space) (Earth-to-space) in the frequency range 2 110-2 120 MHz.

In addition, *recommends* 1 and section 3.2 of Annex 1 in Recommendation ITU-R SA.1016 show the sharing condition between the SRS (deep space) (Earth-to-space) and transmitting terrestrial stations in the 2 GHz frequency band as follows:

– *It is currently considered that stations with an e.i.r.p. that is more than 30 dB below the implemented or planned e.i.r.p. for space research earth stations do not pose a significant problem. Typically, this means an average e.i.r.p. no greater than 82 dBW at 2 GHz, 85 dBW at 7 GHz, and 84 dBW at 34 GHz bands, since the SRS earth station transmit e.i.r.p. is 112 dBW in 2 GHz, 115 dBW in 7 GHz, and 114 dBW in 34 GHz bands (see Recommendation ITU-R SA.1014).*

As the HIBS platform e.i.r.p./cell is 55 dBm (25 dBW) for 1st layer cell and 58 dBm (28 dBW) for 2nd layer cell, i.e. HIBS platform e.i.r.p./HIBS (7 cells) is 33 dBW. This means that total e.i.r.p of HIBS is around 50 dB lower than the average e.i.r.p. for 2 GHz frequency bands in the above condition of Recommendation ITU-R SA.1016.

In addition, the main beam of HIBS would not be directed towards space stations since HIBS antenna platform tilts are large (1st layer cell: 90º and 2nd layer cell: 23°).

Based on the above considerations, the sharing between the SRS (deep space) (Earth-to-space) and HIBS in the frequency range 2 110-2 120 MHz may be feasible under certain circumstances.

In addition, it would be expected that administrations who deploy HIBS in the frequency band 2 110-2 120 MHz will employ the same band plans as those used by ground-based IMT networks described in section 5 of Recommendation ITU-R M.1036, in which only the downlink directions of frequency arrangements based on FDD duplex mode are recommended in the frequency band 2 110-2 120 MHz.

Based on the above considerations, HIBS would only use the frequency band 2 110-2 120 MHz in the downlink direction. However, it is noted that the limitation of HIBS in the uplink direction is not based on regulatory conditions but only on Recommendation ITU-R M.1036. It would be necessary to consider possible regulatory measures/action on how such downlink limitation could be ensured.

1/1.4/3.4.5 Compatibility studies between the mobile-satellite service (space-to-Earth) in the adjacent frequency band 2 170-2 200 MHz and HIBS operating in the frequency range 2 110-2 170 MHz

All studies indicate that compatibility between the mobile-satellite service (space-to-Earth) in the adjacent frequency band 2 170-2 200 MHz and HIBS operating in the frequency range 2 110-2 170 MHz may be feasible under certain circumstances, such as the definition of a HIBS pfd limit.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.4.6 Compatibility studies between the fixed service in the adjacent frequency bands 1 885-1 980 MHz and 2 010-2 170 MHz and HIBS operating in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

One study indicates that compatibility between the FS in the adjacent frequency bands 1 885-1 980 MHz and 2 010-2 170 MHz and HIBS operating in the frequency ranges 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz may be feasible.

In addition, the study provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

1/1.4/3.4.7 Compatibility studies between the space operation service (Earth-to-space) (space-to-space), the Earth exploration-satellite service (Earth-to-space) (space-to-space), and the space research service (Earth-to-space) (space-to-space) in the adjacent frequency band 2 025-2 110 MHz and HIBS operating in the frequency ranges 2 010-2 025 MHz and 2 110-2 170 MHz

One study indicates that compatibility between the space operation service (Earth-to-space) (space-to-space), the Earth exploration-satellite service (Earth-to-space) (space-to-space), and the space research service (Earth-to-space) (space-to-space) in the adjacent frequency band 2 025-2 110 MHz and HIBS operating in the frequency ranges 2 010-2 025 MHz and 2 110-2 170 MHz may be feasible.

In addition, the study provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

It would be expected that administrations who deploy HIBS in the frequency band 2 110-2 170 MHz will employ the same band plans as those used by ground-based IMT networks described in section 5 of Recommendation ITU-R M.1036, in which only the downlink directions of frequency arrangements based on FDD duplex mode are recommended in the frequency band 2 110-2 170 MHz.

Based on the above considerations, HIBS would only use the frequency band 2 110-2 170 MHz in the downlink direction. However, it is noted that the limitation of HIBS in the uplink direction is not based on regulatory conditions but only on Recommendation ITU-R M.1036. It would be necessary to consider possible regulatory measures/action on how such downlink limitation could be ensured.

1/1.4/3.5 Summary of studies of HIBS in the frequency band 2 500-2 690 MHz

1/1.4/3.5.1 Sharing studies between the ground component of IMT and HIBS operating in the frequency range 2 500-2 690 MHz

Studies conducted between proposed HIBS systems and IMT terrestrial systems operating in the frequency band 2 500-2 690 MHz show that co-frequency compatibility between HIBS and IMT systems in the same geographical area is only feasible if a range of separation distances at the border or pfd limits are introduced to ensure the protection of IMT terrestrial systems, particularly for non-synchronized cross-border IMT terrestrial networks.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

Additionally, one adjacent channel study (Study C) indicated that compatibility between proposed HIBS systems and the IMT terrestrial system in a cross-border scenario may be feasible if the channels of the proposed HIBS systems and the IMT terrestrial systems do not overlap.

1/1.4/3.5.2 Sharing studies between the fixed service and HIBS operating in the frequency range 2 500-2 690 MHz

All studies indicate that sharing between the FS and HIBS operating in the frequency range 2 500-2 690 MHz may be feasible under certain circumstances, such as the definition of a HIBS pfd limit.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.5.3 Sharing studies between the broadcasting satellite service in the frequency range 2 520-2 630 MHz and HIBS operating in the frequency range 2 500-2 690 MHz

One study indicates that sharing between the broadcasting satellite service (BSS) in the frequency range 2 520-2 630 MHz and HIBS operating in the frequency range 2 500-2 690 MHz may be feasible under certain circumstances, such as the definition of a HIBS pfd hard limit.

Another study indicates that sharing between the BSS in the frequency range 2 520-2 630 MHz and HIBS operating in the frequency range 2 500-2 690 MHz may not be feasible. This study indicates that, considering the amount of exceedance over the protection criteria, the coexistence of HIBS and the BSS is not possible in this frequency band when BSS user terminals are located within the service area of the HIBS base station.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.5.4 Sharing and compatibility studies between the mobile-satellite service in the frequency bands 2 500-2 535 MHz (space-to-Earth) and 2 655-2 690 MHz (Earth-to-space) in Region 3 and HIBS operating in the frequency range 2 500-2 690 MHz

Some studies indicate that sharing between the mobile-satellite service (MSS) in the frequency bands 2 500-2 535 MHz (space-to-Earth) and 2 655-2 690 MHz (Earth-to-space) in Region 3 and HIBS operating in the frequency range 2 500-2 690 MHz may be feasible under certain circumstances, such as a minimum distance of up to 42 km between the coverage border of the two systems. Other studies indicate that no additional measures are required for this feasibility, when HIBS is operating in Region 1, and MSS is operating in Region 3.

Another study indicates that sharing between the MSS in the frequency bands 2 500-2 535 MHz (space-to-Earth) and 2 655-2 690 MHz (Earth-to-space) in Region 3 and HIBS operating in the frequency range 2 500-2 690 MHz may not be feasible. This study indicates that considering the amount of exceedance over the protection criteria, the coexistence of HIBS and the MSS is not possible in this frequency band. In addition, this study indicates that the adjacent frequency band compatibility on OOBE interference from HIBS base station operating in the frequency band 2 535-2 555 MHz into MSS user terminals operating in the frequency band 2 500-2 535 MHz may only be feasible if measures such as a guardband between HIBS and the MSS and/or constraining the OOBE from HIBS are required.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the sharing conditions are similar in both altitudes.

1/1.4/3.5.5 Compatibility studies between the radiodetermination-satellite service in the adjacent frequency band 2 483.5-2 500 MHz (space-to-Earth) and HIBS operating in the frequency range 2 500-2 690 MHz

Some studies indicate that compatibility between the radiodetermination-satellite service (RDSS) in the adjacent frequency band 2 483.5-2 500 MHz (space-to-Earth) and HIBS operating in the frequency band 2 500-2 690 MHz may be feasible under certain circumstances, such as adopting suitable horizontal separation distance to comply with adjacent frequency band RDSS receiver protection criteria.

Another study indicates that compatibility between the RDSS in the adjacent frequency band 2 483.5-2 500 MHz (space-to-Earth) and HIBS operating in the frequency range 2 500-2 690 MHz may not be feasible. This study indicates that considering the amount of exceedance over the protection criteria, the coexistence of HIBS and the RDSS in the adjacent frequency band may not be possible when RDSS user terminals are located within the HIBS coverage area.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

1/1.4/3.5.6 Compatibility studies between the aeronautical radionavigation service in the adjacent frequency band 2 700-2 900 MHz and HIBS operating in the frequency range 2 500-2 690 MHz

All studies indicate that compatibility between the ARNS in the adjacent frequency band 2 700-2 900 MHz and HIBS operating in the frequency range 2 500-2 690 MHz may be feasible under the definition of a HIBS pfd limit.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

1/1.4/3.5.7 Compatibility studies of HIBS in the frequency range 2 500-2 690 MHz with meteorological radars operating in the adjacent frequency band 2 700-2 900 MHz

Some studies indicate that compatibility of HIBS in the frequency range 2 500-2 690 MHz with meteorological radars operating in the adjacent frequency band 2 700-2 900 MHz may be feasible under the definition of a HIBS pfd limit.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

1/1.4/3.5.8 Compatibility studies with the radio astronomy service in the adjacent frequency band 2 690-2 700 MHz and HIBS operating in the frequency range 2 500-2 690 MHz

Two studies identified the need of additional attenuation associated with operation of a single HIBS in order to protect radio astronomy sites operating in the frequency band 2 690-2 700 MHz: −35 dB on the horizon at nadir distances of approximately 500 km and −50 dB at nadir distances of 100 km, relative to the radio astronomy protection levels defined in Recommendation ITU-R RA.769. In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

Compatibility between the radio astronomy service (RAS) in the adjacent frequency band 2 690-2 700 MHz and HIBS operating in the frequency range 2 500-2 690 MHz may be feasible under certain circumstances, such as more stringent HIBS OOBE values, antenna pointing, guardbands. RF filters or geographical separation as reflected in a pfd limit in regulatory text.

1/1.4/3.5.9 Adjacent frequency band compatibility study between HIBS operating in the frequency band 2 500-2 690 MHz and the MSS (s-E) operating in the frequency band 2 483.5-2 500 MHz

One study indicates that HIBS platforms create interference to the MSS mobile stations (s-E) at large distances from the HIBS's nadir, even if the operation is in adjacent band. Considering the ubiquitous nature of MSS mobile stations, it may not be practically possible to ensure the required protection distances to meet the protection criteria. Further investigations indicated that implementation of mitigation techniques such as a guardband associated with an appropriate HIBS base station spurious emissions level is required to guarantee the protection of the MSS (s-E) in the frequency band 2 483.5-2 500 MHz.

In addition, some studies provided a sensitivity analysis of varying the altitude of the HIBS platform from 20 km to 18 km, showing that the compatibility conditions are similar in both altitudes.

1/1.4/3.6 Parameters and assumptions of the studies

The table below summarizes the parameters and assumptions that might have been used differently in the different studies.

HIBS in the frequency band 694-960 MHz

	IMT Study A	**IMT Study B**	**IMT Study C**	**IMT Study D**	**ARNS Study A**	**ARNS Study B**	**BS Study A**	**BS Study B**	**BS Study C**
Scenario	Co-channel	Co-channel	Co-channel	Co-channel and adjacent channel	Co-channel	Co-channel	Co-channel	Co-channel and adjacent band	-
Methodology	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Statistical study	Rec. ITU-R M.2101	Deterministic and statistical study	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Deterministic study and Statistical study	-
Incumbent service characteristics									
Protection criteria	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	Trigger field-strength values	Trigger field-strength values	INR ≤ −10 dB	INR ≤ −6 dB	-
Propagation and clutter models									
Propagation model	Rec. ITU-R P.528 (50%)	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619 (Ground-analysis) and Rec. ITU-R P.528 (10%) (Airborne analysis)	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	-
Clutter model	Rec. ITU-R P.2108, Doc. 3K/178 and Rec. ITU-R P.2109	Rec. ITU-R P.2108 and Rec. ITU-R P.2109	-	Rec. ITU-R P.2108	-	-	Rec. ITU-R P.2108	-	-

	ARNS Study A	AM(R)S Study A	RAS 2nd harmonics Study A
Scenario	Adjacent channel	Adjacent channel	Deterministic study and statistical study
Methodology	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Single entry, Rec. ITU-R M.2101
Incumbent service characteristics			
Protection criteria	Interference level ≤ −129 dBW	INR ≤ −6 dB	Adjacent-channel, Rec. ITU-R RA.769-2, 0 dBi receiver gain (isotropic) -247 dB(W/(m^2 · Hz))
Propagation and clutter models			
Propagation model	Rec. ITU-R P.528 (50 and 10%)	Rec. ITU-R P.619 (Ground- analysis) and Rec. ITU-R P.528 (50 and 10%) (Airborne analysis)	Rec. ITU-R P.619
Clutter model	-	Rec. ITU-R P.2108 (Ground analysis)	-

HIBS in the frequency band 1 710-1 885 MHz

	IMT Study A	**IMT Study B**	**IMT Study C**	**IMT Study D**	**FS Study A**	**FS Study B**	**FS Study C**
Scenario	Co-channel	Co-channel	Co-channel	Co-channel and adjacent channel	Co-channel	Co-channel	Co-channel
Methodology	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Statistical study	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Statistical study	Statistical study
Incumbent service characteristics							
Protection criteria	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB
Propagation and clutter models							
Propagation model	Rec. ITU-R P.528 (50%)	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.528 (p = 5% and p = 10%) and Rec. ITU-R P.619	Rec. ITU-R P.619
Clutter model	Rec. ITU-R P.2108, Doc. 3K/178 and Rec. ITU-R P.2109	Rec. ITU-R P.2108 and Rec. ITU-R P.2109	-	Rec. ITU-R P.2108	-	None	-

	SRS/SOS Study A	**AMS Study A**	**AMS Study B**	**AMS Study C**
Scenario	Co-channel	Co-channel	Co-channel	Co-channel
Methodology	Deterministic study	Statistical study	Rec. ITU-R M.2101	Statistical study
Incumbent service characteristics				
Protection criteria	Interference level ≤ −177 dBW/kHz ≤ −147 dBW/MHz	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB
Propagation and clutter models				
Propagation model	Rec. ITU-R P.619	Rec. ITU-R P.619 (For HIBS-Ground-based system analysis) and Rec. ITU-R P.528 (5% and 10%) (for HIBS-Airborne system analysis)	Rec. ITU-R P.619 (Ground-analysis) and Rec. ITU-R P.528 (50 and 10%) (Airborne analysis)	Rec. ITU-R P.619 (Ground-analysis) and Rec. ITU-R P.528 (50%) (Airborne analysis)
Clutter model	-	Rec. ITU-R P.2108 (For HIBS-Ground based system analysis) No clutter loss for HIBS-Airborne systems analysis	Rec. ITU-R P.2108 (Ground analysis)	-

HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

	IMT Study A	**IMT Study B**	**IMT Study C**	**FS Study A**	**FS Study B**	**FS Study A**
Scenario	Co-channel	Co-channel	Co-channel	Co-channel	Co-channel	Adjacent channel
Methodology		Rec. ITU-R M.2101	Statistical study	Rec. ITU-R M.2101	Statistical study	Rec. ITU-R M.2101
Incumbent service characteristics						
Protection criteria	INR ≤ −6 dB	INR ≤ −6 dB	I/N < −6 dB	INR ≤ −6 dB	INR < −6 dB	INR ≤ −6 dB
Propagation and clutter models						
Propagation model	Rec. ITU-R P.528 (50%)	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619
Clutter model	Rec. ITU-R P.2108, Doc. 3K/178 and Rec. ITU-R P.2109	Rec. ITU-R P.2108 and Rec. ITU-R P.2109	-	-	-	-

	MSS Study A	**MSS Study B**	**SOS/EESS/SRS Study A**
Scenario	Adjacent channel	Adjacent channel	Adjacent channel
Methodology	Deterministic study and statistical study	Statistical study	Deterministic study
Incumbent service characteristics			
Protection criteria	INR ≤ −6 dB, −10 dB, −12.2 dB	INR ≤ −6 dB, −10 dB, −12.2 dB	Interference level ≤ –184 dBW/kHz ≤ –154 dBW/MHz
Propagation and clutter models			
Propagation model	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619
Clutter model	-	-	-

HIBS in the frequency band 2 500-2 690 MHz

	IMT Study A	IMT Study B	IMT Study C	IMT Study D	IMT Study E	FS Study A	FS Study B	BSS Study A	BSS Study B	MSS (adjacent) Study A
Scenario	-	Co-channel	Co-channel and adjacent channel	Co-channel	-	Co-channel	Co-channel	Co-channel	-	Adjacent channel
Methodology	-	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Statistical study	-	Rec. ITU-R M.2101	Statistical study	Deterministic study and statistical study	-	Deduce the exclusion area contours depending on the protection criterion and the amount of received interference
Incumbent service characteristics										
Protection criteria	-	INR ≤ −6 dB	INR ≤ −6 dB	INR ≤ −6 dB	–	INR ≤ −6 dB	INR ≤ −6 dB	INR < −10.5 dB INR < −6 dB INR < 0 dB	–	*I/N* = −6 dB, −10 dB and −12.2 dB
Propagation and clutter models										
Propagation model	-	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	-	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	-	ITU-R P.528
Clutter model	-	Rec. ITU-R P.2108 and Rec. ITU-R P.2109	Rec. ITU-R P.2108	-	-	-	-	-	-	No clutter

	ARNS Study A	**ARNS Study B**	**Meteorological Radars Study A**	**Meteorological Radars Study B**	**Meteorological Radars Study C**	**MSS Study A**	**MSS Study B**	**MSS Study C**	**MSS Study D**
Scenario	Adjacent channel	Adjacent channel	Adjacent channel	Adjacent channel	-	Adjacent channel	-	-	Co-channel
Methodology	Rec. ITU-R M.2101	Rec. ITU-R M.2101	Deterministic, Rec. ITU-R M.2101 used for HIBS Antenna modelling	Rec. ITU-R M.2101	Dynamic and deterministic Rec. ITU-R M.2101 for HIBS	Deterministic study and statistical study	-	-	Deterministic study
Incumbent service characteristics									
Protection criteria	INR ≤ −10 dB, and I/N ≤ −6 dB	INR ≤ −10 dB	INR ≤ −10 dB	INR ≤ −10 dB	INR ≤ −10 dB	6% (INR≤ −12.2 dB) or 10% (INR ≤ −10 dB) or 25% (INR ≤ −6 dB)	–	–	6% (INR≤ −12.2 dB) or 10% (INR ≤ −10 dB) or 25% (INR ≤ −6 dB)
Propagation and clutter models									
Propagation model	Rec. ITU-R P.528 with a time availability value of 0.05	Rec. ITU-R P.619	Rec. ITU-R P.528 with 5% and 10% (95%- and 90%-time availability)	Rec. ITU-R P.619	Free space	Rec. ITU-R P.619	-	-	Rec. ITU-R P.619
Clutter model	Additional 30 dB clutter reduction at the HIBS horizon distance	-	No clutter	-	No clutter	-	-	-	-

	RDSS Study A	**RDSS Study B**	**RDSS Study C**	**RAS Study A**	**RAS Study B**	**RAS Study C**
Scenario	Adjacent channel	-	Adjacent channel (Blocking interference analysis)	Adjacent-channel	Adjacent channel	Adjacent channel
Methodology	Deterministic study and statistical study	-	Deterministic study and statistical study	Deterministic study and statistical study Single entry, Rec. ITU-R M.2101	Rec. ITU-R M.2101	-
Incumbent service characteristics						
Protection criteria	Interference level ≤ −150.3 dBW/MHz/ −148.7 dBW/MHz/ −146.9 dBW/MHz	-	Blocking interference level ≤ −135 dBW	−247 dB(W/(m^2 · Hz))	Interference level ≤ −207 dBW	−247 dB W/m^2/Hz
Propagation and clutter models						
Propagation model	Rec. ITU-R P.619	-	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619	Rec. ITU-R P.619
Clutter model	-	-	-	-	-	-

NOTE: The above tables provide an overview of the main assumptions for each of the sharing and compatibility studies that are summarized in sections 1/1.4/3.2 to 1/1.4/3.6 and indicates the main parameters used in each study. Since the various studies have used different assumptions for various parameters, the overall summary of all studies, to the extent practicable, is shown in each of these sections. It is evident that it would be difficult or impractical to properly reflect such overall results in the section “Methods to satisfy agenda the item” taking into account that some of the input parameters merely reflect the conditions and circumstances based on which the study was carried out. Consequently, no single unified overall conclusion can be drawn from these studies. Some of these studies also performed some sensitivity analysis by using various of the above-mentioned parameter assumptions. The appropriate conclusions for sharing and compatibility depend on which parameter assumptions are considered most relevant by each administration. It should be noted that WP 3K and WP 3M were unable to agree on further guidance regarding clarifications requested by WP 5D about the clutter loss model due to fundamental differences of opinion and opposing views (see Document 5D/1358). The previous guidance from WP 3K and WP 3M is available in Document 5D/722. This situation creates some additional uncertainty on the overall results of the studies which already contain some degree of uncertainty due to various options for some of the parameters. The attention of the membership is therefore drawn to the content of this NOTE when deciding on methods/options that they may include in their proposals to meetings of Regional Organizations as well as to WRC-23.

1/1.4/4 Methods to satisfy the agenda item

The issues and associated methods in this section include possible examples to address Resolution **247 (WRC-19)**, and they can be considered in conjunction or independently.

1/1.4/4.1 Issue A: HIBS in the frequency band 694-960 MHz

Regarding the discussion on the identification for HIBS by list of countries:

View 1:

Some administrations are the view that Nos. ***5.B14, 5.D14 and 5.G14*** *are out of the scope of AI 1.4 based on the following reasons from ITU-R Resolution* ***247 (WRC-19)****:*

– *In* resolves *2, sharing and compatibility studies for "certain frequency bands below 2.7 GHz, or portions thereof,* ***globally or regionally*** *harmonized for IMT" is requested while RR No.* ***5.313A*** *deals with IMT identification as a country footnote.*

– *Section "*invites the WRC-23*" clearly makes reference to "the use of HIBS in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level".*

– Recognizing d) *lists clearly Nos.* ***5.286AA****,* ***5.317A****,* ***5.341A****,* ***5.341B****,* ***5.341C****,* ***5.346****,* ***5.346A****,* ***5.384A*** *as for globally or regionally identified for IMT. RR No.* ***5.313A*** *is not mentioned in this list and therefore is not recognized for inclusion in this agenda item.*

View 2:

Consideration of the use of HIBS in 698-790 MHz in the countries listed in RR No. ***5.313A*** *is within the scope of this agenda item, while* invites the WRC-23 *of Resolution* ***247 (WRC-19)*** *indicates "on a global or regional level" for the following reasons:*

• *No. 5.2.1 indicates that "It should be noted that where the words "regions" or "regional" are without a capital "R" in these Regulations, they do not relate to the three Regions here defined for purposes of frequency allocation." In* invites the WRC-23 *of Resolution* ***247 (WRC-19)****, the term "regional" does not use capital "R". Therefore, this does not mean to consider the use of HIBS on Region basis (i.e. Regions 1, 2 and 3).*

• Recognizing d) *of Resolution* ***247 (WRC-19)*** *is just reference to the existing footnotes of IMT identifications below 2.7 GHz and does not mention the frequency bands subject to this agenda item. In fact, although this* recognizing *shows "some frequency bands below 2.7 GHz are globally or regionally identified for IMT", this does not exclude all country footnote for the IMT identification and includes RR No.* ***5.346*** *which is the frequency band 1 452-1 492 MHz in some parts of Region 1 countries. Therefore, even if* recognizing d) *does not include RR No.* ***5.313A****, that does not immediately exclude it from the scope of this agenda item.*

• *It is clear that the frequency band 698-960 MHz has no specific condition in* invites ITU-R *2 of Resolution* ***247 (WRC-19)****, while other frequency bands have explicit conditions for Region 3 (e.g.1 710-1 815 MHz to be used for uplink only in Region 3).*

RR No. ***5.313A*** *identifies the frequency band 698-790 MHz for IMT in 27 countries out of 37 countries in Region 3. This situation can be considered that 694-790 MHz is regionally identified for IMT in Region 3.*

Regarding the provisions in the Resolution:

IMT pfd:

View 1:

Some administrations have concerns on Example 3 for resolves *6.1 and 6.2 of the new WRC Resolution in section 1/1.4/5.1.5. The values of pfd masks do not have technical justifications as they are not based on the sharing studies in Annexes 1 to 4 of "Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) on WRC-23 agenda item 1.4" (See Annexes 4.32 to 4.35 in Doc. 5D/1555). Additionally, these values would stipulate the unified limits of pfd to protect both mobile and base stations of ground-based IMT. However the value for the protection of ground-based IMT base stations is overprotective for ground-based IMT mobile stations since their characteristics are different. Furthermore, the aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits have not been established.*

View 2:

Some administrations have concerns that some of the pfd masks being proposed do not protect IMT terrestrial networks with AAS antennas, as these pfd masks were developed for IMT terrestrial base stations with non-AAS antennas. Moreover, considering only the protection of the IMT mobile station would under-protect the IMT terrestrial networks, specifically in the case of incompatible band plans among neighbouring countries.

The applicability and technical justification for the various pfd masks for the protection of IMT terrestrial networks are captured in Annex 4.11 of Doc. 5D/1668.

In addition, the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

Considerings:

View 1:

*The consideration of harmonic emissions is outside the scope of Resolution **247 (WRC-19)**. As such, Example 2 and 3 under* recognizing f) *impose unvalidated constraints on new entrants.*

1/1.4/4.1.1 Method A1: No changes

No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution **247 (WRC-19)**.

1/1.4/4.1.2 Method A2: HIBS in 694-960 MHz

Identification of the frequency band 694-960 MHz, or portions thereof, for the use of HIBS and to include a new WRC Resolution for the use of this band by HIBS as contained in sections 1/1.4/5.1.2 and 1/1.4/5.1.5.

1/1.4/4.1.3 Method A3: HIBS in 694-960 MHz not claiming protection and additional provisions

Identification of the frequency band 694-960 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services and to include a new WRC Resolution for the use of this band by HIBS as contained in sections 1/1.4/5.1.3 and 1/1.4/5.1.5. HIBS shall be notified to the Bureau and RR Nos. **11.2, 11.9** and **11.26A** are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix **4** information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administrations shall immediately reduce the interference to the acceptable level.

View 1:

Views were expressed that Method A3 creates a means for HIBS to contravene Article ***1*** *of the Radio Regulations. This method creates ambiguity with the application of RR No.* ***1.66A*** *regarding the regulatory status of HAPS including HIBS identifications in RR Article* ***5****. If operations are in derogation of RR No.* ***1.66A****, then these should be under RR No.* ***4.4*** *i.e. "shall not cause harmful interference to and shall not claim protection from […]", and therefore RR No.* ***5.43A*** *would apply.*

View 2:

Studies have demonstrated that the operation of HIBS down to 18 km does not create more interference than at 20 km, i.e. that the conditions in the Resolution would also protect other services from HIBS down to 18 km. In addition, under Method A3, HIBS shall not claim protection against other services, independently from the altitude. Therefore, this further resolves *is a provision to make the operation of HIBS down to 18 km compliant with the Radio Regulations.*

1/1.4/4.1.4 Method A4: HIBS in 694-862 MHz and 862-960 MHz per Region

Due to the differences in existing services per Region, identify the relevant frequency bands within the frequency ranges 694-862 MHz and 862-960 MHz for the use of HIBS on a regional basis and to include a new WRC Resolution for the use of these bands by HIBS as contained in sections 1/1.4/5.1.4 and 1/1.4/5.1.5.

<u>Reasons for the frequency band 694-862 MHz</u>: *Clear indication of the main technical and operational characteristics for HIBS, under which the certain conditions are offered to ensure the protection of ARNS was not supported and was not reflected in Resolution* ***[A14-HIBS 694-960 MHZ] (WRC-23)****. Based on that to ensure the protection of the ARNS stations from HIBS transmitters, it is proposed to apply line-of-sight distances as coordination distances in accordance with equation (41 b) from Recommendation ITU-R P.1546-6.*

It should be noted that the impact of IMT UE to the ARNS stations is out of the scope of AI 1.4, based on the understanding that HIBS will operate with the same IMT UE. Therefore, this method cannot impose additional constraints on IMT terrestrial UE with regards to the protection of ARNS stations. It is also noted that studies were carried out by WRC-12 and WRC-15 concerning the impact of IMT UE to the ARNS stations and the results were reflected in Resolutions ***749 (Rev.WRC-19)*** *and* ***760 (Rev.WRC-19)****. In these Resolutions and previous studies, the impact from IMT UE to the ARNS stations was taken into account through restrictions on the location of receiving IMT BS (since only BS are notified), while the radius of the BS cell was adopted as 8 km. Taking a similar approach, protection of ARNS from HIBS receive mode operation with terrestrial IMT UE can be addressed through a larger cell radius of HIBS, which is 100 km. See Example 2 regarding Annex 1 to Resolution* ***[A14-HIBS 694-960 MHz] (WRC-23)****.*

<u>Reasons for the frequency band 862-960 MHz</u>: *There was no study between aeronautical radio navigation service and HIBS for the frequency band 862-960 MHz. If any administration insists on the possibility of using HIBS in the frequency band 862-960 MHz on its territory, then in this case, in order to ensure compatibility HIBS stations (transmitting and receiving) with ARNS it is proposed to apply the separation distance equal to the line-of-sight distance to the border of the countries indicated in RR No.* ***5.323****. See Example 2 regarding Annex 2 to Resolution* ***[A14-HIBS 694-960 MHz] (WRC-23)****.*

View 1:

View from some administrations not supporting Example 1 for Annex 1 to Resolution ***[A14-HIBS 694-960 MHz] (WRC-23)****: Proposed coordination distances for HIBS transmitter cover only 4 types of systems in ARNS. At the same time in accordance to MIFR other types of ARNS systems are notified in the frequency band 694-862 MHz. Also, without clear indication of HIBS characteristics in this Resolution such coordination distance could not guarantee the protection of ARNS.*

It should be noted that from regulatory point of view the HIBS receiver case (when UE influence on ARNS) is not covered. However, impact from IMT UE to the ARNS stations were studied in WRC-12 AI 1.17 and WRC-15 AI 1.2 and the results of the studies were reflected in Resolutions ***749 (Rev.WRC-19)*** *and* ***760 (Rev.WRC-19)****. With adjustment for a much larger radius of the HIBS cell, distances from WRC-12 AI 1.17 and WRC-15 AI 1.2 will vary from 150 km to 515 km (depending on the type of ARNS). At the same time in Example 1 for Annex 1 coordination distance with 100 km from HIBS cannot protect ARNS station, because cell radius of HIBS is 100 km and in such case distance from UE (that could be at the edge of the HIBS cell) to ARNS will be much less than 100 km.*

Therefore Example 1 for Annex 1 cannot insure the protection of ARNS.

View 2:

View from some administrations not supporting Example 1 for Annex 2 to Resolution ***[A14-HIBS 694-960 MHz] (WRC-23)****: In addition to the View from some administrations not supporting Example 1 for Annex 1 it should be noted that there was no study for the frequency band 862-960 MHz. However, an assumption was made that the coordination distances for some types of ARNS in the frequency band 694-862 MHz could be implemented to ARNS in the frequency band 862-960 MHz. At the same time in accordance to MIFR other types of ARNS systems are notified in the frequency band 862-960 MHz.*

Therefore Example 1 for Annex 2 cannot insure the protection of ARNS.

1/1.4/4.2 Issue B: HIBS in the frequency band 1 710-1 885 MHz

Regarding the provisions in the Resolution:

IMT pfd:

View 1:

Some administrations have concerns on Example 2 for resolves *1.2 and 1.3 of the new WRC Resolution in section 1/1.4/5.2.5. The values of pfd masks do not have technical justifications as they are not based on the sharing studies in Annexes 1 to 4 of "Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) on WRC-23 agenda item 1.4" (See Annexes 4.32 to 4.35 in Doc. 5D/1555). Additionally, these values would stipulate the unified limits of pfd to protect both mobile and base stations of ground-based IMT. However the value for the protection of ground-based IMT base stations is overprotective for ground-based IMT mobile stations since their characteristics are different. Furthermore, the aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits have not been established.*

View 2:

Some administrations have concerns that some of the pfd masks being proposed do not protect IMT terrestrial networks with AAS antennas, as these pfd masks were developed for IMT terrestrial base stations with non-AAS antennas. Moreover, considering only the protection of the IMT mobile *station would under-protect the IMT terrestrial networks, specifically in the case of incompatible band plans among neighbouring countries.*

The applicability and technical justification for the various pfd masks for the protection of IMT terrestrial networks are captured in Annex 4.11 of Doc. 5D/1668.

In addition, the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

FS pfd:

View 1:

Some administrators have concerns on Examples 2 and 3 for resolves *1.6 of the new WRC Resolution in section 1/1.4/5.2.5. The aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits has not been established.*

View 2:

Some administrations are of the view that the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

1/1.4/4.2.1 Method B1: No changes

No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution **247 (WRC-19)**.

1/1.4/4.2.2 Method B2: HIBS in 1 710-1 885 MHz

Identification of the frequency band 1 710-1 885 MHz, or portions thereof, for the use of HIBS in accordance with revised RR No. **5.388A** and revised Resolution **221 (Rev.WRC-07)** as contained in sections 1/1.4/5.2.2 and 1/1.4/5.2.5.

1/1.4/4.2.3 Method B3: HIBS in 1 710-1 885 MHz not claiming protection and additional provisions

Identification of the frequency band 1 710-1 885 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services in accordance with revised RR No. **5.388A** and revised Resolution **221 (Rev.WRC-07)** as contained in sections 1/1.4/5.2.3 and 1/1.4/5.2.5. HIBS shall be notified to the Bureau and RR Nos. **11.2, 11.9** and **11.26A** are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix **4** information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administration shall immediately reduce the interference to the acceptable level.

View 1:

*Views were expressed that Method B3 creates a means for HIBS to contravene Article **1** of the Radio Regulations. This method creates ambiguity with the application of RR No. **1.66A** regarding the regulatory status of HAPS including HIBS identifications in RR Article 5. If operations are in derogation of RR No. **1.66A**, then these should be under RR No. **4.4**, i.e. "shall not cause harmful interference to and shall not claim protection from [...]", and therefore RR No. **5.43A** would apply.*

View 2:

Studies have demonstrated that the operation of HIBS down to 18 km does not create more interference than at 20 km, i.e. that the conditions in the Resolution would also protect other services from HIBS down to 18 km. In addition, under Method B3, HIBS shall not claim protection against other services, independently from the altitude. Therefore, this further resolves *is a provision to make the operation of HIBS down to 18 km compliant with the Radio Regulations.*

1/1.4/4.2.4 Method B4: HIBS in 1 710-1 885 MHz per Region

Due to the differences in existing services per Region, identify the relevant frequency band within the frequency range 1 710-1 885 MHz for the use of HIBS on a regional basis in accordance with revised RR No. **5.388A**, additional regional footnotes, and revised Resolution **221 (Rev.WRC-07)** as contained in sections 1/1.4/5.2.4 and 1/1.4/5.2.5.

1/1.4/4.3 Issue C: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

Regarding the provisions in the Resolution:

IMT pfd:

View 1:

Some administrations have concerns on Example 2 for resolves *1.2 and 1.3 of the new WRC Resolution in section 1/1.4/5.3.4. The values of pfd masks do not have technical justifications as they are not based on the sharing studies in Annexes 1 to 4 of "Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) on WRC-23 agenda item 1.4" (See Annexes 4.32 to 4.35 in Doc. 5D/1555). Additionally, these values would stipulate the unified limits of pfd to protect both mobile and base stations of ground-based IMT. However the value for the protection of ground-based IMT base stations is overprotective for ground-based IMT mobile stations since their characteristics are different. Furthermore, the aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits have not been established.*

View 2:

Some administrations have concerns that some of the pfd masks being proposed do not protect IMT terrestrial networks with AAS antennas, as these pfd masks were developed for IMT terrestrial base stations with non-AAS antennas. Moreover, considering only the protection of the IMT mobile station would under-protect the IMT terrestrial networks, specifically in the case of incompatible band plans among neighbouring countries.

The applicability and technical justification for the various pfd masks for the protection of IMT terrestrial networks are captured in Annex 4.11 of Doc. 5D/1668.

In addition, the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

FS pfd:

View 1:

Some administrators have concerns on Examples 2 and 3 for resolves *1.6 of the new WRC Resolution in section 1/1.4/5.3.4. The aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits has not been established.*

View 2:

Some administrations are of the view that the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

1/1.4/4.3.1 Method C1: No changes

No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution **247 (WRC-19)**.

1/1.4/4.3.2 Method C2: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

Review existing conditions in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz, or portions thereof, for the use of HIBS in accordance with revised RR No. **5.388A** and revised Resolution **221 (Rev.WRC-07)** as contained in sections 1/1.4/5.3.2 and 1/1.4/5.3.4.

1/1.4/4.3.3 Method C3: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz not claiming protection and additional provisions

Review of existing conditions in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services in accordance with revised RR No. **5.388A** and revised Resolution **221 (Rev.WRC-07)** as contained in sections 1/1.4/5.3.3 and 1/1.4/5.3.4. HIBS shall be notified to the Bureau and RR Nos. **11.2, 11.9** and **11.26A** are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix **4** information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administration shall immediately reduce the interference to the acceptable level.

View 1:

*Views were expressed that Method C3 creates a means for HIBS to contravene Article 1 of the Radio Regulations. This method creates ambiguity with the application of RR No. **1.66A** regarding the regulatory status of HAPS including HIBS identifications in RR Article **5**. If operations are in derogation of RR No. **1.66A**, then these should be under RR No. **4.4**, i.e. "shall not cause harmful interference to and shall not claim protection from […]", and therefore RR No. **5.43A** would apply.*

View 2:

Studies have demonstrated that the operation of HIBS down to 18 km does not create more interference than at 20 km, i.e. that the conditions in the Resolution would also protect other services from HIBS down to 18 km. In addition, under Method C3, HIBS shall not claim protection against other services, independently from the altitude. Therefore, this further resolves *is a provision to make the operation of HIBS down to 18 km compliant with the Radio Regulations.*

1/1.4/4.4 Issue D: HIBS in the frequency band 2 500-2 690 MHz

Regarding the provisions in the Resolution:

IMT pfd:

View 1:

Some administrations have concerns on Example 2 for resolves *1.1 and 1.2 of the new WRC Resolution in section 1/1.4/5.4.5. The values of pfd masks do not have technical justifications as they are not based on the sharing studies in Annexes 1 to 4 of "Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) on WRC-23 agenda item 1.4" (See Annexes 4.32 to 4.35 in Doc. 5D/1555). Additionally, these values would stipulate the unified limits of pfd to protect both mobile and base stations of ground-based IMT. However the value for the protection of ground-based IMT base stations is overprotective for ground-based IMT mobile stations since their characteristics are different. Furthermore, the aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits have not been established.*

View 2:

Some administrations have concerns that some of the pfd masks being proposed do not protect IMT terrestrial networks with AAS antennas, as these pfd masks were developed for IMT terrestrial base stations with non-AAS antennas. Moreover, considering only the protection of the IMT mobile station would under-protect the IMT terrestrial networks, specifically in the case of incompatible band plans among neighbouring countries.

The applicability and technical justification for the various pfd masks for the protection of IMT terrestrial networks are captured in Annex 4.11 of Doc. 5D/1668.

In addition, the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

FS pfd:

View 1:

Some administrators have concerns on Example 2 for resolves *1.3 of the new WRC Resolution in section 1/1.4/5.4.5. The aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits has not been established.*

View 2:

Some administrations are of the view that the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

RLS pfd:

View 1:

Some administrators have concerns on Example 2 for resolves *1.6 of the new WRC Resolution in section 1/1.4/5.4.5. The aggregate pfd limits would not be applicable since the methodology for examining multiple HIBS to comply with these limits has not been established.*

View 2:

Some administrations are of the view that the lack of a methodology is not a barrier for considering an aggregate pfd limit to protect incumbent services. Such methodology can be established for examining compliance of multiple HIBS with these limits.

1/1.4/4.4.1 Method D1: No changes

No changes to Vols. I and II of the Radio Regulations, and suppression of Resolution **247 (WRC-19)**.

1/1.4/4.4.2 Method D2: HIBS in 2 500-2 690 MHz

Identification of the frequency band 2 500-2 690 MHz, or portions thereof, for the use of HIBS and to include a new WRC Resolution for the use of this band by HIBS as contained in sections 1/1.4/5.4.2 and 1/1.4/5.4.5.

View 1:

Some administrations have concerns on Example 2 for resolves *1.4 of the new WRC Resolution in section 1/1.4/5.4.5 below since there is no technical basis, and the relationship between the pfd limitation and the subsequent provision is inconsistent. For instance, if the compliance with the pfd limitation for protecting BSS does not lead to the immediate not causing unacceptable interference, then there is no reason to establish a pfd limitation.*

View 2:

Some other administrations have different views and strongly believe that the coexistence of pfd limit and an additional provision emphasizing HIBS obligation in case that unacceptable interference is caused to broadcasting-satellite services take immediate actions to cease the interference or reduce that to an acceptable level to protect BSS.

1/1.4/4.4.3 Method D3: HIBS in the frequency band 2 500-2 690 MHz not claiming protection and additional provisions

Identification of the frequency band 2 500-2 690 MHz, or portions thereof, for the use of HIBS not claiming protection from existing primary services and to include a new WRC Resolution for the use of this band by HIBS as contained in sections 1/1.4/5.4.3 and 1/1.4/5.4.5. HIBS shall be notified to the Bureau and RR Nos. **11.2, 11.9** and **11.26A** are applicable for purposes of aiding planning and coordination with neighbouring and concerned countries. For the implementation of the above, the notifying administration of HIBS at the time of submission of the RR Appendix **4** information to the Radiocommunication Bureau (BR) shall send an objective, measurable and enforceable commitment undertaking that in case of causing unacceptable interference, those administrations shall immediately reduce the interference to the acceptable level.

View 1:

*Views were expressed that Method D3 creates a means for HIBS to contravene Article **1** of the Radio Regulations. This method creates ambiguity with the application of RR No. **1.66A** regarding the regulatory status of HAPS including HIBS identifications in RR Article **5**. If operations are in derogation of RR No. **1.66A**, then these should be under RR No. **4.4**, i.e. "shall not cause harmful interference to and shall not claim protection from […]", and therefore RR No. **5.43A** would apply.*

View 2:

Studies have demonstrated that the operation of HIBS down to 18 km does not create more interference than at 20 km, i.e. that the conditions in the Resolution would also protect other services from HIBS down to 18 km. In addition, under Method D3, HIBS shall not claim protection against other services, independently from the altitude. Therefore, this further resolves *is a provision to make the operation of HIBS down to 18 km compliant with the Radio Regulations.*

View 3:

Some administrations have concerns on Example 2 for resolves *1.4 of the new WRC Resolution in section 1/1.4/5.4.5 below since there is no technical basis, and the relationship between the pfd limitation and the subsequent provision is inconsistent. For instance, if the compliance with the pfd limitation for protecting BSS does not lead to the immediate not causing unacceptable interference, then there is no reason to establish a pfd limitation.*

View 4:

Some other administrations have different views and strongly believe that the coexistence of pfd limit and an additional provision emphasizing HIBS obligation in case that unacceptable is caused to broadcasting-satellite services take immediate actions to cease the interference or reduce that to an acceptable level to protect BSS.

1/1.4/4.4.4 Method D4: HIBS in 2 500-2 690 MHz per Region

Due to the differences in existing services per Region, identify the relevant frequency band within the frequency range 2 500-2 690 MHz for the use of HIBS on a regional basis and to include a new WRC Resolution for the use of this band by HIBS as contained in sections 1/1.4/5.4.4 and 1/1.4/5.4.5.

View 1:

Some administrations have concerns on Example 2 for resolves *1.4 of the new WRC Resolution in section 1/1.4/5.4.5 below since there is no technical basis, and the relationship between the pfd limitation and the subsequent provision is inconsistent. For instance, if the compliance with the pfd limitation for protecting BSS does not lead to the immediate not causing unacceptable interference, then there is no reason to establish a pfd limitation.*

View 2:

Some other administrations have different views and strongly believe that the coexistence of pfd limit and an additional provision emphasizing HIBS obligation in case that unacceptable is caused to broadcasting-satellite services take immediate actions to cease the interference or reduce that to an acceptable level to protect BSS.

1/1.4/5 Regulatory and procedural considerations

The regulatory and procedural considerations presented in these sections for the identification and operation of HIBS address each of the frequency bands individually for each of the issues, noting that they can be considered in conjunction or independently.

1/1.4/5.1 For Issue A: HIBS in the frequency band 694-960 MHz

1/1.4/5.1.1 For Method A1: NOC to Vols. I and II of the Radio Regulations

NOC

ARTICLES

NOC

APPENDICES

1/1.4/5.1.2 For Method A2: HIBS in 694-960 MHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td rowspan="6">470-694
BROADCASTING

5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.312</td>
<td rowspan="1">470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td>
<td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td>
</tr>
<tr>
<td rowspan="2">512-608
BROADCASTING
5.295 5.297</td>
</tr>
<tr>
<td rowspan="2">585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td>
</tr>
<tr>
<td rowspan="2">608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td>
</tr>
<tr>
<td rowspan="6">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A ADD 5.A14 ADD 5.B14
BROADCASTING</td>
</tr>
<tr>
<td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td>
</tr>
<tr>
<td rowspan="2">694-790
MOBILE except aeronautical mobile 5.312A 5.317A ADD 5.A14
BROADCASTING
5.300 5.312</td>
</tr>
<tr>
<td rowspan="2">698-806
MOBILE 5.317A ADD 5.A14
BROADCASTING
Fixed

5.293 5.309</td>
</tr>
<tr>
<td rowspan="2">790-862
FIXED
MOBILE except aeronautical mobile 5.316B 5.317A ADD 5.A14
BROADCASTING
5.312 5.319</td>
</tr>
<tr>
<td rowspan="1">806-890
FIXED
MOBILE 5.317A ADD 5.A14</td>
</tr>
</table>

862-890 FIXED MOBILE except aeronautical mobile 5.317A ADD 5.A14 BROADCASTING 5.322 5.319 5.323	BROADCASTING 5.317 5.318	 5.149 5.305 5.306 5.307 5.320

MOD

890-1 300 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">890-942
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.A14
BROADCASTING 5.322
Radiolocation

5.323</td><td>890-902
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.A14
Radiolocation
5.318 5.325</td><td rowspan="3">890-942
FIXED
MOBILE 5.317A ADD 5.A14
BROADCASTING
Radiolocation

5.327</td></tr>
<tr><td>902-928
FIXED
Amateur
Mobile except aeronautical mobile 5.325A ADD 5.A14
Radiolocation
5.150 5.325 5.326</td></tr>
<tr><td>928-942
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.A14
Radiolocation
5.325</td></tr>
<tr><td>942-960
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.A14
BROADCASTING 5.322
5.323</td><td>942-960
FIXED
MOBILE 5.317A ADD 5.A14</td><td>942-960
FIXED
MOBILE 5.317A ADD 5.A14
BROADCASTING

5.320</td></tr>
</table>

ADD

5.A14 The frequency band 698-960 MHz, or portions thereof, in Region 2, the frequency band 694-790 MHz, or portions thereof, in Region 1, and the frequency band 790-960 MHz, or portions thereof, in Regions 1 and 3, are identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 694-728 MHz and 830-835 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.B14 The frequency band 698-790 MHz, or portions thereof, in the countries listed in No. **5.313A**, which are allocated to the mobile service on a primary basis, is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. Such use of HIBS in the frequency band 698-728 MHz is limited to reception by HIBS. (WRC-23)

1/1.4/5.1.3 For Method A3: HIBS in 694-960 MHz not claiming protection and additional provisions

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

460-890 MHz

<table>
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<tr><td rowspan="4">470-694
BROADCASTING

5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.312</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td>512-608
BROADCASTING
5.295 5.297</td></tr>
<tr><td>608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td><td>585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td></tr>
<tr><td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td><td rowspan="2">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A ADD 5.C14 ADD 5.D14
BROADCASTING</td></tr>
<tr><td>694-790</td></tr>
</table>

<table>
<tr><td>MOBILE except aeronautical mobile 5.312A 5.317A ADD 5.C14
BROADCASTING
5.300 5.312</td><td>698-806
MOBILE 5.317A ADD 5.C14
BROADCASTING
Fixed
5.293 5.309</td><td rowspan="3">5.149 5.305 5.306 5.307 5.320</td></tr>
<tr><td>790-862
FIXED
MOBILE except aeronautical mobile 5.316B 5.317A ADD 5.C14
BROADCASTING
5.312 5.319</td><td rowspan="2">806-890
FIXED
MOBILE 5.317A ADD 5.C14
BROADCASTING
5.317 5.318</td></tr>
<tr><td>862-890
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.C14
BROADCASTING 5.322
5.319 5.323</td></tr>
</table>

MOD

890-1 300 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">890-942
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.C14
BROADCASTING 5.322
Radiolocation
5.323</td><td>890-902
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.C14
Radiolocation
5.318 5.325</td><td rowspan="3">890-942
FIXED
MOBILE 5.317A ADD 5.C14
BROADCASTING
Radiolocation
5.327</td></tr>
<tr><td>902-928
FIXED
Amateur
Mobile except aeronautical mobile 5.325A ADD 5.C14
Radiolocation
5.150 5.325 5.326</td></tr>
<tr><td>928-942
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.C14
Radiolocation
5.325</td></tr>
<tr><td>942-960
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.C14
BROADCASTING 5.322
5.323</td><td>942-960
FIXED
MOBILE 5.317A ADD 5.C14</td><td>942-960
FIXED
MOBILE 5.317A ADD 5.C14
BROADCASTING
5.320</td></tr>
</table>

ADD

5.C14 The frequency band 698-960 MHz, or portions thereof, in Region 2, the frequency band 694-790 MHz, or portions thereof, in Region 1, and the frequency band 790-960 MHz, or portions thereof, in Regions 1 and 3, are identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix **4** information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 694-728 MHz and 830-835 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.D14 The frequency band 698-790 MHz, or portions thereof, in the countries listed in No. **5.313A**, which are allocated to the mobile service on a primary basis, is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix **4** information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. Such use of HIBS in the frequency band 698-728 MHz is limited to reception by HIBS. (WRC-23)

1/1.4/5.1.4 For Method A4: HIBS in 694-862 MHz and 862-960 MHz per Region

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td rowspan="6">470-694
BROADCASTING

5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.312</td>
<td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td>
<td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td>
</tr>
<tr>
<td rowspan="2">512-608
BROADCASTING
5.295 5.297</td>
</tr>
<tr>
<td rowspan="2">585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td>
</tr>
<tr>
<td rowspan="2">608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td>
</tr>
<tr>
<td rowspan="7">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A ADD 5.G14 ADD 5.H14
BROADCASTING

5.149 5.305 5.306 5.307 5.320</td>
</tr>
<tr>
<td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td>
</tr>
<tr>
<td rowspan="2">694-790
MOBILE except aeronautical mobile 5.312A 5.317A ADD 5.E14
BROADCASTING
5.300 5.312</td>
</tr>
<tr>
<td rowspan="2">698-806
MOBILE 5.317A ADD 5.F14
BROADCASTING
Fixed

5.293 5.309</td>
</tr>
<tr>
<td rowspan="2">790-862
FIXED
MOBILE except aeronautical mobile 5.316B 5.317A ADD 5.E14
BROADCASTING
5.312 5.319</td>
</tr>
<tr>
<td rowspan="2">806-890
FIXED
MOBILE 5.317A ADD 5.F14 ADD 5.H14
BROADCASTING

5.317 5.318</td>
</tr>
<tr>
<td>862-890
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.H14
BROADCASTING 5.322

5.319 5.323</td>
</tr>
</table>

MOD

890-1 300 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">**890-942**
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.H14
BROADCASTING 5.322
Radiolocation
5.323</td><td>**890-902**
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.H14
Radiolocation
5.318 5.325</td><td rowspan="3">**890-942**
FIXED
MOBILE 5.317A ADD 5.H14
BROADCASTING
Radiolocation
5.327</td></tr>
<tr><td>**902-928**
FIXED
Amateur
Mobile except aeronautical mobile 5.325A ADD 5.H14
Radiolocation
5.150 5.325 5.326</td></tr>
<tr><td>**928-942**
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.H14
Radiolocation
5.325</td></tr>
<tr><td>**942-960**
FIXED
MOBILE except aeronautical mobile 5.317A ADD 5.H14
BROADCASTING 5.322
5.323</td><td>**942-960**
FIXED
MOBILE 5.317A ADD 5.H14</td><td>**942-960**
FIXED
MOBILE 5.317A ADD 5.H14
BROADCASTING
5.320</td></tr>
</table>

ADD

5.E14 The frequency band 694-862 MHz, or portions thereof, in Region 1 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from stations in the aeronautical radionavigation service operating in countries mentioned in No. **5.312** in accordance with the Radio Regulations and from stations operating in accordance with the GE06 Agreement and its future development. No. **5.43A** does not apply. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 694-728 MHz and 830-835 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.F14 The frequency band 698-862 MHz, or portions thereof, in Region 2 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from stations in the aeronautical radionavigation service operating in countries mentioned in No. **5.312** in accordance with the Radio Regulations and from stations operating in accordance with the GE06 Agreement and its future development. No. **5.43A** does not apply. Resolution **[A14-HIBS 694-960 MHz] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 698-728 MHz and 830-835 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.G14 The frequency band 790-862 MHz, or portions thereof, in Region 3 and the frequency band 698-790 MHz, or portions thereof, in the countries listed in No. **5.313A**, which are allocated to the mobile service on a primary basis, are identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from stations in the aeronautical radionavigation service operating in countries mentioned in No. **5.312** in accordance with the Radio Regulations and from stations operating in accordance with the GE06 Agreement and its future development. No. **5.43A** does not apply. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 698-728 MHz and 830-835 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.H14 The frequency band 862-960 MHz, or portions thereof, in [list of countries] is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from stations in the aeronautical radionavigation service operating in countries mentioned in No. **5.323** in accordance with the Radio Regulations and from stations operating in accordance with the GE06 Agreement and its future development. No. **5.43A** does not apply. Resolution **[A14-HIBS 694-960 MHZ] (WRC-23)** shall apply. (WRC-23)

1/1.4/5.1.5 For Methods A2, A3, and A4

ADD

DRAFT NEW RESOLUTION [A14-HIBS 694-960 MHZ] (WRC-23)

Use of high-altitude platform stations as International Mobile Telecommunications base stations (HIBS) in the frequency band 694-960 MHz, or portions thereof

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 694-960 MHz are beneficial to provide cost-effective solutions for coverage, including large areas of low population density;

b) that the operation of high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS) in the same geographical area with existing services may create compatibility issues;

c) that it is necessary to adequately protect existing services in this frequency band;

d) that there is growing demand for access to mobile broadband, requiring more flexibility in the approaches to expand the capacity and coverage provided by IMT systems;

e) that HIBS would be used as part of terrestrial IMT networks, and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;

f) that HIBS would offer a new means of providing IMT services with minimal network infrastructure as they are capable of providing service to a large footprint together with a dense coverage;

g) that the use of HIBS is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;

h) that the mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;

i) that under certain deployment scenarios, HIBS could operate at an altitude down to 18 km;

j) that some sensitivity studies have shown that the difference of interference from HIBS at altitudes between 18 km and 20 km would be negligible;

k) that the ITU Radiocommunication Sector (ITU-R) has addressed sharing and compatibility between HIBS and existing systems of primary allocated services, and adjacent services in the frequency band 694-960 MHz;

l) that spectrum needs, usage and deployment scenarios, and typical technical and operational characteristics for HIBS are provided in the WDPDN Report ITU-R M.[HIBS-CHARACTERISTICS],

considering further

Example 1 for considering further a), *associated with Examples 1 and 2 for* resolves *6.1 and 6.2:*

(This provision is not necessary to be included in the Resolution.)

a) (not used),

Example 2 for considering further a), *associated with Example 3 for* resolves *6.1 and 6.2:*

a) that IMT stations may experience unacceptable interference effects due to the aggregate interference from HIBS and other services,

recognizing

a) that, in Article **5** of the Radio Regulations, the frequency band 694-960 MHz, or parts thereof, is allocated on a primary basis to various services;

b) that the use of the frequency band 470-862 MHz by the broadcasting service and other primary services in Region 1 (except Mongolia) and the Islamic Republic of Iran is covered by the GE06 Agreement;

c) that high-altitude platform station (HAPS) is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

d) that the frequency band 694-960 MHz, or parts thereof, are identified for IMT in accordance with Nos. **5.313A** and **5.317A**;

e) that these frequency bands are allocated to the fixed and mobile services on a co-primary basis;

Example 1 for recognizing f)*:*

(This provision is not necessary to be included in the Resolution.)

f) (not used),

Example 2 for recognizing f)*:*

f) that the spurious emission limit of −85 dBW/MHz and 100 km separation distance is sufficient for ensuring the protection of the radio astronomy service operating in the frequency band 1 610.6-1 613.8 MHz from the second harmonic of HIBS emissions in the frequency band 805.3-806.9 MHz,

Example 3 for recognizing f):

f) that second harmonics of the HIBS downlink transmissions in the frequency band 805.3-806.9 MHz may cause harmful interference to radio astronomy observations in the frequency band 1 610.6-1 613.8 MHz,

emphasizing

that the requirements of the different services to which the frequency band is allocated, including the mobile, aeronautical radionavigation (in accordance with Nos. **5.312** and **5.323**), fixed and broadcasting services, shall be taken into account,

resolves

Example 1 for resolves *1 and 2, associated with Example 1 in Annex 1 and Example 1 to Annex 2:*

1 that, in the frequency band 694-862 MHz in accordance with Nos. [**5.A14** and **5.B14** / **5.C14** and **5.D14** / **5.E14**, **5.F14** and **5.G14**], and based on the criteria contained in Annex 1 to this Resolution, administrations implementing HIBS shall seek agreement under No. **9.21** with respect to the aeronautical radionavigation service in the countries mentioned in No. **5.312** of the Radio Regulations;

2 that, in the frequency band 862-960 MHz in accordance with Nos. [**5.A14** / **5.C14** / **5.H14**], and based on the criteria contained in Annex 2 to this Resolution, administrations implementing HIBS shall seek agreement under No. **9.21** with respect to the aeronautical radionavigation service in the countries mentioned in No. **5.323** of the Radio Regulations;

Example 2 for resolves *1 and 2, associated with Example 2 in Annex 1 and Example 2 to Annex 2:*

1 that, in the frequency band 694-862 MHz in accordance with Nos. [**5.A14** and **5.B14** / **5.C14** and **5.D14** / **5.E14**, **5.F14**, and **5.G14**], and based on the criteria contained in Annex 1 to this Resolution, administrations implementing HIBS shall seek agreement under No. **9.21** with respect to the aeronautical radionavigation service in the countries mentioned in No. **5.312** of the Radio Regulations;

2 that, in the frequency band 862-960 MHz in accordance with No. [**5.A14 / 5.C14 / 5.H14**] administrations implementing HIBS shall use separation distances to the border of the countries indicated in No. **5.323** of the Radio Regulations based on Annex 2 to this Resolution;

Example 1 for resolves *3 to 5:*

3 that administrations shall take into account the need to protect existing and planned broadcasting stations, both analogue and digital, except analogue in the GE06 planning area, in the frequency band 470-806/862 MHz, as well as other primary terrestrial services;

4 that, in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of HIBS is subject to the application of procedures contained in the GE06 Agreement; in so doing:

4.1 administrations that deploy HIBS operating in the frequency band 694/698-862 MHz for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

4.2 for the implementation of *resolves* 4.1 above, the notifying administrations of HIBS at the time of submission of Appendix **4** information to the Radiocommunication Bureau (BR) shall also submit an objective, measurable and enforceable commitment that, in case of causing unacceptable interference, it undertakes to immediately reduce the interference to an acceptable level or cease that interference; as for enforceability referred to in this *resolves*, should the interference not be ceased or reduced to acceptable level, the assignments in question shall be submitted by the Bureau to the Radio Regulations Board to review for suppression from the Master International Frequency Register (MIFR) and the Bureau's database;

4.3 administrations that deploy HIBS for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the Master International Frequency Register (MIFR) of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those HIBS;

5 that, where the GE06 Agreement does not apply, use of the frequency band 728-862 MHz by HIBS is subject to agreement obtained under No. **9.21** with respect to the broadcasting service. The coordination threshold of the power flux-density (pfd) level of -135.8 dB(W/(m^2 · MHz)), which is produced in the territory of other administrations, at the highest of the clutter height or 10 m, per HIBS shall be used;

Example 2 for resolves *3 to 5:*

3 that administrations shall take into account the need to protect existing and planned broadcasting stations, both analogue and digital, except analogue in the GE06 planning area, in the frequency band 470-806/862 MHz, as well as other primary terrestrial services;

4 that, in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of HIBS is subject to the application of procedures contained in the GE06 Agreement; in so doing:

4.1 administrations that deploy HIBS operating in the frequency band 694/698-862 MHz for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

4.2 for the implementation of *resolves* 4.1 above, the notifying administrations of HIBS at the time of submission of Appendix **4** information to the Radiocommunication Bureau (BR) shall also submit an objective, measurable and enforceable commitment that, in case of causing unacceptable interference, it undertakes to immediately reduce the interference to an acceptable level or cease that interference; as for enforceability referred to in this *resolves*, should the interference not be ceased or reduced to acceptable level, the assignments in question shall be submitted by the Bureau to the Radio Regulations Board to review for suppression from the Master International Frequency Register (MIFR) and the Bureau's database;

4.3 administrations that deploy HIBS for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the Master International Frequency Register (MIFR) of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those HIBS;

4.4 the coordination threshold of the power flux-density (pfd) level of −135.8 dB(W/(m2 · Hz)) per HIBS shall be used, instead of those given in Appendix **1** of the GE06 Agreement, which is produced in the territory of other administrations, at the highest of the clutter height or 10 m;

5 that, where the GE06 Agreement does not apply, use of the frequency band 728-862 MHz by HIBS is subject to agreement obtained under No. **9.21** with respect to the broadcasting service. The coordination threshold of the power flux-density (pfd) level of −135.8 dB(W/(m^2 · MHz)) which is produced in the territory of other administrations, at the highest of the clutter height or 10 m, per HIBS shall be used;

<u>*Example 3 for* resolves *3 to 5:*</u>

3 that HIBS operating in the frequency band 694/698-862 MHz shall not cause harmful interference to nor claim protection from the broadcasting service referred to in *recognizing a)* and *b)* above, and, as such, the power flux-density (pfd) level per HIBS produced in the territory of other administrations, at the highest of the clutter height or 10 m, shall not exceed the limit of −135.8 dB(W/(m^2 · MHz));

4 (not used);

5 (not used);

6 that administrations wishing to implement HIBS shall comply with the following:

<u>*Example 1 for* resolves *6.1 and 6.2:*</u>

6.1 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency band 694-960 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

−114	dB(W/(m^2 · MHz))	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

6.2 (not used);

Example 2 for resolves *6.1 and 6.2:*

6.1 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency band 694-960 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-114	$dB(W/(m^2 \cdot MHz))$	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

6.2 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency band 694-960 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

$-136 + 0.21 (\theta)^2$	$dB(W/(m^2 \cdot MHz))$	for	$0° \leq \theta \leq 8.3°$
$-121.8 + 0.08 (\theta)$	$dB(W/(m^2 \cdot MHz))$	for	$8.3° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 3 for resolves *6.1 and 6.2:*

6.1 for the purpose of protecting mobile services including IMT terrestrial systems in the territory of other administrations in the frequency band 694-960 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

-150	$dB(W/(m^2 \cdot MHz))$	for	$0° \leq \theta < 11°$
$-150 + 0.3912 (\theta-11)$	$dB(W/(m^2 \cdot MHz))$	for	$11° \leq \theta < 80°$
-123	$dB(W/(m^2 \cdot MHz))$	for	$80° \leq \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

6.2 (not used);

Example 1 for resolves *6.3 and 6.4, associated with Examples 1 and 2 for* recognizing f)*:*

(These provisions are not necessary to be included in the Resolution.)

6.3 (not used);

6.4 (not used);

Example 2 for resolves *6.3 and 6.4, associated with Example 3 for* recognizing f)*:*

6.3 for the purpose of protecting radio astronomy stations in the frequency band 1 610.6-1 613.8 MHz, the power flux-density (pfd) of HIBS downlinks operating in the frequency band 805.3-806.9 MHz shall not exceed the following value in the frequency band 1 610.6-1 613.8 MHz at any radio astronomy station without the explicit agreement of the affected administrations:

-194 $dB(W/(m^2 \cdot 20 kHz))$;

6.4 that *resolves* 6.3 applies at any radio astronomy station that was in operation prior to XX November 2023 and has been notified to the BR in the frequency band 1 610.6-

1 613.8 MHz before XX May 2024, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix **4** information for notification, for the HIBS system to which *resolves* 6.3 applies; radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HIBS;

7 that administrations intending to implement HIBS system shall notify, in accordance with Article **11**, the frequency assignments to transmitting and receiving HIBS stations by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with the conditions specified in the *resolves* above,

resolves further

For Methods A2 and A4:

that, HIBS may operate in the frequency band 694-960 MHz with an altitude from 18 to 20 km, on the condition that HIBS shall not cause harmful interference nor claim protection from existing and planned primary services,

For Method A3:

that, HIBS may operate in the frequency band 694-960 MHz with an altitude down to 18 km, in derogation to No. **1.66A**,

invites administrations

Example 1 for invites administrations *1:*

(This provision is not necessary to be included in the Resolution.)

1 (not used);

Example 2 for invites administrations *1:*

1 to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports;

2 to review their entries for the broadcasting service in the MIFR in the frequency band above 694 MHz and to remove those no longer required according to Article **8**,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

ANNEX 1 TO DRAFT NEW RESOLUTION [A14-HIBS 694-960 MHZ] (WRC-23)

The criteria for identifying potentially affected administrations with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** by HIBS in the mobile service with respect to the affected aeronautical radionavigation service (ARNS) station operating in countries mentioned in No. **5.312**, the coordination distances (between a HIBS in the mobile service and a potentially affected ARNS station) indicated below should be used.

When applying the procedure for seeking agreement under No. **9.21**, notifying administrations may indicate in the notice sent to BR the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

Example 1 in Annex 1 to draft new Resolution [A14-HIBS 694-960 MHZ] (WRC-23):

ARNS type	System type code	Coordination distance between nadir of HIBS and ARNS station
RSBN	AA8	325 km
RLS 2 (Type 2) (airborne receiver)	BC	100 km
RLS 2 (Type 2) (ground receiver)	AA2	584 km
RLS 1 (Type 1 and 2)	AB	597 km

Example 2 in Annex 1 to draft new Resolution [A14-HIBS 694-960 MHZ] (WRC-23):

1 Case where HIBS in the mobile service is operated according to the frequency arrangement where HIBS transmit only in the frequency band 791-821 MHz and receive only in the frequency band 832-862 MHz

ARNS station	System type code	Coordination distances for receiving HIBS of MS (km)	Coordination distances for transmitting HIBS of MS (km)
RSBN (ground receiver) (h_1 = 10 m)	AA8	–	563/593/930*
RLS 2 (Type 2) (aircraft receiver) (h_1 = 10 000 m)	BC	170/250**	-
RLS 1 (Types 1 and 2) (ground receiver) (h_1 = 10 m)	AB	170/225/275***	-

* The first value is relevant for h_2 = 18 000 m HIBS height, second is relevant for h_2 = 20 000 m HIBS height and third is relevant for h_2 = 50 000 m HIBS height. The value calculated based in the following equation: $4.1\left(\sqrt{h_1}+\sqrt{h_2}\right)$.

** The first value should be used when the notifying administration indicates in the notice form that aggregate e.i.r.p. value of all user equipment operating simultaneously with the notified HIBS is assumed not to exceed 21 dBm in 1 MHz. The second value should be used in other cases.

*** 90% ≤ land path ≤ 100% / 50% ≤ land path < 90% / 0% ≤ land path < 50%.

2 Case where HIBS in the mobile service is operated according to the frequency arrangement where HIBS transmit only in the frequency band 758-788 MHz and receive only in the frequency band 703-733 MHz

ARNS station	System type code	Coordination distances for receiving HIBS of MS (km)	Coordination distances for transmitting HIBS of MS (km)
RSBN (ground receiver) (h_1 = 10 m)	AA8	-	563/593/930*

* The first value is relevant for h_2 = 18 000 m HIBS height, second is relevant for h_2 = 20 000 m HIBS height and third is relevant for h_2 = 50 000 m HIBS height. The value calculated based in the following equation: $4.1\left(\sqrt{h_1}+\sqrt{h_2}\right)$.

3 Other cases

ARNS station	System type code	Coordination distances for receiving HIBS of MS (km)	Coordination distances for transmitting HIBS of MS (km)
RSBN (ground receiver) (h_1 = 10 m)	AA8	225/275**	563/593/930*
RLS 2 (Type 1) (aircraft receiver) (h_1 = 10 000 m)	BD	5 150***	960/990/1 327*
RLS 2 (Type 1) (ground receiver) (h_1 = 10 m)	BA	150	563/593/930*
RLS 2 (Type 2) (aircraft receiver) (h_1 = 10 000 m)	BC	250	960/990/1 327*
RLS 2 (Type 2) (ground receiver) (h_1 = 10 m)	AA2	150/175**	563/593/930*
RLS 1 (Types 1 and 2) (ground receiver) (h_1 = 10 m)	AB	225/275**	563/593/930*
Other types of ARNS terrestrial station (h_1 = 10 m)	Not applicable	225/275**	563/593/930*
Other types of ARNS airborne station (h_1 = 10 000 m)	Not applicable	515***	960/990/1 327*

* The first value is relevant for h_2 = 18 000 m HIBS height, second is relevant for h_2 = 20 000 m HIBS height and third is relevant for h_2 = 50 000 m HIBS height. The value calculated based in the following equation: $4.1\left(\sqrt{h_1}+\sqrt{h_2}\right)$.

** 50% ≤ land path ≤ 100% / 0% ≤ land path < 50%.

*** The value is relevant for h_2 = 1.5 m of IMT mobile stations height. The value calculated based in the following equation: $4.1\left(\sqrt{h_1}+\sqrt{h_2}\right)+100$.

Example 1 of Annex 2 to draft new Resolution [A14-HIBS 694-960 MHZ] (WRC-23):

ANNEX 2 TO DRAFT NEW RESOLUTION [A14-HIBS 694-960 MHZ] (WRC-23)

The criteria for identifying potentially affected administrations with respect to the aeronautical radionavigation service in countries listed in No. 5.323

To identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** by HIBS in the mobile service with respect to the affected aeronautical radionavigation service (ARNS) station operating in countries mentioned in No. **5.323**, the coordination distances (between a HIBS in the mobile service and a potentially affected ARNS station) indicated below should be used.

When applying the procedure for seeking agreement under No. **9.21**, notifying administrations may indicate in the notice sent to BR the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

ARNS type	System type code	Coordination distance between nadir of HIBS and ARNS station
RSBN	AA8	325 km
RLS 2 (Type 2) (airborne receiver)	BC	100 km
RLS 2 (Type 2) (ground receiver)	AA2	584 km
RLS 1 (Type 1 and 2)	AB	597 km

Example 2 of Annex 2 to draft new Resolution [A14-HIBS 694-960 MHZ] (WRC-23):

ANNEX 2 TO DRAFT NEW RESOLUTION [A14-HIBS 694-960 MHZ] (WRC-23)

Separation distances between HIBS and the border of the countries listed in No. 5.323 of the Radio Regulations

HIBS in the mobile service with respect to the border of countries mentioned in No. **5.323** shall use the following separation distances indicated below.

Separation distances for receiving HIBS of MS (km)	Separation distances for transmitting HIBS of MS (km)
515**	960/990/1 327*

* The first value is relevant for h_2 = 18 000 m HIBS height, second is relevant for h_2 = 20 000 m HIBS height and third is relevant for h_2 = 50 000 m HIBS height. The value for h_1 = 10 000 m calculated based in the following equation: $4.1\left(\sqrt{h_1}+\sqrt{h_2}\right)$.

Separation distances for receiving HIBS of MS (km)	Separation distances for transmitting HIBS of MS (km)

** The value is relevant for $h_2 = 1.5$ m of IMT mobile stations height. The value calculated based in the following equation: $4.1\left(\sqrt{h_1}+\sqrt{h_2}\right)+100$.

1/1.4/5.2 For Issue B: HIBS in the frequency band 1 710-1 885 MHz

1/1.4/5.2.1 For Method B1: NOC to Vols. I and II of the Radio Regulations

NOC

ARTICLES

NOC

APPENDICES

1/1.4/5.2.2 For Method B2: HIBS in 1 710-1 885 MHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A MOD 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	

MOD

5.388A ~~In Regions 1 and 3, t~~The frequency bands ~~1 885~~1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and~~, in Region 2,~~ the frequency bands ~~1 885~~1 710-1 980 MHz and 2 110-2 160 MHz in Region 2 ~~may be~~ are identified for use~~d~~ by high-~~-~~altitude platform stations ~~as base stations to provide~~ as International Mobile Telecommunications (IMT) base stations (HIBS)~~, in accordance with Resolution~~ ~~**221 (Rev.WRC-07)**~~. ~~Their use by IMT~~

~~applications using high altitude platform stations as base stations~~ This identification does not preclude the use of these frequency bands by any ~~station in~~ application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency bands 1 710-1 785 MHz in Regions 1 and 2, and 1 710-1 815 MHz in Region 3 is limited to reception by HIBS, and in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS. (WRC-~~12~~23)

1/1.4/5.2.3 For Method B3: HIBS in 1 710-1 885 MHz not claiming protection and additional provisions

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A MOD 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	

MOD

5.388A ~~In Regions 1 and 3, t~~The frequency bands ~~1 885~~1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and~~, in Region 2,~~ the frequency bands ~~1 885~~1 710-1 980 MHz and 2 110-2 160 MHz in Region 2 ~~may be~~ are identified for use~~d~~ by high~~-~~-altitude platform stations ~~as base stations to provide~~ as International Mobile Telecommunications (IMT) base stations (HIBS)~~, in accordance with Resolution **221 (Rev.WRC-07)**~~. ~~Their use by IMT applications using high altitude platform stations as base stations~~ This identification does not preclude the use of these frequency bands by any ~~station in~~ application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency bands 1 710-1 785 MHz in Regions 1 and 2, and 1 710-1 815 MHz in Region 3 is limited to reception by HIBS, and in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix **4** information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. (WRC-~~12~~23)

1/1.4/5.2.4 For Method B4: HIBS in 1 710-1 885 MHz per Region

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A MOD 5.388A 5.388B ADD 5.I14 ADD 5.J14 ADD 5.K14 5.149 5.341 5.385 5.386 5.387 5.388	

MOD

5.388A ~~In Regions 1 and 3, t~~The frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and~~, in Region 2,~~ the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 ~~may be~~ are identified for use~~d~~ by high-altitude platform stations ~~as base stations to provide~~ as International Mobile Telecommunications (IMT) base stations (HIBS)~~, in accordance with Resolution **221 (Rev.WRC-07)**~~. ~~Their use by IMT applications using high altitude platform stations as base stations~~ This identification does not preclude the use of these frequency bands by any ~~station in~~ application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS. (WRC-~~12~~23)

ADD

5.I14 The frequency band 1 710-1 885 MHz in Region 1 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency band 1 710-1 785 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.J14 The frequency band 1 710-1 885 MHz in Region 2 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency band 1 710-1 785 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.K14 The frequency band 1 710-1 885 MHz in Region 3 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency band 1 710-1 815 MHz is limited to reception by HIBS. (WRC-23)

1/1.4/5.2.5 For Methods B2, B3 and B4

MOD

RESOLUTION 221 (REV.WRC-~~07~~23)

Use of high~~ ~~-altitude platform stations as International Mobile Telecommunications base stations (HIBS) ~~providing IMT~~ in the frequency bands ~~1 885~~1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz ~~in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2~~

The World Radiocommunication Conference (~~Geneva, 2007~~Dubai, 2023),

considering

~~*a)* that the bands 1 885-2 025 MHz and 2 110-2 200 MHz are identified in No. 5.388 as intended for use on a worldwide basis for IMT, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the terrestrial and satellite components of IMT;~~

~~*b)* that a high altitude platform station (HAPS) is defined in No. 1.66A as "a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth";~~

a) that there is growing demand for access to mobile broadband, requiring more flexibility in the approaches to expand the capacity and coverage provided by International Mobile Telecommunications (IMT) systems;

b) that high-altitude platform stations as IMT base stations (HIBS) would be used as part of terrestrial IMT networks, and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;

c) that ~~HAPS may~~ HIBS would offer a new means of providing IMT services with minimal network infrastructure as they are capable of providing service to a large footprint together with a dense coverage;

d) that the use of HIBS ~~HAPS as base stations within the terrestrial component of IMT~~ is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;

e) that the mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;

f) that, under certain deployment scenarios, HIBS could operate at an altitude down to 18 km;

g) that some sensitivity studies have shown that the difference of interference from HIBS at altitudes between 18 km and 20 km would be negligible;

~~*e)* that, in accordance with No. **5.388** and Resolution **212 (Rev.WRC-07)***, administrations may use the bands identified for IMT, including the bands referred to in this Resolution, for stations of other primary services to which they are allocated;~~

~~*f)* that these bands are allocated to the fixed and mobile services on a co-primary basis;~~

~~*g)* that, in accordance with No. **5.388A**, HAPS may be used as base stations within the terrestrial component of IMT in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2. Their use by IMT applications using HAPS as base stations does not preclude the use of these bands by any station in the services to which they are allocated and does not establish priority in the Radio Regulations;~~

~~*h)* that ITU-R has studied sharing and coordination between HAPS and other stations within IMT, has considered compatibility of HAPS within IMT with some services having allocations in the adjacent bands, and has approved Recommendation ITU-R M.1456;~~

~~*i)* that radio interfaces of IMT-HAPS are compliant with Recommendation ITU-R M.1457;~~

~~j~~h) that ITU-R has addressed sharing and compatibility between ~~systems using HAPS~~HIBS and ~~some~~ existing systems~~,~~ of primary allocated services, and adjacent services ~~particularly PCS (personal communications system), MMDS (multichannel multipoint distribution system) and systems in the fixed service, which are currently operating in some countries~~ in the frequency bands ~~1 885~~1 710-2 025 MHz and 2 110-2 200 MHz;

~~*k)* that HAPS stations are intended to transmit in the band 2 110-2 170 MHz in Regions 1 and 3 and in the band 2 110-2 160 MHz in Region 2;~~

~~*l)* that administrations planning to implement a HAPS as an IMT base station may need to exchange information, on a bilateral basis, with other concerned administrations, including data items describing the HAPS characteristics in a more detailed manner than the data items currently included in Annex 1 of Appendix **4**, as indicated in the Annex to this Resolution,~~

i) that the conclusion of the compatibility studies between HIBS operating above 1 710 MHz and meteorological satellite (MetSat) operations in the adjacent frequency band 1 670-1 710 MHz has been assuming that the use of HIBS in the frequency band 1 710-1 785 MHz is limited to reception by HIBS;

j) that spectrum needs, usage and deployment scenarios, and typical technical and operational characteristics for HIBS are provided in the WDPDN Report ITU-R M.[HIBS-CHARACTERISTICS];

~~* *Note by the Secretariat:* This Resolution was revised by WRC-15 and WRC-19.~~

k) that the conclusion of the compatibility studies between HIBS operating above 2 110 MHz and SRS/SOS/EESS operations in the adjacent frequency band 2 025-2 110 MHz and the conclusion of the sharing studies between HIBS and SRS in the frequency band 2 110-2 120 MHz have both been assuming that the use of HIBS in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS,

considering further

Example 1 for considering further a), *associated with Examples 1 and 3 for* resolves *1.2 and 1.3:*

(This provision is not necessary to be included in the Resolution.)

a) (not used),

Example 2 for considering further a), *associated with Example 2 for* resolves *1.2 and 1.3:*

a) that IMT stations may experience unacceptable interference effects due to the aggregate interference from HIBS and other services,

recognizing

a) that a high-altitude platform station (HAPS) is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

b) that in Regions 1 and 3, the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz and, in Region 2, the frequency bands 1 710-1 980 MHz and 2 110-2 160 MHz are included in No. **5.388A** for the use of HIBS;

c) that the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, or parts thereof, are identified for IMT in accordance with Nos. **5.384A** and **5.388**;

d) that these frequency bands are allocated to the fixed and mobile services on a co-primary basis,

resolves

~~1 that:~~

~~1.1 for the purpose of protecting IMT mobile stations in neighbouring countries from co-channel interference, a HAPS operating as an IMT base station shall not exceed a co-channel power flux-density (pfd) of −117 dB(W/(m² · MHz)) at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of HAPS;~~

~~1.2 a HAPS operating as an IMT base station shall not transmit outside the frequency bands 2 110-2 170 MHz in Regions 1 and 3 and 2 110-2 160 MHz in Region 2;~~

~~1.3 in Region 2, for the purpose of protecting MMDS stations in some neighbouring countries in the band 2 150-2 160 MHz from co-channel interference, a HAPS operating as an IMT base station shall not exceed the following co-channel pfd at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of the HAPS;~~

~~– −127 dB(W/(m² · MHz)) for angles of arrival (θ) less than 7° above the horizontal plane;~~

~~– −127 + 0.666 (θ − 7) dB(W/(m² · MHz)) for angles of arrival between 7° and 22° above the horizontal plane; and~~

~~–	−117 dB(W/(m² · MHz)) for angles of arrival between 22° and 90° above the horizontal plane;~~

~~1.4	in some countries (see No. 5.388B), for the purpose of protecting fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference caused by a HAPS operating as an IMT base station in accordance with No. **5.388A** in neighbouring countries, the limits of **5.388B** shall apply;~~

~~2	that the limits referred to in this Resolution shall apply to all HAPS operating in accordance with No. **5.388A**;~~

~~3~~1	that administrations wishing to implement ~~HAPS within a terrestrial IMT system~~HIBS shall comply with the following:

1.1	in some countries (see No. **5.388B**), for the purpose of protecting fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference caused by HIBS in accordance with No. **5.388A** in neighbouring countries, the limits of No. **5.388B** shall apply;

~~3.1	for the purpose of protecting IMT stations operating in neighbouring countries from co-channel interference, a HAPS operating as a base station within IMT shall use antennas that comply with the following antenna pattern:~~

~~$G(\psi) = G_m - 3(\psi/\psi_b)^2$ dBi for $0° \le \psi \le \psi_1$~~

~~$G(\psi) = G_m + L_N$ dBi for $\psi_1 < \psi \le \psi_2$~~

~~$G(\psi) = X - 60 \log(\psi)$ dBi for $\psi_2 < \psi \le \psi_3$~~

~~$G(\psi) = L_F$ dBi for $\psi_3 < \psi \le 90°$~~

~~where:~~

~~$G(\psi)$: gain at the angle ψ from the main beam direction (dBi)~~

~~G_m: maximum gain in the main lobe (dBi)~~

~~ψ_b: one-half of the 3 dB beamwidth in the plane considered (3 dB below G_m) (degrees)~~

~~L_N: near side-lobe level (dB) relative to the peak gain required by the system design, and has a maximum value of −25 dB~~

~~L_F: far side-lobe level, G_m − 73 dBi~~

~~$\psi_1 = \psi_b \sqrt{-L_N/3}$ degrees~~

~~$\psi_2 = 3.745\ \psi_b$ degrees~~

~~$X = G_m + L_N + 60 \log(\psi_2)$ dBi~~

~~$\psi_3 = 10^{(X - L_F)/60}$ degrees~~

~~The 3 dB beamwidth ($2\psi_b$) is estimated by:~~

~~$(\psi_b)^2 = 7\,442/(10^{0.1 G_m})$ degrees²;~~

Example 1 for resolves *1.2 and 1.3:*

1.2 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-111	$dB(W/(m^2 \cdot MHz))$	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency bands 1 850-1 880 MHz, 1 920-1 980 MHz and 2 010-2 025 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

$-131 + 0.21\,(\theta)^2$	$dB(W/(m^2 \cdot MHz))$	for	$0° \leq \theta \leq 8.3°$
$-116.8 + 0.08\,(\theta)$	$dB(W/(m^2 \cdot MHz))$	for	$8.3° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 2 for resolves *1.2 and 1.3:*

1.2 for the purpose of protecting mobile service systems including IMT terrestrial systems in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

-145	$dB(W/(m^2 \cdot MHz))$	for	$0° \leq \theta < 11°$
$-145 + 0.4347\,(\theta - 11)$	$dB(W/(m^2 \cdot MHz))$	for	$11° \leq \theta < 80°$
-115	$dB(W/(m^2 \cdot MHz))$	for	$80° \leq \theta < 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 (not used);

Example 3 for resolves *1.2 and 1.3:*

1.2 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-111	$dB(W/(m^2 \cdot MHz))$	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency bands 1 850-1 880 MHz, 1 920-1 980 MHz and 2 010-2 025 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-142	$dB(W/(m^2 \cdot MHz))$	for	$0° \leq \theta < 11°$
$-142 + 0.45\,(\theta - 11)$	$dB(W/(m^2 \cdot MHz))$	for	$11° < \theta \leq 80°$

−111 dB(W/(m² · MHz)) for 80° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

~~3.2 for the purpose of protecting mobile earth stations within the satellite component of IMT from interference, a HAPS operating as an IMT base station, shall not exceed an out-of-band pfd of −165 dB(W/(m² · 4 kHz)) at the Earth's surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;~~

1.4 for the purpose of protecting mobile earth stations within the satellite component of IMT in the territory of other administrations in the frequency bands 2 100-2 160 MHz in Region 2 and 2 100-2 170 MHz in Region 3, the power flux-density (pfd) level per HIBS operating in the frequency bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3 produced at the surface of the Earth in the territory of other administrations shall not exceed the following out-of-band limit:

−165 dB(W/(m² · 4 kHz)),

Example 1 for resolves *1.5:*

(This provision is not necessary to be included in the Resolution.)

~~3.3 a HAPS operating as an IMT base station, in order to protect fixed stations from interference, shall not exceed the following limits of out-of-band power flux-density (pfd) at the Earth's surface in the bands 2 025-2 110 MHz:~~

~~– −165 dB(W/(m² · MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;~~

~~– −165 + 1.75 (θ − 5) dB(W/(m² · MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and~~

~~– −130 dB(W/(m² · MHz)) for angles of arrival between 25° and 90° above the horizontal plane;~~

1.5 (not used);

Example 2 for resolves *1.5:*

~~3.3~~1.5 a HIBS~~HAPS operating as an IMT base station~~, in order to protect fixed stations from interference, shall not exceed the following limits of out-of-band power flux-density (pfd) at the Earth's surface in the frequency band~~s~~ 2 025-2 110 MHz:

– −165 dB(W/(m² · MHz)) for 0° < θ ≤ 5° ~~dB(W/(m² · MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;~~

– −165 + 1.75 (θ − 5) dB(W/(m² · MHz)) for 5° < θ ≤ 25° ~~dB(W/(m² · MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and~~

– −130 dB(W/(m² · MHz)) for 25° < θ ≤ 90° ~~dB(W/(m² · MHz)) for angles of arrival between 25° and 90° above the horizontal plane;~~

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 1 for resolves *1.6:*

1.6 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

−144	dB(W/(m² · MHz))	for	0° < θ ≤ 10°
−144 + 1.6 (θ − 10)	dB(W/(m2 · MHz))	for	10° < θ ≤ 25°
−120	dB(W/(m² · MHz))	for	25° < θ ≤ 90°

Example 2 for resolves *1.6:*

1.6 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

−165	dB(W/(m² · MHz))	for	0° < θ ≤ 5°
−165 + 1.75 (θ − 5)	dB(W/(m² · MHz))	for	5° < θ ≤ 25°
−130	dB(W/(m² · MHz))	for	25° < θ ≤ 90°

Example 3 for resolves *1.6:*

1.6 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

−150	dB(W/(m² · MHz))	for	0° < θ ≤ 2°
−150 + 1.78 (θ − 2)	dB(W/(m² · MHz))	for	2° < θ ≤ 20°
−118 + 0.215 (θ − 20)	dB(W/(m² · MHz))	for	20° < θ ≤ 48°
−112	dB(W/(m² · MHz))	for	48° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 1 for resolves *1.7 and 1.8:*

1.7 for the purpose of protecting airborne aeronautical mobile service systems in the territory of other administrations in the frequency band 1 780-1 850 MHz, any HIBS shall maintain a separation distance of 1 135 km from the border of the affected administration, unless explicit agreement of the affected administration is provided;

1.8 for the purpose of protecting ground-based aeronautical mobile service systems in the territory of other administrations in the frequency band 1 780-1 850 MHz, any HIBS shall maintain a separation distance of 490 km from the border of the affected administration, unless explicit agreement of the affected administration is provided;

Example 2 for resolves *1.7 and 1.8:*

1.7 for the purpose of protecting aeronautical mobile service systems in the territory of other administrations in the frequency band 1 780-1 850 MHz, any HIBS shall maintain a separation distance of 1 135 km from the border of the affected administration, unless explicit agreement of the affected administration is provided;

1.8 (not used);

Example 3 for resolves *1.7 and 1.8:*

(These provisions are not necessary to be included in the Resolution.)

1.7 (not used);

1.8 (not used);

2 that administrations intending to implement HIBS system shall notify, in accordance with Article **11**, the frequency assignments to transmitting and receiving HIBS stations by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with the conditions specified in the *resolves* above,

~~4 that, for facilitating consultations between administrations, administrations planning to implement a HAPS as an IMT base station shall furnish to the concerned administrations the additional data elements listed in the Annex to this Resolution, if so requested;~~

~~5 that administrations planning to implement a HAPS as an IMT base station shall notify the frequency assignment(s) by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with *resolves* 1.1, 1.3 and 1.4 above;~~

~~6 that, since 5 July 2003, the Bureau and administrations provisionally apply Nos. 5.388A and 5.388B as revised by WRC-03 for the frequency assignments to HAPS referred to in this Resolution, including those received before this date but not yet processed by the Bureau,~~

resolves further

For Methods B2 and B4:

that HIBS may operate in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz with an altitude from 18 to 20 km, on the condition that HIBS shall not cause harmful interference nor claim protection from existing and planned primary services,

For Method B3:

that HIBS may operate in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz with an altitude down to 18 km, in derogation to No. **1.66A**,

invites administrations

Example 1 for invites administrations*:*

(This provision is not necessary to be included in the Resolution.)

(not used),

Example 2 for invites administrations*:*

to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports,

~~*invites ITU-R*~~

~~to develop, as a matter of urgency, an ITU-R Recommendation providing technical guidance to facilitate consultations with neighbouring administrations.~~

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

~~ANNEX TO RESOLUTION 221 (REV.WRC-07)~~

~~Characteristics of a HAPS operating as an IMT base station in the frequency bands given in Resolution 221 (Rev.WRC-07)~~

~~A General characteristics to be provided for the station~~

~~A.1 Identity of the station~~

~~*a)* Identity of the station~~

~~*b)* Country~~

~~A.2 Date of bringing into use~~

~~The date (actual or foreseen, as appropriate) of bringing the frequency assignment (new or modified) into use.~~

~~A.3 Administration or operating agency~~

~~Symbols for the administration or operating agency and for the address of the administration to which communication should be sent on urgent matters regarding interference, quality of emissions and questions referring to the technical operation of the station (see Article **15**).~~

~~A.4 Position information of the HAPS~~

~~*a)* The nominal geographical longitude for the HAPS~~

~~*b)* The nominal geographical latitude for the HAPS~~

~~*c)* The nominal altitude for the HAPS~~

~~*d)* The planned longitudinal and latitudinal tolerance for the HAPS~~

~~*e)* The planned tolerance of altitude for the HAPS~~

~~A.5 Agreements~~

~~If appropriate, the country symbol of any administration or administration representing a group of administrations with which agreement has been reached, including where the agreement is to exceed the limits prescribed in Resolution **221 (Rev.WRC-07)**.~~

~~B Characteristics to be provided for each antenna beam~~

~~B.1 HAPS antenna characteristics~~

~~*a)* The maximum isotropic gain (dBi).~~

~~*b)* HAPS antenna gain contours plotted on a map of the Earth's surface.~~

~~C Characteristics to be provided for each frequency assignment for HAPS antenna beam~~

~~C.1 Frequency range~~

~~C.2 Power density characteristics of the transmission~~

~~The maximum value of the maximum power density (dB(W/MHz)), averaged over the worst 1 MHz supplied to the input of the antenna.~~

~~D Calculated pfd limit produced over any country in visibility of HAPS~~

~~The maximum pfd calculated at the Earth's surface within each administration's territory over which the HAPS may be visible and over which these calculated pfd levels exceed the limits indicated in *resolves* 1.1, 1.3 and 1.4 of Resolution **221 (Rev.WRC-07)**.~~

1/1.4/5.3 For Issue C: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

1/1.4/5.3.1 For Method C1: NOC to Vols. I and II of the Radio Regulations

NOC

ARTICLES

NOC

APPENDICES

1/1.4/5.3.2 For Method C2: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

1 710-2 170 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>1 710-1 930</td><td colspan="2">FIXED
MOBILE 5.384A MOD 5.388A 5.388B
5.149 5.341 5.385 5.386 5.387 5.388</td></tr>
<tr><td>1 930-1 970
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td><td>1 930-1 970
FIXED
MOBILE MOD 5.388A 5.388B
Mobile-satellite (Earth-to-space)
5.388</td><td>1 930-1 970
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td></tr>
<tr><td>1 970-1 980</td><td colspan="2">FIXED
MOBILE MOD 5.388A 5.388B
5.388</td></tr>
<tr><td>1 980-2 010</td><td colspan="2">FIXED
MOBILE
MOBILE-SATELLITE (Earth-to-space) 5.351A
5.388 5.389A 5.389B 5.389F</td></tr>
<tr><td>2 010-2 025
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td><td>2 010-2 025
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
5.388 5.389C 5.389E</td><td>2 010-2 025
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td></tr>
<tr><td>2 025-2 110</td><td colspan="2">SPACE OPERATION (Earth-to-space) (space-to-space)
EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space)
FIXED
MOBILE 5.391
SPACE RESEARCH (Earth-to-space) (space-to-space)
5.392</td></tr>
<tr><td>2 110-2 120</td><td colspan="2">FIXED
MOBILE MOD 5.388A 5.388B
SPACE RESEARCH (deep space) (Earth-to-space)
5.388</td></tr>
<tr><td>2 120-2 160
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td><td>2 120-2 160
FIXED
MOBILE MOD 5.388A 5.388B
Mobile-satellite (space-to-Earth)
5.388</td><td>2 120-2 160
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td></tr>
<tr><td>2 160-2 170
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td><td>2 160-2 170
FIXED
MOBILE
MOBILE-SATELLITE
(space-to-Earth)
5.388 5.389C 5.389E</td><td>2 160-2 170
FIXED
MOBILE MOD 5.388A 5.388B

5.388</td></tr>
</table>

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A MOD 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	

MOD

5.388A ~~In Regions 1 and 3, t~~The frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and~~, in Region 2,~~ the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 ~~may be~~ are identified for use~~d~~ by high~~-~~-altitude platform stations ~~as base stations to provide~~ as International Mobile Telecommunications (IMT) base stations (HIBS)~~, in accordance with Resolution **221 (Rev.WRC-07)**~~. ~~Their use by IMT applications using high altitude platform stations as base stations~~ This identification does not preclude the use of these frequency bands by any ~~station in~~ application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS. (WRC-~~12~~23)

1/1.4/5.3.3 For Method C3: HIBS in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz not claiming protection and additional provisions

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A MOD 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	
1 930-1 970 FIXED MOBILE MOD 5.388A 5.388B	**1 930-1 970** FIXED MOBILE MOD 5.388A 5.388B Mobile-satellite (Earth-to-space)	**1 930-1 970** FIXED MOBILE MOD 5.388A 5.388B

5.388	5.388	5.388
1 970-1 980	FIXED MOBILE MOD 5.388A 5.388B 5.388	
1 980-2 010	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.388 5.389A 5.389B 5.389F	
2 010-2 025 FIXED MOBILE MOD 5.388A 5.388B 5.388	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.388 5.389C 5.389E	**2 010-2 025** FIXED MOBILE MOD 5.388A 5.388B 5.388
2 025-2 110	SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) 5.392	
2 110-2 120	FIXED MOBILE MOD 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space) 5.388	
2 120-2 160 FIXED MOBILE MOD 5.388A 5.388B 5.388	**2 120-2 160** FIXED MOBILE MOD 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	**2 120-2 160** FIXED MOBILE MOD 5.388A 5.388B 5.388
2 160-2 170 FIXED MOBILE MOD 5.388A 5.388B 5.388	**2 160-2 170** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.388 5.389C 5.389E	**2 160-2 170** FIXED MOBILE MOD 5.388A 5.388B 5.388

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A MOD 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	

MOD

5.388A ~~In Regions 1 and 3, t~~The frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and~~, in Region 2,~~ the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 ~~may be~~ are identified for use~~d~~ by high~~-~~-altitude platform stations ~~as base stations to provide~~ as International Mobile Telecommunications (IMT) base stations (HIBS)~~,~~ ~~in accordance with Resolution **221 (Rev.WRC-07)**~~. ~~Their use by IMT applications using high altitude platform stations as base stations~~ This identification does not preclude the use of these frequency bands by any ~~station in~~ application of the services to which they are allocated and does not establish priority in the Radio Regulations. Resolution **221 (Rev.WRC-23)** shall apply. Such use of HIBS in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix **4** information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. (WRC-~~12~~23)

1/1.4/5.3.4 For Methods C2 and C3

MOD

RESOLUTION 221 (REV.WRC-~~07~~23)

Use of high~~-~~-altitude platform stations as International Mobile Telecommunications base stations (HIBS) ~~providing IMT~~ in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz ~~in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2~~

The World Radiocommunication Conference (~~Geneva, 2007~~Dubai, 2023),

considering

~~*a)* that the bands 1 885-2 025 MHz and 2 110-2 200 MHz are identified in No. 5.388 as intended for use on a worldwide basis for IMT, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the terrestrial and satellite components of IMT;~~

~~*b)* that a high altitude platform station (HAPS) is defined in No. **1.66A** as "a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth";~~

a) that there is growing demand for access to mobile broadband, requiring more flexibility in the approaches to expand the capacity and coverage provided by International Mobile Telecommunications (IMT) systems;

b) that high-altitude platform stations as IMT base stations (HIBS) would be used as part of terrestrial IMT networks, and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;

c) that ~~HAPS may~~ HIBS would offer a new means of providing IMT services with minimal network infrastructure as they are capable of providing service to a large footprint together with a dense coverage;

d) that the use of HIBS ~~HAPS as base stations within the terrestrial component of IMT~~ is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;

e) that the mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;

f) that under certain deployment scenarios HIBS could operate at an altitude down to 18 km;

g) that some sensitivity studies have shown that the difference of interference from HIBS at altitudes between 18 km and 20 km would be negligible;

~~*e)* that, in accordance with No. **5.388** and Resolution **212 (Rev.WRC-07)***, administrations may use the bands identified for IMT, including the bands referred to in this Resolution, for stations of other primary services to which they are allocated;~~

~~*f)* that these bands are allocated to the fixed and mobile services on a co-primary basis;~~

~~*g)* that, in accordance with No. **5.388A**, HAPS may be used as base stations within the terrestrial component of IMT in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2. Their use by IMT applications using HAPS as base stations does not preclude the use of these bands by any station in the services to which they are allocated and does not establish priority in the Radio Regulations;~~

~~*h)* that ITU-R has studied sharing and coordination between HAPS and other stations within IMT, has considered compatibility of HAPS within IMT with some services having allocations in the adjacent bands, and has approved Recommendation ITU-R M.1456;~~

~~*i)* that radio interfaces of IMT-HAPS are compliant with Recommendation ITU-R M.1457;~~

~~j~~h) that the ITU Radiocommunication Sector (ITU-R) has addressed sharing and compatibility between ~~systems using HAPS~~HIBS and ~~some~~ existing systems~~,~~ of primary allocated services, and adjacent services ~~particularly PCS (personal communications system), MMDS (multichannel multipoint distribution system) and systems in the fixed service, which are currently operating in some countries~~ in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz;

~~*k)* that HAPS stations are intended to transmit in the band 2 110-2 170 MHz in Regions 1 and 3 and in the band 2 110-2 160 MHz in Region 2;~~

~~*l)* that administrations planning to implement a HAPS as an IMT base station may need to exchange information, on a bilateral basis, with other concerned administrations, including data items describing the HAPS characteristics in a more detailed manner than the data items currently included in Annex 1 of Appendix **4**, as indicated in the Annex to this Resolution,~~

i) that spectrum needs, usage and deployment scenarios, and typical technical and operational characteristics for HIBS are provided in the WDPDN Report ITU-R M.[HIBS-CHARACTERISTICS];

j) that the conclusion of the compatibility studies between HIBS operating above 2 110 MHz and SRS/SOS/EESS operations in the adjacent frequency band 2 025-2 110 MHz and the conclusion of the sharing studies between HIBS and SRS in the frequency band 2 110-2 120 MHz have both been assuming that the use of HIBS in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS,

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~~* *Note by the Secretariat:* This Resolution was revised by WRC-15 and WRC-19.~~

considering further

Example 1 for considering further a), *associated with Examples 1 and 3 for* resolves *1.2 and 1.3:*

(This provision is not necessary to be included in the Resolution.)

a) (not used),

Example 2 for considering further a), *associated with Example 2 for* resolves *1.2 and 1.3:*

a) that IMT stations may experience unacceptable interference effects due to the aggregate interference from HIBS and other services,

recognizing

a) that a high-altitude platform station (HAPS) is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

b) that in Regions 1 and 3, the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz and, in Region 2, the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz are included in No. **5.388A** for the use of HIBS;

c) that the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz, and 2 110-2 170 MHz, or parts thereof, are identified for IMT in accordance with Nos. **5.384A** and **5.388**;

d) that these frequency bands are allocated to the fixed and mobile services on a co-primary basis,

resolves

~~1 that:~~

~~1.1 for the purpose of protecting IMT mobile stations in neighbouring countries from co-channel interference, a HAPS operating as an IMT base station shall not exceed a co-channel power flux-density (pfd) of −117 dB(W/(m² · MHz)) at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of HAPS;~~

~~1.2 a HAPS operating as an IMT base station shall not transmit outside the frequency bands 2 110-2 170 MHz in Regions 1 and 3 and 2 110-2 160 MHz in Region 2;~~

~~1.3 in Region 2, for the purpose of protecting MMDS stations in some neighbouring countries in the band 2 150-2 160 MHz from co-channel interference, a HAPS operating as an IMT base station shall not exceed the following co-channel pfd at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of the HAPS;~~

~~– −127 dB(W/(m² · MHz)) for angles of arrival (θ) less than 7° above the horizontal plane;~~

~~– −127 + 0.666 (θ − 7) dB(W/(m² · MHz)) for angles of arrival between 7° and 22° above the horizontal plane; and~~

~~– −117 dB(W/(m² · MHz)) for angles of arrival between 22° and 90° above the horizontal plane;~~

~~1.4 in some countries (see No. **5.388B**), for the purpose of protecting fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference caused by a HAPS operating as an IMT base station in accordance with No. **5.388A** in neighbouring countries, the limits of **5.388B** shall apply;~~

~~2 that the limits referred to in this Resolution shall apply to all HAPS operating in accordance with No. **5.388A**;~~

~~3~~1 that administrations wishing to implement ~~HAPS within a terrestrial IMT system~~HIBS shall comply with the following:

1.1 in some countries (see No. **5.388B**), for the purpose of protecting the fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference caused by HIBS in accordance with No. **5.388A** in neighbouring countries, the limits of No. **5.388B** shall apply;

~~3.1 for the purpose of protecting IMT stations operating in neighbouring countries from co-channel interference, a HAPS operating as a base station within IMT shall use antennas that comply with the following antenna pattern:~~

~~$G(\psi) = G_m - 3(\psi/\psi_b)^2$ dBi for $0° \le \psi \le \psi_1$~~

~~$G(\psi) = G_m + L_N$ dBi for $\psi_1 < \psi \le \psi_2$~~

~~$G(\psi) = X - 60 \log(\psi)$ dBi for $\psi_2 < \psi \le \psi_3$~~

~~$G(\psi) = L_F$ dBi for $\psi_3 < \psi \le 90°$~~

~~where:~~

~~$G(\psi)$: gain at the angle ψ from the main beam direction (dBi)~~

~~G_m: maximum gain in the main lobe (dBi)~~

~~ψ_b: one-half of the 3 dB beamwidth in the plane considered (3 dB below G_m) (degrees)~~

~~L_N: near side-lobe level (dB) relative to the peak gain required by the system design, and has a maximum value of −25 dB~~

~~L_F: far side-lobe level, $G_m - 73$ dBi~~

~~$\psi_1 = \psi_b \sqrt{-L_N/3}$ degrees~~

~~$\psi_2 = 3.745\ \psi_b$ degrees~~

~~$X = G_m + L_N + 60 \log(\psi_2)$ dBi~~

~~$\psi_3 = 10^{(X - L_F)/60}$ degrees~~

~~The 3 dB beamwidth ($2\psi_b$) is estimated by:~~

~~$(\psi_b)^2 = 7\,442/(10^{0.1G_m})$ degrees^2;~~

Example 1 for resolves *1.2 and 1.3:*

1.2 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

−111 dB(W/(m^2 · MHz)) for $0° < \theta \le 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency bands 1 850-1 880 MHz, 1 920-1 980 MHz and 2 010-2 025 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

$-131 + 0.21\,(\theta)^2$	dB(W/(m^2 · MHz))	for	$0° \leq \theta \leq 8.3°$
$-116.8 + 0.08\,(\theta)$	dB(W/(m^2 · MHz))	for	$8.3° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 2 for resolves *1.2 and 1.3:*

1.2 for the purpose of protecting mobile service systems including IMT terrestrial systems in the territory of other administrations in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

-145	dB(W/(m^2 · MHz))	for	$0° \leq \theta < 11°$
$-145 + 0.45\,(\theta - 11)$	dB(W/(m^2 · MHz))	for	$11° \leq \theta < 80°$
-114	dB(W/(m^2 · MHz))	for	$80° \leq \theta < 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 (not used);

Example 3 for resolves *1.2 and 1.3:*

1.2 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-111	dB(W/(m^2 · MHz))	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency bands 1 850-1 880 MHz, 1 920-1 980 MHz and 2 010-2 025 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-142	dB(W/(m^2 · MHz))	for	$0° \leq \theta < 11°$
$-142 + 0.45\,(\theta - 11)$	dB(W/(m^2 · MHz))	for	$11° < \theta \leq 80°$
-111	dB(W/(m^2 · MHz))	for	$80° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

~~3.2 for the purpose of protecting mobile earth stations within the satellite component of IMT from interference, a HAPS operating as an IMT base station, shall not exceed an out-of-band pfd of −165 dB(W/(m² · 4 kHz)) at the Earth's surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;~~

1.4 for the purpose of protecting mobile earth stations within the satellite component of IMT in the territory of other administrations in the frequency bands 2 100-2 160 MHz in Region 2 and 2 100-2 170 MHz in Region 3, the power flux-density (pfd) level per HIBS operating in the frequency bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3 produced at the surface of the Earth in the territory of other administrations shall not exceed the following out-of-band limit:

−165 dB(W/(m^2 · 4 kHz)),

Example 1 for resolves *1.5:*

(This provision is not necessary to be included in the Resolution.)

~~3.3 a HAPS operating as an IMT base station, in order to protect fixed stations from interference, shall not exceed the following limits of out-of-band power flux-density (pfd) at the Earth's surface in the bands 2 025-2 110 MHz:~~

~~– −165 dB(W/(m^2 · MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;~~

~~– −165 + 1.75 (θ − 5) dB(W/(m^2 · MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and~~

~~– −130 dB(W/(m^2 · MHz)) for angles of arrival between 25° and 90° above the horizontal plane;~~

1.5 (not used);

Example 2 for resolves *1.5:*

~~3.3~~1.5 a HIBS~~HAPS operating as an IMT base station~~, in order to protect fixed stations from interference, shall not exceed the following limits of out-of-band power flux-density (pfd) at the Earth's surface in the frequency band~~s~~ 2 025-2 110 MHz:

– −165 dB(W/(m^2 · MHz)) for 0° < θ ≤ 5° ~~dB(W/(m^2 · MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;~~

– −165 + 1.75 (θ − 5) dB(W/(m^2 · MHz)) for 5° < θ ≤ 25° ~~dB(W/(m^2 · MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and~~

– −130 dB(W/(m^2 · MHz)) for 25° < θ ≤ 90° ~~dB(W/(m^2 · MHz)) for angles of arrival between 25° and 90° above the horizontal plane;~~

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 1 for resolves *1.6:*

1.6 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

−144	dB(W/(m^2 · MHz))	for	0° < θ ≤ 10°
−144 + 1.6 (θ − 10)	dB(W/(m^2 · MHz))	for	10° < θ ≤ 25°
−120	dB(W/(m^2 · MHz))	for	25° < θ ≤ 90°

Example 2 for resolves *1.6:*

1.6 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

−165	dB(W/(m² · MHz))	for	$0° < \theta \leq 5°$
−165 + 1.75 (θ − 5)	dB(W/(m² · MHz))	for	$5° < \theta \leq 25°$
−130	dB(W/(m² · MHz))	for	$25° < \theta \leq 90°$

Example 3 for resolves *1.6:*

1.6 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

−150	dB(W/(m² · MHz))	for	$0° < \theta \leq 2°$
−150 + 1.78 (θ − 2)	dB(W/(m² · MHz))	for	$2° < \theta \leq 20°$
−118 + 0.215 (θ − 20)	dB(W/(m² · MHz))	for	$20° < \theta \leq 48°$
−112	dB(W/(m² · MHz))	for	$48° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

2 that administrations intending to implement HIBS system shall notify, in accordance with Article **11**, the frequency assignments to transmitting and receiving HIBS stations by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with the conditions specified in the resolves above,

~~4 that, for facilitating consultations between administrations, administrations planning to implement a HAPS as an IMT base station shall furnish to the concerned administrations the additional data elements listed in the Annex to this Resolution, if so requested;~~

~~5 that administrations planning to implement a HAPS as an IMT base station shall notify the frequency assignment(s) by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with *resolves* 1.1, 1.3 and 1.4 above;~~

~~6 that, since 5 July 2003, the Bureau and administrations provisionally apply Nos. **5.388A** and **5.388B** as revised by WRC-03 for the frequency assignments to HAPS referred to in this Resolution, including those received before this date but not yet processed by the Bureau,~~

resolves further

For Method C2:

that HIBS may operate in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz with an altitude from 18 to 20 km, on the condition that HIBS shall not cause harmful interference nor claim protection from existing and planned primary services,

For Method C3:

that HIBS may operate in the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz with an altitude down to 18 km, in derogation to No. **1.66A**,

invites administrations

Example 1 for invites administrations*:*

(This provision is not necessary to be included in the Resolution.)

(not used),

Example 2 for invites administrations*:*

to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports,

~~*invites ITU-R*~~

~~to develop, as a matter of urgency, an ITU-R Recommendation providing technical guidance to facilitate consultations with neighbouring administrations.~~

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

~~ANNEX TO RESOLUTION 221 (REV.WRC-07)~~

~~Characteristics of a HAPS operating as an IMT base station in the frequency bands given in Resolution 221 (Rev.WRC-07)~~

~~A General characteristics to be provided for the station~~

~~A.1 Identity of the station~~

~~*a)* Identity of the station~~

~~*b)* Country~~

~~A.2 Date of bringing into use~~

~~The date (actual or foreseen, as appropriate) of bringing the frequency assignment (new or modified) into use.~~

~~A.3 Administration or operating agency~~

~~Symbols for the administration or operating agency and for the address of the administration to which communication should be sent on urgent matters regarding interference, quality of emissions and questions referring to the technical operation of the station (see Article 15).~~

~~A.4 Position information of the HAPS~~

~~*a)* The nominal geographical longitude for the HAPS~~

~~*b)* The nominal geographical latitude for the HAPS~~

~~*c)* The nominal altitude for the HAPS~~

~~*d)* The planned longitudinal and latitudinal tolerance for the HAPS~~

~~*e)* The planned tolerance of altitude for the HAPS~~

~~A.5 Agreements~~

~~If appropriate, the country symbol of any administration or administration representing a group of administrations with which agreement has been reached, including where the agreement is to exceed the limits prescribed in Resolution **221 (Rev.WRC-07)**.~~

~~B Characteristics to be provided for each antenna beam~~

~~B.1 HAPS antenna characteristics~~

~~*a)* The maximum isotropic gain (dBi).~~

~~*b)* HAPS antenna gain contours plotted on a map of the Earth's surface.~~

~~C Characteristics to be provided for each frequency assignment for HAPS antenna beam~~

~~C.1 Frequency range~~

~~C.2 Power density characteristics of the transmission~~

~~The maximum value of the maximum power density (dB(W/MHz)), averaged over the worst 1 MHz supplied to the input of the antenna.~~

~~D Calculated pfd limit produced over any country in visibility of HAPS~~

~~The maximum pfd calculated at the Earth's surface within each administration's territory over which the HAPS may be visible and over which these calculated pfd levels exceed the limits indicated in *resolves* 1.1, 1.3 and 1.4 of Resolution **221 (Rev.WRC-07)**.~~

1/1.4/5.4 For Issue D: HIBS in the frequency band 2 500-2 690 MHz

1/1.4/5.4.1 For Method D1: NOC to Vols. I and II of the Radio Regulations

NOC

ARTICLES

NOC

APPENDICES

1/1.4/5.4.2 For Method D2: HIBS in 2 500-2 690 MHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

2 170-2 520 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td>2 500-2 520
FIXED 5.410
MOBILE except aeronautical mobile 5.384A ADD 5.L14
5.412</td>
<td>2 500-2 520
FIXED 5.410
FIXED-SATELLITE (space-to-Earth) 5.415
MOBILE except aeronautical mobile 5.384A ADD 5.L14</td>
<td>2 500-2 520
FIXED 5.410
FIXED-SATELLITE (space-to-Earth) 5.415
MOBILE except aeronautical mobile 5.384A ADD 5.L14
MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A
5.404 5.415A</td>
</tr>
</table>

MOD

2 520-2 700 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td rowspan="2">2 520-2 655
FIXED 5.410
MOBILE except aeronautical mobile 5.384A ADD 5.L14
BROADCASTING-SATELLITE 5.413 5.416
5.339 5.412 5.418B 5.418C</td>
<td rowspan="2">2 520-2 655
FIXED 5.410
FIXED-SATELLITE (space-to-Earth) 5.415
MOBILE except aeronautical mobile 5.384A ADD 5.L14
BROADCASTING-SATELLITE 5.413 5.416
5.339 5.418B 5.418C</td>
<td>2 520-2 535
FIXED 5.410
FIXED-SATELLITE (space-to-Earth) 5.415
MOBILE except aeronautical mobile 5.384A ADD 5.L14
BROADCASTING-SATELLITE 5.413 5.416
5.403 5.414A 5.415A</td>
</tr>
<tr>
<td>2 535-2 655
FIXED 5.410
MOBILE except aeronautical mobile 5.384A ADD 5.L14
BROADCASTING-SATELLITE 5.413 5.416
5.339 5.418 5.418A 5.418B 5.418C</td>
</tr>
</table>

2 655-2 670 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.L14 BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.L14 BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.208B	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.420
2 670-2 690 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.L14 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.208B 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.L14 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (Earth-to-space) 5.351A 5.419 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149

ADD

5.L14 The frequency band 2 500-2 690 MHz in Regions 1 and 2, and the frequency band 2 500-2 655 MHz in Region 3 are identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 2 500-2 510 MHz in Regions 1 and 2, and 2 500-2 535 MHz in Region 3 is limited to reception by HIBS. (WRC-23)

1/1.4/5.4.3 For Method D3: HIBS in 2 500-2 690 MHz not claiming protection and additional provisions

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

2 170-2 520 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 500-2 520 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.M14 5.412	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.M14	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.M14 MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A 5.404 5.415A

MOD

2 520-2 700 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td rowspan="2">2 520-2 655
FIXED 5.410
MOBILE except aeronautical mobile 5.384A ADD 5.M14
BROADCASTING-SATELLITE 5.413 5.416
5.339 5.412 5.418B 5.418C</td>
<td rowspan="2">2 520-2 655
FIXED 5.410
FIXED-SATELLITE (space-to-Earth) 5.415
MOBILE except aeronautical mobile 5.384A ADD 5.M14
BROADCASTING-SATELLITE 5.413 5.416
5.339 5.418B 5.418C</td>
<td>2 520-2 535
FIXED 5.410
FIXED-SATELLITE (space-to-Earth) 5.415
MOBILE except aeronautical mobile 5.384A ADD 5.M14
BROADCASTING-SATELLITE 5.413 5.416
5.403 5.414A 5.415A</td>
</tr>
<tr>
<td>2 535-2 655
FIXED 5.410
MOBILE except aeronautical mobile 5.384A ADD 5.M14
BROADCASTING-SATELLITE 5.413 5.416
5.339 5.418 5.418A 5.418B 5.418C</td>
</tr>
</table>

2 655-2 670 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.M14 BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.M14 BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.208B	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.420
2 670-2 690 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.M14 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.208B 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.M14 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (Earth-to-space) 5.351A 5.419 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149

ADD

5.M14 The frequency band 2 500-2 690 MHz in Regions 1 and 2, and the frequency band 2 500-2 655 MHz in Region 3 are identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)** shall apply. Such use of HIBS in the frequency bands 2 500-2 510 MHz in Regions 1 and 2, and 2 500-2 535 MHz in Region 3 is limited to reception by HIBS. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix **4** information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. (WRC-23)

1/1.4/5.4.4 For Method D4: HIBS in 2 500-2 690 MHz per Region

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

2 170-2 520 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 500-2 520 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.N14 5.412	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.O14	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.P14 MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A 5.404 5.415A

MOD

2 520-2 700 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 520-2 655 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.N14 BROADCASTING-SATELLITE 5.413 5.416	**2 520-2 655** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.O14 BROADCASTING-SATELLITE 5.413 5.416	**2 520-2 535** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.P14 BROADCASTING-SATELLITE 5.413 5.416 5.403 5.414A 5.415A
5.339 5.412 5.418B 5.418C	5.339 5.418B 5.418C	**2 535-2 655** FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.P14 BROADCASTING-SATELLITE 5.413 5.416 5.339 5.418 5.418A 5.418B 5.418C

2 655-2 670 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.N14 BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.O14 BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.208B	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.420
2 670-2 690 FIXED 5.410 MOBILE except aeronautical mobile 5.384A ADD 5.N14 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.208B 5.415 MOBILE except aeronautical mobile 5.384A ADD 5.O14 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (Earth-to-space) 5.351A 5.419 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149

ADD

5.N14 The frequency band 2 500-2 690 MHz in Region 1 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)** shall apply. Such use of HIBS in the frequency band 2 500-2 510 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.O14 The frequency band 2 500-2 690 MHz in Region 2 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)** shall apply. Such use of HIBS in the frequency band 2 500-2 510 MHz is limited to reception by HIBS. (WRC-23)

ADD

5.P14 The frequency band 2 500-2 655 MHz in Region 3 is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)** shall apply. Such use of HIBS in the frequency band 2 500-2 535 MHz is limited to reception by HIBS. (WRC-23)

1/1.4/5.4.5 For Methods D2, D3 and D4

ADD

DRAFT NEW RESOLUTION [B14-HIBS 2 500-2 690 MHz] (WRC-23)

Use of high-altitude platform stations as International Mobile Telecommunications base stations (HIBS) in the frequency band 2 500-2 690 MHz, or portions thereof

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that there is growing demand for access to mobile broadband, requiring more flexibility in the approaches to expand the capacity and coverage provided by International Mobile Telecommunications (IMT) systems;

b) that high-altitude platform stations as IMT base stations (HIBS) would be used as part of terrestrial IMT networks, and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;

c) that HIBS would offer a new means of providing IMT services with minimal network infrastructure as they are capable of providing service to a large footprint together with a dense coverage;

d) that the use of HIBS is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;

e) that the IMT mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;

f) that, under certain deployment scenarios, HIBS could operate at an altitude down to 18 km;

g) that some sensitivity studies have shown that the difference of interference from HIBS at altitudes between 18 km and 20 km would be negligible;

h) that the ITU Radiocommunication Sector (ITU-R) has addressed sharing and compatibility between HIBS and existing systems of primary allocated services, and adjacent services in the frequency band 2 500-2 690 MHz;

i) that spectrum needs, usage and deployment scenarios, and typical technical and operational characteristics for HIBS are provided in the WDPDN Report ITU-R M.[HIBS-CHARACTERISTICS];

j) that the frequency band 2 690-2 700 MHz is allocated to the Earth exploration-satellite service (EESS) (passive), the space research service (SRS) (passive) and the radio astronomy service (RAS), and that No. **5.340** applies in this frequency band;

k) that in Regions 1 and 2, the use of the frequency band 2 500-2 510 MHz is limited to reception by HIBS, in accordance with Nos. [**5.L14 / 5.M14 / 5.N14** and **5.O14**],

considering further

Example 1 for considering further a)*, associated with Examples 1 and 3 for* resolves *1.1 and 1.2:*

(This provision is not necessary to be included in the Resolution.)

a) (not used),

Example 2 for considering further a)*, associated with Example 2 for* resolves *1.1 and 1.2:*

a) that IMT stations may experience unacceptable interference effects due to the aggregate interference from HIBS and other services,

recognizing

a) that a high-altitude platform station (HAPS) is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

b) that, in Regions 1 and 2, the frequency band 2 500-2 690 MHz (2 500-2 510 MHz is limited to reception by HIBS in Regions 1 and 2), and in Region 3, the frequency band 2 500-2 655 MHz (2 500-2 535 MHz is limited to reception by HIBS in Region 3) are included in No[s]. [**5.L14 / 5.M14 / 5.N14**, **5.O14** and **5.P14**] for the use of HIBS;

c) that the frequency band 2 500-2 690 MHz, or parts thereof, is identified for IMT in accordance with No. **5.384A**;

d) that this frequency band is allocated to the fixed and mobile services on a co-primary basis;

e) that, in the frequency band 2 700-2 900 MHz, ground-based meteorological radar stations under the radiolocation service are authorized to operate on a basis of equality with stations of the aeronautical radionavigation service per No. **5.423**,

resolves

1 that administrations wishing to implement HIBS shall comply with the following:

Example 1 for resolves *1.1 and 1.2:*

1.1 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency band 2 500-2 690 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-109	$\mathrm{dB(W/(m^2 \cdot MHz))}$	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.2 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency band 2 500-2 690 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

$-131 + 0.21\,(\theta)^2$	$\mathrm{dB(W/(m^2 \cdot MHz))}$	for	$0° \leq \theta \leq 8.3°$
$-116.8 + 0.08\,(\theta)$	$\mathrm{dB(W/(m^2 \cdot MHz))}$	for	$8.3° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 2 for resolves *1.1 and 1.2:*

1.1 for the purpose of protecting the mobile service including IMT terrestrial systems in the territory of other administrations in the frequency band 2 500-2 690 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-147	dB(W/(m^2 · MHz))	for	$0° \leq \theta < 11°$
$-147 + 0.45\ (\theta - 11)$	dB(W/(m^2 · MHz))	for	$11° \leq \theta < 80°$
-116	dB(W/(m^2 · MHz))	for	$80° \leq \theta < 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.2 (not used);

Example 3 for resolves *1.1 and 1.2:*

1.1 for the purpose of protecting IMT mobile stations in the territory of other administrations in the frequency band 2 500-2 690 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-109	dB(W/(m^2 · MHz))	for	$0° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.2 for the purpose of protecting IMT base stations in the territory of other administrations in the frequency band 2 500-2 690 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

-142	dB(W/(m^2 · MHz))	for	$0° \leq \theta < 11°$
$-142 + 0.45\ (\theta - 11)$	dB(W/(m^2 · MHz))	for	$11° < \theta \leq 80°$
-111	dB(W/(m^2 · MHz))	for	$80° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

Example 1 for resolves *1.3:*

1.3 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 2 500-2 690 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

-135	dB(W/(m^2 · MHz))	for	$0° < \theta \leq 20°$
$-135 + 0.7\ (\theta - 20)$	dB(W/(m^2 · MHz))	for	$20° < \theta \leq 47°$
-116	dB(W/(m^2 · MHz))	for	$47° < \theta \leq 90°$

Example 2 for resolves *1.3:*

1.3 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 2 500-2 690 MHz, the aggregate power flux-density (pfd) level from HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

-148	dB(W/(m^2 · MHz))	for	$0° < \theta \leq 2°$
$-148 + 0.71\ (\theta - 2)$	dB(W/(m^2 · MHz))	for	$2° < \theta \leq 47°$

−116	dB(W/(m² · MHz))	for	47° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

<u>*Example 1 for* resolves *1.4:*</u>

1.4 for the purpose of protecting the broadcasting satellite services in the territory of other administrations in the frequency band 2 520-2 630 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

−130.5	dB(W/(m² · MHz))	for	0° < θ ≤ 20°
−139.8	dB(W/(m² · MHz))	for	20° < θ < 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

<u>*Example 2 for* resolves *1.4:*</u>

1.4 for the purpose of protecting the broadcasting satellite services in the territory of other administrations in the frequency band 2 520-2 630 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided:

−130.5	dB(W/(m² · MHz))	for	0° < θ ≤ 20°
−139.8	dB(W/(m² · MHz))	for	20° < θ < 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees.

1.4.1 In addition, in Regions 1 and 3, in the frequency band 2 520-2 690 MHz, the use of HIBS shall not cause unacceptable interference nor claim protection from the broadcasting-satellite service operating in Region 3. Upon receipt of a report of unacceptable interference, the notifying administration of HIBS shall immediately eliminate or reduce interference to an acceptable level;

1.4.2 for the implementation of *resolves* 1.4 above, the notifying administrations of HIBS at the time of submission of Appendix **4** information to the Radiocommunication Bureau (BR) shall also submit an objective, measurable and enforceable commitment that, in case of causing unacceptable interference, it undertakes to immediately cease emission or reduce the interference to an acceptable level; as for enforceability referred to in this *resolves*, should the interference not be ceased or reduced to acceptable level, the assignments in question shall be submitted by the Bureau to the Radio Regulations Board to review for suppression from the Master International Frequency Register (MIFR) and the Bureau’s database;

1.5 for the purpose of protecting aeronautical-radionavigation service systems in the territory of other administrations in the frequency band 2 700-2 900 MHz, the power flux-density (pfd) level from HIBS operating in the frequency band 2 500-2 690 MHz produced at the surface of the Earth in the territory of other administrations shall not exceed the following unwanted emissions limit, unless explicit agreement of the affected administration is provided:

-156.2	dB(W/(m² · MHz))	for	$\theta \leq 7°$
$-163 + 15 \cdot \log_{10}(\theta - 4)$	dB(W/(m² · MHz))	for	$7° < \theta < 30.5°$
$-141 + 2.7 \cdot \log_{10}(\theta - 4)$	dB(W/(m² · MHz))	for	$\theta = 30.5°$
$-157 + 14 \cdot \log_{10}(\theta - 4)$	dB(W/(m² · MHz))	for	$30.5° < \theta \leq 40.5°$
-101.5	dB(W/(m² · MHz))	for	$\theta > 40.5°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

<u>*Example 1 for* resolves *1.6:*</u>

1.6 for the purpose of protecting radiolocation service systems in the territory of other administrations, in particular those systems operating in accordance with No. **5.423**, in the frequency band 2 700-2 900 MHz, the power flux-density (pfd) level from HIBS operating in the frequency band 2 500-2 690 MHz produced at the surface of the Earth in the territory of other administrations shall not exceed the following unwanted emissions limit, unless explicit agreement of the affected administration is provided:

-165.6	dB(W/($m^2 \cdot$ MHz))	for	$\theta \leq 37°$
$-165.6 + 5.5\ (\theta - 37)$	dB(W/($m^2 \cdot$ MHz))	for	$37° < \theta < 45°$
$-121.6 + (\theta - 45) / 3$	dB(W/($m^2 \cdot$ MHz))	for	$45° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees,

<u>*Example 2 for* resolves *1.6:*</u>

1.6 for the purpose of protecting radiolocation service systems in the territory of other administrations, in particular those systems operating in accordance with No. **5.423**, in the frequency band 2 700-2 900 MHz, the aggregate power flux-density (pfd) level from HIBS operating in the frequency band 2 500-2 690 MHz produced at the surface of the Earth in the territory of other administrations shall not exceed the following unwanted emissions limit, unless explicit agreement of the affected administration is provided:

-165.6	dB(W/($m^2 \cdot$ MHz))	for	$\theta \leq 37°$
$-165.6 + 5.5\ (\theta - 37)$	dB(W/($m^2 \cdot$ MHz))	for	$37° < \theta < 45°$
$-121.6 + (\theta - 45) / 3$	dB(W/($m^2 \cdot$ MHz))	for	$45° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees,

<u>*Example 1 for* resolves *1.7 and 1.8:*</u>

1.7 for the purpose of protecting radio astronomy service stations in the frequency band 2 690-2 700 MHz, the power flux-density (pfd) level of HIBS operating in the frequency band 2 500-2 690 MHz produced at any radio astronomy observatory site shall not exceed the following unwanted emissions limit, unless explicit agreement of the affected administration is provided:

-177 dB(W/($m^2 \cdot$ 10 MHz))

1.8 that *resolves* 1.7 applies at any radio astronomy station that was in operation prior to XX November 2023 and has been notified to the Radiocommunication Bureau (BR) in the frequency band 2 690-2 700 MHz before XX May 2024, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix **4** information for notification, for the HIBS system to which *resolves* 1.7 applies; radio astronomy stations notified after this date need to seek an agreement with administrations that have notified HIBS;

<u>*Example 2 for* resolves *1.7 and 1.8:*</u>

1.7 that, to protect radio astronomy stations operating in the frequency band 2 690-2 700 MHz from unwanted emissions of HIBS operating in the frequency bands 2 500-2 690 MHz, the separation distance between the radio astronomy station and the nadir of a HIBS platform shall exceed the radio horizon for the specific operating altitude of the HIBS platform (see also No. **29.12**);

1.8 that *resolves* 1.7 applies at any radio astronomy station that was in operation prior to XX November 2023 and has been notified to the Radiocommunication Bureau (BR) in the frequency band 2 690-2 700 MHz before XX May 2024, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix **4** information for notification, for the HIBS system to which *resolves* 1.7 applies; radio astronomy stations notified after this date need to seek an agreement with administrations that have notified HIBS;

Example 1 for resolves *1.9:*

1.9 that for the purpose of protecting MSS (space-to-Earth) and RDSS (space-to-Earth) in the frequency band 2 483.5-2 500 MHz, the use of HIBS platform in the frequency band 2 500-2 690 MHz shall comply with an unwanted emission limit of −13 dBm/MHz in the frequency band 2 483.5-2 500 MHz;

Example 2 for resolves *1.9:*

1.9 that for the purpose of protecting MSS (space-to-Earth) and RDSS (space-to-Earth) in the frequency band 2 483.5-2 500 MHz, the use of HIBS platform in the frequency band 2 500-2 690 MHz shall comply with an unwanted emission limit of −30 dBm/MHz in the frequency band 2 483.5-2 500 MHz;

2 that administrations intending to implement HIBS system shall notify, in accordance with Article **11**, the frequency assignments to transmitting and receiving HIBS stations by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with the conditions specified in the *resolves* above,

resolves further

For Methods D2 and D4:

that HIBS may operate in the frequency band 2 500-2 690 MHz with an altitude from 18 to 20 km, on the condition that HIBS shall not cause harmful interference nor claim protection from existing and planned primary services,

For Method D3:

that HIBS may operate in the frequency band 2 500-2 690 MHz with an altitude down to 18 km, in derogation to No. **1.66A**,

invites administrations

Example 1 for invites administrations*:*

(This provision is not necessary to be included in the Resolution.)

(not used),

Example 2 for invites administrations*:*

to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

1/1.4/5.5 For Methods A2, A3, A4, B2, B3, B4, C2, C3, D2, D3 and D4

ARTICLE 11

Notification and recording of frequency assignments[1, 2, 3, 4, 5, 6, 7] (WRC-19)

Section I − Notification

MOD

11.26A Notices relating to assignments for high-~~-~~altitude platform stations ~~operating~~ as IMT base stations ~~to provide IMT~~ in the frequency bands identified in Nos. [**5.A14** and **5.B14** / **5.C14** and **5.D14** / **5.E14**, **5.F14**, **5.G14** and **5.H14**], [**5.I14**, **5.J14** and **5.K14**], [**5.L14** / **5.M14** / **5.N14**, **5.O14** and **5.P14**] and **5.388A** shall reach the Bureau not earlier than three years before the assignments are brought into use. (WRC-~~03~~23)

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 1

Characteristics of stations in the terrestrial services[1]

MOD

TABLE 2 (REV.WRC-~~19~~23)

Characteristics for high-altitude platform stations (HAPS) frequency assignments in the terrestrial services

Item identifier	*1 – GENERAL CHARACTERISTICS OF THE HAPS*	Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9	Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.9	Item identifier
	GENERAL INFORMATION					
...	...	...	...	...	...	...
	COMPLIANCE WITH TECHNICAL OR OPERATIONAL LIMITS					
1.14.a	a commitment that, for the purpose of protecting [IMT mobile stations/mobile services including IMT terrestrial systems] in the territory of other administrations in the frequency band 694-960 MHz, the pfd level of [TBD] per HAPS as IMT base stations (HIBS) [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided (see Resolution **[A14-HIBS 694-960 MHz] (WRC-23)**)	X				1.14.a
1.14.b	a commitment that the HAPS does not exceed an out-of-band pfd of −165 dB(W/(m^2 · 4 kHz)) at the Earth's surface in the territory of other administrations in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3 (see Resolution **221 (Rev.WRC-~~07~~23)**)	**X**				1.14.b

Item identifier	*1 - GENERAL CHARACTERISTICS OF THE HAPS*	**Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.2**	**Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9**	**Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2**	**Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.9**	Item identifier
1.14.ba	a commitment that, for the purpose of protecting [IMT mobile stations/mobile services including IMT terrestrial systems] in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the pfd level of [TBD] from HIBS [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided (see Resolution **221 (Rev.WRC-23)**)	X				1.14.ba
1.14.bb	a commitment that, for the purpose of protecting IMT base stations in the territory of other administrations in the frequency bands [1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz/2 010-2 025 MHz], the pfd level of [TBD] from HIBS [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided (see Resolution **221 (Rev.WRC-23)**)	X				1.14.bb
1.14.bc	a commitment that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the pfd level of [TBD] from HIBS [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided (see Resolution **221 (Rev.WRC-23)**)	X				1.14.bc
1.14.c	a commitment that, for the purpose of protecting [IMT mobile stations/mobile service including IMT terrestrial systems] in the territory of other administrations in the frequency band 2 500-2 690 MHz, the pfd level of [TBD] from HIBS [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**)	X				1.14.c

Item identifier	1 - GENERAL CHARACTERISTICS OF THE HAPS	Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9	Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.9	Item identifier
1.14.ca	a commitment that, for the purpose of protecting IMT base stations in the territory of other administrations in the frequency band 2 500-2 690 MHz, the pfd level of [TBD] from HIBS [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**)	X				1.14.ca
1.14.cb	a commitment that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 2 500-2 690 MHz, the pfd level of [TBD] from HIBS [operating at altitude from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**)	X				1.14.cb
1.14.cd	a commitment that, for the purpose of protecting the broadcasting satellite services in the territory of other administrations in the frequency band 2 520-2 630 MHz, the pfd level of -130.5 dB(W/(m^2 · MHz)) for angles of arrival between 0° and 20° and -139.8 dB(W/(m^2 · MHz)) for angles of arrival between 20° and 90° from HIBS [operating at altitudes from 20 km to 50 km] produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit, unless explicit agreement of the affected administration is provided (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**)	X				1.14.cd

Item identifier	*1 - GENERAL CHARACTERISTICS OF THE HAPS*	Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9	Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.9	Item identifier
1.14.ce	[a commitment that the HAPS as IMT base station [operating at altitudes from 20 km to 50 km] does not exceed the out-of-band pfd limits of ~~−165~~ −156.2 dB(W/(m² · MHz)) for angles of arrival (θ) less than ~~5~~7° above the horizontal plane, ~~−165 + 1.75 (θ − 5)~~ −163 + 15 · *log₁₀* (θ − 4) dB(W/(m² · MHz)) for angles of arrival between ~~5~~7° and ~~25~~30.5°, −141 + 2.7 · *log₁₀* (θ − 4) dB(W/(m² · MHz)) for angles of arrival equal to 30.5°, −157 + 14 · *log₁₀* (θ − 4) dB(W/(m² · MHz)) for angles of arrival between 30.5° and 40.5° and ~~−130~~ −101.5 dB(W/(m² · MHz)) for angles of arrival ~~between 25° and 90° (see Resolution **221 (Rev.WRC-07)**)~~more than 40.5° in the territory of other administrations in the frequency band 2 700-2 900 MHz (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**); or a commitment that the HAPS as IMT base station [operating at altitudes from 20 km to 50 km] does not exceed the out-of-band pfd limits of −165.6 dB(W/(m² · MHz)) for angles of arrival (θ) less than or equal to 37° above the horizontal plane, −165.6 + 5.5 (θ − 37) dB(W/(m² · MHz)) for angles of arrival between 37° and 45° and −121.6 + (θ − 45) / 3 dB(W/(m² · MHz)) for angles of arrival between 45° and 90° (inclusive) in the territory of other administrations in the frequency band 2 700-2 900 MHz (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**)]	X				1.14.ce
1.14.cf	a commitment that the HAPS as IMT base station [operating at altitudes from 20 km to 50 km] does not exceed the out-of-band pfd limits of −177 dB(W/(m² · 10 MHz)) at any radio astronomy observatory site operating in the frequency band 2 690-2 700 MHz (see Resolution **[B14-HIBS 2 500-2 690 MHz] (WRC-23)**	X				1.14.cf
...	...	...	...	...	...	...

Item identifier	*2 - CHARACTERISTICS TO BE PROVIDED FOR EACH INDIVIDUAL OR COMPOSITE HAPS ANTENNA BEAM*	Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9	Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.9	Item identifier
	IDENTIFICATION AND DIRECTION OF THE HAPS ANTENNA BEAM					
...	...	...	...	...	...	...
	ANTENNA CHARACTERISTICS					
2.9.e	the height of the antenna above ground level, in metres, in the case of a HAPS transmitting ground station Required for an assignment in the frequency bands shared with space services (space-to-Earth)				+	2.9.e
2.9.f	antenna diameter, in metres, in the case of a HAPS transmitting ground station Required in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz				+	2.9.f
...	...	...	...	...	...	...

Item identifier	*3 - CHARACTERISTICS TO BE PROVIDED FOR EACH FREQUENCY ASSIGNMENT FOR EACH INDIVIDUAL OR COMPOSITE HAPS ANTENNA BEAM*	Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14]and 5.388A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9	Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550DB and 5.552A for the application of No. 11.9	Item identifier
	ASSIGNED FREQUENCY					
...	...	...	...	...	...	...
	LOCATION OF THE ASSOCIATED ANTENNA(S)					

Item identifier	*3 - CHARACTERISTICS TO BE PROVIDED FOR EACH FREQUENCY ASSIGNMENT FOR EACH INDIVIDUAL OR COMPOSITE HAPS ANTENNA BEAM*	**Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14]and 5.388A for the application of No. 11.2**	**Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9**	**Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2**	**Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550DB and 5.552A for the application of No. 11.9**	Item identifier
3.5.c	the geographical coordinates of the ground station(s) in the fixed service Required in the frequency bands 6 560-6 640 MHz and 25.25-27 GHz, 31-31.3 GHz, and 38-39.5 GHz; Required in the other frequency bands, if neither the geographical coordinates of a given zone (3.c.a) nor a geographical area (3.5.d) nor a circular area (3.5.e and 3.5.f) are provided			+	+	3.5.c
	For an area in which associated transmitting/receiving ground station(s) operate:					
3.5.c.a	the geographical coordinates of a given zone A minimum of six geographical coordinates are required, in degrees, minutes and seconds *Note* – For the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz the geographical coordinates are provided for each of the UAC, SAC and if applicable RAC (see the most recent version of Recommendation ITU-R F.1500) Required if neither a circular area (3.5.e and 3.5.f) nor a geographical area (3.5.d) are provided	+	+	+	+	3.5.c.a
3.5.d	the code of the geographical area (see the Preface) *Note* – For the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz separate geographical areas are provided for each of the UAC, SAC and if applicable RAC (see the most recent version of Recommendation ITU-R F.1500) Required if neither a circular area (3.5.e and 3.5.f) nor the geographical coordinates of a given zone (3.5.c.a) are provided	+	+	+	+	3.5.d
3.5.e	the geographical coordinates of the centre of the circular area in which the associated ground station(s) are operating The latitude and longitude are provided in degrees, minutes and seconds *Note* – For the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz different centres of the circular area may be provided for the UAC, SAC and if applicable RAC (see the most recent version of Recommendation ITU-R F.1500) Required if neither a geographical area (3.5.d) or geographical coordinates of a given zone (3.5.c.a) are provided	+	+	+	+	3.5.e

Item identifier	***3 - CHARACTERISTICS TO BE PROVIDED FOR EACH FREQUENCY ASSIGNMENT FOR EACH INDIVIDUAL OR COMPOSITE HAPS ANTENNA BEAM***	**Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14]and 5.388A for the application of No. 11.2**	**Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9**	**Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2**	**Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550DB and 5.552A for the application of No. 11.9**	**Item identifier**
3.5.f	the radius, in km, of the circular area *Note* – For the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, a separate radius is provided for each of the UAC, SAC and if applicable RAC (see the most recent version of Recommendation ITU-R F.1500) Required if neither a geographical area (3.5.d) nor geographical coordinates of a given zone (3.5.c.a) are provided	+	+	+	+	3.5.f
...	...	**...**	**...**	**...**	**...**	...
	POWER CHARACTERISTICS OF THE TRANSMISSION					
3.8	the symbol (X, Y or Z, as appropriate) describing the type of power (see Article **1**) corresponding to the class of emission	**X**	**X**	**X**	**X**	3.8.
3.8b	the radiated power, in dBW, in one of the forms described in Nos. 1.161 to 1.163 *Note – For a receiving HAPS, the radiated power refers to the associated transmitting mobile station(s)*		**X**			3.8b
3.8.aa	the power delivered to the antenna, in dBW, excluding the level of power control in 3.8.BA under clear-sky conditions *Note* – For a receiving HAPS, the power delivered to the antenna refers to the associated transmitting ground station(s)	**X**		**X**	**X**	3.8.aa
3.8.AB	the power density[1] averaged over the worst 1 MHz band delivered to the antenna under clear-sky conditions	**X**		**X**		3.8AB
3.8.BA	the range of power control, in dB *Note* – For a receiving HAPS, the power control refers to its use by the associated transmitting ground station(s) In the case of a transmitting HAPS, required in the frequency bands, 21.4-22 GHz, 24.25-25.25 GHz, 27-27.5 GHz, 31-31.3 GHz, 38-39.5 GHz, 47.2-47.5 GHz and 47.9-48.2 GHz In the case of a receiving HAPS, required in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz	**X**		+	+	3.8.BA
	POLARIZATION AND RECEIVING SYSTEM NOISE TEMPERATURE					
3.9.d	the code indicating the type of polarization (see the Preface)	**X**	**X**	**X**	**X**	3.9.d

Item identifier	*3 - CHARACTERISTICS TO BE PROVIDED FOR EACH FREQUENCY ASSIGNMENT FOR EACH INDIVIDUAL OR COMPOSITE HAPS ANTENNA BEAM*	Transmitting station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14]and 5.388A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. [5.A14 and 5.B14 / 5.C14 and 5.D14 / 5.E14, 5.F14, 5.G14 and 5.H14], [5.I14, 5.J14 and 5.K14], [5.L14 / 5.M14 / 5.N14, 5.O14 and 5.P14] and 5.388A for the application of No. 11.9	Transmitting station in the frequency bands listed in Nos. 5.457, 5.537A, 5.530E, 5.532AA, 5.534A, 5.543B, 5.550D and 5.552A for the application of No. 11.2	Receiving station in the frequency bands listed in Nos. 5.457, 5.534A, 5.543B, 5.550DB and 5.552A for the application of No. 11.9	Item identifier
3.9.j	the reference radiation pattern of the associated ground station(s) Required in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz			+	+	3.9.j
3.9.k	the lowest total receiving system noise temperature, in kelvins, referred to the output of the receiving antenna		X		X	3.9.k
	HOURS OF OPERATION					
3.10.b	the regular hours of operation (in hours and minutes from ... to ...) of the frequency assignment, in UTC	X	X	X	X	3.10.b

1/1.4/5.6 For all Methods

SUP

RESOLUTION 247 (WRC-19)

Facilitating mobile connectivity in certain frequency bands below 2.7 GHz using high-altitude platform stations as International Mobile Telecommunications base stations

Agenda item 1.5

1.5 to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review in accordance with Resolution ***235 (WRC-15)****;*

Resolution **235 (WRC-15)** – *Review of the spectrum use of the frequency band 470-960 MHz in Region 1*

The following views were presented regarding whether the scope of Resolution **235 (WRC-15)** (WRC-15 agenda item 1.5) includes or not consideration of secondary services:

VIEW 1:

Limiting agenda item 1.5 studies to primary services and excluding secondary services

The view is that only primary services are part of the studies under the scope of WRC-23 agenda item 1.5 and Resolution ***235 (WRC-15)*** *since secondary services are excluded completely from the scope of agenda item 1.5 on spectrum needs, requirement and sharing studies for protection of existing services due to the following:*

– *Resolution* ***235 (WRC-15)****,* considering i)*, states clearly that protection should be limited to primary services as follows:*

  i) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands.

– *Resolution* ***235 (WRC-15)*** resolves *2 and 3 request to study mobile, except aeronautical mobile, and other services including broadcasting for protection of existing services. Broadcasting and other services should have primary allocation to be studied for protection.*

– *Secondary service is not explicitly mentioned and there is not even any reference to the secondary service in Resolution* ***235 (WRC-15)****. Accordingly, secondary services shall not be considered in the studies of agenda item 1.5, taking into account the following Principle (3) in the Annex 3 to the ITU CVC meeting Report. Also, we should not make any precedence in such a situation by considering secondary services in the study.*

– *The principle (3) in the Annex 3 to the Report of CVC meeting stated clearly that secondary service should be explicitly mentioned in the resolution in order to be considered:*

  Quote:

  "3 This principle is important to identify all services in the frequency band under study.

  The impact of the incoming in-band service subject to the agenda item with respect to in-band secondary services need to be assessed if it is mentioned in the resolution supporting that agenda item. In the absence of guidance from the resolution, the matter is to be treated in accordance with the relevant provisions of the Radio Regulations.

  The protection of primary services in the adjacent frequency band is to be treated in accordance with the relevant provisions of the Radio Regulations."

  Unquote

– *As per the ITU Radio Regulations, Article* ***5*** *– Section II, on Categories of services and allocations, the primary service is only subject to protection and secondary services* *should not claim protection. Accordingly, secondary services are outside the scope of agenda item 1.5 studies:*

Quote:

*“**5.28** 3) Stations of a secondary service:*

***5.29** a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;*

***5.30** b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;*

…

***5.33** 5) Where a band is indicated in a footnote of the Table as allocated to a service “on a primary basis”, in an area smaller than a Region, or in a particular country, this is a primary service only in that area or country.*

Unquote

*In addition, there was an opinion presented by the Legal Affairs Unit (LAU) of ITU regarding possible interpretation of Resolution **235 (WRC-15)**, which was in contradiction with the preamble and* resolves *parts of Resolution **235 (WRC-15)** and also in contradiction with the intention by the legislators who are the administrations which drafted Resolution **235 (WRC-15)**. The following are some comments made on the LAU opinion:*

*1) Many administrations in Region 1 and other Regions raised serious concerns that LAU should not take position and his opinion should be limited to his understanding. However, administrations which drafted Resolution **235 (WRC-15)** had a clear intention behind every “word” in the resolution and they are fully free to select the wording to achieve compromises during the WRCs, while referring some of the controversial issues to the SG, WP, TG discussions. This is the reason why “as appropriate” was added to “*resolves *2 and 3” and in other places of the resolution.*

2) LAU’s opinion was that “in the absence of an explicit limitation by the legislator to this effect, the phrase “other existing services” should include both primary and secondary services”.

*It was clarified by the legislator (administrations which drafted Resolution **235 (WRC-15)**) that there was a clear limitation by Resolution **235 (WRC-15)** as follows:*

*a) Resolution **235 (WRC-15)** states clearly that the intention of legislator in “*resolves to invite ITU-R *3” which is “to provide protection”, which is limited to primary service as per preamble in “*considering i)*”:*

Quote:

*“*considering i) *that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;”*

*“*resolves to invite ITU-R *3 to conduct sharing and compatibility studies, as appropriate, in order to provide relevant protection of systems of other existing services,”*

Unquote

As per ITU RR, a secondary service is not subject to protection as clarified above.

b) The majority of the ITU membership has a different understanding from LAU as per the Report of the CVC meeting (Document CVC-16/2) which stated clearly in Principle (3) supported by the majority of the CVC meeting that "secondary service" should be explicitly mentioned in the resolution in order to be considered. The editorial note under Principle (3) reflects a few concerns from certain membership but does not contradict with:

"3 This principle is important to identify all services in the frequency band under study. The impact of the incoming in-band service subject to the agenda item with respect to in-band secondary services need to be assessed if it is mentioned in the resolution supporting that agenda item. In the absence of guidance from the resolution, the matter is to be treated in accordance with the relevant provisions of the Radio Regulations."

3) There was no answer in the LAU opinion to the question raised by administrations objecting to the consideration of secondary services, whether "there is any obligation from Resolution ***235 (WRC-15)*** *to consider secondary services or it is subject to agreement from all administrations?".*

However, and after presentation by LAU in TG 6/1 plenary, the question was raised by a number of administrations again and then LAU clearly stated that the decision on consideration of secondary services within the scope of WRC-23 agenda item 1.5 and relevant studies is subject to the agreement of administrations.

LAU clarified that it was just an opinion provided. However, this LAU opinion was not correct in the views of many administrations.

Conclusion

The studies under the scope of WRC-23 AI 1.5 and Resolution ***235 (WRC-15)*** *should exclude secondary services from spectrum needs, requirement and sharing studies for the protection of existing services which are limited to primary services only.*

END OF VIEW 1

VIEW 2:

Supporting the inclusion of secondary services in studies under* resolves to invite ITU-R *3 of Resolution 235 (WRC-15)

The wording of resolves to invite ITU-R *3 is sufficiently clear, and the phrase "other existing services" should include both primary and secondary services, particularly in light of the absence of an explicit statement of limitation on either service category within the text of Resolution* ***235 (WRC-15)****. This view is further justified with very valid reasons in the response of the Legal Affairs Unit (LAU) of ITU to the questions raised during the meeting of Task Group 6/1 in July 2021 (see Doc. 6-1/57 for further details), quoted below.*

Quote:

Having reviewed the documentation provided, it seems to LAU that the matter could be resolved by a literal interpretation of the text in question.

More specifically, the Chairman of ITU-R Task Group (TG) 6/1 forwarded to LAU a question received from a Member State concerning the interpretation of resolves to invite ITU-R *3 of Resolution* ***235 (WRC-15)****, and particularly whether the reference to "other existing services" should be interpreted to include all services, regardless of whether they have primary or secondary status, or whether it should be interpreted as being limited to primary services only. The Chairman* *of TG 6/1 has slightly rephrased the question by focusing on the interpretation of the phrase "as appropriate", and whether such phrase in fact further limits the scope of the phrase "other existing services" to primary services only, or whether it simply relates to how the ITU-R should "conduct sharing and compatibility studies".*

LAU findings are that the wording of resolves to invite ITU-R *3 is sufficiently clear and that, in the absence of an explicit limitation by the legislator to this effect, the phrase "other existing services" should include both primary and secondary services. Furthermore, the same argument can be drawn from the use of the phrase "as appropriate" which is systematically used in ITU regulatory texts to further describe how an activity set by a verb should be conducted, not a noun. In the case at hand, the phrase further refines the meaning of "conduct". Similarly, the same phrase ("as appropriate") is also used in* resolves to invite ITU-R *2 above, to describe how sharing and compatibility studies should be "carried out", whereas the sentence goes on to specifically name the types of services to which such studies should be limited. Correspondingly, if the legislator wished to limit the scope of "existing services" in* resolves to invite ITU-R *3 only to cover those having primary status, he would have followed the example set by the previous* resolves to invite ITU-R *2. This literal interpretation is further supported by other examples in regulatory texts, e.g.:*

a) *Resolution **246 (WRC-19)**, whose operative part explicitly limits the scope to services allocated on a primary basis ("[…] to conduct sharing and compatibility studies in time for WRC-23 between the mobile service and other services allocated on a primary basis within the frequency band 3 600-3 800 MHz and adjacent frequency bands in Region 1, as appropriate, to ensure protection of those services to which the frequency band is allocated on a primary basis and not impose undue constraints on the existing services and their future development");*

b) *Resolution **248 (WRC-19)**, whose* resolves to invite the ITU-R *2 explicitly mentions the protection of primary services ("[…] to conduct sharing and compatibility studies with existing primary services to determine the suitability of new allocations to the MSS, with a view to protecting the primary services, in the following frequency bands and adjacent frequency bands: […]");*

c) *Resolution **250 (WRC-19)**, whose* resolves to invite the ITU-R *2 also limits the scope of such studies to the protection of primary services ("[…] to conduct sharing and compatibility studies to ensure protection of those services to which the frequency band is allocated on a primary basis, and adjacent frequency bands as appropriate […]" [emphasis added].*

*LAU was also informed that the aforementioned understanding is not supported by some Administrations, claiming that "the agreed principles in the Annex to the Report of CVC meeting for our guidance that secondary service should [be] explicitly mentioned in the resolution in order to be considered" and citing the relevant text: "3 This principle is important to identify all services in the frequency band under study. The impact of the incoming in-band service subject to the agenda item with respect to in-band secondary services need to be assessed **if it is mentioned in the resolution supporting that agenda item. In the absence of guidance from the resolution, the matter is to be treated in accordance with the relevant provisions of the Radio Regulations**. The protection of primary services in the adjacent frequency band is to be treated in accordance with the relevant provisions of the Radio Regulations." (Emphasis added.)*

While considering this information, LAU also considered the following editor's note qualifying this text highlighted in the annex of the Report of the CVC meeting (Document CVC-16/2) "[Editor's note: The meeting considered that the highlighted part of section 3 requires further discussion and did not reach a conclusion on an agreeable text]".

*LAU does not consider that this argument is convincing from the legal standpoint since the text is not approved yet and Resolution **235 (WRC-15)** does in fact provide guidance, as described above. Furthermore, even though secondary services are not mentioned in* resolves to invite ITU-R *3, neither are primary services.*

Unquote

*These conclusions are further supported by precedents such as studies for WRC-15 agenda items 1.1 and 1.2 in Joint Task Group (JTG) 4-5-6-7. The final JTG 4-5-6-7 Chairman's Report in Document 4-5-6-7/715 (www.itu.int/md/R12-JTG4567-C-0715/en) has two annexes with clear precedents of work relevant to TG 6/1. Document JTG 4-5-6-7/715 (Annex 7) with the studies undertaken between RAS 608-614 MHz existing in both secondary and primary status RR Nos. **5.149** and **5.306** for Region 1 and primary mobile IMT as the new proposed incoming service allocation. JTG 4-5-6-7/715 (Annex 7) was incorporated in Report ITU-R RA.2332. JTG 4-5-6-7/715 (Annex 8) also has the example of an existing secondary footnote RR No. **5.296** allocation which continues to apply for SAP/SAB and again a new incoming proposed primary mobile allocation for IMT. Document 4-5-6-7/715 (Annex 8) was incorporated into Report ITU-R BT.2338.*

The inclusion of secondary services in the studies under the agenda item 1.5 will have no immediate impact on the regulatory situation regarding their protection as this is subject to the Radio Regulations in force.

In conducting studies, the relevant provisions of RR also need to be taken into account. In this respect, the following specific provisions are noted in particular:

– *In Region 1, except in the African Broadcasting Area (see RR Nos. **5.10** to **5.13**), the band 608-614 MHz is allocated to the radio astronomy service on a secondary basis, in accordance with RR No. **5.306**. Nevertheless, according to RR No. **5.149**, which applies to the 608-614 MHz band amongst others, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to stations of other services.*

– *The frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making (SAB/SAP) in accordance with RR No. **5.296**. The appropriate treatment for this case is required when conducting studies and considering any possible future primary allocation to the mobile service in the 470-694 MHz band.*

– *In some countries, wind profiler radars (WPR) have a secondary allocation according to RR No. **5.291A**. Of relevance in this instance is the fact that, despite usage for this purpose being limited to some countries only, the results of WPR are supportive to the general weather forecast in the whole of Europe. Therefore, it is important to also acknowledge that such usage in this case has importance to not only the countries within which such WPR applications exist, but also to those other countries to which the WPR provides supportive data.*

<u>END OF VIEW 2</u>

Views regarding whether the scope of Resolution **235 (WRC-15)** (WRC-23 agenda item 1.5) includes or not consideration of interference from the incumbent services to the mobile service as well as consideration of interference among systems of the same service:

<u>VIEW 1:</u>

WRC-23 agenda item 1.5 studies for protection of existing services and excluding the impact on new services as well as consideration of interference among systems of the same service

The proponents of this view consider that interference studies should be limited to the inter-services since the intra-services studies are not within the mandate of TG 6/1 and not within the scope of Resolution ***235 (WRC-15)*** *since there is no coordination requirement for such terrestrial systems of the mobile service in the RR.*

As per the normal ITU practice, the scope of sharing and compatibility studies under WRC-23 agenda item 1.5, in accordance with Resolution ***235 (WRC-15)****, is limited to studying the impact from the new mobile service to existing services, in particular broadcasting, in order to ensure protection of the existing primary services. Accordingly, the relevant studies should exclude completely the following studies:*

– *Studies from existing primary services (broadcasting) to protect new primary services (mobile) are out of scope of WRC-23 agenda item 1.5 and Resolution* ***235 (WRC-15)****.*

– *Studies within the same service (e.g. impact among systems identified within mobile services) are out of scope of WRC-23 agenda item 1.5 and Resolution* ***235 (WRC-15)****.*

The following are some of the reasons:

– *Resolution* ***235 (WRC-15)*** *states clearly that the intention of the legislator from the sharing and compatibility studies under WRC-23 agenda item 1.5 is "to provide relevant protection" of systems of other existing services as per "*resolves to invite ITU-R *3":*

"

[WRC-15] resolves to invite ITU-R, after the 2019 World Radiocommunication Conference and in time for the 2023 World Radiocommunication Conference

…

3 to conduct sharing and compatibility studies, as appropriate, in order to provide relevant protection of systems of other existing services,

"

It is very clear that WRC sharing studies are required to ensure protection of existing primary services. Also, it is crystal clear that such studies are conducted to study the impact from the new primary service on other existing primary services but NOT for systems within the same service.

– *The same intention of studying only the impact from the new mobile service to the existing services, including broadcasting, is also emphasized by "*resolves to invite ITU-R *2" by using "as appropriate" to the studies under WRC-23 agenda item 1.5 intended for protection of all existing primary services.*

"2 to carry out sharing and compatibility studies, as appropriate, in the frequency band 470-694 MHz in Region 1 <u>between the broadcasting and mobile</u>, except aeronautical mobile, <u>services,</u>…".

The phrase "<u>as appropriate</u>" clearly emphasizes the normal ITU practice which is to consider only studying the impact from the new service (e.g. mobile) to existing services (e.g. broadcasting) as also emphasized in "*resolves *3" that definitely implies to exclude the studies of the impact from the existing primary broadcasting service for protection of the new primary mobile service.*

– *It is not explicitly mentioned in Resolution* ***235 (WRC-15)*** *that there is a need to conduct studies for the impact from existing services (e.g. broadcasting) on the new services (e.g. mobile) with the objective to protect new services. Accordingly, such studies shall be excluded from the studies under WRC-23 agenda item 1.5.*

– *Considering studies for protection of new services from existing services is a precedent adding significant further pressure to the already overloaded WRC process, within the very limited time of the WRC study cycle, particularly when conducting such studies across all in-band and adjacent-band scenarios in both directions from the new service to existing services and vice-versa.*

– *ITU-R Reports may include various studies among different services and systems, which are neither relevant to the WRC agenda item nor aligned with Resolution* ***235 (WRC-15)*** *under WRC-23 agenda item 1.5. In addition, ITU-R Reports are subject to revisions based on input contributions, which may consider the impact from any service/systems to any other service/systems. However, this should not be taken as an excuse to expand WRC studies to include protection of new services since WRC decisions for new allocations to new services is based on ensuring protection of existing services as per the followed practice.*

Conclusion

Based on the above justifications, the studies under WRC-23 agenda item 1.5 should be limited to studying the impact from new primary services (e.g. mobile) to existing primary services with the objective of ensuring protection of existing services. On the other hand, studies for the impact from existing services to protect new services should be excluded due to some of the reasons explained above.

END OF VIEW 1

VIEW 2:

Inclusion of studies of interference into the mobile service under Resolution 235 (WRC-15)

This matter was raised to the Legal Affairs Unit (LAU) of the ITU (Doc. 6-1/91) which confirmed that Resolution ***235 (WRC-15)*** *"provides a scope wide enough to include (…) sharing and compatibility studies pertaining to the protection of the mobile service from the broadcasting service" and that "there is no limitation imposed by the legislator to the ITU-R to consider contributions from the membership studying the protection of the mobile service from the incumbent service(s) in the context of Resolution* ***235 (WRC-15)*** *and for WRC-23 to consider such studies, in line with* invites administrations *and* resolves to invite the 2023 World Radiocommunication Conference *of the same resolution".*

Resolution ***235 (WRC-15)*** *includes the following:*

> *"[WRC-15]* resolves to invite ITU-R, after the 2019 World Radiocommunication Conference and in time for the 2023 World Radiocommunication Conference
>
> *…*
>
> *2 to carry out sharing and compatibility studies, as appropriate, in the frequency band 470-694 MHz in Region 1 between the broadcasting and mobile, except aeronautical mobile, services, taking into account relevant ITU-R studies, Recommendations and Reports".*

The phrase "the broadcasting and mobile … services" clearly implies that studies should be considered in both directions, that is from mobile to broadcasting AND broadcasting to mobile.

This was confirmed by the LAU in the above-mentioned document which "considers that frequency sharing studies between different radio services in the same category would in principle include bidirectional protections for each radio service under consideration".

The LAU also noted that any consideration of a mobile co-primary allocation by WRC-23 "without conditioning such co-primary allocation upon the mobile service not claiming protection from the broadcasting service, or not imposing any additional constraints on the broadcasting service (...) would require a prior study of interference from the broadcasting service to the mobile service".

There are many clear examples of previous WRC agenda items where sharing studies into new services looking for allocations in a band have been conducted. A quick look at some has shown the following:

Report ITU-R M.2110 "Sharing studies between radiocommunication services and IMT systems operating in the 450-470 MHz band" prepared for agenda item 1.4 of WRC-07. This report assesses the feasibility of sharing between IMT systems operating in the 450-470 MHz band and the radiocommunication services having a primary allocation in Section IV of Article ***5*** *of the Radio Regulations in the 450-470 MHz band and in the adjacent 420-450 MHz and 470-480 MHz bands. This study addresses one member of the IMT family, i.e. IMT-2000 CDMA Multi-Carrier (CDMA-MC). For ease of reference, CDMA-MC operating in the 450-470 MHz range is referred to as CDMA450.*

Studies reported include radiolocation systems interfering with CDMA450 systems, fixed and mobile service base stations interfering with CDMA450 base station, results of the study of broadcasting systems interfering with CDMA450 system, as well as studies in which CDMA450 systems are the interferer to those other services. (Studies summarized in section 3; details in subsequent sections.)

Report ITU-R BT.2337 "Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz" was prepared for agenda item 1.1 of WRC-15. Sharing and compatibility studies were conducted between terrestrial mobile broadband applications, including IMT, and digital terrestrial television broadcasting (DTTB) in the frequency band 470-694 MHz under WRC-15 agenda item 1.1 both inside and outside the GE06 planning area. Included in this report are the following studies:

Section I, section 2.2.1.2: "Mobile service as a victim: Interference from broadcasting transmissions into mobile base stations".

Section II, Study 3: "Co-channel and adjacent channel sharing and compatibility study of digital terrestrial television broadcasting (DTTB) System A (ATSC) interference into an IMT base station in the 470-694/698 MHz band outside the GE06 planning area"

Report ITU-R BT.2339 "Co-channel sharing and compatibility studies between digital terrestrial television broadcasting and international mobile telecommunication in the frequency band 694-790 MHz in the GE06 planning area" was prepared for agenda item 1.2 at WRC-15. This report describes co-channel sharing studies and their results in the frequency band 694-790 MHz.

Studies reported in Report ITU-R BT.2339 include:

3.2 Broadcasting as an interferer into mobile service base stations

Report ITU-R F.2475 "Sharing and compatibility studies of high altitude platform station systems in the fixed service in the 38-39.5 GHz frequency range" was prepared for agenda item 1.14 at WRC-19. This report includes sharing and compatibility studies of high altitude platform station (HAPS) systems in the 38-39.5 GHz frequency range with the fixed service (FS), the mobile service (MS) and the fixed-satellite service (FSS) to which the bands are allocated on a primary basis, and also with the space research service (SRS) in the adjacent band. The report describes the following studies:

– *Annex 1 – Sharing and compatibility of fixed service and HAPS systems operating in the 38-39.5 GHz frequency range, Study A, section 1.1.2: Impact from the transmitting FS station into HAPS receiving ground station and comparison with the impact from transmitting FS station into FS receiving station.*

– *Annex 1 – Sharing and compatibility of fixed service and HAPS systems operating in the 38-39.5 GHz frequency range, Study B, section 1.2.2: Impact from transmitting FS stations into receiving HAPS.*

– *Annex 2 – Sharing and compatibility of mobile service and HAPS systems operating in the 38-39.5 GHz frequency range, Studies A, B and C: BS to HAPS ground station, UT to HAPS ground station, BS to HAPS and UT to HAPS.*

– *Annex 3 – Sharing and compatibility study of fixed-satellite service and HAPS systems operating in the 38-39.5 GHz frequency range, Studies B, C, D and F: FSS satellite to receiving HAPS, and FSS satellite to receiving HAPS ground station.*

Conclusion

The analysis from the Legal Affair Units of the ITU as well as many precedents of inclusion of studies of interference from incumbent services into any service under consideration for a new allocation, clearly establishes the principle that such studies may be conducted and may be important for WRC decisions.

END OF VIEW 2

1/1.5/1 Executive summary

Resolution **235 (WRC-15)** invites ITU-R to:

– review the spectrum use and study the spectrum needs of existing services within the frequency band 470-960 MHz in Region 1;

– carry out sharing and compatibility studies in the frequency band 470-694 MHz in Region 1 between the broadcasting and mobile, except aeronautical mobile, services;

– conduct sharing and compatibility studies in order to provide relevant protection of systems of other existing services,

and invites WRC-23 to consider, based on the results of studies above, provided that these studies are completed and approved by ITU-R, possible regulatory actions in the frequency band 470-694 MHz in Region 1, as appropriate.

Pursuant to Resolution **235 (WRC-15)**, studies were submitted in regard to WRC-23 agenda item 1.5, the summary of which is contained in section 1/1.5/3. A compilation of studies based on input contributions and comments thereto were included in the Chairman’s Report of the responsible group for this agenda item (Document 6-1/130).

View 1: *Some Members are of the view that Resolution **235 (WRC-15)** clearly sets the condition that the studies called for in the Resolution have to be “completed and approved by ITU-R” before WRC-23 can consider any regulatory action in the 470-694 MHz band. This view is on the basis that the studies carried out in TG 6/1 have not followed the recognized approval procedures as given in Annex 2 of Resolution ITU-R 1-8, i.e. § A2.6 of Annex 2 for ITU-R Recommendations or § A2.7 of Annex 2 for ITU-R reports. Consequently, any regulatory action taken by WRC-23 would be contrary to the conditions specified in Resolution **235 (WRC-15)**.*

View 2: *Some Member States are of the view that studies called for by Resolution **235 (WRC-15)** are completed and approved by ITU-R across this study cycle and other* *study cycles. In addition, these Member States are of the view that approval of the CPM Report constitutes approval of the studies undertaken under Resolution **235 (WRC-15)** even if there is no agreement on a single conclusion. However, some of the studies were out of scope of agenda item 1.5 (such as studies for protection of a new service (mobile) from an incumbent service (broadcasting), and studies for protection of secondary services. Accordingly, results of these studies were not validated nor agreed. This view is on the basis that the studies carried out in TG 6/1 followed the procedures as given in Annex 2 of Resolution ITU-R 1-8. Consequently, the regulatory action, such as a primary allocation of the frequency range 470-694 MHz to the mobile service and identification of the band to IMT, should be taken by WRC-23 based on the results of many studies that showed the feasibility of coexistence between IMT stations in the mobile service and stations of the broadcasting service and that ensure protection of the incumbent broadcasting service in compliance with Resolution **235 (WRC-15)**.*

The following methods have been developed to satisfy this agenda item as described in section 1/1.5/4, applying only to Region 1 countries:

– Method A: No Change.

  For this method, two alternatives are developed.

– Method B: Primary allocation to the mobile service in the frequency band 470-694 MHz with or without identification to IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution **235 (WRC-15)**.

  For this method, three alternatives are developed.

– Method C: Primary allocation to the mobile, except aeronautical mobile, service in the frequency band 470-694 MHz and identification to IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution **235 (WRC-15)**.

  For this method, nine alternatives are developed.

– Method D: Primary allocation to the mobile, except aeronautical mobile, service within the band 470-694 MHz without IMT identification. Suppression of Resolution **235 (WRC-15)**.

  For this method, five alternatives are developed.

– Method E: Primary allocation to the mobile, except aeronautical mobile, service of the band 470-694 MHz in Region 1 with technical conditions limiting mobile service operations to downlink in this band. Suppression of Resolution **235 (WRC-15)**.

– For Method F: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1. For this method three alternatives are developed.

– For Method G: Considerations of the radio astronomy service.

Examples of regulatory and procedural considerations for the methods and alternatives are contained in section 1/1.5/5.

1/1.5/2 Background

This agenda item addresses the future spectrum use of the band 470-694 MHz in Region 1. In that regard, a review of the current spectrum use and a study of future spectrum needs in the frequency band 470-960 MHz were requested as well as an assessment of the results of sharing and compatibility studies between the broadcasting and mobile, except aeronautical mobile, services in the frequency band 470-694 MHz, as well as other existing services** in accordance with Resolution **235 (WRC-15)***** for consideration of possible regulatory actions.

The band 470-960 MHz, or parts thereof, is allocated to the following services on primary basis in Region 1: Broadcasting within the band, mobile, except aeronautical mobile, within 694-960 MHz, fixed within 790-960 MHz. The band, or parts thereof, is also allocated to the following services on a primary basis in some countries of Region 1: aeronautical radionavigation within the band 645-862 MHz and radio astronomy within 606-614 MHz.

In addition, parts of the band 470-960 MHz, are allocated to the following services on secondary** basis in some countries of Region 1: radiolocation within 470-494 MHz, radio astronomy within 608-614 MHz, fixed within 470-582 MHz and 582-790 MHz, mobile, except aeronautical mobile, within 582-694 MHz, the land mobile service within 470-694 MHz, mobile-satellite, except aeronautical mobile-satellite, within 806-840 MHz and 856-890 MHz.

The Geneva 2006 Agreement (“GE06”) applies.

For details, please see RR Article **5** on the Table of Frequency Allocations and relevant footnotes.

1/1.5/3 Summary and analysis of the results of ITU-R studies

<u>*View 1:*</u> *Some administrations are of the view that the studies of TG 6/1 were completed for AI 1.5 and approved by ITU-R, as called for by Resolution* ***235 (WRC-15)****, and consequently it was agreed to attach all studies and their results to the TG 6/1 Chairman’s Report. However, there was no common conclusion for all studies due to the different results obtained from the studies.*

These administrations believe that Resolution ***235 (WRC-15)*** *and guidance from CPM23-1 is to conduct the study and approve these ITU-R studies to be included in TG 6/1 Chairman’s Report.*

<u>*View 2:*</u> *Many studies were received and considered by TG 6/1. They showed significant differences between results, and it was not possible to resolve those differences. The summary of studies in the CPM text and the working document collecting all the studies both show divergences of views and that agreement on the studies was not possible. No Task Group sharing studies have yet been submitted to SG 6 for approval, and only Study Groups can approve studies in ITU-R. Therefore, they are not approved.*

The majority of submitted studies showed consistent results; and a minority of studies, submitted by a few administrations, gave very inexplicable results. This small number of studies devalues the others submitted by various contributing groups, stakeholders and administrations. In particular, the information collected by contributing groups as a result of studies they conducted was ignored by some administrations, whose studies consistently deviated from baseline parameters and approved ITU-R studies (e.g. Reports ITU-R BT.2301-3, ITU-R BT.2302-1 and ITU-R BT.2383-4).

** Please refer to the views in the beginning of the document regarding the scope of WRC-23 agenda item 1.5 in terms of whether or not it is limited to primary services.

*** Please refer to Resolution **235 (WRC-15)** in particular *resolves to invite ITU-R, after the 2019 World Radiocommunication Conference and in time for the 2023 World Radiocommunication Conference* 1, 2 and 3 and *resolves to invite the 2023 World Radiocommunication Conference*, based on the results of studies above, provided that these studies are completed and approved by ITU-R, possible regulatory actions in the frequency band 470-694 MHz in Region 1, as appropriate.

Consequently, the range and variety of views expressed in the analysis and summary of the studies will not help administrations which were not closely involved in the TG process.

1/1.5/3.1 Summary of the review of the spectrum use

The frequency band 470-960 MHz or parts thereof is currently used in accordance with the Radio Regulations by the following services:

– broadcasting service
– mobile, except aeronautical mobile, service
– radio astronomy service
– radiolocation service
– fixed service
– mobile-satellite, except aeronautical mobile-satellite (r), service
– aeronautical radionavigation service,

as detailed below.

1/1.5/3.1.1 Review of the spectrum use by the broadcasting service

A primary allocation to the broadcasting service exists in the frequency band 470-960 MHz in Region 1. RR No. **5.322** applies in some countries of Region 1.

In Region 1, with the exception of Mongolia, and in Iran, the use of the band 470-862 MHz is governed by the Geneva 2006 Agreement (“GE06”). This frequency band is used for the provision of terrestrial television (TV) services in almost all countries in Region 1.

Circular Letter 6/LCCE/104 was sent to 121 countries in Region 1 and Iran in 2020 to which 78 countries responded. Of these, 77 stated that the television broadcasting service operates within the frequency band 470-694 MHz.

1/1.5/3.1.2 Review of the spectrum use by the mobile service

A primary allocation to the mobile, except aeronautical mobile, service exists in the frequency band 694-960 MHz in Region 1. Furthermore, in 76 countries there is an allocation to the mobile service on a secondary basis in the frequency band 470-694 MHz intended for applications ancillary to broadcasting and programme-making (RR No. **5.296**).

The following mobile applications are using parts of the band 470-960 MHz:

– IMT within the band 694-960 MHz.
– Services ancillary to broadcasting/services ancillary to programme-making (SAB/SAP) within the band 470-694 MHz.
– Public protection and disaster relief (PPDR) (including broadband PPDR in accordance with Resolution **646 (Rev.WRC-19)**).
– Non-IMT trunked ad hoc land mobile systems.
– Railway communications.
– Private mobile radio (PMR).
– Devices using temporarily unused/unoccupied spectrum.
– Other non-IMT mobile applications.

The use of these applications varies considerably among countries in Region 1.

1/1.5/3.1.3 Review of the spectrum use by the radio astronomy service

The frequency band 608-614 MHz is allocated to the radio astronomy service on a secondary basis in Region 1, except the African Broadcasting Area (RR No. **5.306**).

In the African Broadcasting Area, the band 606-614 MHz is allocated to the radio astronomy service on a primary basis (RR No. **5.304**).

The radio astronomy service in this frequency band is in operation in 11 countries across Region 1.

1/1.5/3.1.4 Review of the spectrum use by the radiolocation service

An allocation to the radiolocation service on a secondary basis exists in the frequency bands 470-494 MHz (RR No. **5.291A**) and 890-942 MHz. This allocation is used for wind profiler radars. Although wind profiler radars operate only in some European countries their results are used to provide weather forecast to the whole of Europe.

1/1.5/3.1.5 Review of the spectrum use by the other services

There is an allocation to the fixed service on a primary basis in the frequency band 790-960 MHz in the entire Region 1 and, in addition, in some countries on a secondary basis in the frequency band 470-790 MHz (RR Nos. **5.294** and **5.300**).

Furthermore, the frequency bands 806-840 MHz (Earth-to-space) and 856-890 MHz (space-to-Earth) are allocated in some countries to the mobile-satellite, except aeronautical mobile-satellite (R), service as per RR No. **5.319**.

There is also an allocation to the aeronautical radionavigation service on a primary basis in some countries in the frequency bands 645-862 MHz (RR No. **5.312**) and in the frequency band 862-960 MHz (RR No. **5.323**).

1/1.5/3.1.6 Consideration of environmental impact

Resolution ITU-R 60-2 – *Reduction of energy consumption for environmental protection and mitigating climate change by use of ICT/radiocommunication technologies and systems* and Resolution ITU-R 61-2 – *ITU-R's contribution in implementing the outcomes of the World Summit on Information Society and the 2030 Agenda for Sustainable Development* address growing concerns about greenhouse gas emissions and their impact on the environment. Different views were expressed during the discussions, as to how the responsible ITU-R group could address this issue in its work.

1/1.5/3.2 Summary of the study of the future spectrum needs

1/1.5/3.2.1 Spectrum needs for the broadcasting service

The UHF band (470-862 MHz), or parts thereof, is globally allocated to the broadcasting service and used for terrestrial television broadcasting. Digital terrestrial TV broadcasting (DTTB) fulfils an important social, cultural, as well as economic role in many countries. In a large number of countries further investments in DTTB are foreseen, aiming to provide additional TV services, increase the technical quality, add new functionalities, and implement new transmission technologies.

It is noted that in some countries fixed and mobile television broadcasting are also offered through terrestrial and satellite wireless technologies in other frequency bands. Fixed television could also be delivered by using wired (cable) networks, where available.

In response to Circular Letters 6/LCCE/104 and 6/LCCE/78, 102 administrations expressed their views on the future spectrum needs for DTTB in the band 470-960 MHz. Of those, 12 expressed a requirement for more than the 224 MHz available within the 470-694 MHz range, 83 require exactly 224 MHz, and 7 administrations indicated a requirement for less than 224 MHz.

Administrations were not specifically asked about the time-scales in which their responses would apply, but they were made aware the information was sought in the context of WRC-23 agenda item 1.5.

1/1.5/3.2.2 Spectrum needs for the mobile, except aeronautical mobile, service

IMT

Additional spectrum in the UHF band would further enlarge the spectrum portfolio for IMT. Due to favourable propagation conditions in the UHF band this could reduce infrastructure development costs and improve the performance of IMT networks in rural areas. Availability of additional spectrum below 1 GHz for IMT could also support better provision of various applications both in rural and urban areas, including for wider connectivity to streamed video. This would allow streamed video to reach wider audiences outside of fibre footprints and when on the move. Where streamed video usage increases this can place demand on IMT networks.

It is noted that in some countries fixed and mobile broadband services are also offered through wireless networks and satellite networks in other frequency bands. Fixed broadband could also be delivered by using wired (cable) networks, where available.

In response to Administrative Circular CACE/963, 20 administrations expressed their view on the future spectrum needs for IMT in the band 470-960 MHz indicating considerable differences between countries. While four administrations expressed interest in making the entire 470-694 MHz band available for IMT through a co-primary allocation to the mobile service at WRC-23, four administrations did not have additional spectrum requirements for IMT below 694 MHz.

Three responses also showed a lesser requirement for additional spectrum for IMT below 694 MHz (e.g. 120 MHz with a mix of frequency division duplex (FDD) and supplemental down link (SDL), or 2 × 35 MHz with FDD only).

It was further indicated by nine administrations that they had not yet considered requirements for IMT in the 470-694 MHz range and, taking into account other existing incumbent users (e.g. broadcasting, radio astronomy, services ancillary to broadcasting (SAB)/services ancillary to programme-making (SAP) already operational within the band, it was too early at that time to project on requirements for IMT in the band.

Those administrations that did express their interest in opening the band below 694 MHz, or parts thereof, to IMT also indicated different potential time-frames, taking into account the existing use of the band.

Services ancillary to broadcasting/services ancillary to programme-making

Demand for radio spectrum for audio SAB/SAP applications is time- and location-dependent and varies from one country to another. It can be distinguished between daily demand associated with long-term use at fixed locations and temporary peak demand associated with special events (e.g. large sports, cultural, political, or community events). SAB/SAP applications may have societal and cultural value.

It is necessary to ensure that spectrum demand can be satisfied where and when needed. The 470-694 MHz band is used for this audio SAB/SAP application on a worldwide basis.

In addition, a range of SAB/SAP applications can also be delivered employing various wireless technologies, based on IMT, Wi-Fi 5/6, and DECT, in bands other than 470-694 MHz.

In the 470-694 MHz band audio SAB/SAP applications will need to continue to operate for technical reasons.

PPDR

Some administrations expressed interest in using a portion of the frequency band 470-694 MHz for PPDR applications, depending on the evolution of the need for broadcasting, with an expressed requirement of 2 × 10 MHz. Part of this PPDR requirement could be also satisfied in bands above 694 MHz.

Non-IMT trunked ad-hoc land mobile systems

Some administrations expressed interest in using a portion of the frequency band 470-694 MHz for non-IMT trunked ad hoc land mobile systems, depending on the evolution of the need for broadcasting. An expressed requirement is between 80 MHz and 120 MHz.

1/1.5/3.2.3 Spectrum needs for the radio astronomy service

The current amount of the spectrum in the frequency band 606/608-614 MHz meets the needs of the radio astronomy service. The band will continue to be used for the radio astronomy service as it is essential for several unique scientific observations.

1/1.5/3.2.4 Spectrum needs for the radiolocation service

In the frequency band 470-494 MHz the current amount of the spectrum allocated to the radiolocation service in some European countries (as listed in the footnote RR No. **5.291A**) meets the needs of the wind profiler radars. The band will continue to be used for the radiolocation service.

1/1.5/3.2.5 Spectrum needs for other services

The current amount of the spectrum in the frequency band 790-960 MHz meets the needs of the fixed service.

The current amount of the spectrum in the frequency bands 806-840 MHz and 856-890 MHz meets the needs of the mobile-satellite, except aeronautical mobile-satellite (R), service.

The current amount of the spectrum in the frequency bands 645-862 MHz and 862-960 MHz meets the needs of the aeronautical radionavigation service.

For the services listed above no changes in terms of the amount of spectrum needed are required.

1/1.5/3.3 Summary of the sharing and compatibility studies

The various studies are based on input contributions and submitted in response to Resolution **235 (WRC-15)** and summarized in this section have used different assumptions. Therefore, they come to different conclusions and their assumptions should be taken into account when assessing their results. Given this situation, it is not possible to draw an overall conclusion regarding the feasibility of coexistence.

Regarding the reference to the details of some studies submitted during the study cycle, two views were expressed:

View 1: *Some administrations are of the view that a reference to the compilation of studies is not necessary (Annex 3 of the Chairman's Report of the 5th meeting of TG 6/1 – Document 6-1/130) considering that the summary of the studies are provided in the CPM Report and taking into account that a number of these studies are out of the scope of agenda item 1.5 and that they are not in compliance with Resolution **235 (WRC-15)**. It should be also noted that these administrations conducted some studies and made* *them available to TG 6/1 in the SharePoint, to validate the submitted results from some other membership on certain scenarios, but such studies are not submitted in the input contributions since they are considered out of the scope of agenda item 1.5. The results of the studies show significant difference from the given studies submitted by some membership, and the results are very promising on feasibility of coexistence between mobile IMT and broadcasting DTTB systems.*

View 2: *Some administrations are of the view that the CPM Report needs to reference Annex 3 of the Chairman's Report of the 5th meeting of TG 6/1 – Document 6-1/130. As stated in Resolution ITU-R 2-8, "it is necessary to organize the ITU-R studies and provide the results of these studies to WRCs" and moreover that "every effort should be made to ensure that the volume of the CPM Report is kept to a minimum" (see A1.8), and this document contains a compilation the sharing and compatibility studies, as called for by Resolution **235 (WRC-15)** and provided to ITU-R TG 6/1 This content is necessary to understand section 4 with the methods and possible regulatory options to be considered at WRC-23. With the inclusion of this reference, the reader of the CPM Report will have the possibility to refer to these studies in order to understand, in a transparent way, the reasons as to why the results of the studies are different. This is particularly needed in the context of agenda item 1.5, where several studies are based on assumptions which are completely different from and inconsistent with those provided by the responsible working parties. For such studies, this variation in core assumptions leads to the presentation of results which underestimate, by several orders of magnitude, the extent to which compatibility may be an issue of concern, notably the level of impact to the mobile or broadcasting services.*

1/1.5/3.3.1 Summary of submitted studies between the broadcasting service and the land mobile service

DTTB and IMT-2020

Studies that considered the impact from IMT on DTTB

Some studies were submitted on the impact from IMT-2020 base stations and user equipment (UE) into DTTB reception. The results of the co-channel studies vary based on the assumptions considered in the studies and show separation distances to comply with the assumed protection criterion as follows:

	Selected parameters								Results						
	Protection criterion	**Considered IMT base station e.i.r.p.**	**Antenna downtilt**	**Tx antenna height**	**Percentage of locations**	**DTTB reception modes considered**	**Rx ant height**	**DTTB receiver location**	**Distance for a single interferer and outdoor fixed reception with full antenna discrimination**	**Distance for a single interferer and outdoor fixed reception with no antenna discrimination**	**Distance for a single interferer and indoor reception**	**Number of tri-sectorized base stations**	**Distance for multiple interferers and outdoor fixed reception with full antenna discrimination**	**Distance for multiple interferers and outdoor fixed reception with no antenna discrimination**	**Distance for multiple interferers and indoor reception**
Study A.1 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area	4.5 km (urban)		0.5 km				
Study A.2 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area	9.2 km (rural)		1 km				
Study A.3 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	5.5 km (urban)		0.5 km
Study A.4 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	9.3 km (rural)		1.5 km
Study A.5 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area	0.1 km (urban)						
Study A.6 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area	0.2 km (rural)						
Study A.7 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	0.2 km (urban)		
Study A.8 (Doc. 6-1/43 and 6-1/99)	$I/N = -6$ dB	42 dBm	−9°	10 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	0.4 km (rural)		
Study B (Doc. 6-1/63 and 6-1/87)	$I/N = -10$ dB	58 dBm	−3°	30 m	50.00%	Outdoor fixed	clutter height	N/A	Minimum coupling loss (MCL): 38 km (rural)	82 km (rural)		19	MCL: 50 km (rural, LF 20%) 64 km (rural, LF 50%) MC: 44 km (rural, LF 20%) 61 km (rural, LF 50%)	MCL: 112 km (rural, LF 20%) 143 km (rural, LF 50%) MC: 104 km (rural, LF 20%) 141 km (rural, LF 50%)	
Study C (Doc. 6-1/96)	$I/N = -10$ dB	58 dBm	−3°	30 m	50.00%	Outdoor fixed Indoor	10 m 1.5 m	N/A	MCL: 36 km	78 km	7 km (urban) 14 km (sub-urban)	7	26 km (LF 20%) 36 km (LF 50%)	55 km (LF 20%) 84 km (LF 50%)	
Study D.1 (Doc. 6-1/97)	$C/(N+I) = 20$ dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	2 km (rural)		
Study D.2 (Doc. 6-1/97)	$C/(N+I) = 20$ dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	1.5 m	At edge of DTTB coverage area				7	1-6-1.8 km (rural)		
Study D.3 (Doc. 6-1/97)	$C/(N+I) = 20$ dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	Between DTTB Tx and DTTB edge of coverage area				7	0.6-1 km (rural)		
Study D.4 (Doc. 6-1/97)	$C/(N+I) = 20$ dB	Variable in 15 to 52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	0.5-1 km (rural)		
Study E.1 (Doc. 6-1/98)	$C/(N+I) = 20$ dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	1.2-1.4 km (urban)		
Study E.2 (Doc. 6-1/98)	$C/(N+I) = 20$ dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	1.5 m	At edge of DTTB coverage area				7	1-2-1.4 km (urban)		

	Selected parameters								Results						
	Protection criterion	**Considered IMT base station e.i.r.p.**	**Antenna downtilt**	**Tx antenna height**	**Percentage of locations**	**DTTB reception modes considered**	**Rx ant height**	**DTTB receiver location**	**Distance for a single interferer and outdoor fixed reception with full antenna discrimination**	**Distance for a single interferer and outdoor fixed reception with no antenna discrimination**	**Distance for a single interferer and indoor reception**	**Number of tri-sectorized base stations**	**Distance for multiple interferers and outdoor fixed reception with full antenna discrimination**	**Distance for multiple interferers and outdoor fixed reception with no antenna discrimination**	**Distance for multiple interferers and indoor reception**
Study E.3 (Doc. 6-1/98)	$C/(N+I)$ = 20 dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	Between DTTB Tx and DTTB edge of coverage area				7	0.4-0.8 km (urban)		
Study E.4 (Doc. 6-1/98)	$C/(N+I)$ = 20 dB	Variable in 15 to 52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	0.4-1 km (urban)		
Study E.5 (Doc. 6-1/98)	$C/(N+I)$ = 20 dB	52 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				7	1.1-1.4 km (urban)		
Study F.1 (Doc. 6-1/102)	C/I = 20.97 dB	58 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area	3 km			7			
Study F.2 (Doc. 6-1/102)	C/I = 20.97 dB	58 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area	3 km			7			
Study G (Doc. 6-1/107)	I/N = −10 dB	N/A	−3°	30 m	50.00%	Outdoor fixed	10 m	N/A				7	29 km (LF 20%) 47 km (LF 50%)	63 km (LF 20%) 104 km (LF 50%)	
Study H (Doc. 6-1/107)	$C/(N+I)$ = 20 dB	58 dBm	−3°	30 m	95%	Outdoor fixed	10 m	At the DTTB coverage edge				7	33 km (rural LF 50%)		
Study I (Doc. 6-1/107)	$C/(N+I)$ = 20 dB	58 dBm	−3°	30 m	95%	Outdoor fixed	10 m	At the DTTB coverage edge				7	40 km (rural LF 50%)		
Study J (Doc. 6-1/119)	C/I = 20.97 dB	58 dBm	−3°	30 m	95%	Outdoor fixed	10 m	At the DTTB coverage edge				7	31 km (rural LF 50%)		
Study K (Doc. 6-1/125)	I/N = −6 dB	58 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	Middle of DTTB coverage area				7	30 m		
Study L (Doc. 6-1/125)	I/N = −6 dB	58 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	Middle of DTTB coverage area				7	15 km for 50% LF 12 km for 20% LF		
Study M.1 (Doc. 6-1/127)	$C/(N+I)$ = 21 dB	46 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				19	< 1 km	8 km	
Study M.2 (Doc. 6-1/127)	$C/(N+I)$ = 21 dB	46 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				19	< 1 km	1 km	
Study M.3 (Doc. 6-1/127)	$C/(N+I)$ = 21 dB	46 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				19	< 1 km	10 km	
Study M.4 (Doc. 6-1/127)	$C/(N+I)$ = 21 dB	46 dBm	−3°	30 m	50.00%	Outdoor fixed	10 m	At edge of DTTB coverage area				19	< 1 km	5 km	
Study N (Doc. 6-1/113)	I/N = −10 dB	N/A	−3°	30 m	50.00%	Outdoor fixed	10 m	N/A				19	21 km (urban) 65 km (rural)	55 km (urban) 136 km (rural)	

Different views were expressed regarding the studies summarized in the table above.

View 1: *Studies ((Docs 6-1/43 and 6-1/99), (Doc. 6-1/97), (Doc. 6-1/98), (Doc. 6-1/100), (Doc. 6-1/102), (Doc. 6-1/121), (Doc. 6-1/123), (Doc. 6-1/124), (Doc. 6-1/125), (Doc. 6-1/126) and (Doc. 6-1/127)) are fully based on the characteristics provided by the responsible ITU-R working parties (called by some membership as baseline parameters) in particular those recommended by the IMT responsible group in their liaison statement to TG 6/1 on IMT parameters[4]. These studies:*

– *show very promising results which indicate the feasibility of coexistence between IMT systems and broadcasting systems in the given frequency range;*

– *utilize practical deployment cases and scenarios for IMT based on the parameters provided by WP 5D to show a realistic view of coexistence feasibility between the systems;*

– *simulate cases with the two acknowledged interference criteria (*I/N *and* C/(N+I)) *to address all possible concerns using Monte Carlo statistical method;*

– *address the worst-case scenarios and distributions for the selected interference criteria, by placing the DTTB receivers at the edge of their respective coverage areas, as well as the practical scenarios of DTTB reception distribution between the DTTB transmitters and receivers;*

– *utilize recommended DTTB coverage radii for high power and medium power transmission systems according to Report ITU-R BT.2470-2,* Use of Monte Carlo simulation to model interference into DTTB*;*

– *consider multiple scenarios and sensitivity analyses for all possible cases and deployment scenarios (e.g. border cases, variable Tx power, variable DTTB Rx placement, etc.) that confirm the feasibility of coexistence between IMT and DTTB systems.*

Some other studies that were submitted to TG 6/1 considered only worst-case scenarios in terms of protection criteria, including location percentages, deployment parameters, etc. Some used deterministic (non-statistical) MCL to achieve large distance results based on their assumed protection criteria. In addition, operational and practical deployment cases in accordance with the baseline parameters were not considered, and accordingly the distance results are found to be exaggerated. For example:

The study from Doc. 6-1/41 and Doc. 6-1/65:

– *did not consider parameters such as 20 per cent IMT BS activity factor or antenna discrimination;*

– *it was not clear which propagation model used to achieve these results;*

– *considered adjacent channel interference and a guardband of 3 MHz was given in the summary table. However, I Tx and V Rx frequency offset is set to 8 MHz,*

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4 There was no agreement in the responsible group for the broadcasting service on neither a single protection criterion nor an associated percentage of locations (50 per cent or 95 per cent). The correct practice is to consider $C/(I+N)$ to estimate the practical impact of potential interference, if any, taking into account the wanted signal strength nearby the transmitter of at the cell edge. In case I/N criteria are used, practice is to conduct sharing studies with I/N of −6 dB as per the relevant ITU-R Reports and Recommendations provided in the studies. Report ITU-R BT.2470 suggests a value of $I/N = -6$ dB which is often used in compatibility studies.

whereas the DTTB Rx BW is 8 MHz and IMT Tx BW is 10 MHz. The understanding is that an overlap of 1 MHz with no guardband is considered.

The study from Docs 6-1/107 and 6-1/CGShaComp/1:

– *values of the following critical parameters in this study were missing or not clear leading to difficulty in validating the results:*
  - *Methodology and percentage of indoor/outdoor IMT UEs;*
  - *Activity factor or average UE Tx power, or aggregate interference;*
  - *No description of geometry, clutter, or deployment scenario.*

The study from Doc. 6-1/63:

– *considers an* I/N *of −10 dB, which according to Report ITU-R BT.2470, is equivalent to 0.869 per cent allowance of interference, which is stringent. Report ITU-R BT.2470 also suggests a value of* I/N = −6 *dB, which is equivalent to a probability of interference of 2.22 per cent, and is often used in compatibility studies;*

– *for the MCL studies, large numbers of simulations are conducted with single or multiple base stations with significant differences in the values obtained. For the Monte Carlo simulations, only one case with multiple interferers was considered.*

Study 4 from Doc. 6-1/96:

– *there are discrepancies between the parameters provided in the SEAMCAT file which were not in line with the recommended values set out by TG 6/1.*

In addition, some of the studies did not cover important scenarios provided by WP 5D as the responsible group on IMT "IMT deployments in border areas between the territories of concerned neighbouring countries may consider adjustments of base station configurations contained in this document (e.g. larger antenna down tilts, lower antenna heights, sector azimuth restrictions, and other aspects to reduce emissions into a neighbouring country as well as lower user density)", which are part of the recommended parameters for the studies (called baseline parameters by some membership). WP 5D clarified that such deployment situations are to be utilized in technical studies.

*Furthermore, the methodologies used in all the above studies to determine the interference from IMT systems to DTTB is the interference-to-noise ratio (*I/N*).* C/(I+N) *criteria are recommended to be used instead to evaluate the impact from service since the existence of an unwanted signal is not harmful if there is enough margin from the wanted signal. In case of the carrier to noise plus interference ratio (*C/(I+N)*), the victim transmitter and its correlation to the victim receiver is also taken into account. This methodology is arguably more indicative of the interference actually experienced, as simply measuring the power of the interfering signal does not consider the desired received signal strength (dRSS) at the victim Rx from the victim Tx, which in most cases may be strong enough to overcome any interfering signal strength.*

Nevertheless, most of the studies considered DTTB receivers at the edge of their respective coverage areas, which is the worst-case scenario as the received signal strength at the victim will be lowest. This also means that if such worst-case scenarios reveal that coexistence is feasible at the edge cases, then it is also possible for the (majority) rest of the cases.

In summary these studies concluded that no harmful impact from IMT systems (under the mobile service) on DTTB systems (under the broadcasting service) within the band 470-694 MHz for both co-channel and adjacent channel scenarios, and in cases where single IMT station is considered or when the cumulative impact from multiple IMT stations are analysed, taking into account both I/N *and* C/(I+N) *protection criteria for the broadcasting service. Also, the results showed that possible distance between IMT and DTTB systems in limited worst-case scenarios may vary up to a few kilometres depending on the consideration of transmission from IMT UE or IMT base stations as well as the percentages of indoor and outdoor broadcasting receivers. In reality, the majority of DTTB receivers are indoor where coexistence is even more feasible.*

In addition, some studies considered the real deployment nearby the borders between the territories of neighbouring administrations. The results showed that there will be no harmful cross-border interference from IMT systems deployed in one country and the DTTB receivers deployed in the neighbouring country across all relevant scenarios.

In case of any interference observation, the implementation of various technical and mitigation measures (e.g. IMT e.i.r.p. reduction, antenna tilting and orientation) can ensure protection of incumbent services in case of co-channel operation. In adjacent channel situations, similar or other technical measures (incl. filters) may also be used on a national basis as needed.

View 2: *Studies B (from Docs 6-1/63 and 6-1/87), C (from Doc. 6-1/96) and G (from Doc. 6-1/107) are fully based on the characteristics provided by the responsible ITU-R Working Parties (baseline studies). The separation distances to protect a DTTB receiver from possible interference by IMT base station(s) operating on the same frequency are about:*

- *37 km considering a single base station and taking into account antenna discrimination of the DTTB receiver,*
- *60 km considering a network of base stations, therefore including the effect of aggregated interference (via Monte Carlo simulations), and taking into account antenna discrimination, and*
- *80 km considering a single base station but without antenna discrimination.*

Studies A (from Docs 6-1/43 and 6-1/99), D (from Doc. 6-1/97), E (from Doc. 6-1/98) and F (from Doc. 6-1/102) present shorter separation distances to protect DTTB from IMT base station(s). To achieve such results, several adjusted parameters are used in the simulations, including:

- *In three studies (D, E and F), a* C/(I+N) *protection criterion for DTTB instead of −10* dB I/N *(i.e. the protection criteria in Recommendation ITU-R BT.1895, specified by the responsible ITU-R Working Party);*
- *In two studies (D and E), the DTTB receiver is assumed to be located at half the distance of the DTTB coverage area border, leading to an increased margin of 30 dB (wanted signal level of 30 dB above the sensitivity). In another study (F), the DTTB receiver is randomly positioned within the central portion of the DTTB coverage area (up to 12 km from the DTTB transmitter, while the actual coverage area for the considered transmitter is around 31 km) leading also to a large increased margin of the wanted signal;*

– *In two studies (D and E), the target location probability of 50 per cent is used for the protection of DTTB instead of 95 per cent*[5] *while using a* C/(N+I) *protection criterion;*

– *In one study (A), base station antennas have a lower height (10 m instead of 30 m), and are strongly tilted (−9° instead of −3°);*

– *In all these studies (A, D, E and F), base station(s) e.i.r.p. is reduced from the 58 dBm baseline value, to a value between 15 dBm and 52 dBm depending on the study. One study (F) used a distribution function for the e.i.r.p., with a 44.3 dBm mean value and 1 dB standard deviation.*

View 3: *With regard to the studies that considered the impact of IMT-2020 on DTTB, the majority of administrations on the African continent are of the view that although the studies came to different conclusions due to the different assumptions used, it is, however, clear that there will be difficulties in sharing the band with IMT-2020 due, among others, to the large separation distances ranging from tens to hundreds of kilometres required to protect a DTTB receiver from possible interference by IMT base station(s) operating in the same frequency band 470-694 MHz. In view of the results of the studies, and noting that, the DTT band 470-694 MHz is still the only band currently used for terrestrial TV broadcasting in Africa, it is our view that the status quo in the usage of the band is maintained.*

Some other studies were submitted on adjacent channel compatibility between DTTB and IMT-2020. These studies indicated that interference distances can be limited to hundreds of metres when assuming an adjacent channel leakage ratio (ACLR) of the IMT base station of 59 dB/8 MHz. Such ACLR values may be defined on a national and/or regional basis.

Studies that considered impact from DTTB on IMT

Different views were expressed on whether the impact from DTTB on IMT should be studied or not.

View 1: *Some administrations are of the view that such studies for the protection of the mobile service are outside the scope of this agenda item and therefore did not submit input contributions to ITU-R on sharing and compatibility studies of interference from the broadcasting service to the mobile service (into IMT-2020 base station uplink receivers). However, it should be noted that these administrations conducted some studies and made them available to TG 6/1 in the SharePoint, to validate the submitted results from some other membership on certain scenarios, but such studies are not submitted in the input contributions since they are considered out of the scope of agenda item 1.5. The results of the studies showed significant difference from the given studies submitted by some membership, and the results were very promising on feasibility of coexistence between mobile IMT and broadcasting DTTB systems. Their studies on co-channel and adjacent channel compatibility showed results of up to 30 km and up to 1 km distances, respectively, which indicated that the distances would be lower than those mentioned in the other submitted studies. In addition, some administrations have observed shorter distances, e.g. in the order of 10 km. Some studies indicated that adjacent channel operation between DTTB transmitter and*

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[5] To study the protection of broadcasting, it is a common practice to study sharing with an I/N of −10 dB for 50 per cent of locations and compatibility with a $C/(N+I)$ for 95 per cent of locations. See Recommendations ITU-R-BT.1895-0 and ITU-R BT.2136-0, and Reports ITU-R BT.2383-3 and ITU-R BT.2470-1.

IMT-2020 receivers is possible with minimal separation distance, which can be in the range of tens of metres.

In case of any interference observation, the implementation of various technical and mitigation measures (e.g. IMT e.i.r.p. reduction, antenna tilting and orientation) can ensure protection of incumbent services in case of co-channel operation. In adjacent channel situations, similar or other technical measures (including filters) may also be used on a national basis as needed.

View 2: *Some other administrations are of the view that such studies for the protection of the mobile service are in the scope of this agenda item and that this matter is a necessary aspect for the consideration by WRC-23 and therefore have submitted studies described hereafter.*

In addition, these administrations are of the view that the absence of ITU-R studies for the protection of the mobile service will limit possible regulatory action at WRC-23, since Resolution ***235 (WRC-15)*** *states that such actions are under the condition that "these studies are completed and approved by ITU-R".*

The studies submitted on the impact from DTTB transmitters into IMT-2020 base station uplink receivers in co-channel operation showed distances to comply with the assumed protection criterion of up to 350 km (100 per cent land propagation). Interference cases have been reported by some administrations with observed interference distances of 80 km (land path) and 260 km (warm sea path). Some other interference cases have been reported with observed interference distances of 190 km (land path). Such distances lead to the situation that, from an operational and factual perspective, any possible IMT-2020 use will be subject to receiving significant interference from existing operational DTT stations such that the whole territory of some countries will be affected by DTT stations operating within their neighbouring countries, and this makes coexistence very difficult.

Further reported cases of interference from DTTB to IMT are available in Report ITU-R BT.2301-3 "National field reports on the introduction of IMT in the bands with co-primary allocation to the broadcasting and the mobile services". In this report, nine administrations and one organization from Region 1 reported real cases of interference that support the interference distances mentioned above. Also, in almost all these cases, IMT was not able to operate until the DTTB channel could be vacated, which indicates that mitigation measures are either not possible or not effective enough to allow sustainable co-channel operation.

Some studies used a protection criterion based on −6 dB *I/N* (taken from Report ITU-R M.2292) and made assumptions on the time percentage of the protection criterion to be applied in each study, however there was no common view in ITU-R on this time percentage to apply. Other studies have used other criteria such as a *C*/(*I*+*N*) criterion.

Comparison of co-channel sharing situations between IMT and DTTB

Different views were expressed regarding the comparison of co-channel sharing situations between IMT and DTTB:

View 1 *Regarding the comparison of co-channel sharing situations between IMT and DTTB, some administrations have the view that the following table (Source: Section 4.1.1.7 of Annex 3 of Document 6-1/130) presents some separation distances between stations to reach a given protection criterion (*I/N*), resulting from minimum coupling loss analyses in a co-channel situation.*

The parameters used are baseline parameters: percentages of time for the propagation curves are from the GE06 Agreement; the I/N criterion for the protection of the mobile service is taken from Report ITU-R M.2292, as mentioned in Recommendation ITU-R M.2101; and the I/N criterion for the protection of the broadcasting service is taken from Recommendation ITU-R BT.1895.

Among the four possible sharing situations between IMT and DTTB, protection of an IMT base station (uplink), from possible interference caused by a DTTB transmitter requires the largest separation distance: around 200 km. This result is in line with experiences in the 700 and 800 MHz bands as documented in Report ITU-R BT.2301.

TABLE 1/1.5/3-1

Selection of MCL distances between stations to reach an I/N protection criterion, co-channel, with Recommendation ITU-R P.1546-6 for a land propagation path

Interfering station	*Victim station*	*Distance between the interfering transmitter and the victim receiver*	*Criteria*	*Section of Doc. 6-1/130, Annex 3*
IMT base station	*Rooftop DTTB Rx*	*36-38 km*	*1% of time,* I/N = −*10 dB, with antenna discrimination*	*3.1.1.5 and 3.1.1.4*
IMT user equipment	*Rooftop DTTB Rx*	*5.5 km (13.5 km with base station coverage radius)*	*1% of time,* I/N = −*10 dB, without antenna discrimination*	*3.1.2.3*
DTTB Tx	*IMT base station*	*190-202 km*	*10% of time,* I/N = −*6 dB, MPMT*	*3.2.1.2 and 3.2.1.1.1*
DTTB Tx	*IMT user equipment*	*41 km*	*10% of time,* I/N = −*6 dB, MPMT*	*3.2.2.1*

Results of other studies show shorter separation distances by using adjusted parameters, including:

– *relaxed protection criteria (% of locations, I/N threshold, ...);*

– *greater antenna tilt, lower transmitter antenna height and reduced e.i.r.p.;*

– *DTTB receiver rooftop antenna discrimination;*

– *C/(N+I) instead of* I/N*;*

– *receiving antenna height below the surrounding clutter;*

– *IMT network activity, and other varying characteristics, modelled through Monte Carlo simulations.*

Results of other studies show greater separation distances:

– *when considering a mixed or sea propagation path;*

– *in the absence of DTTB receiver rooftop antenna discrimination, and/or;*

– *when considering aggregation of interference from multiple stations.*

View 2: *Regarding the comparison of studies between DTTB and IMT referred to in View 1, some administrations are of the following view:*

The studies for the protection of the mobile service are outside the scope of this agenda item and therefore many administrations and Members did not submit input *contributions to ITU-R on sharing and compatibility studies of interference from the broadcasting service (DTTB) to the mobile service (into IMT-2020 stations uplink receivers).*

Accordingly, the above reflected results were not validated, moreover, these studies took assumption that are neither practical nor valid. For example, the simulation was based on a worst-case scenario of MCL approach with I/N *criteria, but did not consider the Monte Carlo methodology nor C/N+I criteria which provide more realistic results.*

However, it should be noted that some administrations conducted some additional studies and made them available to TG 6/1 to validate the given scenarios mentioned in View 1. The results were very promising on the feasibility of coexistence between mobile IMT and broadcasting DTTB systems, and showed significant difference from the given studies in View 1 and the results. The validating studies on co-channel and adjacent channel compatibility showed results of up to 30 km and up to 1 km distances, respectively, which indicated that the distances would be lower than those mentioned in the other submitted studies. In addition, some administrations have observed shorter distances, e.g. in the order of 10 km. Some studies indicated that adjacent channel operation between DTTB transmitter and IMT-2020 receivers is possible with a minimal separation distance, which can be in the range of tens of metres. Accordingly, Views 1 and 3 are not factual.

View 3: Some other administrations believe that the arguments expressed in View 2 are not factual to the reader for the following reasons:

- *The studies conducted by the proponent of View 2 and its consequent conclusion for the coexistence between broadcasting and mobile services was based on the invalid and significantly diverging from the baseline parameters submitted by WP 5D to TG 6/1 referenced at Document 6-1/28. Therefore, the studies with non-baseline parameters are not valid and such expressed conclusion from those studies should not be taken into account in the CPM Report.*
- *According to the response of LAU of ITU to the question of studies of interference into the mobile service under Res.* ***235 (WRC-15)*** *referenced at Document 6-1/91, LAU considers that there is no limitation imposed by the legislator to the ITU-R to consider studying the protection of the mobile service from the incumbent service(s) in the context of WRC Resolution* ***235****.*
- *The valid studies according to the baseline parameters indicate large interfering distances of several hundreds of kilometres between the mobile service and the broadcasting service that concludes the impossibility of the coexistence of mobile and broadcast services.*

DTTB and PPDR

Some studies were submitted on coexistence between DTTB and PPDR in co-channel operation. In general, the results of these studies indicate similar distances as between DTTB and IMT-2020. These submitted studies applied a protection criterion based on an *I/N* of −10 dB for PPDR and assumed a time percentage of 10 per cent, however there was no common view in ITU-R on this time percentage. Recommendation ITU-R M.1808 contains an *I/N* of −6 dB for land mobile service applications and additionally states that for PPDR applications an *I/N* of −10 dB may be used.

No compatibility studies on the adjacent channel impact from DTTB into PPDR have been submitted in input contributions to ITU-R.

DTTB and non-IMT trunked ad hoc mobile systems[6]

Some studies were submitted on coexistence between non-IMT trunked ad hoc mobile systems and DTTB. The results of these studies showed that co-channel distances to comply with the assumed protection criterion with DTTB transmitters and receivers are in the range of 40-50 kilometres. The non-IMT trunked ad hoc mobile systems can, as necessary, change its operating channel to facilitate coexistence with DTTB.

The results of compatibility studies for adjacent channel situations for non-IMT trunked ad hoc mobile systems showed that interference distances can be limited to 30 metres when assuming a 3 MHz guardband and/or an ACLR of less than 80 dB/8 MHz for vehicle-based nodes and less than 76 dB/8 MHz for handheld nodes. Such ACLR values may be defined on national and/or regional basis.

Different views were expressed regarding the studies between DTTB and non-IMT trunked ad hoc mobile systems.

View 1: *Some administrations are of the view that this system is not implemented in most countries within this frequency range, therefore, studies were not considered to validate the results.*

View 2: *Some other administrations are of the view that excluding this study scenario arbitrarily, without any justification, would contradict the right of administrations to consider the application they wish to operate under a mobile service allocation. The trunked ad hoc system application considered in the studies is operating under the mobile service. Resolution* ***235 (WRC-15)*** *invites ITU-R to carry out sharing and compatibility studies with the mobile service, without any restriction in the considered application.*

1/1.5/3.3.2 Summary of submitted studies between wind profiler radars and the land mobile service

A study showed separation distances of a few kilometres between wind profiler radars and mobile service applications operating on the same channel. This distance could be reduced by additional protective measures like lateral earth walls (or clutter fences) around the wind profiler radar, and by appropriate planning of the location, respectively. For wind profiler installation sites, an individual consideration would be necessary based on local conditions. Compatibility could be further facilitated by a selection of the wind profiler radar operating frequency to maximize the spectral separation.

Due to the different views on whether or not such studies are within the scope of WRC-23 agenda item 1.5, other studies were not submitted which may or may not have different results.

1/1.5/3.3.3 Summary of submitted studies between the radio astronomy service and the land mobile service

Due to the different views on whether or not such studies are within the scope of WRC-23 agenda item 1.5, other studies were not submitted which may or may not have different results.

A study addressed the protection of the RAS, from IMT-2020 usage in or adjacent to the frequency band 608-614 MHz.

[6] Ad hoc is defined in Recommendation ITU-R M.1797 and the ITU Terms and Definitions database. Trunked is defined in Recommendation ITU-R M.1808.

This study shows, taking into account the technical parameters provided to the ITU-R responsible group, for a flat-Earth in-band aggregation scenario, separation distances to comply with the assumed protection criterion of up to 1 000 km (BS) and 450 km (UE) between the studied systems of the relevant services.

The results of a compatibility study demonstrated that for adjacent bands or in the spurious domain, separation distances to comply with the assumed protection criterion are 500 km (adjacent) and 380 km (spurious) for BS, and about 150 km (adjacent) and 10 km (spurious) for UE.

1/1.5/3.3.4 Summary of submitted studies between audio SAB/SAP and IMT-2020

A study on coexistence between IMT-2020 (for a single UE and single BS) and Audio SAB/SAP was submitted. The study showed results for co-channel outdoor operation of Audio SAB/SAP with separation distances up to 300 metres between IMT UE and Audio SAB/SAP; and up to 20 km between IMT base station and Audio SAB/SAP, based on the assumed protection criterion. For the indoor scenario, the study showed co-channel separation distances between SAB/SAP and UE up to 71 metres and IMT base station up to 1.5 km.

Audio SAB/SAP operation considers the local RF environment for its operation on a case-by-case basis.

Due to the different views on whether or not such studies are within the scope of agenda item 1.5, other studies were not submitted which may or may not have different results.

1/1.5/3.3.5 Potential new sub-section "Listing of ITU-R documents" (see views below)

Different views were expressed regarding the listing of ITU-R documents, Reports and Recommendations for sharing and compatibility studies.

View 1: *Some administrations are of the view that the following ITU-R documents, Reports and Recommendations are the relevant list of documents in accordance with* resolves *2 of Resolution* ***235 (WRC-15)****:*

Annex 3 to the Chairman's Report of the final meeting of TG 6/1 (Document 6-1/130) contains sharing and compatibility studies between several applications of the mobile service and other incumbent services in the band 470-694 MHz, developed during the study cycle towards WRC-23.

Recommendations and Reports of relevance to this agenda item are presented in the following sub-sections noting the information provided by concerned groups.

Broadcasting service

The characteristics of digital terrestrial television broadcasting systems in the frequency band 470-862 MHz to be used in sharing studies are to be found in Report ITU-R BT.2383-3, and a methodology suitable for assessing interference to digital terrestrial television systems when using Monte Carlo simulations is found in Recommendation ITU-R BT.2136-0.

On characteristics of broadcasting systems in the UHF band, including protection criteria:

– *Recommendation ITU-R BT.1368-13*
– *Recommendation ITU-R BT.1895-0*
– *Recommendation ITU-R BT.2033-1*
– *Report ITU-R BT.2215-7*
– *Report ITU-R BT.2383-3*

– *Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz (RRC-06).*

On methodology for sharing studies:

– *Recommendation ITU-R BT.2136-0*

– *Report ITU-R BT.2470-1.*

On existing sharing studies and reports from real cases of interference:

– *Report ITU-R BT.2301-3*

– *Report ITU-R BT.2337-1.*

Mobile service

– *Recommendation ITU-R M.2101*

– *Recommendation ITU-R M.1825.*

For railway radiocommunication systems between train and trackside (RSTT):

– *Report ITU-R M.2418*

– *Report ITU-R M.2442.*

For conventional and trunked land mobile systems:

– *Report ITU-R M.2014*

– *Recommendation ITU-R M.1808*

– *Recommendation ITU-R M.1823.*

For programme making and special events (SAB/SAP):

– *Report ITU-R BT.2338*

– *Recommendation ITU-R M.1767.*

For the maritime mobile service:

– *Recommendation ITU-R M.1174.*

Radio astronomy service

The threshold levels detrimental to radio astronomy observations for the relevant frequency bands can be found in Recommendation ITU-R RA.769. Further, the following documents are also relevant for the studies:

– *Recommendation ITU-R RA.1513-2*

– *Recommendation ITU-R RA.769*

– *Report ITU-R RA.2332.*

Radiolocation service

The following Recommendation is relevant to the study of the radiolocation service:

– *Recommendation ITU-R M.1462.*

The following Recommendations are relevant to the study of wind profiler radars operating under allocation to the radiolocation service in accordance with RR No. ***5.291A*** *and Resolution* ***217 (WRC-97)****:*

– *Recommendation ITU-R M.1085*

– *Recommendation ITU-R M.1314.*

Radionavigation service

The following Recommendation is relevant to the study of the radionavigation service:

– *Recommendation ITU-R M.1830.*

View 2: *Some other administrations are of the view that listing ITU-R documents and reports is not in line with the guidelines for preparation of the CPM Report in Resolution ITU-R 2-8 and the information on the preparation of texts for the draft CPM Report to WRC-23 from the Chairman, CPM-23 as contained in Doc. 6-1/9 of making the CPM Report concise as follow:*

- *There is no need to list all ITU-R documentations where some of the references are not relevant to the agenda item 1.5.*
- *In the case that there is need for quoting a text or to make specific reference within a CPM text, then the following Annex 2 of Resolution ITU-R 2-8, applies (but not for listing all ITU-R Reports and documentation):*
  - *A2.3 on page limit and format for draft CPM texts, "d) quoting texts that are already contained in other official ITU-R documents should be avoided by using relevant references (see also § A2.5)".*
  - *A2.5 References to ITU-R Recommendations, Reports, etc.: "A2.5.1 Quoting texts that are already contained in ITU-R Recommendations should be avoided by using relevant references. A similar approach should be followed for ITU-R Reports on a case-by-case basis, as appropriate."*
- *CPM text guidelines in Doc. 6-1/9 clarifies the possibility for adding relevant Recommendations in the studies summary (but not listing all reports and documents even if they are not relevant to the agenda item 1.5) as follows:*

  "N/1.xy/3 Summary and analysis of the results of ITU-R studies

  This section should contain a summary of the technical and operational studies performed within ITU-R, including a list of relevant ITU-R Recommendations. Depending on the agenda item, this section could be divided in two parts, one part dealing with the summary and the other part dealing with the analysis."
- *The consideration of relevant ITU-R Recommendations in the studies does not mean listing them as annexes to the CPM text for each agenda item.*

Accordingly, the above detailed list should not be included in the CPM text, in particular documentation rather than the relevant Recommendations.

1/1.5/4 Methods to satisfy the agenda item*

The Geneva 2006 Agreement ("GE06") applies.

With regard to the methods proposing identification of IMT in the frequency band 470-694 MHz or part thereof, the following views were expressed:

View 1: *Some Members are of the view that the terms "... possible regulatory actions ..., as appropriate." in Resolution* ***235 (WRC-15)*** resolves to invite the 2023 World

* NOTE – This section provides possible Methods/Actions for consideration by WRC-23 while deciding on the regulatory actions related to agenda item 1.5.

Radiocommunication Conference *under WRC-23 agenda item 1.5 refer to the identification of the band to IMT.*

<u>View 2:</u> *Some other Members are of the view that WRC-23 agenda item 1.5 and Resolution **235 (WRC-15)** do not refer to the identification of the band if upgraded to primary status for the allocation to the mobile service, partially or totally, to IMT. Therefore, reference to IMT should not be referred under these methods.*

<u>View 3:</u> *Some other Members are of the view that in the agenda item text as well as in the associated Resolution **235 (WRC-15)** there is no reference to allocation or upgrading the existing allocation nor to and identification. However, the ambiguous and to some extent misleading terms "regulatory actions" are used which interpreted by few administrations referring to a new allocation or upgrading the existing allocation and eventual identification of that allocation to IMT which is contested by other administrations, taking into account the interpretation of the text of the agenda items and associated resolutions are not within the remit of ITU-R study groups, task groups and working parties.*

<u>View 4:</u> *Some Members are of the view that the studies called for in Resolution **235 (WRC-15)** have not been "completed and approved by ITU-R", and that under the terms of that Resolution, therefore, no regulatory action should be taken on this agenda item by WRC-23. In addition, these Members are of the view that approval of the CPM Report does not constitute approval of the studies undertaken under Resolution **235 (WRC-15)**.*

<u>View 5</u>: *Some Member States are of the view that studies called for by Resolution **235 (WRC-15)** are completed and approved by ITU-R across this study cycle and other study cycles. In addition, these Members are of the view that approval of the CPM Report constitutes approval of the studies undertaken under Resolution **235 (WRC-15)** even if there is no agreement on a single conclusion. Consequently, the regulatory action, such as a primary allocation of the band to the mobile service and identification of the band to IMT, should be taken by WRC-23 based on the results of many studies that showed the feasibility of coexistence between IMT stations in the mobile service and stations of the broadcasting service in compliance with Resolution **235 (WRC-15)**.*

1/1.5/4.1 Method A: No Change

1/1.5/4.1.1 Alternative A1: No change

<u>Reasons</u>: Alternative A1 of this method is based on the consideration that the studies on spectrum use and spectrum needs provided by ITU-R are showing that, in the long term (e.g. before 2030), there will not be a significant decrease in the broadcasting service needs in the frequency band 470-694 MHz and on the results of sharing studies showing large separation distances of several hundreds of kilometres between IMT stations in the mobile service and stations in the broadcasting service, which would result in a practical impossibility to implement the two services in neighbouring countries.

<u>View 1:</u> *The frequency band 470-694 MHz is being extensively using for terrestrial television broadcasting in many countries. Terrestrial television is the only viable broadcasting platform in many developing countries. The broadcasting capability of IMT cannot at this time meet the requirements of public service media from technical and social perspectives.*

The results of the sharing and compatibility studies carried out in preparation for this agenda item are extremely divergent, and do not lead to a clear conclusion. Most of the studies show that a large separation distance is required between mobile and broadcasting services that makes the coexistence very difficult.

Considering the actual situation in many countries, the existing operational DTT transmitters do not allow the co-channel implementation of the mobile service, even taking into account possible technical measures and mitigation techniques. This means that, for many countries, a future implementation of the mobile service will be only possible if broadcasting stations in their neighbouring countries are switched off.

View 2: *Although the studies came to different conclusions due to the different assumptions used, it is, however, clear that there will be difficulties in sharing the band with the mobile service or IMT-2020 due to, among others, the large separation distances ranging from tens to hundreds of kilometres required to protect a DTTB receiver from possible interference by IMT base station(s) operating in the same frequency band 470-694 MHz. In view of the results of the studies, and noting that, the DTTB band 470-694 MHz is still the only band currently used for terrestrial TV broadcasting in large parts of the African continent, it is our view that the status quo in the usage of the band is maintained.*

View 3: *Some administrations believe that there is a significant trend of declining usage of DTT in the UHF band. Some of the administrations already reduced the number of multiplexes to a single multiplex, while others have switched off their broadcasting DTT services entirely. Hence, this very precious UHF band is either unused or under-utilized. Furthermore, the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries, reaching as low as single-digit percentages of the population. Some administrations do not have a plan to dedicate any frequency band to broadcasting DTT systems only considering the capability to provide broadcasting and mobile broadband services using the same IMT technologies targeting the majority of the population rather than a few people. In addition, the results of sharing studies showed negligible impact from IMT stations in the mobile service to stations in the broadcasting service without harmful interference. The separation distance results were in terms of few kilometres which would confirm the practical feasibility of coexistence between mobile and broadcasting services in neighbouring countries. Finally, and taking into account the capability of mobile IMT systems to support both broadcasting service and mobile broadband applications, the co-primary allocation of the band 470-694 MHz will support administrations in bridging the digital divide, in particular within developing countries, while delivering both mobile and broadcasting service efficiently.*

View 4: *Some administrations are of the view that the ITU-R questionnaire on the spectrum use and needs under agenda item 1.5 has demonstrated that, at least until 2030, almost all Region 1 countries will need to use the whole 470-694 MHz for broadcasting. The technical studies demonstrating the practical impossibility to operate mobile and broadcasting services in neighbouring countries have been confirmed by the interference situation that neighbouring administrations faced in the 700 MHz. Therefore, a co-primary allocation to the mobile service cannot provide real flexibility to operate IMT networks in this frequency band.*

View 5: *Many studies were received and considered by TG 6/1. They showed significant differences between results, and it was not possible to resolve those differences. The summary of studies in the CPM text and the working document collecting all the studies both show divergences of views and that agreement on the studies was not possible. No task group sharing studies have yet been submitted to SG 6 for approval, and only study groups can approve studies in ITU-R. Therefore, they are not approved.*

The majority of submitted studies showed consistent results; and a minority of studies, submitted by a few administrations, gave very inexplicable results. This small number of *studies devalues the others submitted by various contributing groups, stakeholders and administrations. In particular, the information collected by contributing groups as a result of studies they conducted was ignored by some administrations, whose studies consistently deviated from baseline parameters and approved ITU-R studies (e.g. Reports ITU-R BT.2301-3, ITU-R BT.2302-1 and ITU-R BT.2383-4).*

Consequently, the range and variety of views expressed in the analysis and summary of the studies will not help administrations which were not closely involved in the TG process.

1/1.5/4.1.2 Alternative A2: No change – Revision of Resolution 235 (WRC-15) to review the situation at future competent WRCs

Reasons: Alternative A2 of this method recognizes the need to continue broadcasting operation, considering that some administrations are currently implementing DVB-T/DVB-T2 or are in the transition from DVB-T to DVB-T2, the impossibility of implementing the mobile service in the short term, the need for more time for administrations to consider their spectrum needs for the mobile service in the frequency range 470-694 MHz band (low number of answers given to the ITU Administrative Circulars CACE/963 and CACE/966), as well as to consider any technical or regulatory solutions to improve the coexistence between mobile and broadcasting services and the development of bilateral or multilateral agreements.

Therefore, Alternative A2 of this method suggests a revision of Resolution **235 (WRC-15)** at WRC-23 inviting a future competent conference (e.g. WRC-27 or WRC-31)* to review the spectrum use of the frequency band 470-694 MHz in Region 1.

* Note: These dates were not agreed.

There are different views with respect to the reasons given above.

View 1: *Some administrations believe that there is a significant trend of declining usage of DTT in the UHF band. Some of the administrations already reduced the number of multiplexes to a single multiplex, while others have switched off their broadcasting DTT services entirely. Hence, this very precious UHF band is either unused or under-utilized. Furthermore, the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries, reaching as low as single-digit percentages of the population. Some administrations do not have a plan to dedicate any frequency band to broadcasting DTT systems only considering the capability to provide broadcasting and mobile broadband services using the same IMT technologies targeting the majority of the population rather than a few people. In addition, the results of sharing studies showed negligible impact from the mobile service to the broadcasting service without harmful interference. The separation distance results were in terms of a few kilometres which would confirm the practical feasibility of coexistence between mobile and broadcasting services in neighbouring countries. Finally, and taking into account the capability of mobile IMT systems to support both broadcasting service and mobile broadband applications, the co-primary allocation of the band 470-694 MHz will support administrations in bridging the digital divide, in particular within developing countries, while delivering both mobile and broadcasting services efficiently.*

View 2: *Some administrations are of the view that the ITU-R questionnaire on the spectrum use and needs under agenda item 1.5 has demonstrated that, at least until 2030, almost all Region 1 countries will need to use the whole 470-694 MHz band for broadcasting. The technical studies demonstrating the practical impossibility to operate mobile and broadcasting services in neighbouring countries have been confirmed by the* *interference situation that neighbouring administrations faced in the 700 MHz. Therefore, co-primary allocation to the mobile service cannot provide real flexibility to operate IMT networks in this frequency band until it is envisaged, as for the 700 MHz and 800 MHz band, to have a migration towards IMT among large blocks of countries.*

View 3: *Many studies were received and considered by TG 6/1. They showed significant differences between results, and it was not possible to resolve those differences. The summary of studies in the CPM text and the working document collecting all the studies both show divergences of views and that agreement on the studies was not possible. No task group sharing studies have yet been submitted to SG 6 for approval, and only study groups can approve studies in ITU-R. Therefore, they are not approved.*

The majority of submitted studies showed consistent results; and a minority of studies, submitted by a few administrations, gave very inexplicable results. This small number of studies devalues the others submitted by various contributing groups, stakeholders and administrations. In particular, the information collected by contributing groups as a result of studies they conducted was ignored by some administrations, whose studies consistently deviated from baseline parameters and approved ITU-R studies (e.g. Reports ITU-R BT.2301-3, ITU-R BT.2302-1 and ITU-R BT.2383-4).

Consequently, the range and variety of views expressed in the analysis and summary of the studies will not help administrations which were not closely involved in the TG process.

There are different views with respect to the applicability and appropriateness, or otherwise, of Alternative A2 of this method mentioned above.

View 1: *Agenda items of future WRCs are not under the scope of this agenda item. However, WRC-23 may consider a different approach to achieve the objectives of agenda item 1.5. This method is outside the mandate of ITU-R and should be submitted to WRC-23 agenda item 10.*

View 2: *This method is submitted as one method, among others, to respond to WRC-23 agenda item 1.5 and is therefore within the scope of CPM. The option of postponing the response to WRC-23 agenda item 1.5, until WRC-27 or WRC-31, is based on the conclusion that it is too early to make that decision at WRC-23, with the understanding that the spectrum use and needs in the 470-960 MHz band may evolve at a later point in time.*

1/1.5/4.2 Method B: Primary allocation to the mobile service in the frequency band 470-694 MHz with or without identification to IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution 235 (WRC-15)

Reasons: This method is proposed based on the studies and the fact that in the short term (as of today) there is a trend of declining usage of DTT in the UHF band. Some of the administrations already reduced the number of their multiplexes to a single multiplex, while others have switched off their broadcasting DTT services entirely. Hence, this very precious UHF band is either unused or under-utilized. Furthermore, the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries, reaching as low as single-digit percentages of the population. Some administrations do not have a plan to dedicate any frequency band to broadcasting DTT systems only considering the capability to provide broadcasting and mobile broadband services using the same IMT technologies targeting the majority of the population rather than a few people. In addition, the results of sharing studies showed negligible impact from mobile service to broadcasting service without harmful interference. The separation distance results were in terms of few kilometres which would confirm the practical feasibility of coexistence between mobile and broadcasting services in neighbouring countries. Finally, and taking into account the capability of mobile IMT systems to support both broadcasting service and the mobile broadband applications, the co-primary allocation of the band 470-694 MHz will support administrations in bridging the digital divide, in particular within developing countries, while delivering both mobile and broadcasting services efficiently.

This method proposes an allocation of all or part of the band 470-694 MHz to the mobile service on a primary basis and identification of all (470-694 MHz) or part (614-694 MHz) of the frequency band for IMT through modification of an existing footnote and the suppression of Resolution **235 (WRC-15)**. This method does not prevent the use of stations in the aeronautical mobile service in this frequency band.

For all alternatives of Method B, RR No. **5.300** is proposed to be modified to reflect the changes related to mobile service allocation.

For alternatives of Method B, Resolution **224 (Rev.WRC-19)** is proposed to be modified to include the new frequency band identified for IMT for Alternatives B1 and B2.

There are different views with respect to the reasons given above.

View 1: *This method could not be implemented and leads to harmful interference for incumbent services in the band 470-694 due to the following:*

- *The allocation of the band 470-694 MHz to the mobile service without exception of aeronautical mobile service assumes the use of this band by applications in the aeronautical mobile service. The sharing and compatibility studies as requested by* resolves *2 of Resolution **235 (WRC-15)** were made only for mobile, except aeronautical mobile, service. It can be supposed that sharing of AMS with other services is even more problematic than IMT. It also confirms by existing practice where allocation of the band intended for the operation of IMT systems usually made in the RR for the mobile, except aeronautical mobile, service. At the same time, proposed method does not contain measures for protection of other services from aeronautical mobile service.*
- *Provisions of the GE06 Agreement do not consider the case of coordination between the aeronautical mobile service and the broadcasting service and coordination triggers were not developed.*
- *The studies in accordance to* resolves *1 of Resolution **235 (WRC-15)** also did not consider applications in the aeronautical mobile service. The reasons for the proposed allocation of the band to aeronautical mobile service were not provided.*

Thus, such an allocation proposed in Method B goes beyond the scope of agenda item 1.5.

View 2: *Some administrations are of the view that the reasons given above may only be applicable for a very limited number of countries since the ITU-R questionnaire on the spectrum use and needs under agenda item 1.5 has demonstrated that, at least until 2030, almost all Region 1 countries will need to use the whole 470-694 MHz for terrestrial broadcasting. In addition, the technical studies have shown the practical impossibility to operate mobile and broadcasting services in neighbouring countries. It has been confirmed by the interference situation that neighbouring administrations faced in the 700 MHz. Therefore, the reasons given above are ignoring that a co-primary allocation to the mobile service cannot provide real flexibility to operate IMT networks in a frequency band used in neighbouring administrations for broadcasting.*

<u>View 3:</u> *The studies undertaken by Working Party 6A in response to Resolution* ***235 (WRC-15)*** *clearly show that 95 of 106 responding administrations of Region 1 continue to require at least the whole band from 470-694 MHz for broadcasting. Only seven of those Region 1 administrations report that they require less than this range. There is no evidence of "a significant trend of declining usage of DTT" or that "the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries". Indeed, many administrations reported that they are continuing to invest in development of DTT networks in their countries (ref. Report ITU-R BT.2302-1). In contrast, only 20 out of 121 Region 1 administrations even responded to the WP 5D questionnaire on future requirements for spectrum for IMT in the band.*

The majority of sharing studies submitted showed that a large separation distance is required between stations of the mobile and broadcasting services –significantly greater than the "few kilometres" that some administrations claimed to have found in their studies. Several reports from administrations of real interference experienced between IMT and DTT (as detailed in Report ITU-R BT.2301-3) show that co-channel coexistence between the two systems is very difficult and therefore imposes constraints on the deployment and the operation of both services.

Claims that mobile IMT systems can match DTT systems (for example, DVB-T2) in efficiency are misguided. DVB-T2 has proved to be very efficient for its designed use cases; IMT systems cannot match those efficiencies in the same use cases.

With regard to the understanding of GE06, the following views were presented:

<u>View 1:</u> *GE06 applies in all countries in Region 1, except Mongolia, and the Islamic Republic of Iran. In accordance with the GE06 Agreement:*

– *where the field strengths at borders for new stations of the mobile service are above the GE06 coordination trigger field strengths, and/or*

– *where an administration wishes to have a right to protect stations of the mobile service operating within its national border,*

the use of the mobile service is subject to agreement to be obtained from the concerned administrations through bilateral or multilateral agreements.

In this respect, Resolution ***224 (Rev.WRC-19)*** *resolves:*

that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations.

<u>View 2:</u> *Some administrations are of the view that while GE06 applies, the interpretation of some GE06 provisions by some other administrations regarding the use of the mobile service and stations is not correct and is found to be misleading. The whole GE06 Agreement applies for protection of broadcasting and mobile (generic mobile service including land, maritime, aeronautical mobile) services. Also, any coordination requirement should be considered in accordance with GE06 Agreement and ITU Radio Regulations along with all relevant provisions.*

1/1.5/4.2.1 Alternative B1

This alternative proposes an allocation to the mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. **5.317A** without any additional conditions to protect other services. RR No. **5.296** will be suppressed.

1/1.5/4.2.2 Alternative B2

This alternative proposes an allocation to the mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 470-694 MHz for IMT through modification of RR No. **5.317A** without any additional conditions to protect other services. RR No. **5.296** will be suppressed.

1/1.5/4.2.3 Alternative B3

This alternative proposes an allocation to the mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 without any additional conditions. RR No. **5.296** will be suppressed.

1/1.5/4.3 Method C: Primary allocation to the mobile, except aeronautical mobile, service in the frequency band 470-694 MHz and identification to IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution 235 (WRC-15)

This method proposes an allocation of all or part of the band 470-694 MHz to the mobile, except aeronautical mobile, service on a primary basis and identification of all (470-694 MHz) or part (614-694 MHz) of the frequency band for IMT either in a new or existing footnote and the suppression of Resolution **235 (WRC-15)**.

The co-primary allocation is to ensure regulatory options for administrations which are wishing to implement systems of the broadcasting service, mobile, except aeronautical mobile, service or other existing services in accordance with the RR.

There are different views with respect to the reasons given above.

<u>View 1:</u> *The studies undertaken by Working Party 6A in response to Resolution **235 (WRC-15)** clearly show that 95 of 106 responding administrations of Region 1 continue to require at least the whole band from 470-694 MHz for broadcasting. Only seven of those Region 1 administrations report that they require less than this range. There is no evidence of "a significant trend of declining usage of DTT" or that "the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries". Indeed, many administrations reported that they are continuing to invest in development of DTT networks in their countries (ref. Report ITU-R BT.2302-1). In contrast, only 20 out of 121 Region 1 administrations even responded to the WP 5D questionnaire on future requirements for spectrum for IMT in the band.*

The majority of sharing studies submitted showed that a large separation distance is required between stations of the mobile and broadcasting services –significantly greater than the "few kilometres" that some administrations claimed to have found in their studies. Several reports from administrations of real interference experienced between IMT and DTT (as detailed in Report ITU-R BT.2301-3) show that co-channel coexistence between the two systems is very difficult and therefore imposes constraints on the deployment and the operation of both services.

Claims that mobile IMT systems can match DTT systems (for example, DVB-T2) in efficiency are misguided. DVB-T2 has proved to be a very efficient for its designed use cases; IMT systems cannot match those efficiencies in the same use cases.

View 2: *There is a significant trend of declining usage of DTT in the UHF band. Some of the administrations already reduced the number of multiplexes to a single multiplex, while others have switched off their broadcasting DTT services entirely. Hence, this very precious UHF band is either unused or under-utilized. Furthermore, the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries, reaching as low as single-digit percentages of the population. Some administrations do not have a plan to dedicate any frequency band to broadcasting DTT systems only considering the capability to provide broadcasting and mobile broadband services using the same IMT technologies targeting the majority of the population rather than a few people. In addition, the results of sharing studies showed negligible impact from the mobile service to the broadcasting service without harmful interference.*

The results of sharing and compatibility studies showed separation distances between mobile IMT and DTTB, for the protection of services, in terms of a few kilometres up to a few tens of kilometres in worst-case scenarios, which would confirm the practical feasibility of coexistence between mobile and broadcasting services in neighbouring countries.

Finally, and taking into account the capability of mobile IMT systems to support both broadcasting service and mobile broadband applications, the co-primary allocation of the band 470-694 MHz will support administrations in bridging the digital divide, in particular within developing countries, while delivering both mobile and broadcasting services efficiently.

With regard to the understanding of GE06, the following views were presented:

View 1: *GE06 applies in all countries in Region 1, except Mongolia, and the Islamic Republic of Iran. In accordance with the GE06 Agreement:*

– *where the field strengths at borders for new stations of the mobile service are above the GE06 coordination trigger field strengths, and/or*

– *where an administration wishes to have a right to protect stations of the mobile service operating within its national border,*

the use of the mobile service is subject to agreement to be obtained from the concerned administrations through bilateral or multilateral agreements.

In this respect, Resolution ***224 (Rev.WRC-19)*** *resolves:*

that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent *of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;*

b) *administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations.*

View 2: *Some administrations are of the view that while GE06 applies, the interpretation of some GE06 provisions by some other administrations regarding the use of mobile service and stations is not correct and is found to be misleading. The whole GE06 Agreement applies for protection of broadcasting and mobile (generic mobile service including land, maritime, aeronautical mobile) services. Also, any coordination requirement should be considered in accordance with GE06 Agreement and ITU Radio Regulations along with all relevant provisions.*

For all alternatives of Method C, RR No. **5.300** is proposed to be modified to reflect the changes related to the allocation to the mobile service.

For all alternatives of Method C, Resolution **224 (Rev.WRC-19)** is proposed to be modified to include the new frequency band identified for IMT.

The following alternatives describe possible combinations of primary allocations to the mobile, except aeronautical mobile, service and IMT identifications in the frequency band 470-694 MHz or parts thereof.

1/1.5/4.3.1 Alternative C1

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. **5.317A** without any additional conditions to protect other services. RR No. **5.296** will be suppressed.

View 1: *This alternative without application of additional measures for the protection of other services from the mobile, except aeronautical mobile service contradict the results of compatibility studies, which demonstrate that compatibility between these services is difficult.*

1/1.5/4.3.2 Alternative C2

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 470-694 MHz for IMT through modification of RR No. **5.317A** without any additional conditions to protect other services. RR No. **5.296** will be suppressed.

View 1: *This alternative without application of additional measures for the protection of other services from the mobile, except aeronautical mobile service contradict the results of compatibility studies, which demonstrate that compatibility between these services is difficult.*

1/1.5/4.3.3 Alternative C3

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT. This identification will be done by amending RR No. **5.317A**. A new WRC Resolution **[A15-CONDITIONS C3]** will be referred to in a new footnote RR No. **5.A15** to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 470-694 MHz.

RR No. **5.296** is modified to highlight the continued use of the frequency band 470-694 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1.

1/1.5/4.3.4 Alternative C4

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 and identification of the band 470-694 MHz for IMT. This identification will be done by amending RR No. **5.317A**. A new WRC Resolution **[B15-CONDITIONS C4]** will be referred to in a new footnote RR No. **5.B15** to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 470-694 MHz.

RR No. **5.296** is modified to highlight the continued use of the frequency band 470-694 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1.

1/1.5/4.3.5 Alternative C5

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 614-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. **5.317A**.

RR No. **5.296** is modified to highlight the continued use of the frequency band 470-614 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1. New footnote RR No. **5.C15** is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 614-694 MHz in some countries in Region 1.

1/1.5/4.3.6 Alternative C6

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 614-694 MHz in Region 1 and identification of the band 614-694 MHz for IMT through modification of RR No. **5.317A**. A new WRC Resolution **[C15-CONDITIONS C6]** will be referred to in a new footnote RR No. **5.D15** to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services. RR No. **5.296** is modified to highlight the continued use of the frequency band 470-614 MHz for applications ancillary to broadcasting and programme-making in some countries in Region 1. New footnote RR No. **5.E15** is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 614-694 MHz in some countries in Region 1.

1/1.5/4.3.7 Alternative C7

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis of the frequency band 470-694 MHz and identification of the band 614-694 MHz for IMT in some countries in Region 1. The allocation will be done by adding a new country footnote

RR No. **5.F15** while the identification will be done via a modification to RR No. **5.317A**. A new WRC Resolution **[D15-CONDITIONS C7]** is developed to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 470-694 MHz. RR No. **5.296** is modified to highlight the continued use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1. New footnote RR No. **5.G15** is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1.

1/1.5/4.3.8 Alternative C8

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis of the frequency band 470-694 MHz and identification of the band 470-694 MHz for IMT in some countries in Region 1. The allocation will be done by adding a new country footnote RR No. **5.H15** while the identification will be done via a modification to RR No. **5.317A**. A new WRC Resolution **[E15-CONDITIONS C8]** is developed to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the frequency band 470-694 MHz. RR No. **5.296** is modified to highlight the continued use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1. New footnote RR No. **5.I15** is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1.

1/1.5/4.3.9 Alternative C9

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis of the frequency band 614-694 MHz and identification of the band 614-694 MHz for IMT in some countries in Region 1. The allocation will be done by adding a new country footnote RR No. **5.J15** while the identification will be done via a modification to RR No. **5.317A**. A new WRC Resolution **[F15-CONDITIONS C9]** is developed to establish regulatory/technical conditions for the use of the mobile, except aeronautical mobile, service (i.e. MMS and LMS) in addition to the GE06 Agreement, in particular to protect existing services in the band 614-694 MHz. RR No. **5.296** is modified to highlight the continued use of applications ancillary to broadcasting and programme-making in the band 470-614 MHz and 614-694 MHz in some countries in Region 1. New footnote RR No. **5.K15** is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 614-694 MHz in some countries in Region 1.

1/1.5/4.4 Method D: Primary allocation to the mobile, except aeronautical mobile, service within the band 470-694 MHz without IMT identification. Suppression of Resolution 235 (WRC-15)

This method proposes an allocation of the frequency band 470-694 MHz or parts thereof to the mobile, except aeronautical mobile, service on a primary basis without IMT identification in Region 1, and the suppression of Resolution **235 (WRC-15)**.

The alternatives are to provide regulatory options for administrations which are wishing to implement systems of the broadcasting service, mobile, except aeronautical mobile, service or other existing services in accordance with the RR.

<u>View 1:</u> *The results of several sharing studies between the broadcasting and the mobile services, supported by reports of real cases of interference in UHF bands with co-primary allocation to the broadcasting and the mobile services, show that sharing is very*

difficult and therefore imposes constraints on the deployment and the operation of both services.

View 2: *There is a significant trend of declining usage of DTT in the UHF band. Some of the administrations already reduced the number of multiplexes to a single multiplex, while others have switched off their broadcasting DTT services entirely. Hence, this very precious UHF band is either unused or under-utilized. Furthermore, the share of the population which is reached by broadcasting DTT services is also reducing remarkably in many countries, reaching as low as single-digit percentages of the population. Some administrations do not have a plan to dedicate any frequency band to broadcasting DTT systems only considering the capability to provide broadcasting and mobile broadband services using the same IMT technologies targeting the majority of the population rather than a few people. In addition, the results of sharing studies showed negligible impact from mobile service to broadcasting service without harmful interference.*

The results of sharing and compatibility studies showed distances between mobile IMT and DTTB, for protection of services, in terms of a few kilometres up to a few tens of kilometres in worst-case scenarios, which would confirm the practical feasibility of coexistence between mobile and broadcasting services in neighbouring countries.

Finally, and taking into account the capability of mobile IMT systems to support both broadcasting service and mobile broadband applications, the co-primary allocation of the band 470-694 MHz will support administrations in bridging the digital divide, in particular within developing countries, while delivering both mobile and broadcasting service efficiently.

With regard to the understanding of GE06, the following views were presented:

View 1: *GE06 applies in all countries in Region 1, except Mongolia, and the Islamic Republic of Iran. In accordance with the GE06 Agreement:*

– *where the field strengths at borders for new stations of the mobile service are above the GE06 coordination trigger field strengths, and/or*

– *where an administration wishes to have a right to protect stations of the mobile service operating within its national border,*

the use of the mobile service is subject to agreement to be obtained from the concerned administrations through bilateral or multilateral agreements.

In this respect, Resolution ***224 (Rev.WRC-19)*** *resolves:*

that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future *broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations.*

View 2: *Some administrations are of the view that while GE06 applies, the interpretation of some GE06 provisions by some other administrations regarding the use of mobile service and stations is not correct and is found to be misleading. The whole GE06 Agreement applies for protection of broadcasting and mobile (generic mobile service including land, maritime, aeronautical mobile) services. Also, any coordination requirement should be considered in accordance with GE06 Agreement and ITU Radio Regulations along with all relevant provisions.*

For all alternatives of Method D, RR No. **5.300** is proposed to be modified to reflect the changes related to the mobile service allocation.

1/1.5/4.4.1 Alternative D1

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1.

It recognizes that a co-primary allocation to the mobile service of the band 470-694 MHz in Region 1 would provide a regulatory option for administrations wishing to introduce mobile, except aeronautical mobile, services. RR No. **5.296** is proposed to be modified to highlight the continued use of this frequency band for applications ancillary to broadcasting and programme-making in Region 1. A new WRC Resolution **[G15-ALTERNATIVE D1]**, which is referred to in a proposed new footnote RR No. **5.L15**, will address the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service.

1/1.5/4.4.2 Alternative D2

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the Table of Frequency Allocations of the frequency band 470-694 MHz in Region 1 without any additional conditions. RR No. **5.296** is also proposed to be suppressed.

1/1.5/4.4.3 Alternative D3

This alternative proposes an allocation to the mobile, except aeronautical mobile, service on a primary basis in the band 470-694 MHz in some countries in Region 1.

This alternative would limit the co-primary allocation to the mobile service for to those countries listed in a new footnote (RR No. **5.M15**). In addition, some bilateral discussions with affected countries could take place during WRC-23 to ensure that there is no objection for inclusion of a country name in this new footnote. Thus, the definition of this list of countries would take into account the possibility of coexistence with continued broadcasting use in neighbouring countries. In this respect, the possibility of use of the band by mobile and broadcasting services would be initially considered at WRC-23, not prejudging later bilateral or multilateral detailed agreements. RR No. **5.296** is proposed to be modified to address countries included both in RR No. **5.296** and in the new footnote RR No. **5.M15**. New footnote RR No. **5.N15** is proposed to clarify the use of applications ancillary to broadcasting and programme-making in the band 470-694 MHz in some countries in Region 1. A new WRC Resolution **[H15-ALTERNATIVE D3]**, which is referred to in a proposed new footnote RR No. **5.M15**, will address the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service.

1/1.5/4.4.4 Alternative D4

This alternative proposes a primary allocation to the mobile, except aeronautical mobile, service of the frequency band 470-694 MHz in Region 1 with later date of entry into force (e.g. not earlier than [01/01/2031]) in order to provide a regulatory option for administrations wishing to introduce mobile, except aeronautical mobile, service in the long term.

Radio Regulations No. **5.296** is proposed to be modified to highlight the use of this frequency band by applications ancillary to broadcasting and programme-making in Region 1. A new WRC Resolution **[I15-ALTERNATIVE D4]**, which is referred to in a proposed new footnote RR No. **5.O15**, will address the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service.

1/1.5/4.4.5 Alternative D5

This alternative proposes to apply similar regulatory actions for a new allocation to the mobile, except aeronautical mobile, service on a primary basis as described in Alternatives D1, D2, D3 or D4 above but limited to only a part of the frequency band 470-694 MHz (e.g. 614-694 MHz).

Radio Regulations No. **5.296** will need to be modified to reflect continued use of the rest of the frequency band 470-694 MHz (e.g. 470-614 MHz) by applications ancillary to broadcasting and programme-making under a secondary mobile service in countries of Region 1 currently listed in RR No. **5.296** while a new footnote and/or amendment RR No. **5.296** will be needed to reflect the use of the newly allocated band (e.g. 614-694 MHz) by these applications under the primary mobile service and continued use under a secondary mobile service for those countries where a new allocation to the mobile, except aeronautical mobile, service has not been made.

1/1.5/4.5 Method E: Primary allocation to the mobile, except aeronautical mobile, service of the band 470-694 MHz in Region 1 with technical condition limiting mobile service operations to downlink in this band. Suppression of Resolution 235 (WRC-15)

This method introduces a regulatory option for using the band to the mobile, except aeronautical mobile, service due to the fact that the coexistence between mobile and broadcasting services is much easier with downlink only. A new footnote RR No. **5.P15** limits the use of the allocation to transmit from base stations only and to applications ancillary to broadcasting and programme-making (thus enabling suppression of RR No. **5.296**).

A new WRC Resolution **[J15-METHOD E]**, which is referred to in a proposed new footnote RR No. **5.P15**, will address the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service.

Radio Regulations No. **5.300** is proposed to be modified to reflect the changes related to an allocation to the mobile service under this method.

1/1.5/4.6 Method F: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1

Regarding Method F, the following views were provided:

View 1: *The coexistence between mobile and broadcasting services were studied over multiple WRC study cycles. The results of many studies and real practical experiences showed the feasibility of coexistence in co-channel and adjacent channel to ensure the protection of the broadcasting service from the mobile service, in particular IMT stations.*

The secondary allocation will not be able to satisfy the real need of the majority administrations that are experiencing significant reduction in terrestrial broadcasting *services and not utilizing the important UHF spectrum resources, in particular 470-694 MHz.*

In addition, emerging IMT technologies support broadcasting services with the capability of receiving over the air broadcasting programs. This provides golden opportunities for administrations to efficiently utilize the precious UHF spectrum for supporting the development of futuristic applications under both mobile broadband and broadcasting services with anticipated socio-economic values to different sectors in all countries.

View 2: *Some administrations are of the view that the studies regarding interference from DTT to IMT have shown that interference would range up to several hundreds of kilometres, showing that it will be possible for an administration to use this band for IMT only if this administration is able to negotiate cross-border agreement with its neighbours.*

The secondary status for the mobile service would therefore enable a country wishing to implement mobile to negotiate with its neighbour while fully respecting the priority rights of the broadcasting service to operate. In addition, it may help the introduction of some ad-hoc mobile networks if they are not impacting broadcasting use.

View 3: *The expressed conclusion by the proponent of View 1 for the coexistence between broadcasting and mobile services is based on the invalid and significantly diverging from the baseline parameters submitted by WP 5D to TG 6/1 referenced at Document 6-1/28. The valid studies according to the baseline parameters show large interfering distances of several hundreds of kilometres between the mobile service and the broadcasting service that concludes the impossibility of the coexistence of mobile and broadcast services.*

In addition, the broadcast capability of IMT technologies known as FeMBMS cannot meet the requirements of the broadcasting services provided by DTTB in terms of technical specification, cost-effectivity and also socio- economic aspects and in no way can substitute the broadcasting service. It may add the capability of receiving the broadcast content over mobile phones and tablets which can be considered as complementary to the broadcasting service and not as an alternative.

1/1.5/4.6.1 Alternative F1: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1

This method recognizes the need for regulatory options in the short or long term and introduces the mobile, except aeronautical mobile, service with a secondary status only. Thus, for continued broadcasting service operations in countries wishing to do so, regulatory protection will be provided from a secondary mobile, except aeronautical mobile, service deployment in neighbouring countries. Some revisions to RR No. **5.296** should continue to highlight the use of this frequency band by applications ancillary to broadcasting and programme-making in Region 1. In addition, WRC-31 is invited to consider a possible upgrade of this allocation and Resolution **235 (WRC-15)** is revised accordingly.

1/1.5/4.6.2 Alternative F2

The secondary allocation of the frequency band 470-694 MHz to the mobile, except aeronautical mobile, service in Region 1 would be conditioned that, such a secondary allocation also applies RR No. **9.21** with respect to neighbouring and concerned countries. In addition to that for the implementation of non-interference and non-protection of such a secondary allocation, if agreed by the WRC-23 shall also apply RR No. **9.21** together with a firm commitment to the Bureau when notifying the assignments in question that, in the case unacceptable interference is caused, the notifying administration of such secondary allocation shall immediately reduce the interference to the acceptable level or cease the emission.

Some revisions to RR No. **5.296** should continue to highlight the use of this frequency band for applications ancillary to broadcasting and programme-making in Region 1.

1/1.5/4.6.3 Alternative F3: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in some countries in Region 1 with suppression of Resolution 235 (WRC-15)

This alternative recognizes the need for regulatory options in the short or long term and introduces the mobile, except aeronautical mobile, service with a secondary status only to those countries listed in a new footnote (RR No. **5.M15**). Some revisions to the countries list of RR No. **5.296** are needed to highlight the use of this frequency band for applications ancillary to broadcasting and programme-making in countries not listed in the new footnote RR No. **5.M15**. A new footnote RR No. **5.N15** should continue to highlight the use of this frequency band for applications ancillary to broadcasting and programme-making in countries listed in the new footnote RR No. **5.M15**.

1/1.5/4.7 Method G: Considerations of the radio astronomy service

This method may apply in the case where the mobile service is allocated on a primary basis in all or parts of Region 1 (i.e. Methods B, C, D and E).

In order to ensure the protection of the radio astronomy service from the mobile service, the method consists of an upgrade of the radio astronomy status to primary in the band 608-614 MHz in a list of countries in Region 1 (except the African Broadcasting Area where the status is already primary in the band 606-614 MHz, in accordance with RR No. **5.304**) through a modification of RR Nos. **5.304** and consequent modification of RR No. **5.306**. In addition, in order not to change the regulatory status of the radio astronomy service with regard to broadcasting, an additional provision in RR No. **5.304** is needed to ensure that the radio astronomy service could not claim protection from the broadcasting service.

There are different views with respect to the applicability and appropriateness, or otherwise, of this method mentioned above.

<u>*View 1:*</u> *Views were expressed that, while Resolution **235 (WRC-15)** did not specifically exclude the elevation of secondary service to primary, such consideration should not set a precedent for any other WRC agenda items unless such actions are specifically called out in the associated Resolutions.*

<u>*View 2:*</u> *Such upgrade of an incumbent service has often been decided by a competent WRC as a regulatory consequence of a WRC decision, in particular a new or upgraded allocation.*

1/1.5/5 Regulatory and procedural considerations

*[Editorial note: Further revisions may be required for other relevant Resolutions such as Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)** based on the method proposals.]*

1/1.5/5.1 For Method A: No Change

1/1.5/5.1.1 For Method A, Alternative A1

<u>**NOC**</u>

ARTICLES

1/1.5/5.1.2 For Method A, Alternative A2

NOC

ARTICLES

MOD

RESOLUTION 235 (REV.WRC-~~15~~23)

Review of the spectrum use of the frequency band 470-~~960~~694 MHz in Region 1

*Note: The entire revision of Resolution **235 (WRC-15)** was not agreed.*

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

considering

a) that the favourable propagation characteristics in the frequency bands below 1 GHz are beneficial in providing cost-effective solutions for coverage;

b) that there is a need to continually take advantage of technological developments in order to increase the efficient use of the spectrum and facilitate spectrum access;

c) that the frequency band 470-~~862~~694 MHz is a harmonized band used to provide terrestrial television broadcasting services ~~on a worldwide scale~~in Region 1;

d) that, in many countries, there is a sovereign obligation to provide broadcasting services;

e) that terrestrial broadcasting networks have a long life cycle, and a stable regulatory environment is necessary to provide protection of investment and future development;

f) that, in many countries, there is a need for investment in the next decade for the migration of broadcasting into the frequency band below 694 MHz and for the implementation of new-generation broadcasting technologies, in order to take advantage of technological developments to increase the efficient use of the spectrum;

g) that in many developing countries terrestrial broadcasting is the only viable means of delivery of broadcast services;

h) that the technology trend in digital terrestrial television (DTT) is towards high-definition television which requires a higher bit rate than standard-definition television;

i) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

~~*j)* that International Mobile Telecommunications (IMT) systems, utilizing some parts of the frequency band 694/698-960 MHz, are intended to provide telecommunication services on a worldwide scale, regardless of location, network or terminal used;~~

~~k~~j) that, for countries listed in No. **5.296**, an additional allocation to the land-mobile service on a secondary basis is in place, intended for applications ancillary to broadcasting and programme-making;

~~l~~k) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

~~m~~l) that, in some countries, parts of the frequency band are also allocated to the radiolocation service on a secondary basis, limited to the operation of wind profiler radars (No. **5.291A**), and also to the radio astronomy service on a secondary basis (No. **5.306**), and, according to No. **5.149**, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to stations of other services,

recognizing

a) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in Iran (Islamic Republic of), in particular for the frequency band 470-862 MHz;

b) that the GE06 Agreement contains provisions for the terrestrial broadcasting service and other primary terrestrial services, a Plan for digital television and a list of stations of other primary terrestrial services;

c) that a digital entry in the GE06 Plan may also be used for transmissions in a service other than the broadcasting service under the conditions set out in § 5.1.3 of the GE06 Agreement and the provisions of No. **4.4** of the Radio Regulations;

d) that ~~information on implementation of the digital dividend and on the transition to digital television and its technological evolution is needed and may not be available before 2019,~~the technical and regulatory studies carried out for the preparation of WRC-23 agenda item 1.5 do not need to be updated for applications already considered, except in cases of significantly changed characteristics of the studied applications of the existing secondary and primary services;

e) that there may be some changes over the years in the spectrum use and needs for broadcasting and mobile services,

noting

the ongoing development of new applications and technologies of both the broadcasting and mobile services,

resolves to invite ITU-R~~, after the 2019 World Radiocommunication Conference and in time for the 2023 World Radiocommunication Conference~~

1 to review the spectrum use ~~and study the spectrum needs of existing services within the frequency band 470-960 MHz in Region 1, in particular the spectrum requirements of the broadcasting and mobile, except aeronautical mobile, services, taking into account~~of the existing primary and secondary services and needs of the broadcasting and mobile services, including applications covered by No. **5.296**, in the band 470-694 MHz, taking into account that the World Radiocommunication Conference [2027/2031] will need to consider the most up-to-date information possible (e.g. [2026/2030]), considering the relevant ITU Radiocommunication Sector (ITU-R) studies, Recommendations and Reports;

2 ~~to carry out sharing and compatibility studies, as appropriate, in the frequency band 470-694 MHz in Region 1 between the broadcasting and mobile, except aeronautical mobile, services, taking into account relevant ITU-R studies, Recommendations and Reports~~to report to WRC-[27/31] the results of sharing and compatibility studies taking into account intensive studies carried out in response to WRC-23 agenda item 1.5 in order to avoid any duplication of the ITU-R effort;

3 ~~to conduct sharing and compatibility studies, as appropriate, in order to provide relevant protection of systems of other existing services~~to identify cases where the evolution of technologies for broadcasting and mobile services would adversely impact the outcome of the sharing and compatibility studies referred to in *resolves* 2, and for the ITU-R Working Parties to complete relevant new sharing and compatibility studies as appropriate,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R,

*resolves to invite ~~the 2023 World Radiocommunication Conference~~a future competent conference (e.g. WRC-27 or WRC-31)**

to consider, based on the results of studies above, ~~provided that these studies are completed and approved by ITU-R, possible regulatory~~ necessary actions related to any possible future allocation to the mobile service in the frequency band 470-694 MHz in Region 1, as appropriate,

* Note: These dates were not agreed.

further invites ITU-R

to ensure intersectoral collaboration with the ITU Telecommunication Development Sector (ITU-D) in the implementation of this Resolution.

1/1.5/5.2 For Method B: Primary allocation to the mobile service in the frequency band 470-694 MHz with or without identification for use by IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution 235 (WRC-15)

1/1.5/5.2.1 For Method B, Alternative B1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE MOD 5.317A BROADCASTING	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608	

5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312	BROADCASTING 5.295 5.297 **608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space) **614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307 **610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)** and **749 (Rev.WRC-19)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

SUP

5.296

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.2.2 For Method B, Alternative B2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">470-694
MOBILE MOD 5.317A
BROADCASTING</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td>470-585
FIXED
MOBILE 5.296A
BROADCASTING
5.291 5.298</td></tr>
<tr><td>512-608
BROADCASTING
5.295 5.297</td><td>585-610</td></tr>
</table>

5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312	**608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
	698-806 MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~470-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)** and **749 (Rev.WRC-19)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

SUP

5.296

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~470-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.2.3 For Method B, Alternative B3

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE BROADCASTING	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610**

5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312	**608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING MOD 5.300 5.312	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
	698-806 MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

SUP

5.296

1/1.5/5.3 For Method C - Primary allocation to the mobile, except aeronautical mobile, service in the frequency band 470-694 MHz and identification for use by IMT in the frequency band 470-694 MHz or parts thereof in Region 1. Suppression of Resolution 235 (WRC-15)

1/1.5/5.3.1 For Method C, Alternative C1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE except aeronautical mobile MOD 5.317A BROADCASTING 5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
	614-698 BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)** and **749 (Rev.WRC-19)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

SUP

5.296

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.2 For Method C, Alternative C2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE except aeronautical mobile MOD 5.317A BROADCASTING 5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
	614-698 BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~470-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)** and **749 (Rev.WRC-19)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

SUP

5.296

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~470-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.3 For Method C, Alternative C3

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE except aeronautical mobile ADD 5.A15 MOD 5.317A BROADCASTING 5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 5.312	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
	614-698 BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

ADD

5.A15 In Region 1, the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution **[A15-CONDITIONS C3] (WRC-23)**. See also Resolution **224 (Rev.WRC-23)**. (WRC-23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile, ~~service~~s~~ on a secondary basis. (WRC-~~15~~23)

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement

International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)**,~~ and~~ **749 (Rev.WRC-19)** and **[A15-CONDITIONS C3] (WRC-23)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.296 ~~*Additional allocation:* i~~In Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherl0ands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also ~~allocated on a secondary basis to the land mobile service,~~ intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.3.1 For Method C, Alternative C3, Example 1 for Resolution [A15-CONDITIONS C3] (WRC-23)

ADD

DRAFT NEW RESOLUTION [A15-CONDITIONS C3-EXAMPLE 1] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this frequency band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59,

resolves

1 that, for Region 1 [and the Islamic Republic of Iran]:

a) administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

b) that, interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz should be considered using appropriate mutually agreed criteria between coordinating administrations;

c) that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.3.3.2 For Method C, Alternative C3, Example 2 for Resolution [A15-CONDITIONS C3] (WRC-23)

ADD

DRAFT NEW RESOLUTION [A15-CONDITIONS C3-EXAMPLE 2] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

d) that it is necessary to adequately protect all primary services in the frequency band 614-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis including the broadcasting service;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this frequency band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

f) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the ARNS in the countries mentioned in No. **5.312**, on the other,

resolves

1 that, for countries party to the GE06 Agreement, the use of stations of the mobile, except aeronautical mobile, service is subject to the successful application of the procedures of that Agreement;

2 that administrations planning to implement IMT in the frequency band 470-694 MHz shall effect coordination, as required, with all neighbouring administrations prior to implementation;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

3 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile, except aeronautical mobile, service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

4 that, when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in Recommendations ITU-R BT.1368 and ITU-R BT.2033;

5 that the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is limited to operation within national boundaries;

6 that administrations implementing the mobile, except aeronautical mobile, service in Region 1 shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312** based on the criteria contained in the Annex to this Resolution;

6.1 that stations of the mobile, except aeronautical mobile, service shall not claim protection nor cause harmful interference to the station of the ARNS operating in accordance with No. **5.312**;

7 that, with respect to adjacent channel interference within the frequency band 470-694 MHz:

7.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

7.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned);

8 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations operated in the frequency band 608-614 MHz at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference;

9 that administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **235 (WRC-15)**,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO DRAFT NEW RESOLUTION [A15-CONDITIONS C3-EXAMPLE 2] (WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 645-694 MHz with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. **9.21** by the mobile service with respect to the ARNS operating in countries mentioned in No. **5.312**, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

*Note: Technical conditions in the Annex are to be developed based on Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.*

1/1.5/5.3.4 For Method C, Alternative C4

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE except aeronautical mobile ADD 5.B15 MOD 5.317A BROADCASTING	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610**

5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 5.312	**608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	614-698 BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

ADD

5.B15 In Region 1, the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution **[B15-CONDITIONS C4] (WRC-23)**. See also Resolution **224 (Rev.WRC-23)**. (WRC-23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~470-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)**, ~~and~~ **749 (Rev.WRC-19)** and **[B15-CONDITIONS C4] (WRC-23)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.296 ~~*Additional allocation:* i~~In Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also ~~allocated on a secondary basis to the land mobile service,~~ intended for applications ancillary to broadcasting and programme-making.~~ Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote.~~ (WRC-~~19~~23)

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~470-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.4.1 For Method C, Alternative C4, Example 1 for Resolution [B15-CONDITIONS C4] (WRC-23)

ADD

DRAFT NEW RESOLUTION [B15-CONDITIONS C4-EXAMPLE 1] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59,

resolves

1 that, for Region 1 [and the Islamic Republic of Iran]:

a) administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

b) that, interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz should be considered using appropriate mutually agreed criteria between coordinating administrations;

c) that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.3.4.2 For Method C, Alternative C4, Example 2 for Resolution [B15-CONDITIONS C4] (WRC-23)

ADD

DRAFT NEW RESOLUTION [B15-CONDITIONS C4-EXAMPLE 2] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 614-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis including the broadcasting service;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

f) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the ARNS in the countries mentioned in No. **5.312**, on the other,

resolves

1 that, for countries party to the GE06 Agreement, the use of stations of the mobile, except aeronautical mobile, service is subject to the successful application of the procedures of that Agreement;

2 that administrations planning to implement IMT in the frequency band 470-694 MHz shall effect coordination, as required, with all neighbouring administrations prior to implementation;

3 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile, except aeronautical mobile, service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

4 that, when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in Recommendations ITU-R BT.1368 and ITU-R BT.2033;

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

5 that the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is limited to operation within national boundaries;

6 that administrations implementing the mobile, except aeronautical mobile, service in Region 1 shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312** based on the criteria contained in the Annex to this Resolution;

6.1 that stations of the mobile, except aeronautical mobile, service shall not claim protection nor cause harmful interference to the station of the ARNS operating in accordance with No. **5.312**;

7 that, with respect to adjacent channel interference within the frequency band 470-694 MHz:

7.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

7.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned);

8 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations operated in the frequency band 608-614 MHz at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference;

9 that administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **235 (WRC-15)**,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO DRAFT NEW RESOLUTION [B15-CONDITIONS C4-EXAMPLE 2] (WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 645-694 MHz with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. **9.21** by the mobile service with respect to the ARNS operating in countries mentioned in No. **5.312**, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

*Note: Technical conditions in the Annex are to be developed based on Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.*

1/1.5/5.3.5 For Method C, Alternative C5

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-~~694~~614 BROADCASTING 5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 ~~5.312~~	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
~~470~~614-694 MOBILE except aeronautical mobile MOD 5.317A BROADCASTING ~~5.149 5.291A 5.294 5.296~~ MOD 5.300 ~~5.304 5.306~~ 5.312 ADD 5.C15	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed service on a secondary basis and the frequency band 582-614 MHz allocated to the mobile, except aeronautical mobile, service~~s~~ on a secondary basis. (WRC-~~15~~23)

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)** and **749 (Rev.WRC-19)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.296 *Additional allocation:* in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-~~694~~ 614 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

ADD

5.C15 In Region 1, [except in ...], the mobile service in the frequency band 614-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.6 For Method C, Alternative C6

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-~~694~~614 BROADCASTING	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610**

5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 ~~5.312~~	**608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
~~470~~614-694 MOBILE except aeronautical mobile MOD 5.317A ADD 5.D15 BROADCASTING ~~5.149 5.291A 5.294 5.296~~ MOD 5.300 ~~5.304 5.306~~ 5.312 ADD 5.E15	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

ADD

5.D15 In Region 1, the use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution **[C15-CONDITIONS C6] (WRC-23)**. See also Resolution **224 (Rev.WRC-23)**. (WRC-23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed service on a secondary basis and the band 582-614 MHz allocated to the mobile, except aeronautical mobile, service~~s~~ on a secondary basis. (WRC-~~15~~23)

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)**, ~~and~~ **749 (Rev.WRC-19)** and **[C15-CONDITIONS C6] (WRC-23)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.296 *Additional allocation:* in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-~~694~~ 614 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

ADD

5.E15 In Region 1, [except in ...], the mobile service in the frequency band 614-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.6.1 For Method C, Alternative C6, Example 1 for Resolution [C15-CONDITIONS C6] (WRC-23)

ADD

DRAFT NEW RESOLUTION [C15-CONDITIONS C6-EXAMPLE 1] (WRC-23)

Use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 614-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 614-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 614-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59,

resolves

1 that, for Region 1 [and the Islamic Republic of Iran]:

a) administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

b) that, interference between the mobile service and the broadcasting service in the frequency band 614-694 MHz should be considered using appropriate mutually agreed criteria between coordinating administrations;

c) that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.3.6.2 For Method C, Alternative C6, Example 2 for Resolution [C15-CONDITIONS C6] (WRC-23)

ADD

DRAFT NEW RESOLUTION [C15-CONDITIONS C6-EXAMPLE 2] (WRC-23)

Use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 614-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 614-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

d) that it is necessary to adequately protect all primary services in the frequency band 614-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 614-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis including the broadcasting service;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

f) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the ARNS in the countries mentioned in No. **5.312**, on the other,

resolves

1 that, for countries party to the GE06 Agreement, the use of stations of the mobile, except aeronautical mobile, service is subject to the successful application of the procedures of that Agreement;

2 that administrations planning to implement IMT in the frequency band 614-694 MHz shall effect coordination, as required, with all neighbouring administrations prior to implementation;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

3 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile, except aeronautical mobile, service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

4 that, when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in Recommendations ITU-R BT.1368 and ITU-R BT.2033;

5 that the use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service is limited to operation within national boundaries;

6 that administrations implementing the mobile, except aeronautical mobile, service in Region 1 shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312** based on the criteria contained in the Annex to this Resolution;

6.1 that stations of the mobile, except aeronautical mobile, service shall not claim protection nor cause harmful interference to the station of the ARNS operating in accordance with No. **5.312**;

7 that, with respect to adjacent channel interference within the frequency band 470-694 MHz:

7.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

7.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned);

8 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations operated in the frequency band 608-614 MHz at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference;

9 that administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **235 (WRC-15)**,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO DRAFT NEW RESOLUTION [C15-CONDITIONS C6-EXAMPLE 2] (WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 645-694 MHz with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. **9.21** by the mobile service with respect to the ARNS operating in countries mentioned in No. **5.312**, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

*Note: Technical conditions in the Annex are to be developed based on Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.*

1/1.5/5.3.7 For Method C, Alternative C7

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">470-694
BROADCASTING</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td rowspan="2">512-608
BROADCASTING
5.295 5.297</td></tr>
<tr><td>585-610</td></tr>
</table>

<table>
<tr><td rowspan="3">5.149 5.291A 5.294 MOD 5.296
MOD 5.300 5.304 5.306 5.312
ADD 5.F15 ADD 5.G15
MOD 5.317A</td><td rowspan="2">608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td><td>FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td></tr>
<tr><td rowspan="5">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A
BROADCASTING</td></tr>
<tr><td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td></tr>
<tr><td rowspan="2">694-790
MOBILE except aeronautical mobile 5.312A MOD 5.317A
BROADCASTING
MOD 5.300 5.312</td></tr>
<tr><td rowspan="2">698-806
MOBILE 5.317A
BROADCASTING
Fixed

5.293 5.309</td></tr>
<tr><td></td></tr>
</table>

ADD

5.F15 *Additional allocation:* in [list of countries], the frequency band 470-694 MHz is also allocated to the mobile service on a primary basis, subject to the provisions of Resolution **[D15-CONDITIONS C7] (WRC-23)**. (WRC-23)

MOD

5.296 *Additional allocation:* in [Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe], the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

Note: The list of countries in RR No. ***5.296*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.296****, if included in RR No.* ***5.F15****.*

ADD

5.G15 In [list of countries removed by MOD No. **5.296**], the mobile service in the frequency band 470-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)**, ~~and~~ **749 (Rev.WRC-19)** and **[D15-CONDITIONS C7] (WRC-23)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in [Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan], the frequency band 582-790 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-~~15~~23)

Note: With respect to the mobile, except aeronautical mobile, service, the list of countries in RR No. ***5.300*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.300*** *if included in RR No.* ***5.F15****.*

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~ 614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.7.1 For Method C, Alternative C7, Example 1 for Resolution [D15-CONDITIONS C7] (WRC-23)

ADD

DRAFT NEW RESOLUTION [D15-CONDITIONS C7-EXAMPLE 1] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in some countries in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59,

resolves

1 that, for countries listed in No. **5.F15**:

a) administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

b) that, interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz should be considered using appropriate mutually agreed criteria between coordinating administrations;

c) that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.3.7.2 For Method C, Alternative C7, Example 2 for Resolution [D15-CONDITIONS C7] (WRC-23)

ADD

DRAFT NEW RESOLUTION [D15-CONDITIONS C7-EXAMPLE 2] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in some countries in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

d) that it is necessary to adequately protect all primary services in the frequency band 614-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis including the broadcasting service;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

f) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile service, except aeronautical mobile, under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the ARNS in the countries mentioned in No. **5.312**, on the other,

resolves

1 that, for countries party to the GE06 Agreement, the use of stations of the mobile, except aeronautical mobile, service is subject to the successful application of the procedures of that Agreement;

2 that administrations planning to implement IMT in the frequency band 470-694 MHz shall effect coordination, as required, with all neighbouring administrations prior to implementation;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

3 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile, except aeronautical mobile, service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

4 that, when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in Recommendations ITU-R BT.1368 and ITU-R BT.2033;

5 that the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is limited to operation within national boundaries;

6 that administrations implementing the mobile, except aeronautical mobile, service in countries listed in No. **5.F15** shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312** based on the criteria contained in the Annex to this Resolution:

6.1 that stations of the mobile, except aeronautical mobile, service shall not claim protection nor cause harmful interference to the station of the ARNS operating in accordance with No. **5.312**;

7 that, with respect to adjacent channel interference within the frequency band 470-694 MHz:

7.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

7.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned);

8 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations operated in the frequency band 608-614 MHz at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference;

9 that administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **235 (WRC-15)**,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO DRAFT NEW RESOLUTION [D15-CONDITIONS C7-EXAMPLE 2] (WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 645-694 MHz with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. **9.21** by the mobile service with respect to the ARNS operating in countries mentioned in No. **5.312**, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

*Note: Technical conditions in the Annex are to be developed based on Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.*

1/1.5/5.3.8 For Method C, Alternative C8

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">470-694
BROADCASTING</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td>470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td>512-608
BROADCASTING
5.295 5.297</td><td>585-610</td></tr>
</table>

5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 5.312 ADD 5.H15 ADD 5.I15 MOD 5.317A	**608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	614-698 BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

ADD

5.H15 *Additional allocation:* in [list of countries], the frequency band 470-694 MHz is also allocated to the mobile service on a primary basis, subject to the provisions of Resolution **[E15-CONDITIONS C8] (WRC-23)**. (WRC-23)

MOD

5.300 *Additional allocation:* in [Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan], the frequency band 582-790 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-~~15~~23)

Note: With respect to the mobile, except aeronautical mobile, service, the list of countries in RR No. ***5.300*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.300*** *if included in RR No.* ***5.H15****.*

MOD

5.296 *Additional allocation:* in [Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe], the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

Note: The list of countries in RR No. ***5.296*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.296****, if included in RR No.* ***5.H15****.*

ADD

5.I15 In [list of countries removed by MOD No. **5.296**], the mobile service in the frequency band 470-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~470-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)**, ~~and~~ **749 (Rev.WRC-19)** and **[E15-CONDITIONS C8] (WRC-23)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~470-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.8.1 For Method C, Alternative C8, Example 1 for Resolution [E15-CONDITIONS C8] (WRC-23)

ADD

DRAFT NEW RESOLUTION [E15-CONDITIONS C8-EXAMPLE 1] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in some countries in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59,

resolves

1 that, for countries listed in No. **5.H15**:

a) administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

b) that, interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz should be considered using appropriate mutually agreed criteria between coordinating administrations;

c) that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.3.8.2 For Method C, Alternative C8, Example 2 for Resolution [E15-CONDITIONS C8] (WRC-23)

ADD

DRAFT NEW RESOLUTION [E15-CONDITIONS C8-EXAMPLE 2] (WRC-23)

Use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service in some countries in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

d) that it is necessary to adequately protect all primary services in the frequency band 614-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis including the broadcasting service;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

f) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the ARNS in the countries mentioned in No. **5.312**, on the other,

resolves

1 that, for countries party to the GE06 Agreement, the use of stations of the mobile, except aeronautical mobile, service is subject to the successful application of the procedures of that Agreement;

2 that administrations planning to implement IMT in the frequency band 470-694 MHz shall effect coordination, as required, with all neighbouring administrations prior to implementation;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

3 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile, except aeronautical mobile, service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

4 that, when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in Recommendations ITU-R BT.1368 and ITU-R BT.2033;

5 that the use of the frequency band 470-694 MHz by mobile, except aeronautical mobile, service is limited to operation within national boundaries;

6 that administrations implementing the mobile, except aeronautical mobile, service in countries listed in No. **5.H15** shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312** based on the criteria contained in the Annex to this Resolution;

6.1 that stations of the mobile, except aeronautical mobile, service shall not claim protection nor cause harmful interference to the station of the ARNS operating in accordance with No. **5.312**;

7 that, with respect to adjacent channel interference within the frequency band 470-694 MHz:

7.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

7.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned);

8 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations operated in the frequency band 608-614 MHz at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference;

9 that administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **235 (WRC-15)**,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO DRAFT NEW RESOLUTION [E15-CONDITIONS C8-EXAMPLE 2] (WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 645-694 MHz with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. **9.21** by the mobile service with respect to the ARNS operating in countries mentioned in No. **5.312**, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

*Note: Technical conditions in the Annex are to be developed based on Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.*

1/1.5/5.3.9 For Method C, Alternative C9

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">470-694
BROADCASTING</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td>470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td>512-608
BROADCASTING
5.295 5.297</td><td>585-610</td></tr>
</table>

	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 5.312 ADD 5.J15 ADD 5.K15 MOD 5.317A	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A MOD 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands ~~694~~614-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions **224 (Rev.WRC-~~19~~23)**, **760 (Rev.WRC-19)**, ~~and~~ **749 (Rev.WRC-19)** and **[F15-CONDITIONS C9] (WRC-23)**, where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-~~19~~23)

ADD

5.J15 *Additional allocation:* in [list of countries], the frequency band 614-694 MHz is also allocated to the mobile service on a primary basis, subject to the provisions of Resolution [**F15-CONDITIONS C9] (WRC-23)**. (WRC-23)

MOD

5.296 *Additional allocation:* in [Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe], the frequency band 470-~~694~~614 MHz and in [list of countries] the frequency band 614-694 MHz ~~is~~

are also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

Note: For the frequency band 614-694 MHz, the list of countries in RR No. ***5.296*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.296****, if included in RR No.* ***5.J15****. The text of RR No.* ***5.296*** *may then be adjusted accordingly.*

ADD

5.K15 In Region 1, [except in ...], the mobile service in the frequency band 614-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

MOD

5.300 *Additional allocation:* in [Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan], the frequency band ~~582-790~~694-790 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-~~15~~23)

Note: Countries in [list of countries] above and the band 694-790 MHz can be removed from secondary mobile allocation.

MOD

RESOLUTION 224 (REV.WRC-~~19~~23)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands ~~694~~ 614-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

…

1/1.5/5.3.9.1 For Method C, Alternative C9, Example 1 for Resolution [F15-CONDITIONS C9] (WRC-23)

ADD

DRAFT NEW RESOLUTION [F15-CONDITIONS C9-EXAMPLE 1] (WRC-23)

Use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service in some countries in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 614-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 614-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 614-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in some countries in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59,

resolves

1 that, for some countries in Region 1 [and the Islamic Republic of Iran]:

a) administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

b) that, interference between the mobile service and the broadcasting service in the frequency band 614-694 MHz should be considered using appropriate mutually agreed criteria between coordinating administrations;

c) that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.3.9.2 For Method C, Alternative C9, Example 2 for Resolution [F15-CONDITIONS C9] (WRC-23)

ADD

DRAFT NEW RESOLUTION [F15-CONDITIONS C9-EXAMPLE 2] (WRC-23)

Use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service in some countries in Region 1

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 614-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 614-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

d) that it is necessary to adequately protect all primary services in the frequency band 614-694 MHz and in adjacent frequency bands;

e) that, in many countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating within the frequency band 470-694 MHz,

recognizing

a) that, in Article **5**, the frequency band 614-694 MHz, or parts of that frequency band, is allocated to various services on a primary basis including the broadcasting service;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

f) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile service, except aeronautical mobile, under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the ARNS in the countries mentioned in No. **5.312**, on the other,

resolves

1 that, for countries party to the GE06 Agreement, the use of stations of the mobile, except aeronautical mobile, service is subject to the successful application of the procedures of that Agreement;

2 that administrations planning to implement IMT in the frequency band 614-694 MHz shall effect coordination, as required, with all neighbouring administrations prior to implementation;

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

3 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:

a) administrations which deploy stations in the mobile, except aeronautical mobile, service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 Plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

4 that, when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in Recommendations ITU-R BT.1368 and ITU-R BT.2033;

5 that the use of the frequency band 614-694 MHz by the mobile, except aeronautical mobile, service is limited to operation within national boundaries;

6 that administrations implementing the mobile, except aeronautical mobile, service in countries listed in No. **5.J15** shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312** based on the criteria contained in the Annex to this Resolution;

6.1 that stations of the mobile, except aeronautical mobile, service shall not claim protection nor cause harmful interference to the station of the ARNS operating in accordance with No. **5.312**;

7 that, with respect to adjacent channel interference within the frequency band 470-694 MHz:

7.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

7.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned);

8 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations operated in the frequency band 608-614 MHz at both national level and with neighbouring countries, where required, in order to protect the radio astronomy service from harmful interference;

9 that administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **235 (WRC-15)**,

invites administrations

to communicate on a bilateral basis in order to manage possible interference, as appropriate,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO DRAFT NEW RESOLUTION [F15-CONDITIONS C9-EXAMPLE 2] (WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 645-694 MHz with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. **9.21** by the mobile service with respect to the ARNS operating in countries mentioned in No. **5.312**, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

*Note: Technical conditions in the Annex are to be developed based on Resolutions **749 (Rev.WRC-19)** and **760 (Rev.WRC-19)**.*

1/1.5/5.4 For Method D: Primary allocation to the mobile, except aeronautical mobile, service within the band 470-694 MHz without IMT identification. Suppression of Resolution 235 (WRC-15)

1/1.5/5.4.1 For Method D, Alternative D1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 MOBILE except aeronautical mobile ADD 5.L15 MOD 5.296 BROADCASTING	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610**

5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312	**608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING MOD 5.300 5.312	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
	698-806 MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

ADD

5.L15 In Region 1, the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution **[G15-ALTERNATIVE D1] (WRC-23)**. (WRC-23)

MOD

5.296 ~~*Additional allocation:*~~ ~~i~~In Region 1, [except in ...], ~~Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe,~~ the mobile service in the frequency band 470-694 MHz ~~is also allocated on a secondary basis to the land mobile service, intended~~ can also be used for applications ancillary to broadcasting and programme-making. ~~Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote.~~ (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ services on a secondary basis. (WRC-~~15~~23)

ADD

DRAFT NEW RESOLUTION [G15-ALTERNATIVE D1] (WRC-23)

Provisions relating to the use of the frequency band 470-694 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in most countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating, and will continue to operate, in the frequency band 470-694 MHz or in parts of that frequency band and are expected to continue such operations, but that the availability of frequencies for these applications will be affected by the implementation of other applications of the mobile service;

f) that WRC-23 additionally allocated the frequency band 608-614 MHz in Region 1, except the African Broadcasting Area (see Nos. **5.10** to **5.13**), to the radio astronomy service (RAS) on a primary basis; without imposing additional coordination constraints nor claiming protection from the existing broadcasting services,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated, and is used on a primary basis, for various services;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues, either on a temporary basis for short-term events or permanent installations in fixed locations such as studios and theatres, and provide the applications needed for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that for coordination of applications not covered by the GE06 Regional Agreement, relevant protection ratios are to be found in the latest revisions of relevant Recommendations of ITU-R,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that SAB/SAP cannot coexist with other applications of the mobile service without sufficient frequency and/or geographical separation;

d) that the GE06 Agreement contains provisions to protect RAS operations from broadcasting services;

e) that sharing and compatibility studies between the RAS and mobile applications show that appropriate provisions for coexistence will be required in order to protect RAS operations,

resolves

1 that, for Region 1 [and the Islamic Republic of Iran], administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

2 that, with respect to interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz, such cases should be considered using appropriate mutually agreed criteria between coordinating administrations or through appropriate application of criteria made directly available through the relevant ITU-R Recommendations (such as the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033, as well as ITU-R M.2090 when sharing with the broadcasting service is concerned), as appropriate;

3 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the RAS from harmful interference,

invites the ITU Radiocommunication Sector

to continue to pursue studies on the implementation of SAB/SAP on the basis of Resolution ITU-R 59,

invites administrations

1 to communicate on a bilateral basis in order to manage possible interference, including cumulative interference, as appropriate;

2 to make available a sufficient part of the band 470-694 MHz for the use of SAB/SAP, according to national needs,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

1/1.5/5.4.2 For Method D, Alternative D2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="6">470-694
MOBILE except aeronautical mobile
BROADCASTING

5.149 5.291A 5.294 ~~5.296~~
MOD 5.300 5.304 5.306 5.312</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td rowspan="2">512-608
BROADCASTING
5.295 5.297</td></tr>
<tr><td rowspan="2">585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td></tr>
<tr><td rowspan="2">608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td></tr>
<tr><td rowspan="5">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A
BROADCASTING</td></tr>
<tr><td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td></tr>
<tr><td rowspan="2">694-790
MOBILE except aeronautical mobile 5.312A 5.317A
BROADCASTING
MOD 5.300 5.312</td></tr>
<tr><td rowspan="2">698-806
MOBILE 5.317A
BROADCASTING
Fixed

5.293 5.309</td></tr>
<tr><td></td></tr>
</table>

SUP

5.296

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ services on a secondary basis. (WRC-~~15~~23)

1/1.5/5.4.3 For Method D, Alternative D3

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td rowspan="6">470-694
BROADCASTING

5.149 5.291A 5.294 MOD 5.296 MOD 5.300 5.304 5.306 5.312 ADD 5.M15 ADD 5.N15</td>
<td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td>
<td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td>
</tr>
<tr>
<td rowspan="2">512-608
BROADCASTING
5.295 5.297</td>
</tr>
<tr>
<td rowspan="2">585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td>
</tr>
<tr>
<td rowspan="2">608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td>
</tr>
<tr>
<td rowspan="5">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A
BROADCASTING</td>
</tr>
<tr>
<td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td>
</tr>
<tr>
<td rowspan="2">694-790
MOBILE except aeronautical mobile 5.312A 5.317A
BROADCASTING
MOD 5.300 5.312</td>
</tr>
<tr>
<td rowspan="2">698-806
MOBILE 5.317A
BROADCASTING
Fixed

5.293 5.309</td>
</tr>
<tr>
<td></td>
</tr>
</table>

1/1.5/5.4.3.1 For Method D, Alternative D3, Example 1 for new footnote RR No. 5.M15

ADD

5.M15-Ex1*Additional allocation:* in [list of countries], the frequency band 470-694 MHz is also allocated to the mobile, except aeronautical mobile, service on a primary basis subject to the provisions of Resolution **[H15-ALTERNATIVE D3] (WRC-23)**. (WRC-23)

1/1.5/5.4.3.2 For Method D, Alternative D3, Example 2 for new footnote RR No. 5.M15

ADD

5.M15-Ex2*Additional allocation:* in [list of countries], the frequency band 470-694 MHz is also allocated to the mobile, except aeronautical mobile, service on a primary basis subject to the provisions of Resolution **[H15-ALTERNATIVE D3] (WRC-23)**. The stations of the mobile, except aeronautical mobile, service in the countries listed in this footnote shall not cause harmful interference to, nor claim protection from, existing or planned stations of the broadcasting service in countries other than those listed in this footnote. (WRC-23)

1/1.5/5.4.3.3 For Method D, Alternative D3, other regulatory and procedural considerations

MOD

5.296 *Additional allocation:* in [Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe], the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

Note: The list of countries in RR No. ***5.296*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.296****, if included in RR No.* ***5.M15****.*

ADD

5.N15 In [list of countries removed by MOD No. **5.296**], the mobile service in the frequency band 470-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

MOD

5.300 *Additional allocation:* in [Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan], the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ services on a secondary basis. (WRC-~~15~~23)

*Note: With respect to the mobile, except aeronautical mobile, service, the list of countries in RR No. **5.300** should be aligned in order for a country not to appear in footnote RR No. **5.300** if included in RR No. **5.M15**.*

ADD

DRAFT NEW RESOLUTION [H15-ALTERNATIVE D3] (WRC-23)

Provisions relating to the use of the frequency band 470-694 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in most countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating, and will continue to operate, in the frequency band 470-694 MHz or in parts of that frequency band and are expected to continue such operations, but that the availability of frequencies for these applications will be affected by the implementation of other applications of the mobile service;

f) that WRC-23 additionally allocated the frequency band 608-614 MHz in Region 1, except the African Broadcasting Area (see Nos. **5.10** to **5.13**), to the radio astronomy service (RAS) on a primary basis; without imposing additional coordination constraints nor claiming protection from the existing broadcasting services,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated, and is used on a primary basis, for various services;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues, either on a temporary basis for short-term events or permanent installations in fixed locations such as studios and theatres, and provide the applications needed for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that for coordination of applications not covered by the GE06 Regional Agreement, relevant protection ratios are to be found in the latest revisions of relevant Recommendations of ITU-R,

noting

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile service, except aeronautical mobile, under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) that SAB/SAP cannot coexist with other applications of the mobile service without sufficient frequency and/or geographical separation;

d) that the GE06 Agreement contains provisions to protect RAS operations from the broadcasting service;

e) that sharing and compatibility studies between the radio astronomy service and mobile applications show that appropriate provisions for coexistence will be required in order to protect RAS operations,

resolves

1 that, for Region 1 [and the Islamic Republic of Iran], administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

2 that, with respect to interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz, such cases should be considered using appropriate mutually agreed criteria between coordinating administrations or through appropriate application of criteria made directly available through the relevant ITU-R Recommendations (such as the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033, as well as ITU-R M.2090 when sharing with the broadcasting service is concerned), as appropriate;

3 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the RAS from harmful interference,

invites the ITU Radiocommunication Sector

to continue to pursue studies on the implementation of SAB/SAP on the basis of Resolution ITU-R 59,

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

invites administrations

1 to communicate on a bilateral basis in order to manage possible interference, including cumulative interference, as appropriate;

2 to make available a sufficient part of the band 470-694 MHz for the use of SAB/SAP, according to national needs,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

1/1.5/5.4.4 For Method D, Alternative D4

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="6">470-694
MOBILE except aeronautical mobile ADD 5.O15 MOD 5.296
BROADCASTING

5.149 5.291A 5.294 ~~5.296~~ MOD 5.300 5.304 5.306 5.312</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td rowspan="2">512-608
BROADCASTING
5.295 5.297</td></tr>
<tr><td rowspan="2">585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td></tr>
<tr><td rowspan="2">608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td></tr>
<tr><td rowspan="3">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A
BROADCASTING</td></tr>
<tr><td rowspan="2">614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td></tr>
<tr><td></td></tr>
</table>

694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING MOD 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed	
	5.293 5.309	

ADD

5.O15 In Region 1, the use of the frequency band 470-694 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution [I**15-ALTERNATIVE D4] (WRC-23)**. This allocation will enter into force on [1 January 2031]. (WRC-23)

MOD

5.296 ~~*Additional allocation:* i~~In Region 1, [except in ...],~~Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe,~~ the mobile service in the frequency band 470-694 MHz ~~is also allocated on a secondary basis to the land mobile service, intended for~~can also be used by applications ancillary to broadcasting and programme-making.~~ Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote.~~ (WRC-~~19~~23)

MOD

5.300 *Additional allocation:* in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed ~~and mobile, except aeronautical mobile,~~ service~~s~~ on a secondary basis. (WRC-~~15~~23)

ADD

DRAFT NEW RESOLUTION [I15-ALTERNATIVE D4] (WRC-23)

Provisions relating to the use of the frequency band 470-694 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the favourable propagation characteristics of the frequency band 470-694 MHz are beneficial in providing cost-effective solutions for coverage;

b) that the ITU Radiocommunication Sector (ITU-R) carried out a review, in accordance with Resolution **235 (WRC-15)**, of the spectrum use of the frequency band 470-960 MHz;

c) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis;

d) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

e) that, in most countries, applications ancillary to broadcasting and programme-making (SAB/SAP) are operating, and will continue to operate, in the frequency band 470-694 MHz or in parts of that frequency band and are expected to continue such operations, but that the availability of frequencies for these applications will be affected by the implementation of other applications of the mobile service;

f) that WRC-23 additionally allocated the frequency band 608-614 MHz in Region 1, except the African Broadcasting Area (see Nos. **5.10** to **5.13**), to the radio astronomy service (RAS) on a primary basis; without imposing additional coordination constraints nor claiming protection from the existing broadcasting services,

recognizing

a) that, in Article **5**, the frequency band 470-694 MHz, or parts of that frequency band, is allocated, and is used on a primary basis, for various services;

b) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;

c) that interference generated in one country in this band in Region 1, and affecting a neighbouring country, needs to be considered using the procedures laid down in the GE06 Agreement;

d) that deployments of SAB/SAP are generally planned and coordinated in known locations and venues, either on a temporary basis for short-term events or permanent installations in fixed locations such as studios and theatres, and provide the applications needed for daily content production for the broadcasting service as well as other cultural and social uses in the frequency band 470-694 MHz;

e) that for coordination of applications not covered by the GE06 Regional Agreement, relevant protection ratios are to be found in the latest revisions of relevant Recommendations of ITU-R, *noting*

a) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile, except aeronautical mobile, service under the conditions set out in § 5.1.3 of the GE06 Agreement;

b) that ITU-R is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)[1] in accordance with Resolution ITU-R 59;

c) That SAB/SAP cannot coexist with other applications of the mobile service without sufficient frequency and/or geographical separation;

d) that the GE06 Agreement contains provisions to protect RAS operations from the broadcasting service;

e) that sharing and compatibility studies between the radio astronomy service and mobile applications show that appropriate provisions for coexistence will be required in order to protect RAS operations,

resolves

1 that, for Region 1 [and the Islamic Republic of Iran], administrations are invited to take into account, *inter alia*, the results of the relevant sharing studies conducted by ITU-R;

2 that, with respect to interference between the mobile service and the broadcasting service in the frequency band 470-694 MHz, such cases should be considered using appropriate mutually agreed criteria between coordinating administrations or through appropriate application of criteria made directly available through the relevant ITU-R Recommendations (such as the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033, as well as ITU-R M.2090 when sharing with the broadcasting service is concerned), as appropriate;

3 that administrations should take all reasonable steps to establish the appropriate required separation distances between mobile stations and radio astronomy stations at both national level and with neighbouring countries, where required, in order to protect the RAS from harmful interference,

invites the ITU Radiocommunication Sector

to continue to pursue studies on the implementation of SAB/SAP on the basis of Resolution ITU-R 59,

invites administrations

1 to communicate on a bilateral basis in order to manage possible interference, including cumulative interference, as appropriate;

2 to make available a sufficient part of the band 470-694 MHz for the use of SAB/SAP, according to national needs,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

---

[1] ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

1/1.5/5.5 For Method E: Primary allocation to the mobile, except aeronautical mobile, service of the band 470-694 MHz in Region 1 with technical condition limiting mobile operations to downlink in this band. Suppression of Resolution 235 (WRC-15)

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr>
<td rowspan="4">470-694
<u>MOBILE except aeronautical mobile ADD 5.P15</u>
BROADCASTING
5.149 5.291A 5.294 <s>5.296</s>
<u>MOD</u> 5.300 5.304 5.306 5.312</td>
<td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td>
<td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING
5.291 5.298</td>
</tr>
<tr>
<td>512-608
BROADCASTING
5.295 5.297</td>
</tr>
<tr>
<td>608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td>
<td>585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td>
</tr>
<tr>
<td>614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td>
<td rowspan="3">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A
BROADCASTING</td>
</tr>
<tr>
<td>694-790
MOBILE except aeronautical mobile 5.312A 5.317A
BROADCASTING
<u>MOD</u> 5.300 5.312</td>
<td rowspan="2">698-806
MOBILE 5.317A
BROADCASTING
Fixed
5.293 5.309</td>
</tr>
<tr>
<td></td>
</tr>
</table>

ADD

5.P15 The allocation of the mobile service is limited to transmissions from base stations to mobile stations and to applications ancillary to broadcasting and programme-making, subject to the provisions of Resolution **[J15-METHOD E] (WRC-23)**. (WRC-23)

*Note: Resolution **[J15-METHOD E] (WRC-23)** is to be developed.*

SUP

5.296

1/1.5/5.6 Method F: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1

1/1.5/5.6.1 Alternative F1: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 BROADCASTING Mobile except aeronautical mobile MOD 5.296 5.149 5.291A 5.294 ~~5.296~~ 5.300 5.304 5.306 5.312	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295 **512-608** BROADCASTING 5.295 5.297 **608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space) **614-698** BROADCASTING	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298 **585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307 **610-890** FIXED MOBILE 5.296A 5.313A 5.317A

694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING 5.300 5.312	Fixed Mobile 5.293 5.308 5.308A 5.309	BROADCASTING
	698-806 MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.296 ~~*Additional allocation:* in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote~~In Region 1, [except in ...], applications ancillary to broadcasting and programme-making use the frequency band 470-694 MHz under the land mobile service. (WRC-~~19~~23)

MOD

RESOLUTION 235 (REV.WRC-~~15~~23)

Examination of a possible upgrade of the secondary allocation to the mobile service to a primary allocation in ~~Review of the spectrum use of~~ the frequency band 470-~~960~~ 694 MHz in Region 1

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

considering

a) that the favourable propagation characteristics in the frequency bands below 1 GHz are beneficial in providing cost-effective solutions for coverage;

b) that there is a need to continually take advantage of technological developments in order to increase the efficient use of the spectrum and facilitate spectrum access;

c) that the frequency band 470-~~862~~ 694 MHz is ~~a~~part of the harmonized band used to provide terrestrial television broadcasting services worldwide~~on a worldwide scale~~;

d) that, in many countries, there is a sovereign national obligation on the provision of ~~to provide~~ broadcasting services;

e) that terrestrial broadcasting networks have a long life cycle~~,~~ and a stable regulatory environment is necessary to provide protection of investment and future development;

f) that, in many countries, there is still a need ~~for investment in the next decade~~ for the migration of broadcasting into the frequency band below 694 MHz and for the implementation of new-generation broadcasting technologies, in order to take advantage of technological developments to increase the efficient use of the spectrum;

g) that in many developing countries terrestrial broadcasting is the only viable means of delivery of broadcast services;

h) that the technology trend in digital terrestrial television broadcasting (DTTB) is towards high-definition and ultra-high definition television which require~~s~~ a higher bit rate than standard-definition television;

i) that the LTE-based 5G terrestrial broadcast system is an emerging technology;

~~*i)* that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;~~

j) that WRC-23 allocated the frequency band 470-694 MHz in Region 1 to the mobile, except aeronautical mobile, service on a secondary basis;

~~*j)* that International Mobile Telecommunications (IMT) systems, utilizing some parts of the frequency band 694/698-960 MHz, are intended to provide telecommunication services on a worldwide scale, regardless of location, network or terminal used;~~

k) that~~, for countries listed in~~ No. **5.296**~~, an additional allocation to the land mobile service on a secondary basis is in place,~~ indicates the use of the frequency band 470-694 MHz ~~intended for~~ by applications ancillary to broadcasting and programme-making;

l) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

m) that, in some countries, parts of the frequency band are also allocated to the radiolocation service on a secondary basis, limited to the operation of wind profiler radars (No. **5.291A**);~~, and also to the radio astronomy service on a secondary basis (No. **5.306**), and, according to No. **5.149**, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to stations of other services,~~

n) that, in the African Broadcasting Area (see Nos. **5.10** to **5.13**), the frequency band 606-614 MHz is allocated to the radio astronomy service on a primary basis (No. **5.304**), that in the rest of Region 1 the frequency band 608-614 MHz is allocated to the radio astronomy service on a secondary basis (No. **5.306**), and, according to No. **5.149**, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to stations of other services,

recognizing

a) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in Iran (Islamic Republic of), in particular for the frequency band 470-862 MHz, which includes 470-694 MHz;

b) that the GE06 Agreement contains provisions for the terrestrial broadcasting service and other primary terrestrial services, a Plan for digital television and a list of stations of other primary terrestrial services;

c) that a digital entry in the GE06 Plan may also be used for transmissions in a service other than the broadcasting service under the conditions set out in § 5.1.3 of the GE06 Agreement and the provisions of No. **4.4** of the Radio Regulations;

d) that the sharing and compatibility studies carried out for the preparation of WRC-23 agenda item 1.5 do not need to be updated for applications already considered, except in cases of significantly changed technical characteristics~~information on implementation of the digital dividend and on the transition to digital television and its technological evolution is needed and may not be available before 2019,~~;

e) that there may be some changes over the coming years in the spectrum use and needs for broadcasting and mobile services,

noting

a) the ongoing development of new applications and technologies of both the broadcasting and mobile services;~~,~~

b) the studies regarding spectrum use and needs of the broadcasting and mobile services in the frequency band 470-694 MHz carried out for the preparation of WRC-23 agenda item 1.5;

c) the studies on sharing and compatibility between the broadcasting and mobile services in the frequency band 470-694 MHz carried out for the preparation of WRC-23 agenda item 1.5,

resolves to invite ITU-R, after the ~~2019~~2027 World Radiocommunication Conference and in time for the ~~2023~~2031 World Radiocommunication Conference

1 to review ~~the~~ spectrum use and needs of broadcasting and mobile services, including applications covered by No. **5.296**, in the frequency band 470-694 MHz ~~study the spectrum needs of existing services within the frequency band 470-960 MHz~~ in Region 1~~, in particular the spectrum requirements of the broadcasting and mobile, except aeronautical mobile, services, taking into account the relevant ITU Radiocommunication Sector (ITU-R) studies, Recommendations and Reports~~;

2 to identify the cases where significantly changed technical characteristics of mobile and broadcasting applications would result in a need to ~~carry out~~update the sharing and compatibility studies~~, as appropriate,~~ in the frequency band 470-694 MHz in Region 1 between the ~~broadcasting and~~ mobile, except aeronautical mobile, service~~s,~~ and other existing services that were already carried out in preparation for WRC-23~~taking into account relevant ITU-R studies, Recommendations and Reports~~;

3 on the basis of *resolves* 2 above, to further develop existing sharing and compatibility studies and to determine the technical and regulatory conditions in order to provide adequate protection of systems of other existing primary and secondary services,

~~3 to conduct sharing and compatibility studies, as appropriate, in order to provide relevant protection of systems of other existing services,~~

invites administrations

to participate actively in the studies by submitting contributions to ITU-R, *resolves to invite the ~~2023~~2031 World Radiocommunication Conference*

to consider, based on the results of ITU-R studies~~ above~~, ~~provided that these studies are completed and approved by ITU-R, ~~a possible upgrade of the secondary allocation of the mobile, except aeronautical mobile, service, to primary allocation~~possible regulatory actions~~ in the frequency band 470-694 MHz in Region 1,~~ as appropriate,~~

further invites ITU-R

to ensure intersectoral collaboration with the ITU Telecommunication Development Sector (ITU-D) in the implementation of this Resolution.

1/1.5/5.6.2 Alternative F2: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in Region 1 with coordination and commitment

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 BROADCASTING Mobile except aeronautical mobile ADD 5.Q15 MOD 5.296 5.149 5.291A 5.294 ~~5.296~~ 5.300 5.304 5.306 5.312	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295 **512-608** BROADCASTING 5.295 5.297 **608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space) **614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298 **585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307 **610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING

694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING 5.300 5.312	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

ADD

5.Q15 In Region 1, [except in], the frequency band 470-694 MHz is allocated to the mobile, except aeronautical mobile, service on a secondary basis. The mobile service shall not cause unacceptable interference to nor claim protection from the existing primary services with the application of the agreement obtained under No. **9.21** with neighbouring and concerned countries and a commitment at the time of notification undertaking that in case unacceptable interference is caused, the notifying administration of such secondary allocation shall immediately reduce the interference to the acceptable level or cease the emission. (WRC-23)

MOD

5.296 ~~*Additional allocation:* in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote~~In Region 1, [except in ...], applications ancillary to broadcasting and programme-making use the frequency band 470-694 MHz under the mobile, except aeronautical mobile, service. (WRC-~~19~~23)

1/1.5/5.6.3 Alternative F3: Secondary allocation to the mobile, except aeronautical mobile, service in the band 470-694 MHz in some countries in Region 1 with suppression of Resolution 235 (WRC-15)

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-694 BROADCASTING 5.149 5.291A 5.294 MOD 5.296 5.300 5.304 5.306 5.312 ADD 5.M15 ADD 5.N15	**470-512** BROADCASTING Fixed Mobile 5.292 5.293 5.295	**470-585** FIXED MOBILE 5.296A BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.295 5.297	**585-610** FIXED MOBILE 5.296A BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING 5.300 5.312	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	
	698-806 MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	

MOD

5.296 *Additional allocation:* in [Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe], the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-~~19~~23)

ADD

5.M15 *Additional allocation:* in [list of countries], the frequency band 470-694 MHz is also allocated to the mobile, except aeronautical mobile, service on a secondary basis. (WRC-23)

Note: The list of countries in RR No. ***5.296*** *should be aligned in order for a country not to appear in footnote RR No.* ***5.296****, if included in RR No.* ***5.M15****.*

ADD

5.N15 *Additional allocation:* in [list of countries removed by MOD No. **5.296**], the mobile service in the frequency band 470-694 MHz can also be used for applications ancillary to broadcasting and programme-making. (WRC-23)

SUP

RESOLUTION 235 (WRC-15)

Review of the spectrum use of the frequency band 470-960 MHz in Region 1

1/1.5/5.7 For Method G: Considerations of the radio astronomy service

The example below is given for the case of implementation of Method G together with Method B, Alternative B3. This example could be adapted to other relevant methods/alternatives.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

460-890 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="4">470-694
MOBILE
BROADCASTING

5.149 5.291A 5.294 5.296
MOD 5.300 MOD 5.304
MOD 5.306 5.312</td><td>470-512
BROADCASTING
Fixed
Mobile
5.292 5.293 5.295</td><td rowspan="2">470-585
FIXED
MOBILE 5.296A
BROADCASTING

5.291 5.298</td></tr>
<tr><td>512-608
BROADCASTING
5.295 5.297</td></tr>
<tr><td>608-614
RADIO ASTRONOMY
Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)</td><td>585-610
FIXED
MOBILE 5.296A
BROADCASTING
RADIONAVIGATION
5.149 5.305 5.306 5.307</td></tr>
<tr><td>614-698
BROADCASTING
Fixed
Mobile
5.293 5.308 5.308A 5.309</td><td rowspan="3">610-890
FIXED
MOBILE 5.296A 5.313A 5.317A
BROADCASTING</td></tr>
<tr><td>694-790
MOBILE except aeronautical mobile 5.312A 5.317A
BROADCASTING
MOD 5.300 5.312</td><td rowspan="2">698-806
MOBILE 5.317A
BROADCASTING
Fixed

5.293 5.309</td></tr>
<tr><td></td></tr>
</table>

MOD

5.304 *Additional allocation:* in the African Broadcasting Area (see Nos. **5.10** to **5.13**), the band 606-614 MHz is also allocated to the radio astronomy service on a primary basis. In [list of countries], the band 608-614 MHz is also allocated to the radio astronomy service on a primary basis and the radio astronomy service shall not claim protection from the broadcasting service. (WRC-23)

MOD

5.306 *Additional allocation:* in Region 1, except in the African Broadcasting Area (see Nos. **5.10** to **5.13**) and the countries listed in No. **5.304**, and in Region 3, the band 608-614 MHz is also allocated to the radio astronomy service on a secondary basis. (WRC-23)

1/1.5/5.8 For all methods except Methods A2 and F1: Suppression of Resolution 235 (WRC-15)

SUP

RESOLUTION 235 (WRC-15)

Review of the spectrum use of the frequency band 470-960 MHz in Region 1

CHAPTER 2

Aeronautical and maritime issues

(Agenda items 1.6, 1.7, 1.8, 1.9, 1.10, 1.11)

CONTENTS

Agenda item 1.6

*1.6 to consider, in accordance with Resolution **772 (WRC-19)**, regulatory provisions to facilitate radiocommunications for sub-orbital vehicles;*

Resolution **772 (WRC-19)** – *Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles.*

NOTES: A key issue under this agenda item is whether this "sub-orbital" should be treated as a terrestrial or space service due to the fact that the regulatory procedure for each of these two are different in nature and in application. Moreover, if it is defined as "space service", then it is also necessary to indicate the consequence of being referred to as "space-to-space" which may result in some confusion between inter-satellite.

This is an important element in dealing with this agenda item, in particular, when the protection of incumbent services is considered the above ambiguity would have serious consequences on the protection of the incumbent services.

The view was raised that Method B with its different Approaches / Alternatives are not to be considered at this stage unless all problems, difficulties, inconsistencies and ambiguities are properly addressed and fully responded.

2/1.6/1 Executive summary

The ITU-R was invited to study the spectrum needs for stations on board sub-orbital vehicles, appropriate modification, if any, to the Radio Regulations (RR), excluding any new allocations or changes to the existing allocations in RR Article **5** to accommodate stations on board sub-orbital vehicles of which one objective is to facilitate radiocommunications that support aviation to safely integrate sub-orbital vehicles into airspace and ensure interoperability with international civil aviation. Three methods are proposed to address this agenda item:

Method A

No change to the Radio Regulations (RR).

Method B

A new World Radiocommunication Conference (WRC) Resolution containing the provisions to operate radiocommunications for sub-orbital vehicles without any change to RR Article **5**.

There are four alternative approaches to this method.

Method C

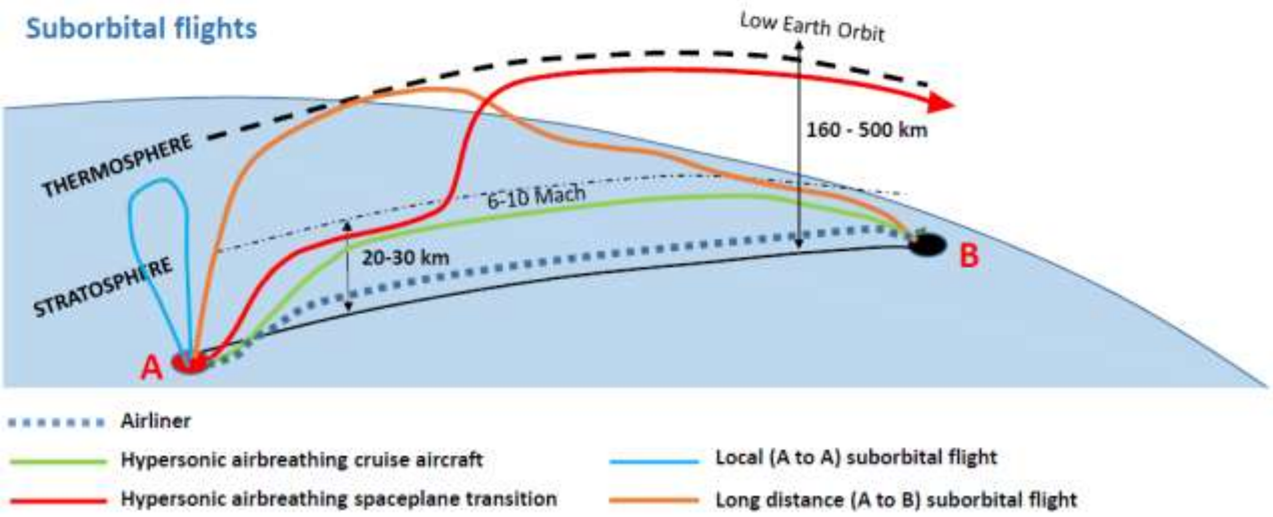
Revision of Resolution **772 (WRC-19)** in order to clarify the list of necessary studies and to extend their duration. In the past study period, no studies according to Resolution **772 (WRC-19)** in *resolves* 2 part concerning compatibility studies, and sharing conditions for transmitting and receiving stations of sub-orbital vehicles during sub-orbital flights were not conducted and the results were not provided. Therefore any decision cannot be taken. Method C provides revision to Resolution **772 (WRC-19)** in order to clarify the list of possible interference scenarios, including scenarios for the use of ground/earth stations on board a sub-orbital vehicle in the part of the flight path in outer space.

2/1.6/2 Background

In Report ITU-R M.2477, in preparation of WRC-19, as contained in *recognizing b)* of Resolution **772 (WRC-19)**, sub-orbital flight is described as "The intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur in space without completing a full orbit around the Earth before returning back to the surface of the Earth." A sub-orbital vehicle is described as "a vehicle executing sub-orbital flight" (see Figure 2/1.6-1 below).

FIGURE 2/1.6-1

Examples of the operational concepts of a sub-orbital flight



Sub-orbital vehicles are to be safely integrated into the airspace used by conventional aircraft and minimize disruption during the transition to and from controlled airspace.

In addition, sub-orbital vehicles are intended to operate at higher altitudes and at higher speed than conventional aircraft during short periods of time without permanently entering an orbit as defined in RR No. **1.184**.

2/1.6/3 Summary and analysis of the results of ITU-R studies

Summary of ITU-R studies during WRC-19 study cycle

Report ITU-R M.2477 states that some sub-orbital vehicle operations may require temporarily making unavailable large areas of international and national airspace for conventional aircraft during their transition to and from space. This results in airspace disruptions, extra travel time, re-routing flight paths, additional aircraft fuel consumption, etc. The studies also show the technical capability of some current aircraft avionics systems to be operated on board sub-orbital vehicles, to facilitate the safe integration of sub-orbital vehicles into the same airspace as conventional aircraft during their transition to and from space to minimize the airspace disruption.

The Report also identifies several existing radiocommunication services that are envisaged for use by stations on board sub-orbital vehicles including, but not limited to:

a) Aeronautical radionavigation service for surveillance and navigation;

b) Aeronautical mobile service, including the aeronautical mobile (Route) service, for VHF voice and data communications and automatic dependent surveillance-broadcast (ADS-B);

c) Aeronautical mobile-satellite service, including the aeronautical mobile-satellite (Route) service (AMS(R)S), for voice and data communications and surveillance ADS-B and automatic dependent surveillance - contract;

d) Mobile-satellite service, including AMS(R)S, for communications and telemetry, tracking and command (TT&C) applications;

e) Aeronautical radiodetermination service (not a specifically defined service in the RR) for surveillance;

f) Radionavigation-satellite service (RNSS) for navigation with global navigation satellite systems operating in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz, and;

g) Space operation service for TT&C.

Summary of ITU-R studies during WRC-23 study cycle

Radio stations operating on board sub-orbital vehicles are expected to operate in frequency bands currently allocated for certain terrestrial and space radiocommunications services, and shall not change the interference environment with existing applications of the same service and other radiocommunication services in-band and in adjacent frequency bands.

There is no intention to define a new category of station in the RR, and hence the station on board a sub-orbital vehicle would have to conform to the definitions of *terrestrial stations* in RR No. **1.62**, *earth stations* in RR No. **1.63**, and *space stations* in RR No. **1.64**.

As the sub-orbital vehicle may be physically located within the major portion of the Earth's atmosphere and for a brief period of time beyond a major portion of the Earth's atmosphere the definitions could lead to an inconsistency in the application of the regulations for the stations on the sub-orbital vehicle which intend to operate as terrestrial and/or earth stations, in case of a period of time in space, since the terrestrial and earth stations would have to remain in the major part of the Earth's atmosphere to comply with these definitions.

One view from the study is to consider that RR No. **1.64** is the baseline for the classification of a station on board sub-orbital vehicle expecting to reach space. The view considers that in accordance with the definition of RR No. **1.64**, the classification of the stations on board a sub-orbital vehicle has to be "*space stations*" when the operation "is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere". These stations need to use the appropriate space service allocation. However, the relevant space service allocation or directions of the space services to be used for sub-orbital vehicles do not always exist in the current Table of Frequency Allocations. In this case, completing the Table of Frequency Allocations with relevant space services or with relevant direction of the appropriate space services would be a solution. However, the *resolves* 2 of Resolution **772 (WRC-19)** states "excluding any new allocations or changes to the existing allocations in Article **5**". Consequently, an earth station or a terrestrial station on board sub-orbital vehicle operating beyond the major portion of the atmosphere could then only be used under RR No. **4.4**. Recognizing that the application of RR No. **4.4** is not sufficient for earth stations or terrestrial stations intending to ensure safe operation when in space, the radiocommunications requiring to apply RR No. **4.10** for aeronautical application would then have to remain in the same service in which the terrestrial station or earth station are classified similarly as for conventional aircraft. Then this view avoids to explicitly state that terrestrial stations and earth stations would operate in space and instead to use the flexibility offered by the lack of clear delimitation between atmosphere and space. But this flexibility could only be considered for the terrestrial stations and/or earth stations required to safely accommodate or integrate a sub-orbital vehicle in airspace where air traffic services are provided, has to be decided by the competent aviation authority of the Member State(s); the responsible Member State(s) are defined accordingly with the Convention on

International Civil Aviation and its annexes. It is also proposed to invite the Director of the BR to report to a subsequent WRC in case of difficulty in the implementation of the Resolution.

Another view is to consider the classification of stations in the context of all RR Article **1** definitions in that the sub-orbital vehicle terrestrial and earth stations retains the status of terrestrial station or earth station during the whole flight when the purpose of the radiocommunications does not change. A *terrestrial station* is defined as "a station effecting *terrestrial radiocommunication*", and *terrestrial radiocommunication* (RR No. **1.7**) is defined as "any radiocommunication other than *space radiocommunication* or *radio astronomy*". As per RR No. **1.61**, each station shall be classified by the service in which it operates permanently or temporarily. While the sub-orbital vehicle is physically located beyond the Earth's atmosphere for a brief period of time, the physical location of the sub-orbital vehicle on which the stations are located does not change the need for, or purpose of the use of, specific radiocommunication applications.

2/1.6/4 Methods to satisfy the agenda item

2/1.6/4.1 Method A: No change (NOC)

No new regulatory provisions are required. This method proposes to suppress Resolution **772 (WRC-19)**. See also inconsistencies and difficulties mentioned in various parts of the draft document.

2/1.6/4.2 Method B: A new WRC Resolution containing the provisions to operate radiocommunications for sub-orbital vehicles

There are four alternative approaches to this method. All four approaches propose to suppress Resolution **772 (WRC-19)**.

2/1.6/4.2.1 Method B, Approach A

The approach consists of a new Resolution:

- providing a perimeter for the stations on board sub-orbital vehicles;
- listing minimum required frequency bands to safely operate sub-orbital vehicles operated for aeronautical purposes defining the conditions under which the terrestrial and earth stations on board sub-orbital vehicles are allowed to operate in the same service under which these stations are classified;
- avoiding adversely affecting other systems and other services;
- inviting the Director of the BR to report to a future WRC in case of difficulties in the implementation of the Resolution.

No changes to the Articles of the Radio Regulations are proposed.

2/1.6/4.2.2 Method B, Approach B

The approach consists of a new WRC Resolution:

- referring to Report ITU-R M.2477 for description of sub-orbital flight and of sub-orbital vehicle;
- requiring frequencies to be used by sub-orbital vehicles in accordance with their regulatory status as either terrestrial or earth stations throughout all phases of flight.

No changes to the Articles of the Radio Regulations, other than the new WRC Resolution.

2/1.6/4.2.3 Method B, Approach C

Approach C consists of a new Resolution, and no changes to the Articles of the Radio Regulations.

The proposed new WRC-23 Resolution is based on the following elements:

– A definition of stations on a sub-orbital vehicle which includes operation when in space and includes space launch vehicles.

– The identification of the specific services in which sub-orbital vehicles may operate (AM(R)S, MSS, RNSS, and potentially others) and to clarify that stations on sub-orbital vehicles may operate as aircraft stations or earth stations in those services, for all parts of a flight.

– The requirement that the operation of stations on sub-orbital vehicles in the above services is under the same conditions as those for conventional stations.

– The exclusion of systems in the space operation service from the scope of the Resolution.

2/1.6/4.2.4 Method B, Approach D

Approach D consists of a new Resolution, which is based on the following elements:

– Definition or description of sub-orbital flight and sub-orbital vehicle.

– The identification of the specific services in which sub-orbital vehicles may operate (AM(R)S, MSS, RNSS and potentially others) and to clarify that stations on board sub-orbital vehicles may operate as terrestrial/aircraft stations or earth stations in those services. RR No. **4.4** shall be applied when the above services are used by stations on board sub-orbital vehicles beyond the major portion of the atmosphere.

– The requirement that the operation of stations on sub-orbital vehicles in the above services is under the same conditions as those for conventional stations.

– The sub-orbital vehicles shall ensure that it does not affect the existing civil aviation and space launch systems, and not impose any additional constraint on other services or applications operated in the same service.

Note: If the application of RR No. **4.4** is not sufficient for earth stations or terrestrial stations when operation beyond the major portion of the atmosphere, the additional studies should be undertaken under a possible new agenda item for WRC-27.

2/1.6/4.3 Method C: A Revision to Resolution 772 (WRC-19)

This method provides for the revision of Resolution **772 (WRC-19)** in order to clarify the list of possible interference scenarios, including scenarios for the use of ground/earth stations on board a sub-orbital vehicle in a section of its flight path passing in outer space, as well as the completion of compatibility studies provided for in "*resolves* 2" of this Resolution.

2/1.6/5 Regulatory and procedural considerations

2/1.6/5.1 For Method A: No Change

<u>NOC</u>

ARTICLES

NOC

APPENDICES

2/1.6/5.2 New proposal to provide the necessary reference to the new Resolution of Method B, Approach B

ARTICLE 43

Special rules relating to the use of frequencies

ADD

43.A16 Operation of stations on board sub-orbital vehicles shall be subject to Resolution **[A16] (WRC-23)**. (WRC-23)

Reasons: Addition of this provision to RR Article **43**, addressing special rules relating to use of frequencies, would provide the necessary reference within the Radio Regulations to the proposed new Resolution.

2/1.6/5.3 For Method B: New WRC-23 Resolution

There is one Resolution with four alternative approaches to Method B.

The view was raised that until all issues, problems, ambiguities referred to in the text of some considering *parts as well as in the* recognizing further *parts are properly addressed and responded there is no need for the Resolution below.*

ADD

DRAFT NEW RESOLUTION [A16] (WRC-23)

Regulatory provisions for the operation of radiocommunications on sub-orbital vehicles

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that sub-orbital vehicles operate at higher altitudes than conventional aircraft;

b) that sub-orbital vehicles operate through the lower levels of the atmosphere, where some may operate in the same airspace as conventional aircraft;

c) that sub-orbital vehicles may perform various missions such as conducting scientific research or providing transportation;

d) that stations on board sub-orbital vehicles are expected to provide all or some of the following applications; voice/data communications, navigation, surveillance, and telemetry, tracking and command (TT&C);

e) that sub-orbital vehicles must be safely integrated into airspace used by conventional aircraft;

f) that some stations on board sub-orbital vehicles may need to communicate with air traffic management systems and relevant ground control facilities;

Approach A supports the *considering* below:

g) that some orbital satellite launch rocket systems or components may be considered as sub-orbital vehicles;

h) that the stations on board orbital satellite launch rocket or deep space launch rocket systems may be operated under the space operation service without having to apply the provisions contained in the present Resolution;

i) that sub-orbital vehicles moving at very high velocity might generate a plasma sheath that may envelop all or most of the vehicle, which could impact communications,

Approach C supports the following *considering*:

g) that some satellite launch rocket systems or components may be considered as sub-orbital vehicles, operating at times above the atmosphere,

Approach D supports the following *considering*:

g) that sub-orbital vehicles moving at very high velocity might generate a plasma sheath that may envelop all or most of the vehicle, which could impact communications,

noting

a) that Report ITU-R M.2477 provides information on radiocommunications for sub-orbital vehicles, including a description of the flight trajectory, categories of sub-orbital vehicles, technical studies related to possible avionics systems used by sub-orbital vehicles, and service allocations of those systems;

b) that the provisions of No. **4.10** may apply to certain operations of sub-orbital vehicles;

c) that the development of conditions of coexistence between International Civil Aviation Organization (ICAO) standardized aeronautical systems is the responsibility of ICAO;

d) that ICAO develops, in some cases, Standards and Recommended Practices (SARPs) to address the coexistence between ICAO aeronautical applications,

Approach B and Approach C and Approach D support the inclusion of the following *noting:*

e) that Report ITU-R M.2477 describes sub-orbital flight as an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur in space without completing a full orbit around the Earth before returning back to the surface of the Earth;

f) that Report ITU-R M.2477 describes a sub-orbital vehicle as a vehicle executing sub-orbital flight,

recognizing

a) that there is no internationally agreed legal demarcation between the Earth's atmosphere and the space domain, nor between the sovereign airspace and outer space;

b) that Annex 10 to the Convention on International Civil Aviation contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation;

c) that, due to the increase of Doppler shift, emissions from stations on board sub-orbital vehicles may impact services operating in the same and adjacent or nearby frequency bands;

d) that, due to the higher altitude of sub-orbital vehicles compared to conventional aircraft, emissions from stations on board sub-orbital vehicles may have a radiocommunication impact on larger areas involving additional territories and/or on space stations,

Approach B, Approach C and Approach D support the following *recognizing:*

e) that some space launch systems may have space stations that already operate as part of existing space operation service allocations;

f) that stations on board sub-orbital vehicles may use systems operating under space or terrestrial radiocommunication services;

g) that some sub-orbital vehicles could reach altitudes for a brief period of time in space without sufficient energy to sustain its orbit,

resolves

Approach A:

1 that stations fitted on board a sub-orbital vehicle shall be restricted to operate around the Earth without having the ability or intention to become a station on board a satellite (see No. **1.179**);

2 that terrestrial stations and earth stations required on board a sub-orbital vehicle to safely accommodate or integrate it into airspace where air traffic services are provided, as decided by the competent aviation authority of the Member State(s)[1]:

2.1 are allowed to operate in the same service under which these stations are classified when they are used on conventional aircraft;

2.2 shall, for the frequency bands identified in the Convention on International Civil Aviation and its annexes that includes SARPs, be operated in accordance with the relevant recognized international aeronautical standards;

2.3 shall not affect the existing and future applications of the same service and/or other radiocommunication services in the same and adjacent frequency bands any more than they would if the same stations were fitted on board a conventional aircraft;

3 that administrations allowing the operation of each station on board sub-orbital vehicles identified in *resolves* 2 shall consider coexistence between these terrestrial stations and/or earth stations, and other applications, taking into account *considering c)* and *d)*;

4 that terrestrial and earth stations on board a sub-orbital vehicle other that those identified in *resolves* 2 shall not claim protection from nor create harmful interference to any station operated in the same and adjacent frequency bands unless there is an agreement between the administrations concerned, taking into account *considering c)* and *d)*,

Approach B:

1 that sub-orbital vehicles may use terrestrial stations (No. **1.62**) and earth stations (No. **1.63**) during all phases of flight;

2 that terrestrial stations and earth stations on board sub-orbital vehicles referred to in *resolves* 1 shall maintain their station class unchanged;

3 that the stations on board sub-orbital vehicles referred to in *resolves* 1 shall not cause additional interference to nor claim additional protection from the existing applications of the same service and on other radiocommunication services in the same and adjacent frequency bands,

---

[1] Defined accordingly with the Convention on International Civil Aviation and its annexes.

Reasons: This action will clarify that stations on board sub-orbital vehicles may be terrestrial stations (RR No. **1.62**) and earth stations (RR No. **1.63**) and can be used in all phases of flight, within their respective service allocations. The stations shall not impose any new constraints on applications of the same service and other radiocommunication services that are allocated on a primary basis.

Approach C:

1 that, for the purpose of this Resolution, a sub-orbital vehicle is a vehicle expected to reach the upper atmosphere and may reach space in portions of its flight, without completing a full orbit around the Earth;

The view was raised that the texts used in the following resolves *are not compatible with the intention of mandatory actions / operation which are covered in any operative / depository part of any resolution, and consequently, the language used therein needs to be revisited and aligned with the intention / and objectives.*

2 that stations on sub-orbital vehicles may operate in all stages of flight in the aeronautical mobile service (including the aeronautical mobile (R) service), the mobile-satellite service (including the aeronautical mobile-satellite (R) service), or in the radionavigation-satellite service;

3 that, when operating in the aeronautical mobile service (including the aeronautical mobile (R) service), stations on sub-orbital vehicles are subject to the same technical and regulatory conditions as aircraft stations operating in the applicable frequency bands and shall cause no more interference than conventional aircraft stations;

4 that, when operating in the mobile-satellite service (including the aeronautical mobile satellite (R) service) or in the radionavigation-satellite service, stations on board sub-orbital vehicles are subject to the same technical and regulatory conditions as earth stations operating in the applicable frequency bands and shall cause no more interference than conventional earth stations,

Reasons: This action clarifies that stations on board sub-orbital vehicles may be terrestrial stations (RR No. **1.62**) and earth stations (RR No. **1.63**) and can be used in all phases of flight, within certain services specified in the Resolution. The stations shall not impose any new constraints on applications of the same service and other radiocommunication services.

Approach D:

1 that, for the purpose of radiocommunications, a sub-orbital flight is described as an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur beyond the major portion of the Earth's atmosphere without completing a full orbit (see No. **1.184**) around the Earth, before returning back to the surface of the Earth, and a sub-orbital vehicle is a vehicle executing a sub-orbital flight;

2 that stations on board sub-orbital vehicles should be considered as earth stations or aircraft stations and may operate in the AM(R)S, MSS, RNSS and other potential services, and No. **4.4** shall be applied when stations on board sub-orbital vehicles in some above services operate beyond the major portion of the atmosphere;

3 that, when operating in the aeronautical mobile (R) service, stations on sub-orbital vehicles are subject to the same technical and regulatory conditions as aircraft stations operating in the applicable frequency bands and shall cause no more interference than conventional aircraft stations;

4 that, when operating in the mobile-satellite service or radionavigation-satellite service, stations on board sub-orbital vehicles are subject to the same technical and regulatory conditions as

earth stations operating in the applicable frequency bands and shall cause no more interference than conventional earth stations,

Reasons: This action clarifies that stations onboard sub-orbital vehicles may be terrestrial stations (RR No. **1.62**) and earth stations (RR No. **1.63**) and the aeronautical mobile (R) service, mobile-satellite service, radionavigation-satellite service can be used. According to existing Radio Regulations, the stations onboard sub-orbital vehicles may have to operate under RR No. **4.4** when in space and relevant sharing and compatibility studies when operation in space have not been carried out at this stage. Moreover, the stations shall not impose any new constraints on applications of the same service and other radiocommunication services.

Note – The remaining elements are common to all approaches:

instructs the Secretary-General

to bring this Resolution to the attention of ICAO,

The view was raised that after and if all problems, difficulties and inconsistencies mentioned above are fully resolved,

invites the International Civil Aviation Organization

to take into account this Resolution in the course of developing SARPs for ICAO systems that may be used by sub-orbital vehicles,

instructs the Director of the Radiocommunication Bureau

to report to future world radiocommunication conferences on any difficulties or inconsistencies encountered in the implementation of this Resolution.

2/1.6/5.4 Suppression of Resolution 772 (WRC-19)

Methods A and B propose to suppress Resolution **772 (WRC-19)**.

SUP

RESOLUTION 772 (WRC-19)

Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles

Reasons: Studies in relation to Resolution **772 (WRC-19)** have been completed and consequently this Resolution is proposed to be suppressed.

2/1.6/5.5 For Method C: Revision of Resolution 772 (WRC-19)

MOD

RESOLUTION 772 (~~WRC-19~~REV.WRC-23)

Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

considering

a) that sub-orbital vehicles are being developed which are intended to operate at higher altitudes than conventional aircraft, with a sub-orbital trajectory;

b) that sub-orbital vehicles are also being developed to fly through the lower levels of the atmosphere, where they are expected to operate in the same airspace as conventional aircraft;

c) that sub-orbital vehicles may perform various missions (e.g. conducting scientific research or providing transportation) and then return to the Earth's surface without completing a full orbital flight around the Earth;

d) that stations on board sub-orbital vehicles have a need for voice/data communications, navigation, surveillance and telemetry, tracking and command (TT&C);

e) that sub-orbital vehicles must be safely accommodated into airspace used by conventional aircraft during certain phases of flight;

f) that there is a need to ensure that equipment installed on such vehicles can communicate with air traffic management systems and relevant ground control facilities;

g) that vehicles operating at the boundary of space and the atmosphere or re-entering the atmosphere may generate a plasma sheath that may envelop all or most of the vehicle;

h) that the plasma-sheath attenuation does not allow for radiocommunications directly to either ground or space stations,

recognizing

a) that there is no internationally agreed legal demarcation between the Earth's atmosphere and the space domain;

b) that there is no formal definition of sub-orbital flight, although it has been assumed in Report ITU-R M.2477 to be an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur in space without completing a full orbit around the Earth before returning back to the surface of the Earth;

c) that stations on board sub-orbital vehicles may use systems operating under space and/or terrestrial services;

d) that the current regulatory provisions and procedures for terrestrial and space services may not be adequate for international use of relevant frequency assignments by stations on board sub-orbital vehicles;

e) that Annex 10 to the Convention on International Civil Aviation contains Standards and Recommended Practices for aeronautical radionavigation and radiocommunication systems used by international civil aviation;

f) that the studies on spectrum requirements for voice/data communications, navigation, surveillance and TT&C on stations on board sub-orbital vehicles have not been completed;

g) that some space launch systems may include components or items not reaching orbital trajectories, and that some of these components or items may be developed as reusable items operating on sub-orbital trajectories;

h) that conventional space launch systems currently have a radiocommunication regulatory framework that may differ from the future radiocommunication framework of sub-orbital vehicles,

noting

a) Question ITU-R 259/5, on operational and radio regulatory aspects for planes operating in the upper level of the atmosphere;

b) that Report ITU-R M.2477 provides information on the current understanding of radiocommunications for sub-orbital vehicles, including a description of the flight trajectory, categories of sub-orbital vehicles, technical studies related to possible avionics systems used by sub-orbital vehicles, and service allocations of those systems;

c) that the provisions of No. **4.10** may apply to certain aspects of these operations;

d) that the development of compatibility criteria between International Civil Aviation Organization (ICAO) standardized aeronautical systems is the responsibility of ICAO;

e) that the definitions and future applicable radiocommunication services for sub-orbital vehicles should be clarified by the ITU Radiocommunication Sector (ITU-R), with necessary coordination with ICAO,

resolves to invite the ITU Radiocommunication Sector

1 to study spectrum needs for communications between stations on board sub-orbital vehicles and terrestrial/space stations providing functions such as, *inter alia*, voice/data communications, navigation, surveillance and TT&C;

2 to study appropriate modification, if any, to the Radio Regulations, excluding any new allocations or changes to the existing allocations in Article **5**, to accommodate stations on board sub-orbital vehicles, whilst avoiding any impact on conventional space launch systems, with the following objectives:

– to determine the status of stations on sub-orbital vehicles, and study corresponding regulatory provisions to determine which existing radiocommunication services can be used by stations on sub-orbital vehicles, if necessary;

– to determine the technical and regulatory conditions to allow some stations on board sub-orbital vehicles to operate under the aeronautical regulation and to be considered as earth stations or terrestrial stations even if a part of the flight occurs in space;

– to facilitate radiocommunications that support aviation to safely integrate sub-orbital vehicles into airspace and ensure interoperability with international civil aviation;

– to define the relevant technical characteristics and protection criteria for the studies to be undertaken in accordance with the bullet point below;

– to conduct sharing and compatibility studies with incumbent services that are allocated on a primary basis in the same and adjacent frequency bands in order to provide that the level of permissible interference for security services is not exceeded and to avoid harmful interference to other radiocommunication services and to existing applications of the same service in which stations on board sub-orbital vehicles operate, having regard to the sub-orbital flight application scenarios, including scenarios that consider the use of ground/earth stations on board a sub-orbital vehicle in a part of its flight path passing through outer space;

3 to identify, as a result of the studies above, whether there is a need for access to additional spectrum that should be addressed after WRC-23 by a future competent conference,

invites the International Civil Aviation Organization

to participate in the studies and provide to ITU the relevant technical characteristics required for the studies called for in *resolves to invite the ITU Radiocommunication Sector*,

invites the ~~2023~~2027 World Radiocommunication Conference

to consider the results of the studies above and take the appropriate action,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of the relevant ITU-R study groups,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R,

instructs the Secretary-General

to bring this Resolution to the attention of the United Nations Committee on the Peaceful Uses of Outer Space and ICAO and other international and regional organizations concerned.

Agenda item 1.7

*1.7 to consider a new aeronautical mobile-satellite (R) service allocation in accordance with Resolution **428 (WRC-19)** for both the Earth-to-space and space-to-Earth directions of aeronautical VHF communications in all or part of the frequency band 117.975-137 MHz, while preventing any undue constraints on existing VHF systems operating in the aeronautical mobile (R) service, in the aeronautical radionavigation service, and in adjacent frequency bands;*

Resolution **428 (WRC-19)** – *Studies on a possible new allocation to the aeronautical mobile-satellite (R) service within the frequency band 117.975-137 MHz in order to support aeronautical VHF communications in the Earth-to-space and space-to-Earth directions*

2/1.7/1 Executive summary

To address this agenda item, ITU-R has undertaken studies, pursuant to Resolution **428 (WRC-19)**, on a possible new aeronautical mobile-satellite (Route) service (AMS(R)S) allocation to accommodate the relay of VHF communications, towards the development of an ITU-R Report (see section 2/1.7/3).

Five methods are considered to address this agenda item:

– Method A: NOC.

– Method B: This method, which provides general common elements required to be complemented with Methods B1, B2, B3 or B4, proposes to add a new allocation to the AMS(R)S in the frequency band 117.975-137 MHz, or part thereof, limited to non-geostationary-satellite systems and to internationally standardized aeronautical systems. This method is not an independent and standalone method as such and thus should be considered together with Methods B1, B2, B3 or B4.

  • Method B1 is containing the elements of Method B, and proposes a new allocation in the range 117.975-137 MHz with the addition of a power flux-density (pfd) limit, on AMS(R)S space stations unwanted emissions falling above 137 MHz, in order to ensure protection of adjacent band services above 137 MHz. Method B1 also proposes coordination for coexistence between AMS(R)S and other primary in-band services according to RR No. **9.11A** with a coordination threshold proposed in Annex 1 of RR Appendix **5**.

  • Method B2 is containing the elements of Method B, and proposes that systems operating under an allocation to the AMS(R)S be subject to the application of regulatory and technical measures to ensure compatibility with existing systems operating under an allocation to a different service in co-frequency bands and in the adjacent bands.

  • Method B3 is containing the elements of Method B, and proposes the specific range 117.975-136.8 MHz for the new AMS(R)S allocation, with the application of RR No. **9.11A** coordination procedure and of a new Resolution providing additional elements on the AMS(R)S regulatory framework.

  • Method B4 is containing the elements of Method B, and proposes to add an AMS(R)S allocation in the frequency band 117.975-136 MHz. Furthermore, RR No. **9.11A** applies to protect and not adversely affecting assignments to stations of the aeronautical mobile (R) service in frequency range 117.975-137 MHz. Its use shall be limited to systems that operate and are planned in accordance with recognized international aeronautical standards.

2/1.7/2 Background

The level of aircraft traffic in oceanic and remote areas remains limited due to the difficulty of providing and maintaining suitable terrestrial communication, navigation and surveillance means, which results in applying a large separation distance between aircraft. Progress has been made over the last years in the areas of navigation and surveillance, with the existing availability of global navigation satellite systems and reception by satellite of automatic dependent surveillance-broadcast signals in the frequency band 1 087.7-1 092.3 MHz.

WRC-23 agenda item 1.7 deals with a possible new allocation to the AMS(R)S within the frequency band 117.975-137 MHz, to relay standard VHF communications operating under the AM(R)S, and to complement terrestrial infrastructures over oceanic and remote areas. This would not require modification to aircraft equipment, as the space segment would be able to receive and transmit to standard VHF radios already installed on board aircraft.

The systems operating under an allocation either in-band or adjacent band were identified and sharing and compatibility studies were carried out to determine the operating conditions for systems intended to operate under a new AMS(R)S allocation. This is to ensure the protection of these in-band and adjacent band systems from possible interference resulting from the introduction of a new AMS(R)S system in this frequency band, and also to ensure that AMS(R)S protection will not constrain planned usage of those systems as mandated by Resolution **428 (WRC-19)**.

Additionally, some studies were conducted to estimate interference from adjacent band services above 137 MHz into the receiving space stations in the AMS(R)S in the frequency band 117.975-137 MHz and leading to different conclusions reflected in different sub-methods B in order to avoid additional constraint of the planned usage of adjacent band services.

2/1.7/3 Summary and analysis of the results of ITU-R studies

2/1.7/3.1 Summary of technical and operational studies

In liaison with the International Civil Aviation Organization (ICAO), ITU-R has studied the architecture, parameters, and baseline link budgets of a reference AMS(R)S system for the provision of standardized communications for air traffic management, without modification to aircraft equipment. Voice is considered in the frequency band 117.975-136 MHz, and VHF digital data link Mode 2 (VDL Mode 2) application in the frequency band 136-137 MHz (with the frequency 136.975 MHz reserved on a worldwide basis to provide a common signalling channel (CSC) to the VDL Mode 2 link. ITU-R has determined that an AMS(R)S system will have to rely on non-geostationary satellites. To support compatibility studies, example of link budgets for satellite-to-aircraft (downlink) and aircraft-to-satellite (uplink) VHF links were developed, based on propagation considerations discussed with the relevant ITU-R group. Additionally, an example architecture for a constellation providing global coverage is considered to support dynamic studies.

Maximum Doppler shift and latency times associated with the AMS(R)S system were studied. It is envisaged to implement a compensation mechanism on the satellite transmitter to mitigate Doppler effects at the aircraft receiver without making any modification on existing aircraft equipment. No operational impact is expected, as the latency ranges from the AMS(R)S systems are compatible with existing aeronautical VHF systems.

Studies with existing systems operating under an in-band/adjacent band allocation to a primary service has been assessed in close cooperation with ICAO and the relevant ITU-R Working Parties.

Work is still ongoing within ITU-R on the protection of AMS(R)S space stations reception below 137 MHz from the out-of-band emissions of space stations operating above 137 MHz in the mobile-satellite service (space-to-Earth), space operation service (space-to-Earth), meteorological-satellite service (space-to-Earth), and space research service (space-to-Earth).

In addition, consideration has been given to the in-band coexistence between AMS(R)S and the aeronautical mobile (off-route) service (AM(OR)S) which is allocated on a primary basis under Radio Regulations (RR) Nos. **5.201** and **5.202**, respectively in the frequency band 132-136 MHz (24 countries) and in the frequency band 136-137 MHz (22 countries).

2/1.7/3.2 Relevant ITU-R Recommendations and Reports

The relevant ITU-R Recommendations are: M.1231-0, M.1232-0, M.2092-0, P.531-14, SA.363-5, SA.609-2 and SA.1026-5, SA.1027-6 and SA.1743.

The relevant ITU-R Reports are: SA.2426-0 and SA.2488-0.

To perform studies required under agenda item 1.7 and Resolution **428 (WRC-19)**, Report ITU-R M.[SPACE-VHF][7] is being developed.

2/1.7/3.3 Analysis of the results of studies

2/1.7/3.3.1 In-band sharing between the systems operating in the aeronautical mobile-satellite (route) service and systems operating in the aeronautical mobile (route) service

AM(R)S and AMS(R)S would represent two different radiocommunication services within the frequency band 117.975-137 MHz, with the same on-board cockpit avionics system (for aeronautical VHF communications) being used for ground and satellite communications. It is planned that the AMS(R)S would relay VHF communications operating under the AM(R)S over oceanic and remote areas, without modification to aircraft equipment.

ICAO is currently working on any potential interference between the AM(R)S and AMS(R)S, which could stem from the possibly significantly larger service area of the AMS(R)S compared to the AM(R)S, with a view to resolve it through the conventional ICAO frequency planning exercise, assigning frequencies to the satellite system over interested regions, to ensure compatibility between ground and satellite facilities.

Therefore, from an ICAO perspective there is no need to perform a comprehensive compatibility study between systems operating under these two different services that cover the same system on-board the aircraft. Both ground and satellite communication links are technically similar using the same on-board cockpit avionics system (for ATC VHF communications).

The possible application to the AMS(R)S of RR No. **9.11A** coordination procedure, or at least of certain coordination provisions between RR Nos. **9.12** and **9.16**, is being considered under this agenda item. Several administrations believe that RR Nos. **9.11A** and **9.16** are not to be applied to AM(R)S stations. It may also provide a mechanism for administrations to ensure compatibility between their AM(R)S systems and AMS(R)S systems.

2/1.7/3.3.2 In-band sharing with other services

View 1:

View 1 is that the characteristics of AM(OR)S systems are not available and no sharing studies have been undertaken. Nevertheless, the AM(OR)S systems are understood to operate in channels within the national assignments of the AM(R)S, thus the compatibility between AM(OR)S and AMS(R)S assignments would be resolved through the existing frequency planning exercise. If a new

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[7] If the Report is approved by the Member States at Study Group 5 before WRC-23.

allocation is made to the AMS(R)S in this VHF band, ICAO, regional organizations as well as national regulators will continue to perform the conventional frequency planning exercise, assigning frequencies to the satellite system over interested regions, to ensure compatibility between ground and satellite facilities. This planning exercise will continue to be reflected as necessary in ICAO SARPs. This approach will protect any existing assignments including those for the AM(OR)S.

View 2:

View 2 is that the use of the AM(OR)S is carried out within the current primary allocations in the frequency bands 132-138 MHz in a number of countries (see RR Nos. ***5.201****,* ***5.202****,* ***5.206****), as well as in the frequency band 138-144 in Region 1. At present, the RR already have an example of the joint use of the MSS (space-to-Earth) and AM(OR)S in the frequency band 137-138 MHz. The MSS (space-to-Earth) compatibility with the AM(OR)S in the frequency band 137-138 MHz is achieved by applying the coordination procedures of RR No.* ***9.11A*** *for the MSS (see RR No.* ***5.208****) and limiting the use of non-geostationary-satellite systems to the MSS only.*

According to this view, given that:

– *AM(OR)S systems in the 137-138 MHz frequency band and AM(OR)S systems in the 132-137 MHz frequency band are of the same type and have similar characteristics;*

– *transmitting earth stations in the AMS(R)S (Earth-to-space) will correspond to AM(R)S aircraft stations that are already in use (in fact, the same aircraft stations will be used);*

– *planned AMS(R)S (space-to-Earth) systems in the frequency band 117.975-137 MHz will be limited to non-geostationary systems and their performance will be similar to those of MSS (space-to-Earth) systems in the band 137-138 MHz for which allocations already exist and the conditions of combination in the RR are defined,*

therefore, the alignment of the AMS(R)S with the AM(OR)S in the frequency band 117.975-137 MHz can be provided under the same conditions as the alignment of the MSS (space-to-Earth) and the AM(OR)S in the frequency band 137-138 MHz. This means that ensuring compatibility of AMS(R)S systems with AM(OR)S systems in the co-frequency bands in the range 117.975-137 MHz is possible under the following conditions:

– *application of the coordination procedures under RR No.* ***9.11A*** *(RR Nos.* ***9.14*** *and* ***9.15****) for AMS(R)S systems. AMS(R)S systems will require coordination in the event that space stations exceed the pfd level* -140 *dB(W/(m*$^2 \cdot 4$ *kHz)) at the Earth's surface (by analogy as this is done in the band 137-138 MHz - see RR No.* ***5.208****, and Annex 1 to RR Appendix* ***5****). In applying RR No.* ***9.11A*** *(RR Nos.* ***9.14*** *and* ***9.15****) for AMS(R)S stations, RR No.* ***9.16*** *is not to be applied to AM(OR)S stations;*

– *AMS(R)S systems should not require protection from AM(OR)S systems.*

2/1.7/3.3.3 Adjacent band compatibility between systems operating in the aeronautical mobile-satellite (route) service above 117.975 MHz and systems operating in the aeronautical radionavigation service below 117.975 MHz

ICAO has indicated that the frequency planning and coordination work is ongoing within ICAO to ensure compatibility between systems operating in the AMS(R)S and aeronautical radionavigation service (ARNS).

One view is that, currently, there are no ICAO standards related to the AMS(R)S within the frequency band 117.975-137 MHz. However, such standards would be developed in the future, as necessary, and would address the question of adjacent band compatibility between systems operating under allocations to the AMS(R)S above and the ARNS below 117.975 MHz, if required, as a complement to ICAO frequency planning exercises. It is expected that such AMS(R)S standards would provide equivalent protection to the ARNS in the adjacent band as that afforded to the ARNS by current AM(R)S standards.

Another view is that ICAO does not carry out any work on planning and coordinating frequencies between the AM(R)S in the frequency band 117.975-137 MHz of one administration and the ARNS in the frequency band 108-117.975 MHz of the other administration. In practice, these issues are resolved by regional agreements between the countries and compliance with ICAO standards for AM(R)S and ARNS equipment. Currently, there are no ICAO standards for transmitting and receiving space stations equipment of the AMS(R)S.

According to this view, to ensure compatibility of the AMS(R)S in the frequency band 117.975-137 MHz with the ARNS in the frequency band 108-117.975 MHz, it is required to develop and adopt the appropriate technical and/or regulatory conditions for the AMS(R)S.

For example, to protect the ARNS in the frequency band 108-117.975 MHz from the AMS(R)S space stations operating in the frequency band 117.975-137 MHz it is necessary:

– for transmitting AMS(R)S space stations to accept limits for unwanted emissions in the frequency band 108-117.975 MHz. Such limits shall not be worse than those established in the ICAO standards and Recommended Practices (SARPs) for on-board AM(R)S transmitting stations in the adjacent channels (see section 6.3.4, Annex 10 to the Convention on International Civil Aviation. *Aeronautical Telecommunications*, Volume III. *Communication systems*, ICAO);
– for receiving AMS(R)S space stations to accept the condition: "do not claim protection from interference caused by ARNS stations operating in the frequency band 108-117.975 MHz."

2/1.7/3.3.4 Adjacent band compatibility with systems operating above 137 MHz

A possible new primary AMS(R)S allocation within the frequency band 117.975-137 MHz is planned to be in both directions (Earth-to-space and space-to-Earth). However, transmitting earth stations in the AMS(R)S (Earth-to-space) would correspond to the AM(R)S aircraft station that is already in place. Therefore, compatibility studies should only be considered with respect to:

– the transmitting space stations in the AMS(R)S (space-to-Earth), operating in the frequency band 117.975-137 MHz into the receiving earth stations of adjacent band services;
– the transmitting space stations of adjacent band services into the receiving space stations in the AMS(R)S in the frequency band 117.975-137 MHz.

Characteristics and protection criteria have been received for systems operating above 137 MHz in the mobile-satellite service (MSS) (space-to-Earth), the space operations service (SOS) (space-to-Earth), the space research service (SRS) (space-to-Earth), and the MetSat (space-to-Earth). Compatibility studies were conducted and are referenced in preliminary draft new Report ITU-R M.[SPACE-VHF].

– For transmitting space stations in the AMS(R)S operating in the sub-band 117.975-136 MHz:
    • Protection criteria for adjacent-band systems operating in 137-138 MHz in the mobile-satellite service (space-to-Earth) and meteorological satellite service (space-to-Earth) is met with a 1 MHz guardband (136-137 MHz) and RR Appendix **3** limits for AMS(R)S spurious emissions falling in 137-138 MHz, under the assumptions considered in studies. Different assumptions on AMS(R)S systems may lead to different conclusions.

- Regarding protection of adjacent-band systems operating in 137-138 MHz in the space operation service (space-to-Earth) and space research service (space-to-Earth):
  - When AMS(R)S spurious emissions is considered as uncorrelated interference events distributed over time, protection is also met with a 1 MHz guardband (136-137 MHz) and RR Appendix **3** limits for AMS(R)S spurious emissions falling above 137 MHz, under the assumptions considered in studies relative to the maximum number of co-frequency satellites seen from any point on the Earth.
  - Further studies are planned to address potential scenarios when AMS(R)S spurious emissions are considered as constant interference events. The above considerations will have to be taken into account when defining the applicable pfd values in relevant methods.

– For transmitting space stations in the AMS(R)S operating in the sub-band 136-137 MHz:

- Protection criteria for adjacent-band systems operating in 137-138 MHz in the mobile satellite service (space-to-Earth) and meteorological satellite service (space-to-Earth) is met through a roll-off factor for AMS(R)S unwanted emissions, under the assumptions considered. Studies show that a maximum pfd level of −166.6 dB(W/(m² · 14 kHz)) at the Earth's surface for the unwanted emissions in the adjacent band 137 -138 MHz of AMS(R)S systems operating in the frequency band 136-137 MHz is required to ensure this result.
- Regarding protection criteria of adjacent-band systems operating in adjacent band 137-138 MHz in the space operation service (space-to-Earth) and space research service (space-to-Earth):
  - When AMS(R)S unwanted emissions is considered as uncorrelated interference events distributed over time, protection is also met with a maximum pfd level of −166.6 dB(W/(m² · 14 kHz)) at the Earth's surface for the unwanted emissions in adjacent band 137-138 MHz of AMS(R)S systems operating in the frequency band 136-137 MHz, under the assumptions considered in studies relative to the maximum number of co-frequency satellites seen from any point on the Earth.
  - Further studies are planned to address potential scenarios when AMS(R)S unwanted emissions are considered as constant interference events. The above considerations will have to be taken into account when defining the applicable pfd values in relevant methods.

In addition, considerations could be added on an alternative approach, which would define a maximum pfd value from the aggregated unwanted emissions in adjacent band 137-138 MHz of all AMS(R)S systems combined. First analysis under this approach provides the following values for the protection of low gain receiving earth stations in the different services, to be lowered by relevant gain value for higher antenna gains:

– maximum pfd value of −179.93 dB(W/(m² · kHz)) at the Earth's surface for 1% of time in the case of SOS protection, under the understanding of constant interference.

– maximum pfd value of −211.93 dB(W/(m² · Hz)) at the Earth's surface for 10-3% of the time in the case of SRS protection, under the understanding of constant interference.

– maximum pfd values for unwanted emissions of −146.93 dB(W/(m² · 150 kHz)) at the Earth's surface for 20% of the time and −132.93 dB(W/(m² · 150 kHz)) at the Earth's surface for 0.0013% of the time in the case of MetSat protection.

– For receiving space stations in the AMS(R)S operating in the band 117.975-137 MHz:

  • One view is that compatibility studies have been undertaken with respect to the transmitting space stations of adjacent band services in 137-138 MHz. In response to the *resolves* of Resolution **428 (WRC-19)**, it can be concluded that planned usage of systems operating above 137 MHz will not be adversely affected.

  • A second view is that protection from transmitting space stations in the adjacent-band systems operating in 137-138 MHz in the MSS (space-to-Earth), SOS (space-to-Earth), SRS (space-to-Earth), and MetSat (space-to-Earth) of AMS(R)S receiving space stations can be covered by mandating that the receiving space stations of AMS(R)S shall not place additional constraints on adjacent-band services operating in 137-138 MHz.

  • A third view is that protection of AMS(R)S receiving space stations from the spurious emissions of adjacent-band space stations operating in 137-138 MHz in the MSS (space-to-Earth), SOS (space-to-Earth), SRS (space-to-Earth), and MetSat (space-to-Earth) is ensured through RR Appendix **3**. This applies for the spurious domain of MSS/SOS/SRS/MetSat emissions, hence at a frequency separation of about 200 kHz below 137 MHz. In order not to constraint services in 137-138 MHz, dynamic studies are still ongoing with the aim to define potential techniques to be applied for the AMS(R)S receiving space stations to mitigate interference from the out-of-band emissions of adjacent-band space stations operating in 137-138 MHz.

Protection of the radio astronomy service in the frequency band 150.05-153 MHz has also been addressed. Considering that AMS(R)S emissions are narrow band, and that the frequency separation between the possible new AMS(R)S allocation and the radio astronomy allocation in 150.05-153 MHz would be 13.05 MHz or more:

– One view is that, given this frequency separation, it does not appear necessary to mandate specific protection limit.

– Another view is that, as the RR currently provides conditions for the protection of the radio astronomy service from unwanted emissions of space stations in the MSS allocated in the frequency band 137-138 MHz (see RR No. **5.208A**), therefore, similar conditions can be applied for the new allocation of the AMS(R)S in the band 117.975-137 MHz.

2/1.7/3.3.5 Compatibility between systems operating in the aeronautical mobile-satellite (route) service from different administrations

The new AMS(R)S allocation might be used by several systems filed by different administrations. It is anticipated that compatibility between these systems would be addressed within ICAO through its conventional frequency planning exercise, assigning frequencies to the satellite system over interested regions, and ultimately between administrations through the application of RR No. **9.12** for coordination between non-geostationary-satellite systems as provided in the RR in many other cases.

2/1.7/4 Methods to satisfy the agenda item

2/1.7/4.1 Method A: No change

2/1.7/4.2 Method B: New allocation to the aeronautical mobile-satellite (route) service within the frequency band 117.975-137 MHz

This method is not an independent and standalone method as such and thus should be considered together with Methods B1 or B2 or B3 or B4.

Create a new co-primary allocation for the AMS(R)S in the Earth-to-space and space-to-Earth directions in the frequency band 117.975-137 MHz, or part thereof, under the following conditions:

– limiting the use of the new AMS(R)S allocation to non-geostationary-satellite systems only;

– limiting the use of the new AMS(R)S allocation to internationally standardized aeronautical systems;

– application of RR No. **9.12** for the coordination of the AMS(R)S satellite networks.

2/1.7/4.2.1 Method B1: Method B with the following additions

– Ensuring protection of the AM(R)S in the frequency band 117.975-137 MHz and the AM(OR)S in the frequency band 132-137 MHz, noting that the characteristics of the AM(OR)S are not available. Nevertheless, AM(OR)S systems are understood to operate on channels within national assignments of the AM(R)S, and coexistence between the AM(R)S, AMS(R)S and AM(OR)S might therefore be envisioned through frequency planning and coordination;

– ensuring protection of services in adjacent bands and not constraining these services.

In-band coexistence between the AM(R)S and AMS(R)S and adjacent-band coexistence between the ARNS and AMS(R)S around 117.975 MHz needs to be ensured through frequency planning and coordination work.

The protection of adjacent band services operating above 137 MHz from AMS(R)S space stations unwanted emissions falling above 137 MHz is ensured:

– through an additional limit of satellite pfd of -166.6 dB(W/(m² · 14 kHz)) at the Earth's surface on the level of unwanted emissions in the adjacent band 137-138 MHz for AMS(R)S emissions from systems operating in 117.975-137 MHz. This limit should ensure compliance against the protection criteria of SRS, SOS, MSS and MetSat. It would be also possible to require the application of this limit to AMS(R)S emissions only within the band 136-137 MHz, as emissions in the band 117.975-136 MHz shall meet the RR Appendix **3** limits. Method B1 also proposes coordination for coexistence between AMS(R)S and other primary in-band services according to RR No. **9.11A** with a coordination threshold proposed in Annex 1 of Appendix **5**.

2/1.7/4.2.2 Method B2: Method B with the following additions

– Protection of the existing services, AMS(R)S, AM(R)S and AM(OR)S, in common frequency bands by applying RR No. **9.11A** coordination procedures (RR Nos. **9.12**, **9.14** and **9.15**) for AMS(R)S systems, e.g. extending scope of RR No. **5.208** to the AMS(R)S in 117.975-137 MHz. In applying RR No. **9.11A** to AMS(R)S stations, the provisions of RR No. **9.16** are not to be applied to AM(R)S or AM(OR)S stations;

– applying coordination threshold -140 dB(W/(m^2 · 4 kHz)) at the Earth's surface for AMS(R)S space stations during coordination under RR No. **9.14**, by including the

AMS(R)S in the frequency band 117.975-137 MHz in Annex 1 to Appendix **5** of the RR;

– ensuring protection of systems in existing aeronautical services (AM(R)S, AM(OR)S and ARNS) operating in adjacent bands and not constraining these systems by adopting restrictions on unwanted emissions from AMS(R)S space stations. Attenuation of such unwanted emissions should not be less than those specified in ICAO SARPs for AM(R)S aircraft transmitting stations in adjacent channels (see Section 6.3.4, Annex 10 to the Convention on International Civil Aviation – Aeronautical Telecommunications, Volume III – Communication Systems, ICAO);

– applying RR No. **5.208A** for new AMS(R)S allocations in the frequency band 117.975-137 MHz for protection of radio astronomy in the frequency band 150.05-153 MHz.

– Protection of services operating in adjacent frequency band 137-138 MHz might be ensured through a limit on unwanted emissions from the AMS(R)S operating in the frequency band 117.95-137 MHz with the following maximum pfd levels at the Earth's surface:

−211.93 dB(W/(m² · Hz)) 0.001% of the time SRS;

−179.93 dB(W/(m² · kHz)) 1% of the time SOS;

−146.93 dB(W/(m² · 150 kHz)) 20% of the time MetSat.

2/1.7/4.2.3 Method B3: Method B with the following additions

– Specifying that the new AMS(R)S allocation is in the frequency band 117.975-136.8 MHz. The 200 kHz frequency separation between 136.8 MHz and 137 MHz is intended to ensure that AMS(R)S protection will not constrain planned usage of satellite systems operating in adjacent band 137-138 MHz in the MSS (space-to-Earth), SOS (space-to-Earth), SRS (space-to-Earth) and MetSat (space-to-Earth), as mandated by Resolution **428 (WRC-19)**. The 200 kHz frequency gap also ensures *de facto* protection of these adjacent band services operating above 137 MHz from AMS(R)S stations unwanted emissions.

– Applying RR No. **9.11A** coordination procedures (including RR No. **9.14**) for AMS(R)S systems.

– Applying coordination threshold −140 dB(W/(m² · 4 kHz)) at the Earth's surface for AMS(R)S space stations during coordination under RR No. **9.14**, with respect to AM(OR)S, by including the AMS(R)S in the frequency band 117.975-136.8 MHz in Annex 1 to Appendix **5** of the RR.

– Applying new Resolution **[A7-SATVHF B3] (WRC-23)** on the use of the frequency band 117.975-136.8 MHz by the AMS(R)S, in order to detail certain elements of the regulatory framework of AMS(R)S, in particular to address the respective roles of ITU and ICAO.

2/1.7/4.2.4 Method B4: Method B with the following addition

– In-band coexistence between the AM(R)S and AMS(R)S will be ensured through RR No. **9.11A** coordination through ITU-R and operational frequency planning and coordination in ICAO. The coordination arrangement in the ITU-R Radio Regulations should allow administrations to participate in planning a new AMS(R)S service without impacting administrations that are not participating or have not yet decided to use a new AMS(R)S service. Selection of an adequate coordination threshold using ICAO planning criteria for aviation systems could permit some areas to develop new AMS(R)S communications services without impacting AM(R)S communications services in other areas. It is important to ensure the entire AM(R)S designated operational coverage of 480 kilometres from a country's border is protected from harmful interference, noting that some stations may not be registered in the Master International Frequency Register (MIFR).

2/1.7/5 Regulatory and procedural considerations

2/1.7/5.1 For Method A: NOC

NOC

ARTICLES

NOC

APPENDICES

2/1.7/5.2 For Method B: New allocation to the aeronautical mobile-satellite (route) service within the frequency band 117.975-137 MHz

2/1.7/5.2.1 For Method B1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

75.2-137.175 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
117.975-137 AERONAUTICAL MOBILE (R) AERONAUTICAL MOBILE-SATELLITE (R) ADD 5.A17 ADD 5.B17 5.111 5.200 5.201 5.202		

ADD

5.A17 The use of the frequency band 117.975-137 MHz by the aeronautical mobile-satellite (R) service is subject to coordination under No. **9.11A**. This use is also limited to non-geostationary-satellite systems and internationally standardized aeronautical systems. (WRC-23)

Reasons: To ensure coexistence amongst AMS(R)S systems, as well as, between AM(R)S systems with respect to AM(R)S and AM(OR)S in the frequency band 117.975-137 MHz. To ensure that the new AMS(R)S allocation is used only by non-geostationary-satellite systems and internationally standardized aeronautical systems.

ADD

5.B17 In the frequency band 117.975-137 MHz, space stations operating in the aeronautical mobile-satellite (R) service should ensure that the power flux-density of their unwanted emissions in the adjacent band 137-138 MHz does not exceed −166.6 dB(W/(m² · 14 kHz)) at the Earth's surface. (WRC-23)

Reasons: To ensure the protection of the incumbent services in the adjacent band 137-138 MHz, noting that unwanted emission in the spurious domain for AMS(R)S apply to emissions below 136.9375 MHz.

APPENDIX 5 (REV.WRC-19)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1 (REV.WRC-19)

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-12)

MOD

1.1 Below 1 GHz*

1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **5.204** and **5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds −125 dB(W/(m² · 4 kHz)) at the Earth's surface.

1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

– −125 dB(W/(m² · 4 kHz)) for networks for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996;

– −140 dB(W/(m² · 4 kHz)) for networks for which complete Appendix **4/S4/3**** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

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* These provisions apply only to the MSS.

** *Note by the Secretariat*: Edition of 1990, revised in 1994.

1.1.3 In the band 137-138 MHz, coordination is also required for a space station on a replacement satellite of a MSS network for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996 and the pfd exceeds −125 dB(W/(m^2 · 4 kHz)) at the Earth's surface for the administrations referred to in § 1.1.1 above.

1.1.4 In the band 117.975-137 MHz, coordination of a space station of the aeronautical mobile-satellite (R) service (space-to-Earth) with respect to the aeronautical mobile (R) service and the aeronautical mobile (OR) service is required only if the pfd produced by the space station exceeds −140 dB(W/(m^2 · 4 kHz)) at the Earth's surface and within [TBD km] from a country's border.

Note: Element from this provision could be used to develop a potential new footnote.

Reasons: Modification needed to specify the coordination threshold to be used for the identification of coordination requirements with respect to terrestrial services in the band 117.075-137 MHz as per RR No. **9.27**. There is a pfd limit in Annex 1 of RR Appendix **5** that applies to MSS systems to ensure coexistence with AM(OR)S in the adjacent bands, which may be applicable to AMS(R)S allocation as well.

2/1.7/5.2.2 For Method B2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

75.2-137.175 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
117.975-137	AERONAUTICAL MOBILE (R) AERONAUTICAL MOBILE-SATELLITE (R) MOD 5.208 MOD 5.208A MOD 5.209 ADD 5.C17 ADD 5.D17 5.111 5.200 5.201 5.202	

MOD

5.208 The use of the bands 117.975-137 MHz by the aeronautical mobile-satellite (R) service and 137-138 MHz by the mobile-satellite service is subject to coordination under No. **9.11A**. In applying No. **9.11A** for the aeronautical mobile-satellite (R) service in the frequency band 117.975-137 MHz, the provisions of No. **9.16** are not to be applied to the AM(R)S and AM(OR)S. (WRC-~~97~~23)

Reasons: Implementation of the new AMS(R)S allocation should not place additional constraints (coordination requirements) on the existing services AM(R)S and AM(OR)S.

MOD

5.208A In making assignments to space stations in the aeronautical mobile-satellite (R) service in the frequency band 117.975-137 MHz and in the mobile-satellite service in the frequency bands 137-138 MHz, 387-390 MHz and 400.15-401 MHz and in the maritime mobile-satellite service (space-to-Earth) in the frequency bands 157.1875-157.3375 MHz and 161.7875-161.9375 MHz, administrations shall take all practicable steps to protect the radio astronomy service in the frequency bands 150.05-153 MHz, 322-328.6 MHz, 406.1-410 MHz and 608-614 MHz from harmful interference from unwanted emissions as shown in the most recent version of Recommendation ITU-R RA.769. (WRC-~~19~~23)

MOD

5.209 The use of the band 117.975-137 MHz by the aeronautical mobile-satellite (R) service and the bands 137-138 MHz, 148-150.05 MHz, 399.9-400.05 MHz, 400.15-401 MHz, 454-456 MHz and 459-460 MHz by the mobile-satellite service is limited to non-geostationary-satellite systems. (WRC-~~97~~23)

ADD

5.C17 The use of the frequency band 117.975-137 MHz by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems. The attenuation of unwanted emissions from aeronautical mobile-satellite (R) service space stations operating in the frequency band 117.975-137 MHz should not be less than the attenuation of unwanted emissions in adjacent channels specified in ICAO SARPs for aeronautical mobile (R) service airborne transmitting stations operating in the same frequency band (see Section 6.3.4, Annex 10 to the Convention on International Civil Aviation – Aeronautical Telecommunications, Volume III – Communications Systems, ICAO). (WRC-23)

Reasons: To ensure that the new AMS(R)S allocation is used only by internationally standardized aeronautical systems.

ADD

5.D17 In the frequency band 117.975-137 MHz, systems operating in the aeronautical mobile-satellite (R) service shall ensure that their maximum level of their unwanted emissions in adjacent band 137-138 MHz does not exceed the following maximum levels of pfd at the Earth's surface:

−211.93 dB(W/(m² · Hz)) 0.001% of the time to protect the SRS;

−179.93 dB(W/(m² · kHz)) 1% of the time to protect the SOS;

−146.93 dB(W/(m² · 150 kHz)) 20% of the time to protect the MetSat. (WRC-23)

APPENDIX 5 (REV.WRC-19)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1 (REV.WRC-19)

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-12)

MOD

1.1 Below 1 GHz*

1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **5.204** and **5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds −125 dB(W/(m^2 · 4 kHz)) at the Earth's surface.

1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

– −125 dB(W/(m^2 · 4 kHz)) for networks for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996;

– −140 dB(W/(m^2 · 4 kHz)) for networks for which complete Appendix **4/S4/3**** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

1.1.3 In the band 137-138 MHz, coordination is also required for a space station on a replacement satellite of a MSS network for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996 and the pfd exceeds −125 dB(W/(m^2 · 4 kHz)) at the Earth's surface for the administrations referred to in § 1.1.1 above.

<u>1.1.4 Coordination of a space station of the aeronautical mobile-satellite (R) service (space-to-Earth) with respect to the aeronautical mobile (R) service in the band 117.975-137 MHz and the aeronautical mobile (OR) service in the band 132-137 MHz is required only if the pfd produced by the space station exceeds −140 dB(W/(m^2 · 4 kHz)) at the Earth's surface including international waters within [TBD km] from the coastline.</u>

Reasons: Modification needed to specify the coordination threshold to be used for the identification of coordination requirements with respect to terrestrial services in the band 117.975-137 MHz as per RR No. **9.27**. There is a pfd limit in Annex 1 of RR Appendix **5** that applies to MSS systems to ensure coexistence with AM(OR)S in the adjacent bands, which may be applicable to AMS(R)S allocation as well.

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* These provisions apply only to the MSS.

** *Note by the Secretariat*: Edition of 1990, revised in 1994.

2/1.7/5.2.3 For Method B3

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

75.2-137.175 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
117.975-13~~7~~6.8	AERONAUTICAL MOBILE (R) AERONAUTICAL MOBILE-SATELLITE (R) MOD 5.209 ADD 5.E117 5.111 5.200 5.201 5.202	
~~117.975~~136.8-137	AERONAUTICAL MOBILE (R) 5.111 5.200 5.201 5.202	

MOD

5.209 The use of the frequency bands 117.975-136.8 MHz by the aeronautical mobile-satellite (R) service and of the frequency bands 137-138 MHz, 148-150.05 MHz, 399.9-400.05 MHz, 400.15-401 MHz, 454-456 MHz and 459-460 MHz by the mobile-satellite service is limited to non-geostationary-satellite systems. (WRC-~~97~~23)

Reasons: To ensure that the new AMS(R)S allocation is limited to non-geostationary satellite systems.

ADD

5.E117 The use of the frequency band 117.975-136.8 MHz by the aeronautical mobile-satellite (R) service is subject to coordination under No. **9.11A**. Resolution **[A17-SATVHF B3] (WRC-23)** applies. (WRC-23)

Reasons: To make the new AMS(R)S allocation subject to RR No. **9.11A** coordination and to mandate application of new Resolution **[A17-SATVHF B3] (WRC-23)**.

APPENDIX 5 (REV.WRC-19)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1 (REV.WRC-19)

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-12)

MOD

1.1 Below 1 GHz*

1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **5.204** and **5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds −125 dB(W/(m^2 · 4 kHz)) at the Earth's surface.

1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

– −125 dB(W/(m^2 · 4 kHz)) for networks for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996;

– −140 dB(W/(m^2 · 4 kHz)) for networks for which complete Appendix **4/S4/3**** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

1.1.3 In the band 137-138 MHz, coordination is also required for a space station on a replacement satellite of a MSS network for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996 and the pfd exceeds −125 dB(W/(m^2 · 4 kHz)) at the Earth's surface for the administrations referred to in § 1.1.1 above.

1.1.4 In the frequency band 132-136.8 MHz, coordination of a space station of the aeronautical mobile-satellite (R) service (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station exceeds −140 dB(W/(m^2 · 4 kHz)) on the territory of countries listed in No. **5.201** or No. **5.202**, respectively.

Reasons: In countries with an AM(OR)S allocation under RR No. **5.201** or RR No. **5.202**, to apply the same pfd coordination threshold of −140 dB(W/(m^2 · 4 kHz)) as currently in force in the adjacent frequency band 137-138 MHz between MSS (space-to-Earth) and AM(OR)S allocated in some countries under RR No. **5.206**.

* These provisions apply only to the MSS.

** *Note by the Secretariat*: Edition of 1990, revised in 1994.

ADD

DRAFT NEW RESOLUTION [A17-SATVHF B3] (WRC-23)

Use of the frequency band 117.975-136.8 MHz by the aeronautical mobile-satellite (R) service

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the optimization of air traffic management (ATM) over oceanic and remote areas necessitates appropriate aeronautical surveillance and communication means, in order to meet the required communication performance for reduced separation minima;

b) that WRC-23 allocated the frequency band 117.975-136.8 MHz to the aeronautical mobile-satellite (R) service (AMS(R)S), limited to non-geostationary satellite systems that operate in accordance with recognized international aeronautical standards, and subject to No. **9.11A** coordination provisions;

c) that the allocation of the frequency band 117.975-136.8 MHz to the AMS(R)S) is intended for the relay via satellite of VHF communications under the AM(R)S, in order to complement terrestrial communication infrastructures when aircraft are operating in oceanic and remote areas;

d) that the VHF channels have become congested in some areas and the new AMS(R)S systems need to operate in such a manner as not to constrain existing systems, without modification to aircraft equipment,

noting

a) that there are Standards and Recommended Practices (SARPs) developed by the International Civil Aviation Organization (ICAO) detailing frequency assignment planning criteria for VHF air-ground communication systems;

b) that in accordance with ICAO SARPs the emergency channel (121.5 MHz) shall be used only for genuine emergency purposes, and where a requirement is established for the use of a frequency auxiliary to 121.5 MHz, the frequency 123.1 MHz shall be used;

c) that the frequency planning between stations operated under AM(R)S and AM(OR)S in the band 117.975-137 MHz is performed by competent aviation organizations under ICAO's purview;

d) that the development of compatibility criteria between new AMS(R)S systems proposed for operations under *considering c)* and ICAO-standardized aeronautical systems in the frequency band 117.975-136.8 MHz is the responsibility of ICAO;

e) that ICAO frequency planning exercises between aeronautical systems in the band 117.975-136.8 MHz will take into account the operational areas of AM(R)S/AM(OR)S aircraft stations and of AMS(R)S aircraft earth stations including where recording of frequency assignments in the Master International Frequency Register (MIFR) is not possible;

f) that feeder links of AMS(R)S systems may be accommodated in the fixed-satellite service,

recognizing

a) that the frequency band 117.975-137 MHz is allocated on a primary basis to the AM(R)S and is used by air-ground, air-air and ground-air systems operated in accordance with ICAO SARPs, providing critical voice and data communications for ATM on a global basis;

b) that under No. **5.200**, the frequency 121.5 MHz is the aeronautical emergency frequency and, where required, the frequency 123.1 MHz is the aeronautical frequency auxiliary to 121.5 MHz;

c) that under Nos. **5.201** and **5.202**, the frequency bands 132-136 MHz and 136-137 MHz are also allocated in several countries to the aeronautical mobile (OR) service on a primary basis;

d) that coordination under No. **9.11A** applies for assignments of administrations wishing to operate AMS(R)S space stations or AMS(R)S aircraft earth stations in the frequency band 117.975-136.8 MHz;

e) that AMS(R)S space stations are subject to coordination under No. **9.14** with respect to AM(R)S stations in overlapping frequencies when in line of sight;

f) that AMS(R)S space stations are subject to coordination under No. **9.14** with respect to AM(OR)S stations in overlapping frequencies when the pfd threshold in Annex 1 to Appendix **5** is exceeded;

g) that AMS(R)S aircraft earth stations and AM(R)S/AM(OR)S aeronautical or aircraft stations are subject to coordination under Nos. **9.15** and No. **9.16** with respect to stations located in the respective coordination areas, using the predetermined coordination distances indicated in Table 10 of Appendix **7**, for which overlapping assignments are recorded in the MIFR;

h) that Annex 10 to the Convention on International Civil Aviation contains SARPs for safety aeronautical radionavigation and radiocommunication systems used by international civil aviation,

resolves

1 that the use of the frequency band 117.975-136.8 MHz by AMS(R)S shall be limited to ICAO-standardized aeronautical systems;

2 that until standards are developed within ICAO, administrations shall operate AMS(R)S stations only for experimentation purposes in cooperation with ICAO;

3 that use of the frequencies 121.5 MHz and 123.1 MHz referred to in *noting c)* for AMS(R)S shall require coordination on a worldwide basis under the overview of ICAO;

4 that the identification of channels for possible use by AMS(R)S shall:

– take into account the current operational deployment of stations operating in the AM(R)S;

– not adversely affect the potential modifications on the AM(R)S deployment when required,

– take into account *noting c)* to include the space component in the existing frequency management process in order to seek agreement for the coordination under No. **9.11A**,

invites the International Civil Aviation Organization

to develop SARPs for the AMS(R)S and work on frequency planning exercises between aeronautical systems in the frequency band 117.975-136.8 MHz, taking into account *considering c)* and *noting b)*, *instructs the Secretary-General*

to bring this Resolution to the attention of ICAO.

2/1.7/5.2.4 For Method B4

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

75.2-137.175 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
117.975-~~137~~136	AERONAUTICAL MOBILE (R) AERONAUTICAL MOBILE-SATELLITE (R) ADD 5.F17 5.111 5.200 5.201 5.202	
~~117.975~~136-137	AERONAUTICAL MOBILE (R) 5.111 5.200 5.201 5.202	

ADD

5.F17 In the frequency band 117.975-136 MHz, the use of the aeronautical mobile-satellite (R) service is limited to non-geostationary-satellite systems and is subject to coordination under No. **9.11A.** The coordination threshold used under No. **9.14** between AMS(R)S space stations and AM(R)S stations, is to be applied when the power flux-density level of an aeronautical mobile-satellite (R) service space station exceeds -148 dB(W/(m$^2 \cdot$ 4 kHz)) on the Earth's surface and within 480 km of a country's border. Stations in the aeronautical mobile-satellite (R) service operating in the 117.975-136 MHz frequency band shall not cause harmful interference to, nor claim protection from, stations in the aeronautical mobile (R) service. The use of this band by the aeronautical mobile-satellite (R) service shall be limited to systems that operate and are planned in accordance with recognized international aeronautical standards. (WRC-23)

Reasons: To ensure the current and future AM(R)S systems are not constrained.

2/1.7/5.3 For Method B: SUP Resolution 428 (WRC-19)

SUP

RESOLUTION 428 (WRC-19)

Studies on a possible new allocation to the aeronautical mobile-satellite (R) service within the frequency band 117.975-137 MHz in order to support aeronautical VHF communications in the Earth-to-space and space-to-Earth directions

Agenda item 1.8

*1.8 to consider, on the basis of ITU R studies in accordance with Resolution **171 (WRC-19)**, appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution **155 (Rev.WRC-19)** and No. **5.484B** to accommodate the use of fixed-satellite service (FSS) networks by control and non-payload communications of unmanned aircraft systems;*

Resolution **171 (WRC-19)** – *Review and possible revision of Resolution **155 (Rev.WRC-19)** and No. **5.484B** in the frequency bands to which they apply*

2/1.8/1 Executive summary

Under WRC-23 agenda item 1.8, two methods have been identified (see sections 2/1.8/4 and 2/1.8/5):

– **Method A** proposes suppression of RR No. **5.484B**, Resolution **155 (Rev.WRC-19)** and Resolution **171 (WRC-19)**.

– **Method B** proposes possible revision of RR No. **5.484B**, revision of Resolution **155 (Rev.WRC-19)** and suppression of Resolution **171 (WRC-19)**.

However, no agreement was reached in respect of the solution for Method B as contained in sections 2/1.8/4.2 and 2/1.8/5.2. For this reason, three alternative texts are provided, labelled Method B1, B2 and B3. The text of Method B1 is a reproduction of the draft CPM text as contained in Document CPM23-2/1. Methods B2 and B3 are mergers of contributions received at CPM23-2 where the mergers are conducted by the respective authors and are provided for information. CPM23-2 had no time to review or discuss the content of the text for these methods and no agreement to these by CPM therefore should be assumed.

In addition to the above, several important issues were raised in section 2/1.8/3.

2/1.8/2 Background

Unmanned aircraft (UA) are aircraft that are piloted remotely through the established communication link.

Report ITU-R M.2171 identified the spectrum requirements for UA command and non-payload communication (CNPC) that would be needed to support flight through non-segregated airspace.

2/1.8/2.1 Unmanned aircraft system architecture

Geostationary fixed-satellite service (FSS) based unmanned aircraft systems (UAS) comprise:

Unmanned aircraft (UA): UA designates all types of remotely piloted aircraft[8].

Definition of an earth station on a UA: A fixed-satellite service earth station on an unmanned aircraft shall be defined as an earth station operating in the fixed-satellite service.

Control and non-payload communications (CNPC) is understood as the radio data links used to exchange information between the UA and unmanned aircraft control station (UACS) ensuring safe, reliable, and effective UA flight operation. A CNPC communication link comprises data for:

– Telecommand (forward) control messages and telemetry (return) data relevant to enable full remote control of all UA functions.

[8] In ICAO, the UA is referred to *Remotely Piloted Aircraft* (RPA).

– ATC relay communication to ensure at the remote pilot site the same situational awareness of VHF voice communication representative for the radio vicinity at the current location of the UA.

– Sense and avoid data: comprising target track data, airborne weather radar data corresponding to the piloting principle of "see and avoid" which is used in all airspace volumes where the pilot is responsible for ensuring separation from nearby aircraft, terrain and obstacles.

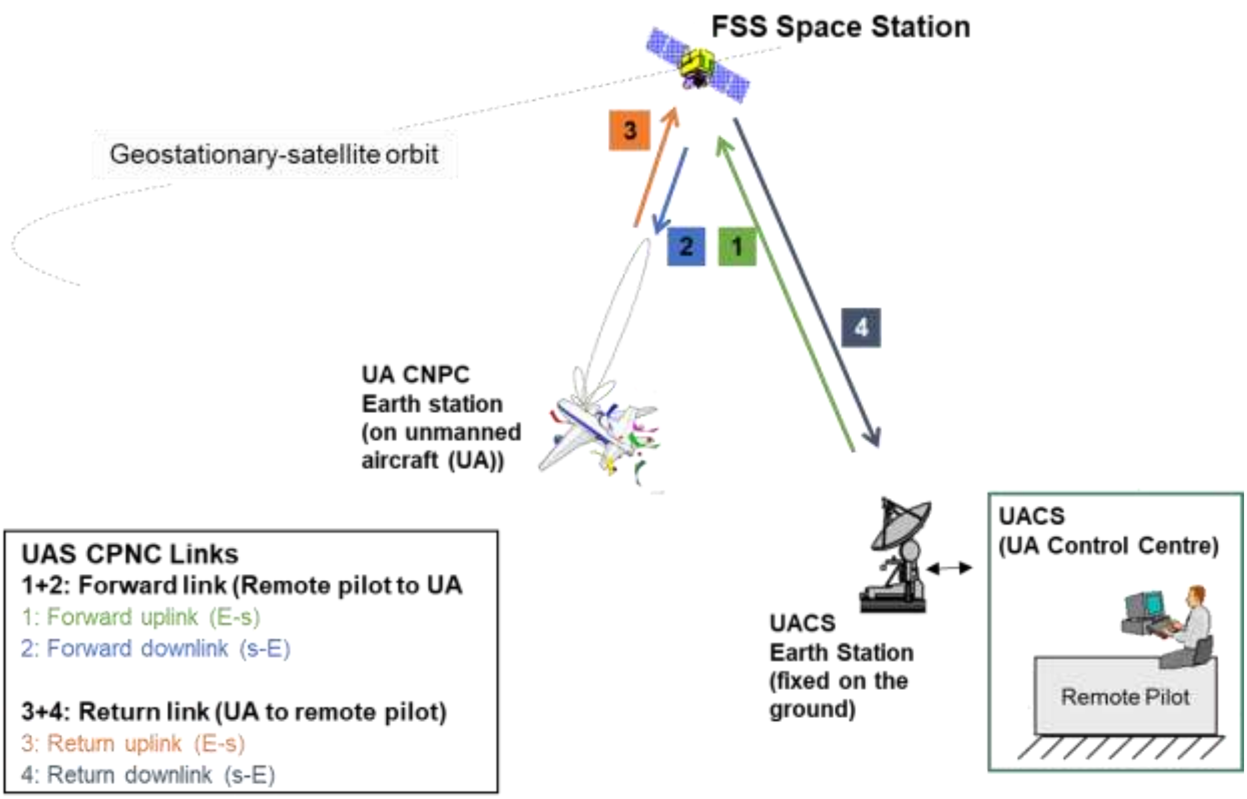
UA control station (UACS[9]): Facility from which a UA is controlled remotely. The studies so far performed consider UACS earth stations using satellite communication located at a fixed point.

Geostationary satellite: See RR No. **1.189**.

Figure 2/1.8/2-1 shows the UAS CNPC structure with its links, earth stations and space station. The UACS earth station allows the remote pilot to communicate with the UA earth station on-board the unmanned aircraft through transponders of a geostationary FSS space station. Links 1 and 2 signify the forward links for signals from the transmitting UACS earth station to the receiving UA earth station and Links 3 and 4 are the return links for the signals from the transmitting UA earth station to the receiving UACS earth station.

FIGURE 2/1.8/2-1

Elements of unmanned aircraft system architecture using the fixed-satellite service



9 In ICAO, UACS is referred to as *Remote Pilot Station (RPS)* with the *Ground Earth Station* (GES).

2/1.8/3 Summary and analysis of the results of ITU-R studies

2/1.8/3.1 Relevant ITU-R recommendations and reports

ITU-R Recommendations, relevant for studies under WRC-23 agenda item 1.8, as appropriate, are the latest versions of:

– ITU-R F.758, ITU-R F.1494, ITU-R F.1495, ITU-R F.1565;

– ITU-R M.1180, ITU-R M.1233, ITU-R M.1372, ITU-R M.1643, ITU-R M.1644, ITU-R M.1730, ITU-R M.2008;

– ITU-R P.528-5, ITU-R P.2108-1;

– ITU-R SF.1006, ITU-R SF.1650;

– ITU-R S.465, ITU-R S.484, ITU-R S.524, ITU-R S.579, ITU-R S.728, ITU-R S.734, ITU-R S.738, ITU-R S.740, ITU-R S.1062, ITU-R S.1064, ITU-R S.1254, ITU-R S.1424, ITU-R S.1432, ITU-R S.1716, ITU-R S.1806, ITU-R S.1856, ITU-R S.2099, ITU-R S.2131.

ITU-R Reports, relevant for the studies under WRC-23 agenda item 1.8 are the latest versions of:

– ITU-R M.2171, ITU-R M.2233, ITU-R M.[UA_PFD].

2/1.8/3.2 Analyses of the results of studies

In carrying out the technical and operational studies under WRC-23 agenda item 1.8, several key points were identified. Some of these key points are included in this section. Moreover, these key points are also included/reflected in Section 5 of draft CPM text where applicable.

As can be seen in Figure 2/1.8/2-1, there are four different types of links between unmanned aircraft earth stations and the fixed-satellite service (FSS) space stations:

Link 1 UACS earth station to FSS space station;

Link 2 FSS space station to UA earth station;

Link 3 UA earth station to FSS space station;

Link 4 FSS space station to UACS earth station.

Earth stations for Links 1 and 4 are at a fixed specified location and are thus consistent with regular FSS operation. Links 2 and 3 involve mobile earth stations and require additional consideration.

Key principles for UAS CNPC operation include:

1) The FSS space stations and the UACS earth stations would fall in the category of regular FSS and be coordinated and notified following the regular RR Article **9** and **11** procedures for FSS networks and associated Typical/Specific FSS earth stations.

2) UAS CNPC operation considered under WRC-23 agenda item 1.8 is seen as an operation under the FSS which has a primary status in the frequency bands under consideration and continues to have primary status.

3) The use of FSS for UAS CNPC needs to be within the limits stemming from the bilateral coordination of the associated FSS network. Furthermore, the operation needs to be within the envelope of operational arrangements agreed outside the formal bilateral coordination process. Operational limitations need to be provided by the satellite operator responsible for the FSS network in question.

4) In order to assess whether the safety-of-life requirements for a CNPC link could be fulfilled for a given flight, while the notifying administration has a certain amount of information related to the coordination of its satellite networks, only the operator of the

satellite on which the CNPC link operates has the full information related to the technical performance which is needed by the entity assessing the compliance to the safety-of-life requirement for a CNPC link.

5) FSS satellite networks with which UAS CNPC communicate do not have safety status.

6) In line with RR No. **4.10**[10], in order to ensure the safety of flight of the UA, measures are required to ensure freedom from harmful interference. However, due to the nature of the operation, the notifying administration of regular FSS networks/links are not in the position to apply RR No. **4.10** to any assignment pertaining in the link used for UAS CNPC as it would change the regulatory status of that assignment with respect to other assignments. Consequently, the issue of safety of flight is totally outside the possibility and capability of the notifying administration of the FSS network. This issue needs to be addressed differently, e.g. by exploring mechanisms together with associated measures and techniques to address the above-mentioned objectives of RR No. **4.10**. However, there is no agreed solution to this issue at this stage.

7) In ITU, notifying administrations of other FSS networks have no responsibility in respect of the safe operation of UAS CNPC.

8) No additional status is to be granted to UAS CNPC links and its associated space and earth stations than that already obtained through the associated FSS network and its specific and typical earth stations.

9) No change of existing bilateral coordination agreements or additional agreements between the notifying administration of the FSS network under which the UAS CNPC links are provided and the notifying administrations of other FSS networks shall be needed.

10) UAS CNPC operation under the associated FSS network shall not have an adverse effect during the regular satellite coordination processes of future FSS networks nor impose any additional coordination requirements due to the UAS CNPC operation. Safety of life or other special requirements for UAS CNPC operation shall not be used as an argument to request more protection than what is normally considered during the regular bilateral coordination process between FSS networks.

11) The operation of UA earth stations on-board the unmanned aircraft shall neither restrict nor limit/impact current operation and future development of terrestrial services/stations.

12) Earth stations on board UA shall be designed and operated so as to be able to accept the interference caused by terrestrial services operating in conformity with the Radio Regulations in the frequency bands listed in *resolves* 1 of Resolution **155 (Rev.WRC-19)** without complaints under RR Article **15**.

13) Transmitting UA earth stations shall not cause unacceptable interference to receiving stations of terrestrial services.

14) Recognizing that ICAO Standards and Recommended Practices (SARPs) define the responsibilities of ICAO Member States related to the UA operations, the responsibilities of ITU Member States under the Radio Regulations in relation to the CNPC link need also to be defined.

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[10] "*Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies*".

In respect of ensuring the safe operation of UA, the following views were expressed:

View 1:

The responsibilities of the ITU Member State(s) to ensure the safe operation of UAS CNPC shall be defined, recognizing that ICAO is responsible for developing Standards and Recommended Practices (SARPs) related to UA operation.

View 2:

The responsibilities of the ITU Member State(s) responsible for the operation of the UAS CNPC, to ensure that the use of UAS CNPC links are in accordance with international SARPs consistent with Article 37 of the Convention on International Civil Aviation shall be defined.

View 3:

It is not possible that ITU Member State(s) would take any responsibility to ensure the safety of the UA CNPC links operated under FSS in the frequency band listed in the resolves *1 of Resolution* ***155****.*

15) Responsibility under the Radio Regulations (RR) for the licensing and resolving the case of interference from the CNPC links, including the actions to be taken to address cases of harmful interference, will have to stay in line with the current ITU principles and procedures, notably as established for the operation of other aeronautical-satellite earth stations.

16) The responsibilities of administrations involved in the operation of UAS CNPC in regard with safety aspects shall be defined (see also § 15).

17) The procedures and mechanisms dealing with the safety related issues shall be defined (see also § 15).

2/1.8/3.3 Sharing considerations

Under this agenda item, assignments pertaining to geostationary FSS networks operating in the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space), may be used for UAS CNPC links. Article **5** of the Radio Regulations provides a complete overview of frequency allocations for various services and special conditions for their operation. Table 2/1.8/3.3.2-1 provides an overview of primary allocations for services in the subject frequency bands from Article **5** of the Radio Regulations.

In considering UAS CNPC operation under this agenda item, issues related to compatibility with the services having primary allocations in the subject frequency bands is discussed in the following sub-sections.

In addition to consideration of compatibility with services having primary allocations in the subject frequency bands, the radio astronomy service is allocated on a secondary basis in the adjacent frequency band 14.47-14.5 GHz and is subject to RR No. **5.149** in which “administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see RR Nos. **4.5** and **4.6** and Article **29**)”. Consequently, in sub-section 2/1.8/3.4.4, is a discussion on measures in respect of the radio astronomy service.

Stations are in operation in countries under secondary frequency allocations and have been deployed taking into account the regulatory conditions for services under primary allocations at that time. In considering new applications under primary allocations and new regulatory provisions for these, it is recognized that this could change the interference scenario for these stations operating under secondary allocations. This matter needs to be addressed by the Conference.

TABLE 2/1.8/3.3.2-1

Overview of primary allocations in the frequency bands subject to WRC-23 agenda item 1.8

	Space-to-Earth					**Earth-to-space**		**Space-to-Earth**		**Earth-to-space**	
	10.95-11.2 GHz	**11.45-11.7 GHz**	**11.7-12.2 GHz**	**12.2-12.5 GHz**	**12.5-12.75 GHz**	**14-14.3 GHz**	**14.3-14.47 GHz**	**19.7-20.1 GHz**	**20.1-20.2 GHz**	**29.5-29.9 GHz**	**29.9-30 GHz**
	Globally	**Globally**	**Region 2**	**Region 3**	**Regions 1 & 3**	**Globally**	**Globally**	**Globally**	**Globally**	**Globally**	**Globally**
FSS	√	√	√	√	√	√	√	√	√	√	√
MSS	-	-	-	-	-	-	-	√[ii]	√[iii]	√[ii]	√[iii]
BSS	-	-	-	-	√[iv]	-	-	-	-	-	-
FS	√	√	√[v]	√	√[vi]	-[vii]	√[viii]	-[x]	-[x]	-	-
MS[i]	√	√	-	√	√[vi]	-	√[viii]	-[x]	-[x]	-	-
RNS	-	-	-	-	-	√[ix]	-	-	-	-	-

[i] Except aeronautical mobile.

[ii] Only Region 2, with special conditions outlined in RR Nos. **5.525**, **5.526**, **5.527**, **5.528** and **5.529**.

[iii] Special conditions outlined in RR Nos. **5.525**, **5.526**, **5.527** and **5.528**.

[iv] Only for Region 3.

[v] Only 11.7-12.1 GHz (secondary in USA in accordance with RR No. **5.486**). 12.1-12.2 GHz primary in Peru (RR No. **5.489**).

[vi] Country footnotes RR No. **5.494** and No. **5.496** with primary allocations to the FS and MS for named Region 1 countries.

[vii] Country footnote RR No. **5.505** with primary allocation to the FS in 14-14.3 GHz for named Region 1 and 3 countries. Country footnote RR No. **5.508** with primary allocation to the FS in 14.25-14.3 GHz for named Region 1 countries.

[viii] For 14.3-14.4 GHz, only Regions 1 and 3.

[ix] In accordance with RR No. **5.504**, The use of the frequency band 14-14.3 GHz by the radionavigation service shall be such as to provide sufficient protection to space stations of the fixed-satellite service.

[x] Country footnote RR No. **5.524** with primary allocation to the FS and MS in 19.7-21.2 GHz for named Region 1, 2 and 3 countries. This additional use shall not impose any limitation on the power flux-density of space stations in the fixed-satellite service.

2/1.8/3.3.1 Relationship between unmanned aircraft system command and control communication links and other satellite networks

UAS CNPC links need to operate within the notified and recorded technical parameters of the associated FSS satellite network as well as within the coordinated limits of that satellite network. The use of FSS networks for CNPC links should in no way give rise to adversely affect other satellite networks. In this respect it is to be noted that the FSS in the frequency bands in question is heavily used for commercial applications, and as any such radiocommunication service, is subject to unpredictable unintentional interference which needs to be taken into account and duly mitigated in considering UAS CNPC operation in the above-mentioned frequency bands.

UA CNPC earth stations need to be designed and operated with the interference caused by other satellite networks in their application of RR Articles **9** and **11**, and notably those assignments pertaining to other satellite networks recorded in MIFR under RR No. **11.41**. Moreover, operation of UAS CNPC links should not have any impact on the existing and future satellite networks coordination agreements or the regular satellite coordination process.

Consequently, interference to/from other satellite networks need to be addressed under the current regulatory procedures/provisions and therefore would not require any further sharing and interference analysis with satellite networks and systems. The above conditions are necessary in order not to put any constraints/not adversely affect the operations of other FSS networks.

It is worth mentioning that safety aspects of UAS CNPC operation is addressed in section 2/1.8/3.3.

2/1.8/3.3.2 Relationship with terrestrial services

With respect to the relationship between UAS CNPC and terrestrial services, the following three cases need to be taken into account:

1) Space station used for UAS CNPC;
2) UACS earth station at fixed, known location;
3) UA CNPC earth stations on board unmanned aircraft.

The relationship between the stations referred in 1) and 2) above and terrestrial services are covered under the current procedures of the Radio Regulations. The relationship between UA CNPC earth stations and terrestrial services is described below.

UA CNPC earth stations will operate within a specified geographic area, but not at one specific and defined location. As such, they are understood as typical earth stations (see RR No. **11.17**). The relationship of UA CNPC earth stations with terrestrial services is based on two principles (see also section 2/1.8/3.3):

– Receiving UA earth stations need to not seek protection from terrestrial services and shall pose no limitation on the current terrestrial services nor the future development of these.
– Transmitting UA earth stations need to not cause unacceptable interference to current or future receiving stations of terrestrial services.

Taking note of this, no technical studies have been conducted in respect of protection of receiving UA CNPC earth stations from terrestrial services nor are any provisions in the Radio Regulations required in this respect.

In respect of transmitting UA earth stations, it can be seen from Table 2/1.8/3.3.2-1 that while there are secondary allocations, there are no primary allocations to terrestrial services in the frequency band

29.5-30 GHz which is subject to this agenda item. Consequently, no provisions in the Radio Regulations to protect terrestrial services in this band were studies in this respect.

For the frequency band 14-14.47 GHz which is the other transmitting band for UA earth stations under this agenda item, it can however be seen that this band is shared with terrestrial services. Consequently, there is a need for provisions to ensure that no unacceptable interference is inflicted on current or future receiving stations of terrestrial services.

2/1.8/3.3.3 Relationship with radionavigation service

The radionavigation service (RNS) is allocated on a primary basis in frequency band 14-14.3 GHz. Under this agenda item, this band is used by transmitting UA CNPC and UACS earth stations and receiving space stations. It is to be noted that no technical characteristics of RNS systems are available at this stage.

As discussed earlier, the space station and the UACS earth station are filed with ITU and coordinated as regular FSS under the normal procedures of the current Radio Regulations. It is also noted that in respect of protection of the receiving space station, RR No. **5.504** stipulates that "The use of the frequency band 14-14.3 GHz by the radionavigation service shall be such as to provide sufficient protection to space stations of the fixed-satellite service." For these reasons, no particular consideration of the space station or the UACS earth station is required under this agenda item.

In respect of protection of the RNS from transmitting UA CNPC earth stations, it is to be emphasised that should these UA CNPC earth stations operate within the envelope of technical characteristics and operational parameters as well as the envelope of coordinated limits of specific and/or typical earth stations of the associated FSS network recorded in MIRF with favourable findings there would be no additional requirements to protect the RNS from transmitting UA CNPC earth stations.

2/1.8/3.3.4 Relationship with radio astronomy service

The radio astronomy service is allocated on a secondary basis in the frequency band 14.47-14.5 GHz which is immediate adjacent to the FSS (Earth-to-space) in the frequency band 14-14.47 GHz subject to this agenda item. This band will see operation of transmitting UA CNPC and UACS earth stations. UACS earth stations are filed and coordinated as required as regular specific FSS earth stations under the normal procedures of the current Radio Regulations. Consequently, consideration under this agenda item has only been given to transmitting UA earth stations.

– RR No. **5.149** stipulates that "administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see RR Nos. **4.5** and **4.6** and Article **29**)".

– RR Nos. **4.5** and **4.6** further stipulate:

  - RR No. **4.5**: *The frequency assigned to a station of a given service shall be separated from the limits of the band allocated to this service in such a way that, taking account of the frequency band assigned to a station, no harmful interference is caused to services to which frequency bands immediately adjoining are allocated.*

  - RR No. **4.6**: *For the purpose of resolving cases of harmful interference, the radio astronomy service shall be treated as a radiocommunication service. However, with regard to emissions from services operating in other bands, it shall be afforded the same degree of protection as such services are afforded vis-à-vis each other.*

– *Resolves* 17 of Resolution **155 (Rev.WRC-19)** also specifically addresses protection of the radio astronomy service:

  • "that, in order to protect the radio astronomy service in the frequency band 14.47-14.5 GHz, administrations operating UAS in accordance with this Resolution in the frequency band 14-14.47 GHz within line-of-sight of radio astronomy stations are urged to take all practicable steps to ensure that the emissions from the UA in the frequency band 14.47-14.5 GHz do not exceed the levels and percentage of data loss given in the most recent versions of Recommendations ITU-R RA.769 and ITU-R RA.1513;"

– Recommendation ITU-R RA.769-2 provides the interference threshold power flux-density (pfd) for radio astronomy receivers (-221 dB(W/(m^2 · Hz))). Recommendation ITU-R RA.1513-2 explains that the protection threshold in Recommendation ITU-R RA.769-2 may be exceeded for 2% of the time by systems operating in one network, as long as the threshold is not violated for more than 5% of the time by all networks.

– RR Article **29** describes how, due to the very high sensitivity to interference of the radio astronomy service, mitigation techniques to avoid interference needs to be implemented both by the radio astronomy side and those services potentially interfering with the radio astronomy service. Such mitigation techniques include choice of sites for radio astronomy stations, use of site shielding, time sharing and consideration of actual characteristics for each case. Such measures can only be applied on a case-by-case basis.

Noting that there are a limited number of radio astronomy stations at known locations, it may be appropriate to address compatibility with radio astronomy stations on a case-by-case basis taking into account the specific characteristics for each station and the out-of-band frequency discrimination towards the adjacent radio astronomy frequency band 14.47-14.5 GHz. However, no compatibility or sharing studies have yet been conducted.

2/1.8/4 Methods to satisfy the agenda item

Two methods to satisfy WRC-23 agenda item 1.8 have been identified. The below subsections give a description of each of these methods.

2/1.8/4.1 Method A

Method A proposes to suppress RR No. **5.484B** together with Resolution **155 (Rev**.**WRC-19)** as well as Resolution **171 (WRC-19)**.

Reasons: Resolution **171 (WRC-19)** is requiring a review and possible revision of Resolution **155 (Rev.WRC-19)** since this in its current state does not enable operation of UA earth stations. This agenda item stems from agenda item 1.3 of WRC-12 and agenda item 1.5 of WRC-15 and consideration of the matter of WRC-19 which resulted in Resolution **171 (WRC-19)**. After more than ten years of extensive studies, there are still key problems that have not been resolved, in particular the contradiction between the safety nature of the operation of UAS and the non-safety status of the fixed-satellite service.

The FSS frequency bands identified in *resolves* 1 of Resolution **155 (Rev.WRC-19)** are heavily congested and interference is a regular occurrence, also into FSS networks that has completed all the frequency coordination. The communication link of the UAS CNPC via FSS consequently can be interrupted by various forms of interference and is therefore not sufficiently robust. This could negatively impact the ability to achieve the required service quality needed for safe operation and could even render it impossible to use. The interruption of the CNPC link would be an incident affecting the safety of aviation, including the safety of people.

With no satisfactory solution identified for the operation of UA earth stations, it therefore would be necessary to suppress RR No. **5.484B** together with Resolution **155 (Rev.WRC-19)** as well as Resolution **171 (WRC-19)**.

2/1.8/4.2 Method B

Method B intends to revise Resolution **155 (Rev.WRC-19)** in accordance with Resolution **171 (WRC-19)** and consequently suppress Resolution **171 (WRC-19)**. In addition, this method contains the revision of RR No. **5.484B** as an option.

Note: No agreement was reached in respect of text for Method B. For this reason, three alternative texts are provided, labelled Method B1, B2 and B3. The text of Method B1 is a reproduction of the draft CPM text as contained in Document CPM23-2/1. Methods B2 and B3 are mergers of contributions received at CPM23-2 where the merging is conducted by the respective authors and are provided for information. CPM23-2 had no time to review or discuss the content of the text for these methods and no agreement to these by CPM therefore should be assumed.

2/1.8/4.2.1 Method B1

Resolution **155 (Rev.WRC-19)** is revised in view of the principles listed in section 2/1.8/3.2 above. In particular it is intended to:

- clearly separate between the responsibilities of ICAO and ITU;
- consider how to ensure the safety of flight while recognizing the issue of RR No. **4.10**;
- remove ambiguities contained in Resolution **155 (Rev.WRC-19)**;
- clarify that UAS CNPC is an operation under the primary FSS while avoiding adverse effects to terrestrial stations;
- maintain the existing procedure for the FSS network coordination as well as for bilateral coordination agreements;
- provide a process to treat cases of interference caused by UA earth station.

As an option, RR No. **5.484B** would be updated to improve the clarity to the services and systems to which the footnote applies.

Reasons: After considering the progress obtained by the International Civil Aviation Organization (ICAO) in the process of establishing and preparing Standards and Recommended Practices (SARPs) for the safe operation of unmanned aircraft systems, the studies to protect the terrestrial services from harmful interference, revisions to Resolution **155 (Rev.WRC-19)** are proposed to satisfy this agenda item. The intention being that compliance with the Resolution would ensure that all required ITU-R technical, operational, and regulatory conditions are met, and would not adversely affect existing and future FSS networks or terrestrial services.

2/1.8/4.2.2 Method B2

Resolution **155** (**Rev.WRC-19**) is revised in view of the principles listed in section 2/1.8/3.2 above. In particular it is intended to:

- clarify that with the introduction of UA in non-segregated airspace, continued safety of other airspace users as well as life and property on the ground needs to be maintained;
- emphasize that RR No. **4.10** is one of the main provisions of the Radio Regulations relating to the interference-free operation of safety services;

- require that the assignments and use of the relevant frequency bands are consistent with No. **4.10** of the Radio Regulations which recognizes that safety services require special measures to ensure their freedom from harmful interference;
- require that the frequency bands specified in *resolves* 1 shall not be used for the UAS CNPC links before the issue of safety of life referred to in RR No. **4.10** is solved and agreed in ITU-R framework;
- specify that the use of frequency assignments of GSO FSS networks for UAS CNPC links does not confer on the satellite network special regulatory status or any advantage or priority in the application of RR Articles **9** and **11** or any other regulatory provisions.

RR No. **5.484B** would be updated to improve the clarity to the services and systems to which the footnote applies.

2/1.8/4.2.3 Method B3

Resolution **155** (**Rev.WRC-19**) is revised in view of the principles listed in section 2/1.8/3.2 above. In particular it is intended to:

- clearly separate between the responsibilities of ICAO and ITU;
- ensure that UAS CNPC links shall only operate in accordance with the convention on international civil aviation and its annexes;
- confirm that the provisions of RR No. **4.10** shall not apply to the use of UAS CNPC links through FSS networks, or creates a responsibility of administrations to ensure safety of flight in any way;
- clarify that UAS CNPC operations shall not impose any additional constraints on the terrestrial systems;
- maintain the existing procedure for the FSS network coordination as well as for bilateral coordination agreements;
- ensure that UAS CNPC links shall not have any impact on the relevant existing agreements reached during FSS satellite coordination process or on the future coordination of FSS networks during the application of the provisions of the Radio Regulations; and that this application shall not create any obstacle to coordination and development of regular FSS in the bands;
- provide that UAS CNPC links should ensure the protection of the current systems operating in terrestrial and space services without imposing any undue constraints on them;
- provide a process to treat cases of interference caused by UA earth station.

As an option, RR No. **5.484B** would be updated to improve the clarity to the services and systems to which the footnote applies.

2/1.8/5 Regulatory and procedural considerations

The following subsections provide example regulatory text in response to the methods to satisfy WRC-23 agenda item 1.8 as identified in section 2/1.8/4.

2/1.8/5.1 Method A

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

SUP

5.484B

SUP

RESOLUTION 155 (REV.WRC-19)

Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces*

SUP

RESOLUTION 171 (WRC-19)

Review and possible revision of Resolution 155 (Rev.WRC-19) and No. 5.484B in the frequency bands to which they apply

2/1.8/5.2 Method B

For this method, the following is proposed for consideration.

Note: No agreement was reached in respect of text for Method B. For this reason, three alternative texts are provided, labelled Methods B1, B2 and B3. The text of Method B1 is a reproduction of the draft CPM text as contained in Document CPM23-2/1. Methods B2 and B3 are mergers of contributions received at CPM23-2 where the merging is conducted by the respective authors and are provided for information. CPM23-2 had no time to review or discuss the content of the text for these methods and no agreement to these by CPM therefore should be assumed.

2/1.8/5.2.1 Method B1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

Method B1, Option 1

MOD

5.484B Resolution **155 (Rev.WRC-~~15~~23)*** shall apply. (WRC-~~15~~23)

Method B1, Option 2

MOD

5.484B The operation of earth stations on board unmanned aircraft communicating with geostationary fixed-satellite service (FSS) space stations within the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space) are an application of the FSS, are limited to internationally standardized aeronautical systems, and Resolution **155 (Rev.WRC-~~15~~23)*** shall apply. (WRC-~~15~~23)

Method B1, Options 1 and 2

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

TBD

~~* *Note by the Secretariat:* This Resolution was revised by WRC-19.~~

~~* *Note by the Secretariat:* This Resolution was revised by WRC-19.~~

MOD

RESOLUTION 155 (REV.WRC-~~19~~23)

Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces*

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

considering

TBD

considering further

TBD

noting

TBD

recognizing

TBD

recognizing further

TBD

resolves

1 that frequency assignments to stations of GSO FSS networks operating in the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space), may be used for UAS CNPC links to communicate with earth stations on board UA operating in non-segregated airspace*, provided that the conditions specified in the following *resolves* ~~below~~ are met;

2 that frequency assignments used by UAS CNPC links operating in the frequency bands specified in *resolves* 1 above are an application of the primary frequency allocations to the FSS;

3 that frequency assignments to UA CNPC earth stations subject to this Resolution shall be notified under No. **11.2** by the notifying administration of the FSS satellite network with which these earth stations communicate;

* ~~May also be used consistent with international standards and practices approved by the responsible civil aviation authority.~~TBD

~~* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.~~

4 that for the implementation of *resolves* 3 above, the notifying administration for the GSO FSS system with which the UAS CNPC earth station communicates shall send to the Radiocommunication Bureau (BR) the relevant Appendix **4** notification information related to the characteristics of the UAS CNPC earth station identified as class of station "UG";

5 that, for the implementation of *resolves* 4 above, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall also be responsible to observe, and comply with all relevant regulatory and administrative provisions applicable to the operation of the above-mentioned UA CNPC earth station as included in this Resolution and those contained in the Radio Regulations, the implementation of No. **4.10** is addressed in *resolves* xx below;

6 that the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that UA CNPC earth stations operate only in the territory under the jurisdiction of any administration(s)/country(ies) from which an explicit authorization has been obtained under Article **18**, taking into account *recognizing further c)* and *d)* above;

7 that the notifying administration of the GSO FSS satellite network with which the UA CNPC earth stations communicate shall ensure that they have the capability to limit operations of such earth stations to the territory or territories of administrations having authorized those earth stations;

8 that the authorization to a UAS CNPC earth station to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the GSO FSS network with which the UAS CNPC earth station communicates from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations;

~~2~~9 that the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that ~~earth stations in motion on board UA may communicate with the space station of a GSO FSS network operating in the frequency bands listed in *resolves* 1 above, provided that~~ the class of the UA CNPC earth station ~~in motion on board UA~~ is matched with the class of the space station and that other conditions of this Resolution are met ~~(see also *instructs the Director of the Radiocommunication Bureau* 3 below)~~;

~~3 that the frequency bands specified in *resolves* 1 shall not be used for the UAS CNPC links before the adoption of the relevant international aeronautical SARPs consistent with Article 37 of the Convention on International Civil Aviation, taking into account *instructs the Director of the Radiocommunication Bureau* 4;~~

~~4 that administrations responsible for an FSS network providing UA CNPC links shall apply the relevant provisions of Articles **9** (necessary provisions need to be identified or developed) and **11** for the relevant assignments, including, as appropriate, assignments to the corresponding space station, specific and typical earth station and earth station in motion on board UA, including the request for publication in the International Frequency Information Circular (BR IFIC) of items referred to in *resolves* 2 and the course of actions identified in that *resolves* in order to obtain international rights and recognition as specified in Article **8**;~~

10 that, with respect to other satellite networks in the frequency bands referred to in *resolves* 1, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that its UA CNPC earth stations comply with the following conditions:

~~5~~10.1 ~~that~~ the UA CNPC earth station~~s of UAS CNPC links shall operate~~ characteristics shall remain within the ~~notified and recorded technical parameters~~ envelope of characteristics of the

~~associated satellite network, including specific or~~ typical earth stations of the associated ~~GSO~~ FSS satellite network~~(s)~~ as notified and published by the Radiocommunication Bureau (BR);

~~6~~10.2 ~~that~~ the operation of UA CNPC earth stations ~~of UAS CNPC links~~ shall not cause more interference to and shall not~~, or~~ claim more protection ~~from, other satellite networks and systems~~ than ~~specific or~~ that of the typical earth stations of that GSO FSS network~~as indicated in *resolves* 5 as published by BR~~;

~~7 that, in order to apply *resolves* 6 above, administrations responsible for the FSS network to be used for UAS CNPC links shall provide the level of interference for the reference assignments of the network used for CNPC links upon request by an administration authorizing the use of UAS CNPC links within its territory;~~

~~8 that earth stations of UAS CNPC links of a particular FSS network shall not cause more interference to, or claim more protection from, stations of terrestrial services than specific or typical earth stations of that FSS network as indicated in *resolves* 5 that have been previously coordinated and/or notified under relevant provisions of Articles **9** and **11**;~~

~~9~~10.3 ~~that~~ the use of assignments of an FSS satellite network for UAS CNPC links shall not constrain other ~~FSS~~ satellite networks beyond what is already imposed by the typical earth stations of the associated FSS satellite network during the application of the provisions of Articles **9** and **11**;

10.4 the operation of the UA CNPC earth station shall comply with the coordination agreements for the frequency assignments of the typical earth station of the associated GSO FSS network obtained under the relevant provisions of the Radio Regulations, taking into account *resolves* 16.6;

10.5 operation of UAS CNPC links shall not adversely affect the existing and future satellite networks coordination agreements or the regular satellite coordination process;

11 that, with respect to terrestrial services in the frequency bands referred to in *resolves* 1, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that its UA CNPC earth stations comply with the following conditions:

~~10~~11.1 ~~that~~ the ~~introduction~~ use of UAS CNPC links shall not result in additional coordination constraints on terrestrial services under Articles **9** and **11**;

11.2 unless otherwise agreed between the administrations concerned, receiving UA CNPC earth stations shall not claim protection from transmitting stations of terrestrial services operating in conformity with the Radio Regulations, No. **5.43A** does not apply and there is therefore no change of the regulatory status of UA CNPC earth stations with respect to those of the terrestrial service;

resolves following 11.2

TBD

encourages administrations

TBD

invites the 2023 World Radiocommunication Conference

TBD

invites the ITU Radiocommunication Sector

TBD

instructs the Director of the Radiocommunication Bureau

TBD

instructs the Secretary-General

TBD

invites the International Civil Aviation Organization

TBD

ANNEX 1 TO RESOLUTION 155 (REV.WRC-~~19~~23)

TBD

ANNEX 2 TO RESOLUTION 155 (REV.WRC-~~19~~23)

Protection of the fixed service from UAS CNPC emissions

TBD

SUP

RESOLUTION 171 (WRC-19)

Review and possible revision of Resolution 155 (Rev.WRC-19) and No. 5.484B in the frequency bands to which they apply

2/1.8/5.2.2 Method B2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

5.484B The operation of earth stations on board unmanned aircraft communicating with geostationary fixed-satellite service (FSS) space stations within the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz

(Earth-to-space) and 29.5-30.0 GHz (Earth-to-space) are an application of the FSS, are limited to internationally standardized aeronautical systems, and Resolution **155 (Rev.WRC-~~15~~23)**[*] shall apply. (WRC-~~15~~23)

MOD

APPENDIX 4 (REV.WRC-~~19~~23)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

MOD

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-~~12~~23)

TBD

MOD

RESOLUTION 155 (REV.WRC-~~19~~23)

Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces[*]

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

considering

a) that the operation of unmanned aircraft systems (UAS) requires reliable control and non-payload communication (CNPC) links, in particular to relay air traffic control communications and for the remote pilot to control the flight;

~~* *Note by the Secretariat:* This Resolution was revised by WRC-19.~~

* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.

b) that satellite networks may be used to provide CNPC links of UAS beyond the line-of-sight, as shown in Annex 1 to this Resolution;

c) that CNPC links between space stations and stations on board unmanned aircraft (UA) are proposed to be operated under this Resolution in the primary fixed-satellite service (FSS) in frequency bands shared with other primary services, including terrestrial services, however that would not preclude the use of other available allocations to accommodate this application,

considering further

a) that the operation of UA CNPC earth stations within territory under the jurisdiction of an administration, including territorial waters and airspace, shall only be carried out with the authorization of that administration;

b) that the administration authorizing the operation of UA earth stations on territory under its jurisdiction, including territorial waters and airspace, may change/withdraw its authorization at any time,

~~that UAS CNPC links relate to the safe operation of UAS and have to comply with certain technical, operational and regulatory requirements,~~

noting

a) that WRC-15 adopted Resolution **156 (WRC-15)** on the use of earth stations in motion communicating with geostationary FSS space stations in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz;

b) that Report ITU-R M.2171 provides information on characteristics of UAS and spectrum requirements to support their safe operation in non-segregated airspace,

recognizing

TBD

recognizing further

a) that with the introduction of UA in non-segregated airspace, continued safety of other airspace users as well as life and property on the ground needs to be maintained;

b) that No. **4.10** is one of the main provisions of the Radio Regulations relating to the interference-free operation of safety services;

c) that the assignments and use of the relevant frequency bands have to be consistent with No. **4.10** of the Radio Regulations which recognizes that safety services require special measures to ensure their freedom from harmful interference,

resolves

1 that frequency assignments to stations of GSO FSS networks operating in the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space), may be used for UAS CNPC links to communicate with earth stations on board UA operating in non-segregated airspace*, provided that the conditions specified in the following *resolves* ~~below~~ are met;

~~* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.~~

2 that frequency assignments used by UAS CNPC operating in the frequency bands specified in *resolves* 1 are an application of the primary frequency allocations to the FSS;

3 the use of frequency assignments of GSO FSS networks for UAS CNPC links does not confer on the satellite network special regulatory status or any advantage or priority in the application of Articles **9** and **11** or any other regulatory provisions;

4 that frequency assignments to UA CNPC earth stations subject to this Resolution shall be notified under No. **11.2** by the notifying administration of the FSS satellite network with which these earth stations communicate;

5 that for the implementation of *resolves* 4 above, the notifying administration for the GSO FSS with which the UAS CNPC earth station communicates shall send to the Radiocommunication Bureau (BR) the relevant Appendix **4** notification information related to the characteristics of the UAS CNPC earth station identified as class of station "UG";

6 that, for the implementation of *resolves* 5 above, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall also be responsible to observe, and comply with all relevant regulatory and administrative provisions applicable to the operation of the above-mentioned UA CNPC earth station as included in this Resolution and those contained in the Radio Regulations, the implementation of No. **4.10** is addressed in *resolves* xx below;

7 that, for the use of frequency assignments of GSO FSS networks for CNPC links, the administration authorizing the use of the UAS CNPC earth stations, as well as the notifying administration of the satellite network used for the UAS CNPC earth stations, shall ensure compliance with the provisions of No. **4.10**. Obligations arising from the application of the provisions of No. **4.10** as a result of such use of UAS CNPC earth stations shall not extend to other administrations;

8 that the administration authorizing the use of the UAS CNPC earth stations, along with the notifying administration of the satellite network with which the UAS CNPC earth stations communicate, shall ensure the safe operation of the UAS CNPC links, in accordance with the ICAO SARPs and pursuant to *resolves* 7 of this Resolution;

Reasons: The administration authorizing the use of the frequency assignments of a GSO FSS satellite network for the operation of UA CNPC links, as well as the notifying administration of the satellite network in question, shall bear responsibility for the safety of UA flights in non-segregated airspace.

9 that the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that UA CNPC earth stations operate only in the territory under the jurisdiction of any administration(s)/country(ies), including its/their territorial waters and airspace, from which an explicit authorization has been obtained under Article **18**;

10 that the notifying administration of the GSO FSS satellite network with which the UA CNPC earth stations communicate shall ensure that they have the capability to limit operations of such earth stations to the territory or territories of administrations, including their territorial waters and airspace, having authorized those earth stations;

11 that the authorization to an UAS CNPC earth station to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the GSO FSS network with which the UAS CNPC earth station communicates from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations;

12 that the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that ~~earth stations in motion on board UA may communicate with the space station of a GSO FSS network operating in the frequency bands listed in *resolves* 1 above, provided that~~ the class of the UA CNPC earth station ~~in motion on board UA~~ is matched with the class of the space station and that other conditions of this Resolution are met ~~(see also *instructs the Director of the Radiocommunication Bureau* 3 below)~~;

~~3 that the frequency bands specified in *resolves* 1 shall not be used for the UAS CNPC links before the adoption of the relevant international aeronautical SARPs consistent with Article 37 of the Convention on International Civil Aviation, taking into account *instructs the Director of the Radiocommunication Bureau* 4;~~

~~4 that administrations responsible for an FSS network providing UA CNPC links shall apply the relevant provisions of Articles **9** (necessary provisions need to be identified or developed) and **11** for the relevant assignments, including, as appropriate, assignments to the corresponding space station, specific and typical earth station and earth station in motion on board UA, including the request for publication in the International Frequency Information Circular (BR IFIC) of items referred to in *resolves* 2 and the course of actions identified in that *resolves* in order to obtain international rights and recognition as specified in Article **8**;~~

13 that, with respect to other satellite networks in the frequency bands referred to in *resolves* 1, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that its UA CNPC earth stations comply with the following conditions:

~~5~~13.1 ~~that~~ the UA CNPC earth station~~s of UAS CNPC links shall operate~~ characteristics shall remain within the ~~notified and recorded technical parameters~~ envelope of characteristics of the ~~associated satellite network, including specific or~~ typical earth stations of the associated ~~GSO~~ FSS satellite network~~(s)~~ as notified and published by the Radiocommunication Bureau (BR);

~~6~~13.2 ~~that~~ the operation of UA CNPC earth stations ~~of UAS CNPC links~~ shall not cause more interference to and shall not~~, or~~ claim more protection ~~from, other satellite networks and systems~~ than ~~specific or~~ that of the typical earth stations of that GSO FSS network ~~as indicated in *resolves* 5 as published by BR~~;

~~7 that, in order to apply *resolves* 6 above, administrations responsible for the FSS network to be used for UAS CNPC links shall provide the level of interference for the reference assignments of the network used for CNPC links upon request by an administration authorizing the use of UAS CNPC links within its territory;~~

~~8 that earth stations of UAS CNPC links of a particular FSS network shall not cause more interference to, or claim more protection from, stations of terrestrial services than specific or typical earth stations of that FSS network as indicated in *resolves* 5 that have been previously coordinated and/or notified under relevant provisions of Articles **9** and **11**;~~

~~9~~13.3 ~~that~~ the use of assignments of an FSS satellite network for UAS CNPC links shall not constrain other ~~FSS~~ satellite networks beyond what is already imposed by the typical earth stations of the associated FSS satellite network during the application of the provisions of Articles **9** and **11**;

13.4 operation of UAS CNPC links shall not adversely affect the existing and future satellite networks coordination agreements or the regular satellite coordination process;

14 that, with respect to terrestrial services in the frequency bands referred to in *resolves* 1, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that its UA CNPC earth stations comply with the following conditions:

~~10~~14.1 ~~that~~ the ~~introduction~~ use of UAS CNPC links shall not result in additional coordination constraints on terrestrial services under Articles **9** and **11**;

14.2 unless otherwise agreed between the administrations concerned, receiving UA CNPC earth stations shall not claim protection from transmitting stations of terrestrial services operating in conformity with the Radio Regulations, No. **5.43A** does not apply and there is therefore no change of the regulatory status of UA CNPC earth stations with respect to those of the terrestrial service;

Editor's Note: Provisions should be added to protect stations of terrestrial radio services from possible interference caused by earth stations of UAS CNPC links.

~~*resolves* following 11.2~~

15 to ensure that UA CNPC earth stations are designed and operated so as to be able to meet their required performance with interference caused by other satellite networks resulting from application of Articles **9** and **11**, and notably those assignments pertaining to other satellite networks recorded in MIFR under No. **11.41**;

16 that, in case administrations wished to use FSS frequency assignments for UAS CNPC links, they should use measures in order to be consistent with No. **4.10**;

17 that the frequency bands specified in *resolves* 1 shall not be used for the UAS CNPC links before the issue of safety of life referred to in No. **4.10** is solved and agreed in ITU-R framework;

18~~7~~ that, in order to protect the radio astronomy service in the frequency band 14.47-14.5 GHz, administrations operating UAS in accordance with this Resolution in the frequency band 14-14.47 GHz within line-of-sight of radio astronomy stations are urged to take all practicable steps to ensure that the emissions from the UA in the frequency band 14.47-14.5 GHz do not exceed the levels and percentage of data loss given in the most recent versions of Recommendations ITU-R RA.769 and ITU-R RA.1513;

resolves further

TBD

encourages administrations

TBD

instructs the Director of the Radiocommunication Bureau

TBD

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary General of ICAO,

invites the International Civil Aviation Organization

TBD

ANNEX 1 TO RESOLUTION 155 (REV.WRC-~~19~~23)

UAS CNPC links

TBD

ANNEX 2 TO RESOLUTION 155 (REV.WRC-~~19~~23)

Protection of the fixed service from UAS CNPC emissions

TBD

SUP

RESOLUTION 171 (WRC-19)

Review and possible revision of Resolution 155 (Rev.WRC-19) and No. 5.484B in the frequency bands to which they apply

2/1.8/5.2.3 Method B3

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

Method B3, Option 1

MOD

5.484B Resolution **155 (Rev.WRC-~~15~~23)*** shall apply. (WRC-~~15~~23)

Method B3, Option 2

MOD

5.484B The operation of earth stations on board unmanned aircraft communicating with geostationary fixed-satellite service (FSS) space stations within the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space) are an application of the FSS, are limited to internationally standardized aeronautical systems, and Resolution **155 (Rev.WRC-~~15~~23)*** shall apply. (WRC-~~15~~23)

~~* *Note by the Secretariat:* This Resolution was revised by WRC-19.~~

~~* *Note by the Secretariat:* This Resolution was revised by WRC-19.~~

Method B3, Option 1

No change to RR Appendix **4** is required.

NOC

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

Method B3, Option 2

MOD

APPENDIX 4 (REV.WRC-~~19~~23)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

MOD

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-~~12~~23)

Footnotes to Tables A, B, C and D

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
…	…											
A.25	**COMPLIANCE WITH NOTIFICATION OF GSO FSS NETWORKS USING EARTH STATIONS USING CNPC LINKS**										**A.25**	-
A.25.a	information on satellite network assignments for which the UG station class shall be applied Required only for the bands listed in *resolves* 1 of Resolution **155 (Rev.WRC-23)**, when a CNPC UA earth station in the fixed-satellite service communicates with a space station in the fixed-satellite service				+						A.25.a	
A.25.b	a commitment that unless an agreement is received pursuant to *resolves* 8.2 of Resolution **155 (Rev.WRC-23)** that the notifying administration shall meet the pfd limits in Annex 2 of Resolution **155 (Rev.WRC-23)** Required only for the bands and territories listed in *recognizing e)* of Resolution **155 (Rev.WRC-23)** when an earth station in the fixed-satellite service using CNPC links communicates with a space station in the fixed-satellite service				+						A.25.b	
A.25.c	information on Network Control and Monitoring Centre NCMC or equivalent facility permanent points of contact consistent with *resolves* 14.6 of Resolution **155 (Rev.WRC-23)** Required only for the bands listed in *resolves* 1 of Resolution **155 (Rev.WRC-23)**, when a CNPC UA earth station in the fixed-satellite service communicates with a space station in the fixed-satellite service				+						A.25.c	

End of Option 2.

MOD

RESOLUTION 155 (REV.WRC-~~19~~23)

Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces*

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

considering

a) that the operation of unmanned aircraft systems (UAS) requires reliable control and non-payload communication (CNPC) links, as shown in Annex 1 of this Resolution, in particular to relay air traffic control communications and for the remote pilot to control the flight;

~~*b)* that satellite networks may be used to provide CNPC links of UAS beyond the line-of-sight, as shown in Annex 1 to this Resolution;~~

b) that the use of FSS for CNPC links would not preclude the use of other available allocations to accommodate CNPC links,

~~*c)* that CNPC links between space stations and stations on board unmanned aircraft (UA) are permitted to be operated under this Resolution in the primary fixed-satellite service (FSS) in frequency bands shared with other primary services, including terrestrial services, however that would not preclude the use of other available allocations to accommodate this application,~~

considering further

~~that UAS CNPC links relate to the safe operation of UAS and have to comply with certain technical, operational and regulatory requirements,~~

a) that UAS CNPC earth stations operating within the service area of the GSO FSS networks with which they communicate may provide service within more than one country;

b) that for the operation of UAS CNPC earth stations, notification of any frequency assignment under Article **11** of the Radio Regulations can only be made by one single notifying administration;

c) that, an administration authorizing the operation of UAS CNPC earth stations within the territory under its jurisdiction may modify or withdraw that authorization at any time,

noting

a) that WRC-15 adopted Resolution **156 (WRC-15)** on the use of earth stations in motion communicating with geostationary-satellite orbit (GSO) FSS space stations in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz for non-safety applications and does not apply for UAS CNPC links;

* ~~May also be used consistent with international standards and practices approved by the responsible civil aviation authority.~~TBD

b) that Report ITU-R M.2171 provides information on characteristics of UAS and spectrum requirements to support their safe operation in non-segregated airspace,

recognizing

~~*a)* that the UAS CNPC links will operate in accordance with international standards and recommended practices (SARPs) and procedures established in accordance with the Convention on International Civil Aviation;~~

a) that the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space) are allocated to the fixed-satellite service (FSS on a primary basis);

~~*b)* that, in this Resolution, conditions are provided for operations of CNPC links without prejudging whether the International Civil Aviation Organization (ICAO) would be able to develop SARPs to ensure safe operation of UAS under these conditions,~~

b) that the frequency bands 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.1 GHz (Region 2), 12.1-12.2 GHz (on the territory of the country listed in No. **5.489**), 12.2-12.5 GHz (Region 3), 12.5-12.75 GHz (on the territory of the countries listed in No. **5.494** and in Region 3) considered for FSS downlink are allocated to the fixed and/or mobile except aeronautical mobile on a primary basis;

c) that the frequency bands 14.0-14.3 GHz (on the territory of countries listed in No. **5.505**), 14.25-14.3 GHz (on the territory of countries listed in No. **5.508**), 14.3-14.4 GHz (Regions 1 and 3), and 14.4-14.47 GHz considered for FSS uplink are allocated to the fixed and/or mobile except aeronautical mobile on a primary basis,

recognizing further

a) that the UAS CNPC links support safe operation of UAS;

b) that, in this Resolution, conditions are provided for operations of CNPC links without prejudging whether the International Civil Aviation Organization (ICAO) would be able ~~to develop SARPs~~ to ensure safe operation of UAS under these conditions,

c) that the provisions within the Standards and Recommended Practices contained in the International Convention on Civil Aviation for unmanned aircraft systems addresses aviation's requirements for the safe operation of UAS;

d) that the assessment of the capability of a candidate or an operated FSS link to comply or not with the ICAO SARPs, in particular the required link performance, for the safe operation of UAS is outside the purview of the ITU-R;

e) that notifying administrations of GSO FSS networks would not be involved in case of the CNPC required performance is impacted by interference which remains below the thresholds resulting from the regular coordination process under Article **9**;

f) that notifying administrations of GSO FSS networks would not be able to provide any interference resolution (e.g. real-time, …) different from the regular process under Article **15**;

g) that administrations operating terrestrial stations cannot provide an accurate prediction of the interference that might be present in the airspace being used by UA everywhere, anytime UA could fly;

h) that the environment in which GSO FSS is operated within the frequency bands identified by this resolution cannot support the implementation of No. **4.10**; this implies that any administrations notifying FSS network as well as any administrations operating stations in the terrestrial services in the frequency bands identified in *resolves* 1 of Resolution **155 (Rev.WRC-19)** have no responsibility for the safety of life for these links;

Option 1

i) that the application of No. **4.10** is a requirement to be applied by default for UAS CNPC links by the ITU Member States which implies:

– that FSS cannot be used globally for UAS CNPC and;

– that FSS might be operated for UAS CNPC in a given airspace only provided that the State(s) responsible[1] to ensure safety of this airspace, decide(s) that the application of No. **4.10** is not required for specific safety cases of the UAS flight,

Option 2

Not using the provision under Option 1 for *recognizing further i)*.

Option 1

Not using the provision under Option 2 for *recognizing further j)*.

Option 2

j) that Section VI of Article **22** contains limits on equivalent isotropically radiated power at off-axis angles of 3 degrees or more for earth stations of a geostationary-satellite network in the fixed-satellite service in the frequency bands 14-14.47 GHz and 29.5-30 GHz;

End of Option 2

resolves

1 that frequency assignments to stations of GSO FSS networks operating in the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space), ~~may~~are permitted to be used for UAS CNPC links to communicate with earth stations on board UA operating in non-segregated airspace[1~~*~~], ~~provided that the conditions specified in~~under the following conditions~~*resolves* below are met~~;

2 that UAS CNPC operating in the frequency bands specified in *resolves* 1 are an application of the primary frequency allocations to the FSS;

3 that frequency assignments to UA CNPC earth stations subject to this Resolution shall be notified under No. **11.2** by the notifying administration of the FSS satellite network with which these typical earth stations communicate;

4 that the notifying administration for the GSO FSS network with which the UA CNPC earth station communicates shall send to the Radiocommunication Bureau (BR) the relevant

[1] Defined accordingly with the Convention of the International Civil Aviation Organization (ICAO).

~~* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.~~

Appendix **4** notification information related to the characteristics of the UAS CNPC earth station identified as class of station “UG”;

5 that the operation of a UAS CNPC earth station within the territory under the jurisdiction of an administration shall be subject to obtaining by the notifying administration of the GSO FSS network under Article **18**, an explicit authorization from that administration;

Option 1

~~2 that earth stations in motion on board UA may communicate with the space station of a GSO FSS network operating in the frequency bands listed in *resolves* 1 above, provided that the class of the earth station in motion on board UA is matched with the class of the space station and that other conditions of this Resolution are met (see also *instructs the Director of the Radiocommunication Bureau* 3 below);~~

Option 2

~~2~~6 that the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that ~~earth stations in motion on board UA may communicate with the space station of a GSO FSS network operating in the frequency bands listed in *resolves* 1 above, provided that~~ the class of the UA CNPC earth station ~~in motion on board UA~~ is matched with the class of the space station and that other conditions of this Resolution are met ~~(see also *instructs the Director of the Radiocommunication Bureau* 3 below)~~;

End of Option 2

~~3 that the frequency bands specified in *resolves* 1 shall not be used for the UAS CNPC links before the adoption of the relevant international aeronautical SARPs consistent with Article 37 of the Convention on International Civil Aviation, taking into account *instructs the Director of the Radiocommunication Bureau* 4;~~

~~4 that administrations responsible for an FSS network providing UA CNPC links shall apply the relevant provisions of Articles **9** (necessary provisions need to be identified or developed) and **11** for the relevant assignments, including, as appropriate, assignments to the corresponding space station, specific and typical earth station and earth station in motion on board UA, including the request for publication in the International Frequency Information Circular (BR IFIC) of items referred to in *resolves* 2 and the course of actions identified in that *resolves* in order to obtain international rights and recognition as specified in Article **8**;~~

7 that, with respect to other satellite networks in the frequency bands referred to in *resolves* 1, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that its UA CNPC earth stations comply with the following conditions:

~~5~~7.1 ~~that~~ the UA CNPC earth station~~s of UAS CNPC links shall operate~~ characteristics shall remain within the ~~notified and recorded technical parameters~~ envelope of characteristics of the ~~associated satellite network, including specific or~~ typical earth stations of the associated ~~GSO~~ FSS satellite network~~(s)~~ as notified and published by the Radiocommunication Bureau (BR);

~~6~~7.2 ~~that~~ the operation of UA CNPC earth stations ~~of UAS CNPC links~~ shall not cause more interference to and shall not~~, or~~ claim more protection ~~from, other satellite networks and systems~~ than ~~specific or~~ that of the typical earth stations of that GSO FSS network in the same area~~as indicated in *resolves* 5 as published by BR~~;

~~7 that, in order to apply *resolves* 6 above, administrations responsible for the FSS network to be used for UAS CNPC links shall provide the level of interference for the reference assignments~~

~~of the network used for CNPC links upon request by an administration authorizing the use of UAS CNPC links within its territory;~~

~~8 that earth stations of UAS CNPC links of a particular FSS network shall not cause more interference to, or claim more protection from, stations of terrestrial services than specific or typical earth stations of that FSS network as indicated in *resolves* 5 that have been previously coordinated and/or notified under relevant provisions of Articles **9** and **11**;~~

~~9~~7.3 ~~that~~ the use of assignments of an FSS satellite network by ~~for~~ UAS CNPC links shall not constrain other ~~FSS~~ satellite networks beyond what is already imposed by the typical earth stations of the associated FSS satellite network during the application of the provisions of Articles **9** and **11**;

7.4 the operation of the UA CNPC earth station shall comply with the coordination agreements for the frequency assignments of the typical earth station of the associated GSO FSS network obtained under the relevant provisions of the Radio Regulations;

7.5 the operation of UAS CNPC links shall not have any impact on the relevant existing agreements reached during the FSS satellite coordination process or on the future coordination of FSS networks during the application of the provisions of the Radio Regulations;

8 that, with respect to terrestrial services in the frequency bands referred to in *resolves* 1, the notifying administration of the GSO FSS network with which the UA CNPC earth station communicates shall ensure that its UA CNPC earth stations comply with the following conditions:

~~10~~8.1 ~~that~~ the ~~introduction~~ use of UAS CNPC links shall not result in additional coordination constraints on terrestrial services under Articles **9** and **11**;

8.2 unless otherwise agreed between the administrations concerned, UA CNPC earth stations shall reduce interference to terrestrial services of other administrations by meeting the power flux-density (pfd) masks contained in Annex 2 to this Resolution;

8.3 UA CNPC earth stations receiving in the frequency bands referred to in *recognizing b)* shall not claim protection from transmitting stations of terrestrial services operating in conformity with the Radio Regulations, No. **5.43A** does not apply and there is therefore no change of the regulatory status of UA CNPC earth stations with respect to stations of the terrestrial service;

~~3~~9 that the use of frequency bands specified in *resolves* 1 ~~shall not be used for the~~ by the UAS CNPC links ~~before the adoption of the relevant international aeronautical SARPs consistent with Article 37 of~~ shall be in accordance with the Convention on International Civil Aviation and its annexes that includes Standards and Recommended Practices (SARPs)~~, taking into account *instructs the Director of the Radiocommunication Bureau* 4~~;

Option 1

10 that any station used for UAS CNPC links (see Figure 1 in Annex 1) shall use assignments that have been successfully coordinated under Article **9** (including provisions identified in *resolves* 4) and recorded in the Master International Frequency Register with a favourable finding under Article **11**, including Nos. **11.31**, **11.32** or **11.32A** where applicable, and except those assignments that have not successfully completed coordination procedures under No. **11.32** by applying Appendix **5** § 6.d.i;

Option 2

10 use frequency assignments associated with the GSO FSS networks for UAS CNPC links (see Figure 1 in Annex 1), including frequency assignments to space stations, specific or typical

earth stations and earth stations on board UA, that have successfully applied the coordination procedure under Article **9** and notification procedure under Article **11**;

Option 3

None of the two options.

End of Option 3

11 that earth stations on board UA shall be designed and operated so as to be able to accept the interference caused by terrestrial services operating in conformity with the Radio Regulations in the frequency bands listed in *resolves* 1 without complaints under Article **15**;

12 that earth stations on board UA shall be designed and operated so as to be able to operate with interference caused by other satellite networks resulting from application of Articles **9** and **11**;

13 that No. **4.10** does not apply to the use of networks of the FSS for the UAS CNPC links operated in the frequency bands listed in *resolves* 1;

Option 1

Deletion of *resolves* 13 from Resolution **155 (Rev.WRC-19)** as contained in RR 2020 and labelled as *resolves* 14 in this document.

Option 2

14~~3~~ that, in order to ensure safety-of-flight operation of UAS by ensuring freedom from harmful interference, ~~administrations~~States responsible for operating UAS CNPC links under the ICAO requirements established in the standards to ensure safety of life shall:

~~ensure that the use of UAS CNPC links be in accordance with international SARPs consistent with Article 37 of the Convention on International Civil Aviation;~~

Editor's note: moved to resolves 9

~~–~~14.1 take the required measures, consistent with No. **4.10**, to ensure freedom from harmful interference to earth stations on board UA and operated in accordance with this Resolution;

Option 2.1

~~–~~14.2 act immediately when their attention is drawn to any such harmful interference~~, as freedom from harmful interference to UAS CNPC links is imperative to ensure their safe operation, taking into account *resolves* 11~~cases where harmful interferences could not be mitigated by the State responsible for operating UAS CNPC links leading to a loss of the UAS CNPC links, would need to be addressed by aeronautical operational procedures defined within ICAO;

Option 2.2

14.2 act immediately when their attention is drawn to any such harmful interference, as freedom from harmful interference to UAS CNPC links is imperative to ensure their safe operation;

End of Option 2.2

~~use assignments associated with the FSS networks for UAS CNPC links (see Figure 1 in Annex 1), including assignments to space stations, specific or typical earth stations and earth stations on board UA (see *resolves* 2), that have been successfully coordinated under Article **9** (including provisions identified in *resolves* 4) and recorded in the Master International Frequency Register with a favourable finding under Article **11**, including Nos. **11.31**, **11.32** or **11.32A** where applicable, and except those assignments~~

~~that have not successfully completed coordination procedures under No. **11.32** by applying Appendix 5 § 6.d.i;~~

Editor's note: Moved to resolves 10

~~–~~14.3 ensure that real-time interference monitoring, estimation and prediction of interference risks and planning solutions for potential interference scenarios are addressed by the FSS operator~~s~~ and the UAS operator~~s~~ with guidance from aviation authorities;

14.4 use techniques to maintain antenna pointing accuracy for the operation of CNPC UA ES with the associated GSO FSS satellites, without inadvertently tracking adjacent GSO satellites;

14.5 take all necessary measures so that CNPC UA ES are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility in order to comply with the provisions in this Resolution;

14.6 provide NCMC or equivalent facility permanent points of contact for the purpose of tracing any suspected cases of harmful interference from CNPC UA ES and to immediately respond to requests from the points of contact of authorizing administrations,

End of Option 2

~~14 that, unless otherwise agreed between the administrations concerned, UA CNPC earth stations shall not cause harmful interference to terrestrial services of other administrations (see also Annex 2 to this Resolution);~~

~~15 that, in order to implement *resolves* 14 above, power flux-density (pfd) hard limits need to be developed for UAS CNPC links; possible examples of such provisional limits to protect the fixed service are provided in Annex 2; subject to agreement between the administrations concerned, that annex may be used for the implementation of this Resolution;~~

~~16 that the pfd hard limits provided in Annex 2 shall be reviewed and, if necessary, revised by WRC-23[1];~~

~~17~~15 that, in order to protect the radio astronomy service in the frequency band 14.47-14.5 GHz, administrations ~~operating UAS~~authorizing the operation of CNPC UA ES in accordance with this Resolution in the frequency band 14-14.47 GHz within line-of-sight of radio astronomy stations are urged to take all practicable steps to ensure that the emissions from the UA in the frequency band 14.47-14.5 GHz do not exceed the levels and percentage of data loss given in the most recent versions of Recommendations ITU-R RA.769 and ITU-R RA.1513~~;~~,

~~18 to consider the progress obtained by ICAO in the process of preparation of SARPs for UAS CNPC links, to review this Resolution at WRC-23, taking into account the results of the implementation of Resolution **156 (WRC-15)**, and to take necessary actions as appropriate;~~

~~19 that the ITU Radiocommunication Sector (ITU-R) studies on technical, operational and regulatory aspects in relation to the implementation of this Resolution shall be completed, together with the adoption of relevant ITU-R Recommendations defining the technical characteristics of CNPC links and conditions of sharing with other services,~~

~~[1] WRC-19 received a proposal from one regional organization regarding protection of the fixed service using a revised pfd mask as contained in Annex 2 section b). ITU-R is invited, in continuing its study on the implementation of this Resolution, to consider this mask and take necessary action as appropriate.~~

Option 1

resolves further

1 that in case of unacceptable interference caused by any type of UAS CNPC earth station:

1.1 the notifying administration of the GSO FSS satellite network with which the UAS CNPC earth station on board UA communicates is the responsible administration for resolving the case of unacceptable interference;

1.2 the notifying administration of the GSO FSS satellite network with which the UAS CNPC earth station on board UA communicates shall undertake an investigation on the matter and provide the required information to the administration reporting unacceptable interference on the operation of those earth stations;

1.3 the administration responsible of the aircraft on which the UAS earth station on board UA operates shall cooperate with the investigation on the matter and provide the affected administration with any required information on the operation of the UAS earth station, if within its ability, as well as a point of contact to seek the required information; see also *recognizing k)*;

1.4 the notifying administration of the GSO FSS satellite network with which the UAS CNPC earth station on board UA communicates shall, take the required actions to eliminate or reduce interference to an acceptable level,

Option 2

Not having *resolves further*

encourages administrations

1 ~~to provide the relevant information where available in order to facilitate the application of *resolves* 6;~~to notify their stations operated under terrestrial services in order to assist the responsible State(s) to assess the level of interference where the UAS plans to operate;

2 ~~to participate actively in the studies referred to in *invites the ITU Radiocommunication Sector* by submitting contributions to ITU-R,~~ to consider the available AMS(R)S and AM(R)S which comply with No. **4.10**, as the preferred allocations to be used for UAS CNPC when possible or to consider these allocations as a backup of FSS for UAS CNPC as appropriate,

~~*invites the 2023 World Radiocommunication Conference*~~

~~to consider the results of the above studies referred to in this Resolution with a view to reviewing and, if necessary, revising this Resolution, and take necessary actions, as appropriate,~~

~~*invites the ITU Radiocommunication Sector*~~

~~to conduct, as a matter of urgency, relevant studies of technical, operational and regulatory aspects in relation to the implementation of this Resolution[1],~~

~~[1] WRC-19 received a proposal from one regional organization regarding protection of the fixed service using a revised pfd mask as contained in Annex 2 section b). ITU-R is invited, in continuing its study on the implementation of this Resolution, to consider this mask and take necessary action as appropriate.~~

instructs the Director of the Radiocommunication Bureau

~~1 to examine the relevant part of this Resolution requiring actions to be taken by administrations to implement this Resolution, with a view to sending it to administrations and posting it on the ITU website;~~

~~2 to present to subsequent WRCs a progress report relating to the implementation of this Resolution;~~

~~3 to define a new class of station in order to be able to process satellite network filings submitted by administrations for earth stations providing UA CNPC links, after the Resolution is implemented, in accordance with this Resolution, and publish the information as referred to in *resolves* 4;~~

~~4 not to process satellite network filing submissions by administrations with a new class of a station for earth stations providing UA CNPC links before *resolves* 1-12 and 14-19 of this Resolution are implemented;~~

~~5 to report to subsequent WRCs on the progress made by ICAO on the development of SARPs for UAS CNPC links,~~

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary General of ICAO~~,~~.

~~*invites the International Civil Aviation Organization*~~

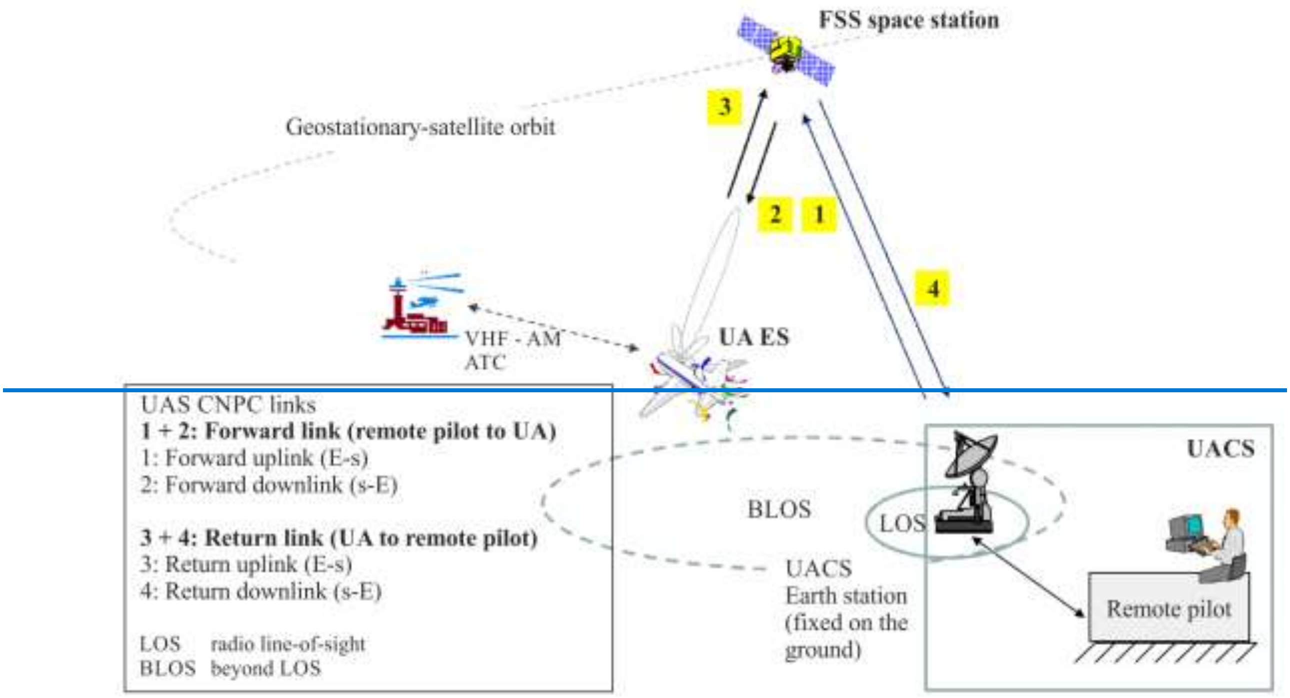
~~to provide to the Director of BR, in time for WRC-23, information on ICAO efforts regarding implementation of UAS CNPC links, including the information related to the development of SARPs for UAS CNPC links.~~

ANNEX 1 TO RESOLUTION 155 (REV.WRC-~~19~~23)

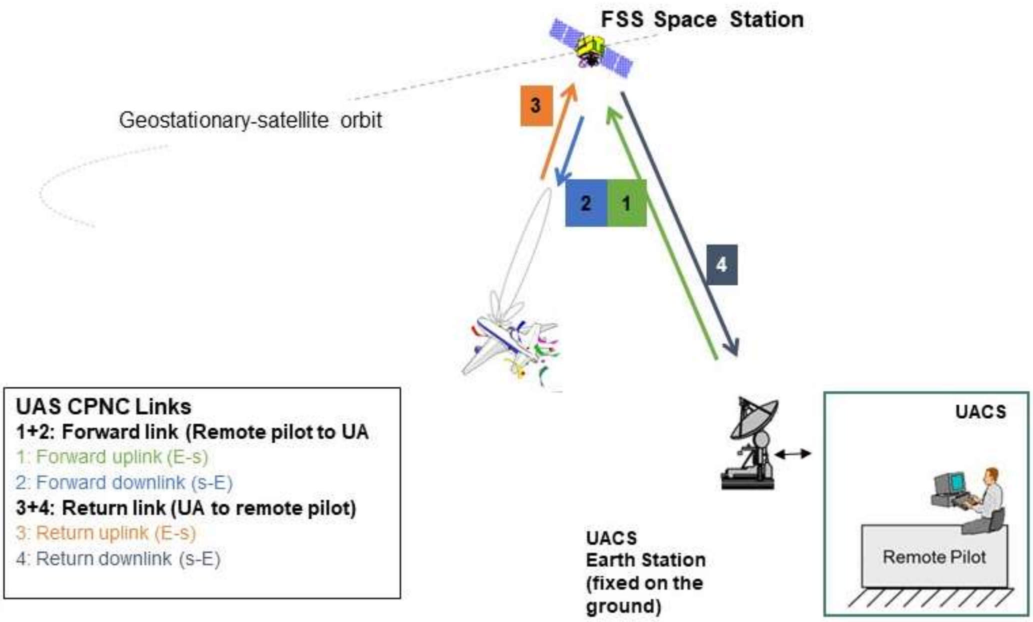
UAS CNPC links

FIGURE 1

Elements of UAS architecture using the FSS



RES155_Annex1-01



f

ANNEX 2 TO RESOLUTION 155 (REV.WRC-~~19~~23)

Option 1

Protection of the fixed service from UAS CNPC emissions

Option 2

Protection of the ~~fixed~~ terrestrial services from UAS CNPC emissions

~~**a) Example provided to WRC-15**~~

~~The fixed service is allocated by table entries and footnotes in several countries with co-primary status with FSS. Conditions of UA using CNPC shall be such that the fixed service is protected from any harmful interference as follows:~~

~~An earth station on board UA in the frequency band 14.0-14.47 GHz shall comply with provisional power flux-density (pfd) limits described below:~~

~~$-132 + 0.5 \cdot \theta$ dB(W/(m^2 · MHz)) for $0° \leq \theta \leq 40°$~~

~~-112 dB(W/(m^2 · MHz)) for $40° < \theta \leq 90°$~~

~~where θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal).~~

~~NOTE – The aforementioned limits relate to the pfd and angles of arrival that would be obtained under free-space propagation conditions.~~

~~**b) Example provided to WRC-19**~~

An earth station on board UA in the frequency band 14.0-14.3 GHz shall comply with the pfd limits described below, on the territory of countries listed in No. **5.505**:

$$15\log(\theta+0.9)-124\ \mathrm{dB}\left(\mathrm{W}/\left(\mathrm{m}^2\cdot\mathrm{MHz}\right)\right)\quad \text{for}\ \ 0°\leq\theta\leq 90°$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

An earth station on board UA:

– in the frequency band 14.25-14.3 GHz on the territory of countries listed in No. **5.508**;

– in the frequency band 14.3-14.4 GHz in Regions 1 and 3;

– in the frequency band 14.4-14.47 GHz worldwide,

shall comply with the pfd limits described below:

$$15\log(\theta+0.9)-133.5\mathrm{dB}\left(\mathrm{W}/\left(\mathrm{m}^2\cdot\mathrm{MHz}\right)\right)\quad \text{for}\ \ 0°\leq\theta\leq 90°$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

NOTE – The aforementioned limits relate to the pfd and angles of arrival that would be obtained under free-space propagation conditions.

SUP

RESOLUTION 171 (WRC-19)

Review and possible revision of Resolution 155 (Rev.WRC-19) and No. 5.484B in the frequency bands to which they apply

Agenda item 1.9

*1.9 to review Appendix **27** of the Radio Regulations and consider appropriate regulatory actions and updates based on ITU-R studies, in order to accommodate digital technologies for commercial aviation safety-of-life applications in existing HF bands allocated to the aeronautical mobile (route) service and ensure coexistence of current HF systems alongside modernized HF systems, in accordance with Resolution **429 (WRC-19)**;*

Resolution **429 (WRC-19)** – *Consideration of regulatory provisions for updating Appendix **27** of the Radio Regulations in support of aeronautical HF modernization*

2/1.9/1 Executive summary

To address this agenda item, ITU-R has undertaken a regulatory analysis, pursuant to Resolution **429 (WRC-19)**, on consideration of regulatory provisions for updating Appendix **27** of the Radio Regulations (RR) in support of aeronautical HF modernization.

Two methods are considered to address this agenda item:

– Method A: no change (NOC);

– Method B: inclusion into RR Appendix **27**, the relevant part of the Rules of Procedure, and explicit recognition of the aggregation of single channels for wideband digital communications.

2/1.9/2 Background

HF radiocommunications is the long-range communication system supporting safe, efficient air travel over long-range routes beyond the range of ground-based VHF radiocommunication systems. However, technology now provides for satellite communications which have also been recognized by regulatory authorities for use in long-range communications.

Communications using both satellite and terrestrial means for long-range communication provides diversity and synergy that offers increased availability and reliability.

The current HF voice systems suffer from noise and propagation effects that require skilled and knowledgeable radio operators on the ground to provide reliable HF communications. Existing HF data links do not have the throughput required to sufficiently satisfy the communication needs.

In order to use digital HF aeronautical spectrum which would increase the data rates to reach required performance by modern aeronautical systems, RR Appendix **27** needs to allow the use of multiple contiguous and/or non-contiguous 3 kHz channels simultaneously.

2/1.9/3 Summary and analysis of the results of ITU-R studies

Recommendations ITU-R BS.216-2; ITU-R BS.559-2; ITU-R BS.560-4; ITU-R BS.639-0; ITU-R BS.703-0; ITU-R BS.1514-2; ITU-R BS.1615-2; ITU-R BT.1895-0; ITU-R F.1487-0; ITU-R M.1458-0; ITU-R P.368-9; ITU-R P.371-8; ITU-R P.372-14; ITU-R P.373-9; ITU-R P.525-4; ITU-R P.533-14; ITU-R P.534-5; ITU-R P.581-2; ITU-R P.845-3; ITU-R SM.328-11; ITU-R SM.329-12

Since the approach followed for the analyses was to keep the provisions of this RR Appendix **27** for the individual channels unchanged, for wideband communication using aggregation of channels no technical studies were required.

2/1.9/4 Methods to satisfy the agenda item

2/1.9/4.1 Method A: No change

It may be considered that the current version of RR Appendix **27** does not preclude the wideband digital HF communication for the relevant type of classes. In this method, the suppression of Resolution **429 (WRC-19)** is also proposed (see section 2/1.9/5.3).

2/1.9/4.2 Method B: Inclusion into RR Appendix 27, the relevant part of the Rules of Procedure, and explicit recognition of the aggregation of single channels for wideband digital communications

This agenda item could be the opportunity to include in RR Appendix **27** the relevant part of the current text of the Rules of Procedure and make other changes to this Appendix on the use of wideband digital emissions. Should this method be agreed by WRC-23, then appropriate action needs be taken in regards with the Rules of Procedure relating to RR Appendix **27**. Although aggregation of carriers could be considered, this method proposes to explicitly recognize the possibility to aggregate single channels in order to benefit from wideband digital communications without modifying the existing Plan. In this method, the suppression of Resolution **429 (WRC-19)** is also proposed (see section 2/1.9/5.3).

2/1.9/5 Regulatory and procedural considerations

2/1.9/5.1 For Method A: No change (NOC)

<u>NOC</u>

APPENDIX 27 (REV.WRC-19)*

Frequency allotment Plan for the aeronautical mobile (R) service and related information

2/1.9/5.2 For Method B: Inclusion into RR Appendix 27, the relevant part of the Rules of Procedure, and explicit recognition of the aggregation of single channels for wideband digital communications

APPENDIX 27 (REV.WRC-19)*

Frequency allotment Plan for the aeronautical mobile (R) service and related information

PART I – General provisions

Section II – Technical and operational principles used for the establishment of the Plan of allotment of frequencies in the aeronautical mobile (R) service

A – Channel characteristics and utilization

2 Frequencies allotted

ADD

27/18A Individual contiguous or non-contiguous channels complying with the provisions of the Plan[3] contained in this Appendix may be aggregated to provide wideband communication without changing the Plan of individual channels.

ADD

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[3] **27**/18A.1 In particular the provisions related to the protection (Part I, Section II B), to power limits (Nos. **27**/60 and **27**/61), to class of emissions (No. **27**/58), to out-of-band spectrum mask (No. **27**/74), to assigned frequency (No. **27**/75), and to channel spacing (No. **27**/11).

C – Classes of emission and power

1 Classes of emission

MOD

27/57 **1.1 Telephony – amplitude modulation:**

– double sideband A3E*

– single sideband, full carrier H3E*

– single sideband, suppressed carrier J3E, J2E, J7E, J9E

MOD

1.2 Telegraphy ~~(including automatic~~and data transmission~~)~~

---

* A3E and H3E to be used only on 3 023 kHz and 5 680 kHz.

MOD

27/58 **1.2.1 Amplitude modulation:**

– telegraphy without the use of a modulating audio frequency (by on-off keying) A1A, A1B**

– telegraphy by the on-off keying of an amplitude modulating audio frequency or audio frequencies or by the on-off keying of the modulated emission and including selective calling, single sideband, full carrier H2B

– multichannel voice frequency telegraphy, single sideband, suppressed carrier J7~~B~~A

~~– other transmissions such as automatic data transmission, single sideband, suppressed carrier JXX~~

– telegraphy or data transmissions using any other single sideband, suppressed carrier modulation, under the condition that the reference frequency of the concerned transmission corresponds to the list of carrier (reference) frequencies (No. **27**/18) and its occupied bandwidth does not exceed the upper limit of J3E emissions (No. **27**/12), i.e. 2 800 Hz for each individual channel J2B, J2D, J7B, J7D, J9B, J9D

2 Power

MOD

27/60 2.1 Unless otherwise specified in Part II of this Appendix, the peak envelope powers supplied to the antenna transmission line shall not exceed the maximum values indicated in the Table below; the corresponding peak effective radiated powers being assumed to be equal to two-thirds of these values.

Class of emission	Stations	Maximum peak envelope power
H2B, J3E, J7A~~B~~, J2E, J7E, J9E, J2B, J2D, J7B, J7D, J9B, J9D~~JXX,~~ A3E*, H3E* (100% modulation)	Aeronautical stations Aircraft stations	6 kW 400 W
Other emissions such as A1A, A1B, F1B	Aeronautical stations Aircraft stations	1.5 kW 100 W

* A3E and H3E to be used only on 3 023 kHz and 5 680 kHz.

Note: the “(100% modulation)” may require additional clarification.

** A1A, A1B and F1B are permitted provided they do not cause harmful interference to the classes of emission H2B, J3E, J2E, J7E, J9E, J7A~~B~~, J2B, J2D, J7B, J7D, J9B, and J9D~~ and JXX~~. In addition, AlA, A1B and FlB emissions shall be in accordance with the provisions in Nos. **27**/70 to **27**/74 and care should be taken to place these emissions at or near the centre of the channel. However, a modulating audio frequency is permitted with single sideband transmitters, where the carrier is suppressed in accordance with No. **27**/69.

2/1.9/5.3 For both Methods A and B: SUP Resolution 429 (WRC-19)

SUP

RESOLUTION 429 (WRC-19)

Consideration of regulatory provisions for updating Appendix 27 of the Radio Regulations in support of aeronautical HF modernization

Agenda item 1.10

1.10 to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with Resolution ***430 (WRC-19)****;*

Resolution **430 (WRC-19)** – *Studies on frequency-related matters, including possible additional allocations, for the possible introduction of new non-safety aeronautical mobile applications*

2/1.10/1 Executive summary

This agenda item seeks possible new allocations to the aeronautical mobile service (AMS) for non-safety applications. To address this agenda item, ITU-R has undertaken studies, pursuant to Resolution **430 (WRC-19)**, on frequency-related matters for these possible new allocations, see section 2/1.10/3.

The following methods are considered to satisfy this agenda item:

– Method A: No change (NOC);

– Method B: New primary aeronautical mobile (off-route) service (AM(OR)S) allocation in the frequency band 15.4-15.7 GHz;

– Method C: Remove the exception of AM(OR)S in the frequency band 22-22.21 GHz;

– Method D: Combination of Methods B and C;

– Method E: Combination of Methods B and C with 10 MHz guardbands.

The suppression of Resolution **430 (WRC-19)** is included in all the methods.

2/1.10/2 Background

Wideband line-of-sight data links (WB LOS DLs) operate in the AM(OR)S and are not related to safety of life. They are used to exchange mission data between aircraft and aeronautical stations to support applications such as: observation missions, search and rescue, earth science and land management. This agenda item considers possible new allocations to the AM(OR)S in the frequency bands 15.4-15.7 and 22-22.21 GHz to support the growing use of WB LOS DL.

Per the Radio Regulations (RR), stations in the AM(OR)S can support bi-directional communication links including those between aircraft stations or an aircraft station and an aeronautical station on the ground, on board a ship or on a platform at sea.

The frequency band 15.4-15.7 GHz is allocated to the radiolocation service (RLS) and, to the aeronautical radionavigation service (ARNS). The ARNS in the frequency band 15.4-15.7 GHz is used for automatic landing systems (ALS) and unmanned aircraft detect and avoid (DAA) systems. Some previous ITU-R studies have shown that sharing between RLS and AM(OR)S could be difficult. A working document towards a preliminary draft new (WDPDN) Recommendation ITU-R M.[15.4-15.7_GHZ_ARNS][11] is currently being developed to provide characteristics and protection requirements for these ARNS systems. The sub-band 15.43-15.63 GHz is allocated to the fixed-satellite service (FSS) (Earth-to-space) used by feeder links of non-geostationary systems.

The lower adjacent frequency band 15.35-15.4 GHz is allocated to the Earth exploration-satellite service (EESS) (passive), radio astronomy service (RAS) and space research service (SRS)

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[11] If the Report is approved by the Member States at Study Group 5 before WRC-23.

(passive), subject to RR No. **5.340**. The upper adjacent frequency band at 15.7-17.3 GHz is allocated to the RLS.

The frequency band 22-22.21 GHz is allocated to the fixed service (FS) and mobile service (except aeronautical mobile). The lower adjacent frequency band 21.4-22 GHz has allocations to the fixed and mobile services and to the broadcasting-satellite service in Regions 1 and 3. The upper adjacent frequency band at 22.21-22.5 GHz has allocations to the fixed and mobile services (except aeronautical mobile), RAS, SRS (passive) and EESS (passive). With regard to the RAS operating in the frequency band 22.21-22.5 GHz, RR No. **5.149** applies.

The frequency band 22.01-22.21 GHz is not allocated to the RAS. In making assignments to stations of other services to which the frequency band 22.01-22.21 GHz is allocated, administrations are urged to take all practicable steps to protect the RAS from harmful interference, according to RR No **5.149**. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the RAS. In these cases coordination may be needed between the concerned administrations.

Under the EESS (passive) allocation, the frequency band 22.21-22.5 GHz allows for remote sensing observations near a water absorption line that is essential for measuring atmospheric water vapour, which in turn helps reducing error in other geophysical parameters due to the presence of water vapour.

Passive ground-based water-vapour radiometers operating in the frequency band 22-22.5 GHz are also used worldwide to characterize vertical profiles of water-vapour concentrations for applications including, but not limited to, studies of Earth's atmosphere, climatology and meteorology. Furthermore, such radiometers are an important helper application for several application of different radiocommunication services to calibrate signals that travel through Earth's atmosphere and are subject to attenuation and phase shifts caused by water molecules in the troposphere.

2/1.10/3 Summary and analysis of the results of ITU-R studies

2/1.10/3.1 Relevant ITU-R Recommendations and Reports

The relevant ITU-R Recommendations are:

Characteristics and protection criteria: F.758-7, F.1495-2, F.1565-1, M.1461-2, M.1730-1, M.1825-0, M.2089-0, M.2114-0, M.2115-0, M.2116-0, M.2120-0, RA.769-2, RA.1513-2, RS.1861-1, RS.2017-0, and WDPDN Recommendation ITU-R M.[15.4-15.7_GHZ_ARNS]

Antenna patterns: F.699-8, F.1245-3, F.1336-5, M.1851-1, RA.1631-0, RS.1813-1, S.465-6, S.580-6, S.672-4, and SA.509-3.

Propagation models and others: P.452-17, P.453-7, P.528-5, P.619-5, P.676-12, P.835-6, P.1409-2, RA.1513-2, S.1340-0, SM.337-6, and SM.1541-6.

The relevant sharing studies ITU-R Reports are: M.2230-0, and RA.2188-0, M.2170-0, M.2229-0.

To perform studies required under WRC-23 agenda item 1.10 and Resolution **430 (WRC-19)**: WDPDN Report ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES][12].

[12] If the Report is approved by the Member States at Study Group 5 before WRC-23.

2/1.10/3.2 Summary of spectrum requirements

Resolution **430 (WRC-19)** states in *considering a)* that "the number of aircraft equipped with sensors has grown significantly in the past 20 years" and in *considering b)* that "the need for bidirectional low to high data rate communications between aeronautical stations and aircraft stations, or between aircraft stations, is consequently increasing", and *resolves to invite the ITU-R* "to conduct, and complete in time for WRC-23, studies on spectrum needs for new non-safety aeronautical mobile applications for air-air, ground-air and air-ground communications of aircraft systems".

WDPDN Report ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES] has performed such a study on spectrum needs related to new applications of WB LOS DLs. The study makes the assumption that two aircraft stations in line-of-sight (LoS) of each other using overlapping channels interfere with each other. In a first step, the analysis has introduced and considered four operational scenarios involving a number of air-air, ground-air and air-ground communications between aircraft and aeronautical stations. In a second step, the study has computed the necessary amount of spectrum needs to support an increase in the number aircraft stations equipped with sensors without decreasing the number of usable channels. The study came to the conclusion that with 510 MHz of additional spectrum, it would be possible to accommodate for a growth between 11 and 50% of the number of aircraft.

2/1.10/3.3 Summary of the sharing and compatibility studies

2/1.10/3.3.1 Radio astronomy operating in the frequency bands 15.35-15.4 GHz and 22.21-22.5 GHz

Study A considered a data network application with air-air and air-ground links used by one aircraft and showed that AM(OR)S use of the frequency band 15.4-15.7 GHz and 22.21-22.5 GHz needs mitigation (such as avoiding pointing towards a RAS station, avoiding channels closest to the RAS allocations, lowering transmit power, choosing an appropriate bandwidth, or introducing separation distances) to achieve compatibility with RAS operations in the passive service band at 15.35-15.4 GHz and 22.21-22.5 GHz. The study showed that the aggregate incident power from steerable synthetic aperture antennas will be dominated by aircraft at large nadir distances and steering of directional aircraft antenna beams should be used to avoid the direction of the RAS station. The requirements of RR No. **5.340** may be satisfied if the mean incident power flux-density in the frequency band 15.35-15.4 GHz from aggregated AM(OR)S non-safety applications does not exceed -233 dB(W/(m^2 · Hz)) at RAS stations operating in 15.35-15.4 GHz, and -231 dB(W/(m^2 · Hz)) at RAS stations operating in 22.21-22.5 GHz.

Study B is a multiple-entry Monte-Carlo study considering four different operational scenarios of non-safety AM(OR)S, together with referenced deployment densities. 1 000 independent trajectories of AM(OR)S systems over the course of the 2 000s RAS integration time were simulated. It shows that the protection criterion of the RAS operating in 22.21-22.5 GHz is met in the four operational scenarios and at the studied radio astronomy sites. For RAS in the 15.35-15.4 GHz frequency band, the study showed that mitigations techniques are needed for two of the four operational scenarios.

Study C builds upon Study B to investigate how introducing a guardband can help coexistence with RAS operating the 15.35-15.4 GHz frequency band. Results show that a 10 MHz guardband is sufficient to meet the protection criterion of the RAS in the four operational scenarios and at all studied radio astronomy sites.

Study D is a single-entry site-specific minimum coupling loss (MCL) study that focuses on the omnidirectional AM(OR)S system. It shows that terrain profiles surrounding RAS stations can in some cases provide a natural protection in which case further mitigation techniques are not necessary.

The frequency band 22.01-22.21 GHz is not allocated to the RAS. However, in making assignments to stations of other services to which the band 22.01-22.21 GHz is allocated, administrations are urged to take all practicable steps to protect the RAS from harmful interference, according to RR No. **5.149**.

2/1.10/3.3.2 Radiolocation operating in the frequency band 15.4-15.7 GHz

Study A is a MCL analysis providing the required separation distance between an AM(OR)S and an RLS system to ensure $I/N < -6$ dB at the RLS receiver. The study assumes aircraft stations operating in the AM(OR)S with transmit power of 25 or 40 dBm (no transmit power control), co-frequency operation, transmitter bandwidths from 10 to 200 MHz and an equal altitude of both RLS and AM(OR) systems (10 000 m above ground level). The following conclusions can be drawn from this study:

– Under certain conditions (alignment of the side lobe of AM(OR)S transmitter with the main lobe of the RLS receiver, maximum power of the interferer, propagation conditions from Recommendation ITU-R P.528-5), separation distances of 61 to 610 km would be necessary;

– Under alignment of the side lobe of AM(OR)S transmitter with the side lobe of the RLS receiver condition, these distances would be 1.6 to 26 km.

Study B is a multiple-entry Monte Carlo study. AM(OR)S channels are randomly selected within the tuning range, transmit power control is taken into account (making sure that the maximum power is reached in certain snapshots). It shows that, in all studied scenarios, the protection criterion of systems operated in the RLS in the frequency band 15.4-15.7 GHz is exceeded less than 0.001% of total simulation snapshots (100 000 snapshots). More specifically, the aggregate I/N value at the RLS receiver is less than −12 dB in at least 99.999% of the snapshots, and less than −50 dB in at least 99.6% of the snapshots.

Studies C and D are multiple-entry Monte Carlo studies that consider all four scenarios for the non-safety AM(OR)S. These are co-frequency analyses, with the transmit power of the AM(OR)S system assumed at its maximum value (i.e. no power control for AM(OR)S). These studies investigate high deployment densities of the AM(OR)S system. In that regard, studies C and D show that the protection criterion of the RLS is exceeded up to 0.2% of total simulation snapshots. Studies C and D also show that interference can be precluded by introducing additional separation distances.

Study E investigates the temporal behaviour of the interference from an AM(OR)S system flying towards an RLS system with co-channel operation. When considering the scanning behaviour of RLS radars and the directivity of antennas used for AM(OR)S and RLS, in such a scenario an encounter between an AM(OR)S station and an RLS radar would produce interference occurring four times in 30 minutes and each interference event will last for approximately six seconds.

2/1.10/3.3.3 Aeronautical radionavigation operating in the frequency band 15.4-15.7 GHz

For ALS, one multiple-entry Monte-Carlo analysis was made, considering all four AM(OR)S typical deployment scenarios of non-safety AM(OR)S, together with reference densities. 100 000 snapshots were simulated. No snapshot of any studied operational scenarios exceeded an aggregate I/N value of −10 dB.

For DAA systems, Study A uses the same methodology as the ALS study, and shows that 99.9% of the encounters between ARNS DAA radars and AM(OR)S systems would result in an aggregate I/N value at the DAA radar of less than −10 dB.

Study B is an MCL analysis. The study assumes aircraft stations operating in the AM(OR)S with transmit power of 25 or 40 dBm (no transmit power control), co-frequency operation, the antenna side-lobe gain of AM(OR)S and ARNS system (DAA system) are both 0 dBi and propagation model from Recommendation ITU-R P.528-5. It shows such an airborne AM(OR)S system would need separation distances of 3 to 68 km when its side lobe is aligned with the side lobe of the ARNS system and 12 to 720 km when its side lobe is aligned with the main lobe of the ARNS system.

2/1.10/3.3.4 Fixed satellite operating in the frequency band 15.43-15.63 GHz

One multiple-entry Monte Carlo analysis was made, considering four typical deployment scenarios of non-safety AMS, together with reference densities. Three different FSS carriers were considered separately. 10 000 snapshots were simulated. The long-term and short-term protection criteria of systems operated in the FSS (Earth-to-space) were met in all of the studied operational scenarios.

2/1.10/3.3.5 Broadcasting satellite operating in the frequency band 21.4-22 GHz

One multiple-entry Monte Carlo analysis was made, considering four typical deployment scenarios of non-safety AMS, together with reference densities. Three different broadcasting-satellite service (BSS) carriers were considered separately. 100 000 snapshots were simulated. The long-term and short-term protection criteria of systems operated in the BSS were met in all of the studied operational scenarios.

2/1.10/3.3.6 Fixed service operating in the frequency band 22-22.21 GHz

Study A contains both a single-entry and a multiple-entry analysis that are based on a Monte Carlo methodology. All four typical deployment scenarios of non-safety AM(OR)S are considered. The single-entry part (where a single cluster of aircraft stations is studied) shows that the short-term interference threshold of fixed stations may be exceeded in some situations, for instance when omnidirectional or other wide-beam antennas are used. The multiple-entry part shows that if high densities of such omnidirectional aircraft stations are operated within the visibility area of a sector (azimuth between −15° and +15° and −30° and +30° with respect to the main beam) of the fixed station (which may be typical for in some missions), the long-term protection criterion maybe exceeded. It also shows that both the long and the short-term protection criteria of the FS are met when considering a single cluster of AM(OR)S systems, working with ATPC and using highly directive antennas. Investigating the effect of multiple AM(OR)S clusters onto a fixed station showed that under certain circumstances (for instance when massive deployments of aircraft stations take place in within the visibility sector of the fixed stations), the long-term protection criterion of the FS is exceeded.

Study B is a multiple-entry Monte Carlo analysis that considered four typical deployment scenarios of non-safety AMS, together with reference deployment densities. Two modulation schemes (FSK[13] and 128-QAM[14]) of FS stations were assessed separately. 100 000 snapshots were simulated. The study comes to the conclusion that the long-term and the short-term protection criteria of FS are met in all scenarios except for the scenario using omnidirectional antennas. In this later case, the short-term protection criterion is exceeded for some configurations of the FS elevation and altitude.

[13] Frequency-shift keying.

[14] Quadrature amplitude modulation.

Study C proposed two pfd masks options in order to protect stations of the FS.

2/1.10/3.3.7 Mobile service operating in the frequency band 22-22.21 GHz

No characteristics were available regarding the mobile service. Hence, no study was performed.

2/1.10/3.3.8 Earth exploration-satellite service (passive) operating in the frequency band 22.21-22.5 GHz

Sharing in the frequency band 22.21-22.5 GHz should take into account the characteristics and protection requirements for these EESS (passive) systems that operate in the frequency band 22.21-22.5 GHz.

Study A is a multiple-entry Monte Carlo analysis that considers multiple AM(OR)S airborne terminals flying at 900 km/h with constant bearing at an altitude of 15 km above ground level within the mission area of interest (MAI) of the EESS (passive) satellite. The study concludes that the average unwanted emissions in the band 22.21-22.5 GHz should be kept below −1 dB(W/100 MHz) considering a single interferer within the MAI, and −18 dB(W/100 MHz) when considering 5 of them within the MAI.

Study B indicates the following summarized observations.

Regarding Wildfire Observation, the downlink transmission direction provides opportunity for a workable solution. Considering the uplink transmission direction, the interference potential is greater for the EESS passive, and a maximum number of clusters supporting operations in the uplink transmission direction cannot be determined. The study found that the majority of the contribution to harmful interference from Wildfire Observations comes from non-safety-of-life AM(OR)S air-air systems operating immediately adjacent to the EESS (passive) band specifically within 50 MHz of the band edge.

Regarding search and rescue, the majority of the contribution to harmful interference comes from non-safety-of-life AM(OR)S air-air systems operating immediately adjacent to the EESS (passive) band specifically within 30 MHz of the band edge.

Regarding border surveillance, the majority of the contribution to harmful interference comes from non-safety-of-life AM(OR)S air-air relay return systems operating immediately adjacent to the EESS (passive) band specifically within 20 MHz of the band edge.

Regarding data networks above the clouds operations, the majority of the contribution to harmful interference comes from non-safety-of-life AM(OR)S air-air relay forward systems operating immediately adjacent to the EESS (passive) band specifically within 80 MHz of the band edge.

As an overall assessment, taking into account all scenarios under consideration by the non-safety-of-life AM(OR)S configurations, Study B found it is necessary to limit the out-of-band emissions of the AM(OR)S to −23 dBW/100 MHz for operations less than 100 MHz in offset to the band edge in order to ensure the protection of the EESS passive service.

2/1.10/3.3.9 Space research service operating in the frequency band 22.21-22.5 GHz

No characteristics were available regarding the space research service. Hence, no study was performed.

2/1.10/4 Methods to satisfy the agenda item

All the methods propose the suppression of Resolution **430 (WRC-19)**.

2/1.10/4.1 Method A: No change to Radio Regulations

This method proposes no changes to the Radio Regulations.

2/1.10/4.2 Method B: New primary aeronautical mobile (off-route) service allocation in the frequency band 15.4-15.7 GHz

This method proposes to add an AM(OR)S allocation in the frequency band 15.4-15.7 GHz with an associated footnote.

2/1.10/4.3 Method C: Remove the exception of aeronautical mobile (off-route) service in the frequency band 22-22.21 GHz

This method proposes to remove the exception of aeronautical mobile service of the mobile service allocation in the frequency band 22-22.21 GHz, and to add associated footnotes.

2/1.10/4.4 Method D: Combination of Methods B and C

This method proposes to add an AM(OR)S allocation in the frequency band 15.4-15.7 GHz with an associated footnote, and to remove the exception to aeronautical mobile (off-route) service of the MOBILE allocation in the frequency band 22-22.21 GHz, and to add associated footnotes.

2/1.10/4.5 Method E: Combination of Methods B and C with 10 MHz guardbands

This method proposes to add an AM(OR)S allocation in the frequency band 15.41-15.7 GHz with associated footnotes, and to remove the exception to aeronautical mobile (off-route) service of the MOBILE allocation in the frequency band 22-22.2 GHz, and to add associated footnotes.

2/1.10/5 Regulatory and procedural considerations

2/1.10/5.1 For Method A: No change to the Radio Regulations

NOC

ARTICLES

NOC

APPENDICES

2/1.10/5.2 For Methods B and D: New primary aeronautical mobile (off-route) service allocations in the frequency band 15.4-15.7 GHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

15.4-18.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
15.4-15.43	AERONAUTICAL MOBILE (OR) ADD 5.A110 ADD 5.B110 ADD 5.C110 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION	
15.43-15.63	FIXED-SATELLITE (Earth-to-space) 5.511A AERONAUTICAL MOBILE (OR) ADD 5.A110 ADD 5.B110 ADD 5.C110 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION 5.511C	
15.63-15.7	AERONAUTICAL MOBILE (OR) ADD 5.A110 ADD 5.B110 ADD 5.C110 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION	

Reasons: To provide a new allocation in the band 15.4-15.7 GHz to the aeronautical mobile (off-route) service for introduction of new non-safety aeronautical mobile applications (off-route) in response to agenda item 1.10.

ADD

5.B110 In the frequency band 15.4-15.7 GHz, stations operating in the aeronautical mobile (off-route) service shall not cause harmful interference to, or claim protection from, stations operating in the aeronautical radionavigation and radiolocation services. (WRC-23)

ADD

5.C110 The use of the aeronautical mobile (OR) service in the frequency band 15.4-15.7 GHz is limited to non-safety applications. (WRC-23)

2/1.10/5.2.1 For Methods B and D, Alternative BD1

ADD

5.A110-BD1 In order to protect radio astronomy stations operating in the frequency band 15.35-15.4 GHz, out-of-band e.i.r.p. of stations operating in the aeronautical mobile (OR) service shall not exceed [XX] dBm in any 50 MHz band in the frequency band 15.35-15.4 MHz. (WRC-23)

2/1.10/5.2.2 For Methods B and D, Alternative BD2

ADD

5.A110-BD2 Use of the frequency band 15.4-15.7 GHz by the aeronautical mobile (OR) service shall not cause harmful interference to services operating in the frequency band 15.35-15.4 GHz, and is subject to agreement obtained under No. **9.21** with respect to the radio astronomy service. No. **4.10** does not apply. The power flux-density at the radio astronomy station operating in the frequency band 15.35-15.4 GHz from aeronautical mobile service stations shall not exceed −233 dB(W/(m^2 · Hz)), unless otherwise specifically agreed by the affected administration(s). (WRC-23)

2/1.10/5.2.3 For Methods B and D, Alternative BD3

ADD

5.A110-BD3 Stations in the aeronautical mobile (OR) service operating in the frequency band 15.4-15.7 GHz shall not cause harmful interference to the radio astronomy service operating in the frequency band 15.35-15.4 GHz. The aggregate power flux-density (pfd) received from these stations at any radio astronomy station operating in this band shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2, unless specifically agreed by the affected administration(s). (WRC-23)

2/1.10/5.3 For Methods C and D: Remove the exception of AM(OR)S in the frequency band 22-22.21 GHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

22-24.75 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
22-22.21	FIXED MOBILE except aeronautical (R) ADD 5.D110 ADD 5.E110 ADD 5.F110 ADD 5.H110 5.149 ADD 5.G110	
22.21-22.5	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 5.149 5.532 ADD 5.G110	

Reasons: To provide a new allocation in the band 22-22.21 GHz to the aeronautical mobile (off-route) service for introduction of new non-safety aeronautical mobile (off-route) applications.

Option 1

ADD

5.D110 In order to protect stations of the Earth exploration-satellite (passive) service operating in the frequency band 22.21-22.5 GHz, out-of-band e.i.r.p. of stations operating in the aeronautical mobile (OR) service shall not exceed −18 dBW in any 100 MHz band in the frequency band 22.21-22.5 GHz. (WRC-23)

Reasons: Summary of Study A in WDPDN Report ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES] section A9.1 indicates that "the average unwanted emissions in the band 22.21-22.5 GHz should be kept below −1 and −18 dB(W/100 MHz)".

Option 2

ADD

5.D110 In order to protect stations of the Earth exploration-satellite (passive) service operating in the frequency band 22.21-22.5 GHz, out-of-band e.i.r.p. of stations operating in the aeronautical mobile (OR) service shall not exceed −23 dBW in any 100 MHz band in the frequency band 22.21-22.5 GHz. (WRC-23)

Reasons: Summary of Study B in WDPDN Report ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES] section A9.2.3 indicates that "the average unwanted emissions in the band 22.21-22.5 GHz should be kept below −23 dB(W/100 MHz)".

Option 1

ADD

5.E110 In order to protect stations of the fixed service operating in the frequency band 22-22.21 GHz, the following power flux-density (pfd) values shall be used as a threshold for coordination under No. **9.21** for any station in the aeronautical mobile (off-route) service visible from the territory of another administration, unless otherwise agreed between the notifying and the concerned administration(s):

$0.88\ \theta - 130$	for	$0° \leq \theta \leq 8°$
$2.86\ \theta - 146$	for	$8° < \theta \leq 15°$
$0.87\ \theta - 116$	for	$15° < \theta \leq 30°$
$0.067\ \theta - 92$	for	$30° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. (WRC-23)

Option 2

ADD

5.E110 In order to protect stations of the fixed service operating in the frequency band 22-22.21 GHz, the following power flux-density (pfd) values shall be used as a threshold for coordination under No. **9.21** for any station in the aeronautical mobile (off-route) service visible from the territory of another administration, unless otherwise agreed between the notifying and the concerned administration(s):

-110 dB(W/(m$^2 \cdot$ MHz))	for	$0° \leq \theta \leq 10°$
$50\log(\theta/10) - 110$	for	$10° \leq \theta \leq 30°$
$50\log(3) - 110$	for	$30° \leq \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. (WRC-23)

Option 3

No footnote for protection of the fixed service operating in the frequency band 22-22.21 GHz.

ADD

5.F110 The use of the aeronautical mobile (OR) service in the frequency band 22-22.21 GHz is limited to non-safety applications. (WRC-23)

ADD

5.G110 Due to the physical properties of the frequency band 22-22.5 GHz, passive ground-based water-vapour radiometers are operated under national arrangements in this band. (WRC-23)

Reasons: Passive ground-based water vapour radiometers, supporting a large variety of applications all over the world, are an important helper application for different radiocommunication services to calibrate signals that travel through Earth's atmosphere and are subject to attenuation and phase shifts caused by water molecules in the troposphere.

2/1.10/5.3.1 For Methods C and D, Alternative CD1

ADD

5.H110-CD1 In order to protect stations of the radio astronomy service operating in the frequency band 22.21-22.5 GHz, out-of-band e.i.r.p. of stations operating in the aeronautical mobile (OR) service shall not exceed [XX] dBm in any 290 MHz band and [XX] dBm in any 250 kHz band in the frequency band 22.21-22.5 GHz. (WRC-23)

2/1.10/5.3.2 For Methods C and D, Alternative CD2

ADD

5.H110-CD2 The use of frequencies in the band 22-22.21 GHz by non-safety applications of the aeronautical mobile service shall not cause harmful interference to the radio astronomy service operating in the frequency band 22.21-22.5 GHz and the mean power flux-density received at radio astronomy stations operating in the band 22.21-22.5 GHz from non-safety aeronautical mobile service applications operating in the frequency band 22-22.21 GHz shall not exceed -231 dB(W/(m$^2 \cdot$ Hz)). For the frequency band 22.01-22.21 GHz, No. **5.149** applies. (WRC-23)

Reasons: RR No. **5.149** urges administrations to protect the RAS from harmful interference when making assignments to stations of other services. This frequency range is extremely important to astronomers, as it allows to observe highly redshifted water masers, which is needed for precise and independent determination of cosmological parameters, otherwise inaccessible.

2/1.10/5.3.3 For Methods C and D, Alternative CD3

ADD

5.H110-CD3 Stations in the aeronautical mobile (OR) service operating in the frequency band 22-22.21 GHz shall not cause harmful interference to the radio astronomy service operating in the frequency band 22.21-22.5 GHz. The aggregate power flux-density (pfd) received from these stations at any radio astronomy station operating in this band shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2, unless specifically agreed by the affected administration(s). (WRC-23)

2/1.10/5.4 For Method D: Combination of Methods B and C

See sections 2/1.10/5.2 and 2/1.10/5.3 above.

2/1.10/5.5 For Methods E: Combination of Methods B and C with 10 MHz guardbands

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

15.4-18.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
15.4-15.413	RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION	
15.41-15.43	AERONAUTICAL MOBILE (OR) ADD 5.I110 ADD 5.J110 ADD 5.K110 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION	
15.43-15.63	FIXED-SATELLITE (Earth-to-space) 5.511A AERONAUTICAL MOBILE (OR) ADD 5.I110 ADD 5.J110 ADD 5.K110 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION 5.511C	
15.63-15.7	AERONAUTICAL MOBILE (OR) ADD 5.I110 ADD 5.J110 ADD 5.K110 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION	

Reasons: To provide a new allocation in the band 15.41-15.7 GHz to the aeronautical mobile (off-route) service for introduction of new non-safety aeronautical mobile applications (off-route) in response to agenda item 1.10.

ADD

5.I110 Stations in the aeronautical mobile (OR) service operating in the frequency band 15.41-15.7 GHz shall not cause harmful interference to the radio astronomy service operating in the frequency band 15.35-15.4 GHz. The aggregate power flux-density (pfd) received from these stations at any radio astronomy station operating in this band shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2, unless specifically agreed by the affected administration(s). (WRC-23)

ADD

5.J110 In the frequency band 15.41-15.7 GHz, stations operating in the aeronautical mobile (off-route) service shall not cause harmful interference to, or claim protection from, stations operating in the aeronautical radionavigation and radiolocation services. (WRC-23)

ADD

5.K110 The use of the aeronautical mobile (OR) service in the frequency band 15.41-15.7 GHz is limited to non-safety applications. (WRC-23)

MOD

22-24.75 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
22-22.2~~1~~	FIXED MOBILE except aeronautical mobile (R) ADD 5.L110 ADD 5.M110 ADD 5.N110 ADD 5.O110 5.149 ADD 5.P110	
22.2-22.21	FIXED MOBILE except aeronautical mobile 5.149 ADD 5.P110	
22.21-22.5	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 5.149 5.532 ADD 5.P110	

Reasons: To provide a new allocation in the band 22-22.2 GHz to the aeronautical mobile (off-route) service for introduction of new non-safety aeronautical mobile (off-route) applications.

ADD

5.L110 The use of the aeronautical mobile (OR) service in the frequency band 22-22.2 GHz is limited to non-safety applications. (WRC-23)

Option 1

ADD

5.M110 In order to protect stations of the Earth exploration-satellite (passive) service operating in the frequency band 22.21-22.5 GHz, out-of-band e.i.r.p. of stations operating in the aeronautical mobile (OR) service shall not exceed −18 dBW in any 100 MHz band in the frequency band 22.21-22.5 GHz. (WRC-23)

Reasons: Summary of Study A in WDPDN Report ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES] section A9.1 indicates that “the average unwanted emissions in the band 22.21-22.5 GHz should be kept below −1 and −18 dB(W/100 MHz)”.

Option 2

ADD

5.M110 In order to protect stations of the Earth exploration-satellite (passive) service operating in the frequency band 22.21-22.5 GHz, out-of-band e.i.r.p. of stations operating in the aeronautical mobile (OR) service shall not exceed −23 dBW in any 100 MHz band in the frequency band 22.21-22.5 GHz. (WRC-23)

Reasons: Summary of Study B in WDPDN Report ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES] section A9.2.3 indicates that “the average unwanted emissions in the band 22.21-22.5 GHz should be kept below −23 dB(W/100 MHz)”.

ADD

5.N110 Stations in the aeronautical mobile (OR) service operating in the frequency band 22-22.2 GHz shall not cause harmful interference to the radio astronomy service operating in the frequency band 22.21-22.5 GHz. The aggregate power flux-density (pfd) received from these stations at any radio astronomy station operating in this band shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2, unless specifically agreed by the affected administration(s). (WRC-23)

Option 1

ADD

5.O110 In order to protect stations of the fixed service operating in the frequency band 22-22.2 GHz, the following power flux-density (pfd) values shall be used as a threshold for coordination under No. **9.21** for any station in the aeronautical mobile (off-route) service visible from the territory of another administration, unless otherwise agreed between the notifying and the concerned administration(s):

$0.88\,\theta - 130$	for	$0° \leq \theta \leq 8°$
$2.86\,\theta - 146$	for	$8° < \theta \leq 15°$
$0.87\,\theta - 116$	for	$15° < \theta \leq 30°$
$0.067\,\theta - 92$	for	$30° < \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. (WRC-23)

Option 2

ADD

5.O110 In order to protect stations of the fixed service operating in the frequency band 22-22.2 GHz, the following power flux-density (pfd) values shall be used as a threshold for coordination under No. **9.21** for any station in the aeronautical mobile (off-route) service visible from the territory of another administration, unless otherwise agreed between the notifying and the concerned administration(s):

-110 dB(W/(m^2 · MHz))	for	$0° \leq \theta \leq 10°$
$50\log(\theta/10) - 110$	for	$10° \leq \theta \leq 30°$
$50\log(3) - 110$	for	$30° \leq \theta \leq 90°$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. (WRC-23)

Option 3

No footnote for protection of the fixed service operating in the frequency band 22-22.2 GHz.

ADD

5.P110 Due to the physical properties of the frequency band 22-22.5 GHz, passive ground-based water-vapour radiometers are operated under national arrangements in this band. (WRC-23)

Reasons: Passive ground-based water vapour radiometers, supporting a large variety of applications all over the world, are an important helper application for different radiocommunication services to calibrate signals that travel through Earth's atmosphere and are subject to attenuation and phase shifts caused by water molecules in the troposphere.

2/1.10/5.6 For Methods A, B, C, D and E

SUP

RESOLUTION 430 (WRC-19)

Studies on frequency-related matters, including possible additional allocations, for the possible introduction of new non-safety aeronautical mobile applications

Agenda item 1.11

1.11 to consider possible regulatory actions to support the modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation, in accordance with Resolution ***361 (Rev.WRC-19)****;*

Resolution **361 (Rev.WRC-19)** – *Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation*

2/1.11/1 Executive summary

Resolves 1 of Resolution **361 (Rev.WRC-19)** invites WRC-23 to consider possible regulatory actions in support of the modernization of the global maritime distress and safety system (GMDSS) which has just been finalized by the International Maritime Organization (IMO). Considering the decisions of IMO and after an analysis of all the Radio Regulations (RR) provisions impacted by these decisions, the following measures have been proposed in a unique method:

– The deletion of narrow-band direct-printing (NBDP) for distress and safety communications from GMDSS in RR Appendices **15** and **17** for MF and HF in all bands.

– Introduction of a new automatic connection system (ACS) which will be proposed to be implemented on the frequencies which had previously been used by NBDP for GMDSS in all MF and HF bands in RR Article **5** and Appendix **17** by a footnote. Provision for ACS in Chapter IX (RR Articles **51**, **52** and **54*bis***) and modification of Resolution **354 (WRC-07)** (to include RR Nos. **5.110**, **52.130** to **52.136**) is proposed.

– Introduction of the NAVDAT frequencies in MF and HF in RR Appendix **15** and modification of the relevant provisions in RR Articles **5**, **32**, **33** and **52**. Those frequencies have been already introduced by WRC-19 in RR Appendix **17**, the difference is that now NAVDAT is part of the GMDSS.

– To implement automatic identification system search and rescue transmitter (AIS SART) as locating equipment for which frequencies are protected by reference in RR Appendix **15**. Taking into account studies performed within ITU-R, especially in Recommendation ITU-R M.1371, it is proposed to amend RR No. **31.7** that survival craft stations may carry this equipment as an alternative to the RADAR-SART to be in line with SOLAS Chapter IV.

In this method regarding the frequency band 1 645.5-1 646.5 MHz which is no longer used by the satellite emergency position indicating radio beacons (EPIRBs) no consensus has been reached for the regulatory action proposed to WRC-23:

Some administrations are of the view that modification to RR No. **5.375** and Table 15-2 of RR Appendix **15** are required.

Some other administrations are of the view that minor modification to RR No. **5.375** and Table 15-2 of RR Appendix **15** are required.

Some further administrations are of the view that any modifications to the Radio Regulations at this stage are premature and hence no change is proposed.

Resolves 2 of Resolution **361 (Rev.WRC-19)** invites WRC-23 to consider possible regulatory actions in support of e-navigation. E-navigation is developed by IMO which has concluded that various existing satellite networks already support the e-navigation concept, and usability studies have been conducted. The VHF data exchange system (VDES) and NAVDAT systems, for which

IMO has agreed to develop performance standards, would also support e-navigation by means of enabling broadcasting (by NAVDAT) and exchange of digital files (by VDES). From a spectrum regulatory point of view, the requirements for e-navigation are thus covered. Therefore, a unique Method NOC to the RR is proposed.

Resolves 3 of Resolution **361 (Rev.WRC-19)** invites WRC-23 to consider regulatory provisions, if any, based on the results of ITU-R studies referred to in *invites the ITU Radiocommunication Sector*, to support the introduction of additional satellite systems into the GMDSS.

The IMO considered an existing geostationary-satellite system operating at 1 610-1 626.5 MHz (Earth-to-space) and 2 483.5-2 500 MHz (space-to-Earth). These frequency bands already contain a primary allocation to the mobile-satellite service (MSS); for this reason no new allocation is necessary by WRC-23 in order to accommodate the GMDSS.

The IMO's Maritime Safety Committee (MSC) in resolution MSC.529(106), has "*recognized the maritime mobile satellite services provided by CTTIC through BDMSS*" [15, 16], limited to the coverage area within 75°E to 135°E longitude and 10°N to 55°N latitude which partly overlaps Regions 1 and 3, "*for use in the GMDSS*".

The IMO MSC also noted[17] "*the commitment of China and CTTIC to addressing any outstanding implementation issues, including those listed in NCSR 9/WP.5, Annex 2, Appendix 2, before the commencement of services*" including the following outstanding implementation issue within the purview of ITU:

"*6. WRC-23 to complete the necessary regulatory actions to safeguard the availability and full protection of the spectrum used for BDMSS (e.g. solving the issue of frequency coordination with other systems and inclusion of the frequencies used by BDMSS in Appendix **15** of the ITU Radio Regulations)*".

In this regard, CPM23-2 noted that in "*solving the issue of frequency coordination*", WRC-23 does not have the mandate to address this but the candidate GSO MSS system/network needs to comply with regulatory procedures "*to safeguard the availability and full protection of the spectrum it proposes to use*". This includes solving the issues of any experienced interference and frequency coordination with other existing systems in a timely manner. Thus before the commencement of GMDSS services by the candidate geostationary-satellite system, it needs to complete coordination with the HIBLEO-2, and HIBLEO-X and HIBLEO-4 satellite systems.

ITU-R has undertaken studies on the regulatory provisions (see section 1/1.11/3), the spectrum requirement and the frequency coordination status of the proposed geostationary orbit (GSO) MSS system.

Four methods have been proposed to satisfy Issue C (i.e. *resolves* 3 of Resolution **361 (Rev.WRC-19)**) of this agenda item:

– Method C1: No change to the RR except suppression of *resolves* 3, Resolution **361 (Rev.WRC-19)**;

– Method C2: Identify spectrum for GMDSS if the candidate GSO MSS system/network has been completely coordinated in accordance with Articles **9** and **11** of the Radio

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[15] China Transport Telecommunication Information Group Co. Ltd. (CTTIC).

[16] BeiDou Message Service System (BDMSS).

[17] *Report of the Maritime Safety Committee on its 106th Session*, MSC 106/19 at § 13.24.4 (30 November 2022).

Regulations and recorded in the MIFR in accordance with RR No. **11.37**. Coordination is an outstanding implementation issue that needs to be effected before the commencement of GMDSS services. There are two options associated with the method in relation to the applicability of RR No. **4.10** to GMDSS.

– Method C3: Support the requirement of safety of life aspects by the GMDSS and implement applicable provisions of the Radio Regulations, including applicability of RR No. **4.10** to the specific frequency bands used by the additional MSS system for GMDSS. This method proposes an associated new Resolution.

– Method C4: Identify spectrum for GMDSS if the candidate GSO MSS system/network has been completely coordinated in accordance with Articles **9** and **11** of the Radio Regulations and recorded in the MIFR in accordance with RR No. **11.37**. Coordination is an outstanding implementation issue that needs to be effected before the commencement of GMDSS services. Apply RR No. **4.10** to the concrete frequency bands used by the new MSS system for GMDSS.

2/1.11/2 Background

Resolution **361 (Rev.WRC-19)** through the section *resolves to invite the 2023 World Radiocommunication Conference* identifies three topics which are studied and solved independently.

2/1.11/2.1 Global maritime distress and safety system modernization

This topic is the continuation of the agenda item (AI) 1.8, Issue A of WRC-19. The modernization of GMDSS, for which the work is undertaken by the IMO was not finalized at the time of WRC-19. That Conference has solely been able to take some preliminary decisions regarding NAVDAT in the MF and HF bands. In 2022, IMO has adopted amendments to the 1974 Safety of Life at Sea (SOLAS) Convention Chapters III and IV, together with related and consequential amendments to existing instruments other than SOLAS. These amendments will enter into force in 2024 and concluded the IMO work on modernization of the GMDSS.

One of the changes to the SOLAS Convention is the removal of non-406 MHz satellite EPIRBs, leaving only satellite EPIRBs operating on 406 MHz. Consequently, satellite EPIRBs operating on 1.6 GHz (1 645.5-1 646.5 MHz) and EPIRBs using VHF digital selective calling (DSC) operating at 156.525 MHz no longer form a part of the GMDSS. Given the removal of 1.6 GHz EPIRBs by the IMO, and noting that the use of the 1.6 GHz EPIRB has already ceased operation. Some administrations are of the view that WRC-23 may consider possible changes to the RR related to use of the frequency band 1 645.5-1 646.5 MHz (Earth-to-space) for EPIRBs under issue A of AI 1.11. However, some other administrations are of the view that modifications to the RR in relation to this frequency range is outside the scope of this agenda item.

2/1.11/2.2 E-navigation

E-navigation is a concept under study at IMO since the MSC 81 in 2005. The definition of e-navigation is given by IMO:

> "E-navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment."

As shipping moves into the digital world, e-navigation is expected to provide digital communications and digital information for the benefit of maritime safety, security and protection of the marine environment, reducing the administrative burden and increasing the efficiency of maritime trade and transport.

Among the objectives of e-navigation, quoting the strategy implementation plan of the IMO, there are the improvements of communications in general, the standardization and automation of ship's reporting and the integration and presentation of available information in graphical displays received via communication equipment.

Communication is a key element for e-navigation. Future communication systems should be digital and could include VDES and in the future NAVDAT and be developed to facilitate wide information management solutions.

2/1.11/2.3 Introduction of additional satellite systems into the global maritime distress and safety system

Two satellite systems have been providing safety communication in the GMDSS. The introduction of an additional GSO MSS system for GMDSS may require new or modified regulatory provisions, based on the results of the ITU-R studies.

2/1.11/3 Summary and analysis of the results of ITU-R studies

Existing relevant ITU-R Recommendations and Reports for Issue A and Issue B:

– Recommendations ITU-R M.476, ITU-R M.492, ITU-R M.493, ITU-R M.541, ITU-R M.625, ITU-R M.1798, ITU-R M.2010, ITU-R M.2058.

– Report PDN Report ITU-R M.[ACS][18].

Existing relevant Recommendations and Reports for Issue C:

– Recommendations ITU-R M.1184-3, ITU-R M.1188-1, ITU-R RA.769-2, ITU-R RA.1513-2, ITU-R RA.1031-3.

– Reports ITU-R M.2369-0, ITU-R RA.2131-0, WDPDN Report ITU-R M.[ADD-GSO-GMDSS][19].

2/1.11/3.1 Global maritime distress and safety system modernization

2/1.11/3.1.1 Current regulatory status of narrow-band direct printing for the global maritime distress and safety system

Technical characteristics of NBDP in the maritime mobile service (MMS) are provided by Recommendations ITU-R M.476-5 and ITU-R M.625-4, which are incorporated by reference in the RR. In Recommendation ITU-R M.625-4 direct printing telegraphy is explicitly considered as part of the GMDSS. Further characteristics are given in Recommendation ITU-R M.627 (referenced by RR No. **51.41**).

2/1.11/3.1.2 An automatic connection system for MF and HF

Recommendations ITU-R M.493 and ITU-R M.541 have been revised in order to allow the introduction of an ACS based on DSC for communication in the MF and HF bands. Communication by MF/HF remains an integral part of the GMDSS. The implementation of ACS will ensure simple and reliable access to the required radio links for the mariner.

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[18] If the Report is approved by the Member States at Study Group 5 before WRC-23.

[19] If the Report is approved by the Member States at Study Group 4 before WRC-23.

2/1.11/3.1.3 NAVDAT

The amendments to the 1974 SOLAS Convention chapters III and IV made it possible for NAVDAT to become an element of the modernized GMDSS. The frequencies for NAVDAT in MF and HF have been identified in RR Article **5** and Appendix **17** by the WRC-19. These frequencies need now to be inserted in RR Appendix **15.**

2/1.11/3.1.4 1.6 GHz satellite emergency position indicating radio beacons

The frequency band 1 645.5-1 646.5 MHz is allocated to the MSS (Earth-to-space) and was previously intended to be used by satellite EPIRBs ("1.6 GHz EPIRBs") operating with MSS networks. Recommendation ITU-R M.632-3, last revised in 1997, provides technical characteristics. The 1.6 GHz EPIRB service has been withdrawn from GMDSS by the IMO, and this band has remained unused for many years. The adjacent frequency band, 1 626.5-1 645.5 MHz is allocated to the MSS and is used to provide MSS service (Earth-to-space) for ships, including GMDSS SAT-COM communications (see RR No. **5.353A**).

Some administrations are of the view that the use of the frequency band 1 645.5-1 646.5 MHz in the Earth-to-space direction for the transmission of safety messages and, on a non-priority basis, for general maritime radiocommunications would provide additional spectrum to support new GMDSS SAT-COM requirements, and actions may be taken at WRC-23.

However, some other administrations are of the view that there has been no indication that additional spectrum is required for provision of general maritime radiocommunications within the 1 645.5-1 646.5 MHz frequency band, and consideration of allocating this spectrum to general maritime communications requires further study. No studies have been carried out in relation to this need nor the need of other potential MSS applications which could benefit from this 1 MHz of unused spectrum.

2/1.11/3.2 E-navigation

The study in IMO has not introduced e-navigation in the GMDSS. NAVDAT may become part of the GMDSS as a result of the modernization and thereby potentially become one of the systems that support e-navigation; however, it will not change the regulatory status of e-navigation.

Various existing satellite networks, NAVDAT and VDES could support e-navigation.

The NAVDAT system is described in the Recommendations ITU-R M.2010 for the MF band and ITU-R M.2058 for the HF band. The VDES is described in Recommendation ITU-R M.2092.

2/1.11/3.3 Introduction of additional satellite systems into the global maritime distress and safety system

One additional GSO MSS system, which consists of three operational satellites, which are located at 80° E, 110.5° E and 140° E, and two in-orbit spares located at 58.75° E and 160° E, which is introduced by the IMO to provide satellite communication within GMDSS, uses primary MSS allocations within the frequency bands 1 610-1 626.5 MHz (Earth-to-space) and 2 483.5-2 500 MHz (space-to-Earth). The primary MSS allocations in those bands are also used by other non-GSO MSS systems and further coordination is required.

This system could provide a two-way communication service for the Asia and Western Pacific region. The satellites used by the GSO MSS system operate under the filings CHINASAT-31 (80° E), -32 (140° E), -33 (110.5° E) and COMPASS-58.75E, -80E, -110.5E, -140E, -160E, which are recorded in the ITU MIFR under RR No. **11.41**. RR No. **11.41** is used when a satellite network is notified without having completed the frequency coordination. Such recording occurs after a notice is returned under RR No. **11.38**. The remedy is to effect successful coordination with the relevant parties.

The service uplink signals of the GSO MSS system have three carriers in frequency bands 1 610.18-1 618.34 MHz, 1 614.26-1 622.42 MHz and 1 618.34-1 626.5 MHz. The service downlink signal of the additional GSO MSS system has one carrier in the frequency band 2 483.59-2 499.91 MHz. There are currently over 700 000 subscribers with over 1.2 million messages transmitted on average per hour. The GSO MSS system will have sufficient capacity to support communications for the GMDSS. The report on the assessment of the GSO MSS system was submitted by the International Mobile Satellite Organization (IMSO) to the Sub-committee on Navigation, Communications and Search and Rescue-9 (NCSR-9) session, which was held in June 2022.

Frequency coordination of the GSO MSS system has not been completed with the existing global non-GSO MSS systems with date priority and terrestrial services in some countries.

– There is potential harmful interference caused by the GSO MSS system without the possibility of frequency avoidance. In the event that harmful interference is caused by the GSO MSS system into those satellite systems and terrestrial services, such interference must be immediately eliminated (see RR No. **11.42**).

– There is also potential for harmful interference to be caused to the GSO MSS system without the possibility of frequency avoidance. In the event that harmful interference is received by the GSO MSS system, from global non-GSO MSS systems with date priority and terrestrial services in some countries and other allocated services, such interference must be accepted.

Consideration also needs to be given to the potential for interference both to and from the GSO MSS system.

A contribution (CPM23-2/73) was submitted regarding harmful interference being received into a system at its fixed earth station located approximately at 127.5°E, 37.2°N; but to date, that interference has not been officially reported in accordance with RR Appendix **10**.

The notifying administration of the GSO MSS system/network has indicated that there has been no report of harmful interference received by the terminals of the GSO MSS system from other systems or services.

It is noted that harmful interference is only reported where it occurs over a long time-frame, or is repeated on a regular basis, and where the source can be identified. Lack of reported harmful interference in the past does not provide any assurance of compatible operation in the future, particularly in mobile-satellite systems which may experience significant changes in traffic over time. Only the successful completion of coordination could provide assurance of operations.

The GSO MSS system operator has proposed the following mitigation measures:

1) lowering transmitting power: the maximum transmitting e.i.r.p. from the terminals of the GSO MSS system is reduced from 12.8 dBW to 7.6 dBW. The maximum e.i.r.p. transmitted from GSO satellites is reduced from 54 dBW to 51 dBW after 2020. The lower transmitting e.i.r.p. could reduce the potential harmful interference into the HIBLEO-2 and HIBLEO-4/HIBLEO-X systems.

2) polarization separation: LHCP is used in the L-band and RHCP in the S-band while HIBLEO-2 with RHCP in the L-band and HIBLEO-4/X with LHCP in the L- and S-bands.

However, no studies were provided to show these techniques protect the operation of existing MSS systems. Further, there are no studies demonstrating protection of the GSO MSS system from harmful interference from existing MSS systems and, studies are needed to determine whether the above measures could protect existing MSS systems.

In order to determine the quantity of spectrum for GMDSS, the following factors should be considered:

1) the spectrum requirements to meet projected distress safety traffic for an additional regional system for GMDSS.

Using established techniques for estimating capacity requirements for digital communications, one study on spectrum requirements for an additional regional system for GMDSS that was based upon available distress safety traffic reports, was submitted to WP 4C. This study showed that the bandwidth required to meet projected distress safety traffic was approximately 1.0 MHz for both up and downlinks. Information on another study, which was not considered ant WP 4C, based on the same methodology using different parameters, indicates that the bandwidth required was approximately 6.11 MHz / 12.22 MHz for S-band and 2.3 MHz / 6.9 MHz for L-band.

Further information on spectrum requirements can be found in WDPDN Report ITU-R M.[ADD_GSO_GMDSS] and further study is encouraged in WP 4C.

2) to reference the application of operating GMDSS satellite systems.

According to the IMSO reports to NCSR-9, a total of 1 031 ship-to-shore Inmarsat C distress alert events (uplink) were recorded during the period from 1 October 2020 to 31 December 2021[20] (for a total average of 2.5 messages per day globally) and eight Iridium distress alerts were recorded during the period from 1 November 2020 to 30 November 2021[21] (for a total average of 0.02 messages per day globally). It should be noted that distress alerts are only a part of the GMDSS communications traffic, which includes maritime safety information, mostly in the forward link direction.

In respect of existing satellites uses, the following further need to be taken into consideration:

– The frequency band 1 621.35-1 626.5 MHz (Earth-to-space and space-to-Earth) is identified in Table 15-2 of RR Appendix **15** for use by distress and safety communications of the GMDSS.

– The frequency band 1 610-1 626.5 MHz (Earth-to-space and space-to-Earth) is allocated in RR No. **5.367** for use by AMS(R)S, an aeronautical safety service. One non-GSO satellite system provides this service globally in 1 618.725-1 626.5 MHz, under ICAO standards.

If an identification for GMDSS is made in parts or all of these frequency bands, it is not possible to avoid partial or complete frequency overlap between the potential GSO MSS system and the safety and non-safety use of other non-GSO MSS and AMS(R)S systems.

– For the uplink Carrier 1 of the potential GSO MSS system in the frequency band 1 610.18-1 618.34 MHz. No frequency overlapping with the operating GMDSS system for safety and non-safety use in the frequency band 1 621.35-1 626.5 MHz and the AMS(R)S system operating in the frequency band 1 618.725-1 626.5 MHz. However, there is 100% overlap with an operating MSS system providing non-safety services.

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20 See NCSR 9/10/3 *Analysis and assessment of the GMDSS performance of Inmarsat Global Limited*, submitted by IMSO.

21 See NCSR 9/10/4 *Analysis and assessment of the GMDSS performance of Iridium*, submitted by IMSO.

– For the uplink Carrier 2 of the potential GSO MSS system in the frequency band 1 614.26-1 622.42 MHz. One study indicated that:
  - 1.2% transmitting power (i.e. maximum e.i.r.p. −11.6 dBW) of a single carrier in the frequency band 1 621.35-1 622.42 MHz, which is overlapped 1.07 MHz with the operating GMDSS system for safety and non-safety use in the frequency band 1 621.35-1 626.5 MHz.
  - 29.6% transmitting power (i.e. maximum e.i.r.p. 2.29 dBW) of a single carrier in the frequency band 1 618.725-1 622.42 MHz, which is overlapping 3.7 MHz with the AMS(R)S system operating in the frequency band 1 618.725-1 626.5 MHz.
  - 100% overlap with non-safety MSS systems.

– For the downlink Carrier 1 of the potential GSO MSS system in the frequency band 2 483.59-2 499.91 MHz, there is 100% overlap with non-safety non-GSO MSS systems.

(Note: These calculations consider frequency band overlap only, but do not consider channelization or modulation techniques of the victim systems, or the actual interference impact. Compatibility studies still need to be completed.)

2/1.11/3.3.1 Allocations and other regulatory provisions to be taken into account

The frequency band 1 610.0-1 626.5 MHz is allocated to the following services:

– mobile-satellite service (MSS);

– aeronautical mobile-satellite (route) service (AMS(R)S);

– aeronautical radionavigation service (ARNS);

– radio astronomy service (RAS);

– fixed service (FS);

– radiodetermination-satellite service (RDSS), and

– maritime mobile-satellite service (MMSS) (space-to-Earth).

The frequency band 2 483.5-2 500 MHz is allocated to the following services:

– mobile-satellite service (MSS);

– radiodetermination-satellite service (RDSS);

– fixed service (FS);

– mobile service (MS), and

– radiolocation service (RLS).

2/1.11/3.3.1.1 Allocations and the status of the current operational use

The allocations of the frequency band 1 610.0-1 626.5 MHz and their current operational status are described below:

– MSS (Earth-to-space) is allocated in the frequency band 1 610.0-1 626.5 MHz on a primary basis, subject to coordination under RR No. **9.11A**. Three non-GSO global MSS systems and one regional GSO MSS system are operating in this frequency band.

– MSS (space-to-Earth) is allocated in the sub-band 1 613.8-1 626.5 MHz on a secondary basis. One non-GSO global MSS system is operating in this sub-band.

– MMSS (space-to-Earth) is allocated in the sub-band 1 621.35-1 626.5 MHz on a primary basis and currently in use by one non-GSO global MSS system for provision of GMDSS. It is noted that RR Nos. **5.373** and **5.373A** identify the status between MMSS (space-to-Earth) in the frequency band 1 621.35-1 626.5 MHz and MSS and RDSS in the direction Earth-to-space in the frequency band 1 610-1 626.5 MHz.

– RR No. **5.367** provides an additional allocation to the AMS(R)S on a primary basis in the frequency band 1 610.0-1 626.5 MHz in both uplink and downlink directions, subject to agreement obtained under RR No. **9.21**. At least one satellite system has notified assignments that operate in the frequency band 1 618.725-1 626.5 MHz under this allocation. It is worth mentioning that RR No. **43.1** identifies AMS(R)S allocations are reserved for communications related to safety and regulatory of flight.

– ARNS is allocated in the frequency band 1 610.0-1 626.5 MHz on a primary basis and protected from harmful interference caused by the MSS stations. Some countries use this frequency band for ARNS operations and have plans for its further use.

– The stations of the RAS in the frequency band 1 610.6-1 613.8 MHz are protected from harmful interference caused by the stations of RDSS and MSS as described in RR No. **5.372**.

– RR No. **5.359** provides an additional allocation to the FS on a primary basis to the 27 countries listed in the footnote. In that footnote implementation of new FS stations in this band is discouraged to the extent practicable.

– RDSS (Earth-to-space) is allocated in the frequency band 1 610-1 626.5 MHz on a primary basis in Region 2, and on a secondary basis in Regions 1 and 3, subject to coordination under RR No. **9.11A**. In addition, RR No. **5.369** provides a different category of RDSS (Earth-to-space) on a primary basis to the 20 countries identified in the footnote, subject to agreement under RR No. **9.21** from countries not listed in this footnote.

– RR No. **5.366** identifies ARNSS in the frequency band 1 610-1 626.5 MHz for reservation on a worldwide basis, subject to agreement obtained under RR No. **9.21**.

– RR No. **5.364** identifies that the stations of MSS in the band 1 610-1 626.5 MHz shall not claim protection from stations in ARNS, ARNSS and FS.

The allocations of the frequency band 2 483.5-2 500 MHz and their current operational status are described below:

– MSS (space-to-Earth) is allocated in the frequency band 2 483.5-2 500 MHz on a primary basis and is currently in use by three non-GSO global satellite systems since 1998 and one regional satellite system.

– RDSS (space-to-Earth) is allocated in the frequency band 2 483.5-2 500 MHz on a primary basis. RR No. **5.401** identifies that RDSS for 20 countries listed in the footnote is subject to agreement obtained under RR No. **9.21**, from countries not included in the footnote.

– FS is allocated in the frequency band 2 483.5-2 500 MHz on a primary basis. The typical applications in the band include point-to-point fixed service, services ancillary to programme-making (SAP)/services ancillary to broadcasting (SAB) (ancillary applications used to support programme making, or broadcasting (i.e. wireless video camera links), operating in the fixed service or mobile service).

– MS is allocated in the frequency band 2 483.5-2 500 MHz on a primary basis. The typical applications in the band in some countries include Wireless Access, specifically IEEE 802.16e, Intelligent Transport Systems and SAP/SAB systems: In some countries services SAB, SAP, electronic news gathering (ENG) and outside broadcasting (OB), which can be considered to operate as mobile or fixed services, extensively use the band.

– RLS is allocated in the frequency band 2 483.5-2 500 MHz on a primary basis in Regions 2 and 3 and on a secondary basis in Region 1. In addition, RLS in nine countries listed in RR No. **5.398A** is allocated on a primary basis. The RLS stations in those nine countries shall not cause harmful interference to, or claim protection from stations of the MSS operating in the band 2 483.5-2 500 MHz.

– According to RR No. **5.402**, the additional GSO MSS system is urged to take all practicable steps to prevent harmful interference to the radio astronomy service from emissions in the frequency band 2 483.5-2 500 MHz, especially those caused by second-harmonic radiation that would fall into the frequency band 4 990-5 000 MHz allocated to the RAS worldwide.

2/1.11/3.3.1.2 Other regulatory provisions

– RR No. **1.59**, which defines a safety service.

– RR No. **5.368**, which references RR No. **4.10** and its applicability to the ARNS, AMS(R)S and MMSS in the band or some part of the band 1 610-1 626.5 MHz.

– RR No. **11.41**, which define an entry of the assignment in the Master Register.

– RR No. **11.42**, which defines the operation of the assignment recorded under RR No. **11.41**.

– RR Appendix **15** including all frequencies and frequency bands used by the GMDSS.

– RR No. **33.50** including the frequencies used for transmission of maritime safety information.

– RR No. **33.53** including the other frequencies used for safety.

2/1.11/4 Methods to satisfy the agenda item

2/1.11/4.1 Method A for Issue A: global maritime distress and safety system modernization

This method proposes:

– The deletion of NBDP for distress and safety communications from GMDSS in RR Appendices **15** and **17** for MF and HF in all bands. This is due to the fact that NBDP for such purpose has been deleted by the IMO from SOLAS Chapter IV. As NBDP is not in practical use on ships for distress alerting the deletion simplifies the operational use and reduces the burden on the administrations to maintain a system which is no longer in use.

– The implementation of an ACS for MF and HF in selected bands using DSC technology as indicated by IMO in the related performance standards, taking into account studies performed within ITU-R, especially in Recommendation ITU-R M.493 and Recommendation ITU-R M.541 and working document towards a preliminary draft new Report ITU-R M.[ACS]. It is proposed to implement this on the frequencies which had previously been used by NBDP for GMDSS in MF and all HF bands in RR Article **5** and Appendix **17** by a footnote.

– The introduction of the NAVDAT frequencies in MF and HF in RR Appendix **15** and modification of the relevant provisions in RR Articles **5**, **32**, **33** and **52**.

– To implement AIS SART as locating equipment for which frequencies are protected by reference in RR Appendix **15**. Taking into account studies performed within ITU-R, especially in Recommendation ITU-R M.1371, it is proposed to amend RR No. **31.7** that survival craft stations may carry this equipment as an alternative to the RADAR-SART to be in line with SOLAS Chapter IV.

– Regarding the frequency band 1 645.5-1 646.5 MHz:

Some administrations are of the view that to modify RR No. ***5.375*** *and Table 15-2 of RR Appendix* ***15*** *such that the frequency band 1 645.5-1 646.5 MHz is no longer limited to use exclusively by satellite EPIRBs. The band would be available for use for the GMDSS and, on a non-priority basis, for general maritime radiocommunications.*

Some other administrations are of the view that minor modification to RR No. ***5.375*** *is required and modify Table 15-2 of RR Appendix* ***15*** *by replacing the phrase "D&S-OPS" in column 2 with the phrase "SAT-COM." This action removes the no longer needed EPIRB limitation in the frequency band 1 645.5-1 646.5 MHz while leaving the band available for GMDSS SAT-COM communications.*

Some further administrations are of the view that any modifications to the Radio Regulations at this stage are premature and hence no change is proposed. Those administrations encourage proper studies to be conducted in this regard to ensure most efficient use of this spectrum.

2/1.11/4.2 Method B for Issue B: E-Navigation

– Previous WRCs have identified the frequency bands to be utilized for VDES and NAVDAT. These two systems can both support e-navigation.

– Satellite networks which would support e-navigation have already their allocation identified in the Radio Regulations.

– E-navigation is not part of the GMDSS.

These elements bring to the conclusion that no additional frequency allocation is necessary in RR Article **5** for e-navigation. Therefore, it is proposed a no change to RR Article **5**.

2/1.11/4.3 Issue C: Introduction of additional satellite systems into the global maritime distress and safety system

An existing geostationary-satellite system operating in the frequency bands 1 610-1 626.5 MHz (Earth-to-space) and 2 483.5-2 500 MHz (space-to-Earth) is under consideration by IMO in order to become a new GMDSS satellite provider.

These frequency bands under study already contain a primary allocation to the MSS; for this reason no new allocation is necessary by WRC-23 in order to accommodate the GMDSS.

The introduction of additional satellite systems for the GMDSS operations is subject to the completion of relevant and applicable provisions of the Radio Regulations in force including RR Articles **9** and **11** together with the objectives of their associated Rules of Procedure (RoP), before such addition is made with a view to complying with the protection of existing services to which the frequency band is allocated, taking into account the conditions under which these existing services are currently operating and implemented.

2/1.11/4.3.1 Method C1: No Change (NOC)

No change to the Radio Regulations. Suppress *resolves* 3 of Resolution **361 (Rev.WRC-19)**.

2/1.11/4.3.2 Method C2

Following the IMO recognition of the service provided by the GSO MSS system/network for use in the GMDSS, a number of implementation issues were identified including satellite coordination of the GSO MSS system/network with existing assignments in all or part of the frequency bands 1 610.18-1 626.5 MHz and 2 483.59-2 499.91 MHz. In addition, the spectrum requirements are yet to be determined for the GSO MSS system/network for its GMDSS use.

Alternative 1

Prior to the adoption of the example regulatory solution provided in Method C2 the new GMDSS system must be fully coordinated in accordance with Articles **9** and **11** of the Radio Regulations prior to introduction of a new safety system including the elimination of any experienced harmful interference. The system must also be recorded in the MIFR in accordance with RR No. **11.37**. Conditional recording under RR No. **11.41** does not fulfil these criteria.

Alternative 2

For the new GMDSS system it is necessary for it to be successfully coordinated in accordance with Articles **9** and **11** of the RR and associated Rules of Procedure, and the subject assignments recorded in the MIFR.

When the conditions are satisfied, this method proposes:

– the addition of the frequency bands [1 610.00-1 610.5/1 610.18-1 618.34] MHz and [2 499.5-2 500/2 483.59-2 499.91] MHz to Table 15-2 of RR Appendix **15**, as well as provisions RR No. **33.50** and RR No. **33.53** of RR Article **33**, in order to support the requirement of safety of life aspects by the GMDSS and implement applicable provisions of RR;

– two options to apply or not RR No. **4.10** to the MMSS for GMDSS:

  • Option 1 proposes to modify RR Nos. **5.364** and **5.368** to apply RR No. **4.10** in the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz to GMDSS stations operating in the MMSS (Earth-to-space) and to modify RR No. **5.368** to keep the status between GMDSS stations operating in the MMSS and AMS(R)S in the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz.

  • Option 2 proposes NOC to RR Nos. **5.364** and **5.368** in order not to expand the application of RR No. **4.10** on MMSS in the frequency band [1 610.00-1 610.5/1 610.1 8-1 618.34] MHz to uphold the existing priority of the ARNS and AMS(R)S systems.

Some administrations are of the view that:

1) The decision of WRC-23 on the new GMDSS should not implicitly or explicitly/directly or indirectly be conditioned on the completion of coordination of that system due to the fact the issue of completion of any network/system is entirely a separate issue from the decision of any WRC since the coordination process has already been clearly included in the Radio Regulations currently in force.

2) The issue of recognition of the new GMDSS by IMO is an issue which is not related to the ITU activities or WRC outcome of this agenda item as it is a matter under the purview of IMO without any involvement of ITU.

Some other administrations are of the strong view that the above statement is misleading for the following reasons:

1) Compliance with the Radio Regulations is a requirement for all signatories and does not need confirmation by WRC-23. Systems supporting a safety-of-life service such as GMDSS will require protection from harmful interference, and this can only be assured if coordination and notification are completed. Without such completion, any restrictions required for coordination cannot be reflected in a GMDSS identification.

2) The IMO approval/recognition of a GSO satellite network to provide GMDSS is a key factor in Resolution ***361 (Rev.WRC-19)****. Without such approval/recognition, there is no* *obligation on WRC-23 to undertake changes to the Radio Regulations as an applicant may never become approved, and the identification never used.*

2/1.11/4.3.3 Method C3

The introduction of additional satellite systems for the GMDSS operations is subject to the completion of relevant and applicable provisions of the Radio Regulations in force including RR Articles **9** and **11** together with the objectives of their associated Rules of Procedure (RoP), before such addition is made with a view to comply with the protection of existing services to which the frequency band is allocated, taking into account the conditions under which these existing services are currently operating and implemented.

This method also includes:

– the addition of the frequency bands 1 610.18-1 621.35 MHz and 2 483.59-2 499.91 MHz to Table 15-2 of RR Appendix **15**, as well as provisions RR No. **33.50** and RR No. **33.53** of RR Article **33**, in order to support the requirement of safety of life aspects by the GMDSS and implement applicable provisions of RR;

– to modify RR Nos. **5.364** and **5.368** to apply RR No. **4.10** in the frequency band 1 610.18-1 621.35 MHz to GMDSS stations operating in the MMSS (Earth-to-space) and to modify RR No. **5.368** to keep the status between GMDSS stations operating in the MMSS and AMS(R)S in the frequency band 1 610.18-1 621.35 MHz.

– an associated Resolution with a view to addressing the coordination needs and the mitigation and elimination of possible harmful interference.

*Some administrations are of the view that completion of coordination and notification of the new proposed GMDSS system, in accordance with Articles **9** and **11** of the RR, is a prerequisite for making changes to the Radio Regulations to accommodate it. Without this, a GMDSS system cannot claim protection from harmful interference, and may not satisfy the requirements of a safety system. To this effect it is emphasized that assignments recorded under RR No. **11.41** are not suitable for use in a GMDSS system. Recognition and approval of the GSO satellite network/system by IMO to provide GMDSS function prior to WRC-23 is also a determining factor for adopting any changes to the Radio Regulations.*

Some other administrations are of the strong view that the above statement is not factual and misleading for the following reasons:

1) There is no relation between the process of coordination of the assignments and decision of any WRC including WRC-23 since the course of actions to be taken for coordination are currently clearly described and outlined in the Radio Regulations and thus does not need and additional decision by WRC-23.

*2) Reference to inclusion of a given frequency assignments pertaining to a given GSO satellite network or non-GSO satellite system in the Radio Regulations is an integral part of the notification and recording procedure of these assignment as outlined in Article **11** of the Radio Regulations and thus is entirely independent of the decision of any WRC including WRC-23.*

3) The issue of recognition IMO of a GSO satellite network or non-GSO satellite system to be qualified as a candidate to provide GMDSS has no relation with the decision of any WRC, such WRC-23 due to the fact that such recognition is entirely a separate issue within the mandate and remit of IMO which could be done before any WRC or after any WRC or not be recognized at all.

2/1.11/4.3.4 Method C4

This method proposes:

– the addition of all or part of the frequency band 1 614.4225-1 621.35 MHz and all or part of the frequency band 2 483.59-2 500 MHz to Table 15-2 of RR Appendix **15**, as well as provisions RR No. **33.50** and RR No. **33.53** of RR Article **33**, in order to support the requirement of safety of life aspects by the GMDSS and implement applicable provisions of RR;

– the modification of RR No. **5.368** to apply RR No. **4.10** in all or part of the frequency band 1 614.4225-1 621.35 MHz to GMDSS stations operating in the MMSS (Earth-to-space);

– the suppression of Resolution **361 (Rev.WRC-19)**.

2/1.11/5 Regulatory and procedural considerations

2/1.11/5.1 For Method A (Issue A): global maritime distress and safety system modernization

2/1.11/5.1.1 For Method A, proposed modification for RR Article 5

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

495-1 800 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
495-505	MARITIME MOBILE 5.82C ADD 5.A111	

MOD

3 230-5 003 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
4 063-4 438	MARITIME MOBILE 5.79A ADD 5.A111 5.109 MOD 5.110 5.130 5.131 MOD 5.132 5.128	

MOD

5 003-7 000 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
6 200-6 525	MARITIME MOBILE 5.109 5.110 5.130 MOD 5.132 ADD 5.B111 5.137	

MOD

7 450-13 360 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
8 195-8 815	MARITIME MOBILE 5.109 5.110 MOD 5.132 5.145 ADD 5.B111 5.111	
…		
12 230-13 200	MARITIME MOBILE 5.109 5.110 MOD 5.132 5.145 ADD 5.B111	

MOD

13 360-18 030 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
16 360-17 410	MARITIME MOBILE 5.109 5.110 MOD 5.132 5.145 ADD 5.B111	

MOD

18 030-23 350 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
22 000-22 855	MARITIME MOBILE MOD 5.132 ADD 5.B111 5.156	

ADD

5.A111 When establishing coast stations in the NAVDAT service on the frequencies 500 kHz and 4 226 kHz, the conditions for the use of the frequencies 500 kHz and 4 226 kHz are prescribed in Articles **31** and **52**. Administrations are strongly recommended to coordinate the operating characteristics in accordance with the procedures of the International Maritime Organization (IMO) (see Resolution **[A111] (WRC-23)**). (WRC-23)

Reasons: Coordination of the NAVDAT services should be done through the procedures established by IMO, in the same way as it is done for the NAVTEX services, see Resolution **339 (Rev.WRC-07)**.

MOD

5.110 The frequencies 2 174.5 kHz, 4 177.5 kHz, 6 268 kHz, 8 376.5 kHz, 12 520 kHz and 16 695 kHz are ~~international distress frequencies for narrow-band direct-printing telegraphy. The conditions for the use of these frequencies are prescribed in Article **31**.~~used for the automatic connection system as described in the most recent version of Recommendation ITU-R M.541. (WRC-23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. The distress frequencies for NBDP are reused for the ACS described in Recommendation ITU-R M.541 (under revision) and the new Report ITU-R M.[ACS].

ADD

5.B111 The frequencies 6 337.5 kHz, 8 443 kHz, 12 663.5 kHz, 16 909.5 kHz and 22 450.5 kHz are the regional frequencies for the transmission of maritime safety information (MSI) by means of the NAVDAT system (see Appendices **15** and **17**). (WRC-23)

Reasons: Introduction of the regional NAVDAT frequencies.

MOD

5.132 The frequencies 4 210 kHz, 6 314 kHz, 8 416.5 kHz, 12 579 kHz, 16 806.5 kHz, 19 680.5 kHz, 22 376 kHz and 26 100.5 kHz are the international frequencies for the transmission of maritime safety information (MSI) (see ~~Appendix~~ Appendices **15** and **17**). (WRC-23)

Reasons: First to correct the omission of RR Appendix **15** and second to be aligned with RR No. **5.B111**.

MOD

5.228C The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the maritime mobile service and the mobile-satellite (Earth-to-space) service is limited to the automatic identification system (AIS), including the AIS search and rescue transmitter (AIS-SART). The use of these frequency bands by the aeronautical mobile (OR) service is limited to AIS emissions from search and rescue aircraft operations. The AIS and AIS-SART operations in these frequency bands shall not constrain the development and use of the fixed and mobile services operating in the adjacent frequency bands. (WRC-~~12~~23)

Reasons: The AIS-SART also use AIS frequencies for locating signal.

2/1.11/5.1.1.1 For Method A, Alternative A1 for RR No. 5.375

MOD

5.375 The ~~use of the~~frequency band 1 645.5-1 646.5 MHz is used by the mobile-satellite service (Earth-to-space) and ~~for~~by inter-satellite links ~~is limited to~~for distress, urgency and safety communications (see Article **31**). Additionally, for the mobile-satellite service, use of this band from earth stations operating in the GMDSS for other than distress purposes is also permitted. (WRC-23)

Reasons: The frequency band 1 645.5 to 1 646.5 MHz was used by 1.6 GHz satellite EPIRBs but these have been withdrawn. Unless the permitted use of this band is updated, this 1 MHz band will continue to be unused. Expanding its permitted use to more general distress, urgency and safety use will support the safety of seafarers and shipping. Also, to improve the efficiency of the use of this band, non-distress communications may also be used on a non-priority basis from earth stations supporting distress, urgency and safety communications in this band.

2/1.11/5.1.1.2 For Method A, Alternative A2 for RR No. 5.375

MOD

5.375 The use of the band 1 645.5-1 646.5 MHz by the mobile-satellite service (Earth-to-space) and for inter-satellite links is limited to distress, urgency and safety communications (see Article **31**). (WRC-23)

Reasons: Introduction of the word urgency in order to reflect the last modification of SOLAS Chapter IV.

2/1.11/5.1.1.3 For Method A, Alternative A3 for RR No. 5.375

NOC

5.375

Reasons: The frequency band 1 645.5-1 646.5 MHz (Earth-to-space) change of use from EPIRBs to other applications is out of the scope of this AI and require further studies to ensure proper and efficient use of this valuable frequency band. It has become known recently that this frequency band has been unused for many years and it is prudent to carry out proper studies to make best use of the band.

2/1.11/5.1.2 For Method A, proposed modification for RR Article 19

ARTICLE 19

Identification of stations

Section I − General provisions

2/1.11/5.1.2.1 For Method A, Alternative B1 for RR No. 19.11

MOD

19.11 5) All transmissions by satellite emergency position-indicating radiobeacons (EPIRBs) operating in the band 406-406.1 MHz~~ or the band 1 645.5-1 646.5 MHz, or by EPIRBs using digital selective calling techniques,~~ shall carry identification signals. (WRC-23)

Reasons: No EPIRB operation in L band and VHF DSC.

2/1.11/5.1.2.2 For Method A, Alternative B2 for RR No. 19.11

NOC

19.11

Reasons: The frequency band 1 645.5-1 646.5 MHz (Earth-to-space) change of use from EPIRBs to other applications is out of the scope of the AI and require further studies to ensure proper and efficient use of this valuable frequency band. It has become known recently that this frequency band has been unused for many years and it is prudent to carry out proper studies to make best use of the band.

2/1.11/5.1.3 For Method A, proposed modification for RR Article 31

ARTICLE 31

Frequencies for the global maritime distress and safety system (GMDSS)

Section II – Survival craft stations

MOD

31.7 2) Equipment for transmitting locating signals from survival craft stations shall be capable of operating in the frequency band 9 200-9 500 MHz ~~band.~~or on 161.975 MHz (AIS 1 of Appendix **18**) and 162.025 MHz (AIS 2 of Appendix **18**). (WRC-23)

Reasons: The frequencies for AIS-SART homing signal need to be included.

2/1.11/5.1.4 For Method A, proposed modification for RR Article 32

ARTICLE 32

Operational procedures for distress communications in the global maritime distress and safety system (GMDSS) (WRC-07)

Section I – General

MOD

32.7 § 6 The phonetic alphabet and figure code in Appendix **14** and the abbreviations and signals in accordance with the most recent version of Recommendation ITU-R M.1172 should be used where applicable MOD [1]. (WRC-~~03~~23)

MOD

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[1] **32.7.1** The use of the Standard Marine Communication Phrases (SMCP) and, where language difficulties exist~~s~~, the International Code of Signals, both published by the International Maritime Organization (IMO), is also recommended. It should be noted that the pronunciations for figures in Appendix **14** and IMO SMCP are different. (WRC-23)

Reasons: In order to avoid potential confusion, it is necessary to remind the mariners and administrations of the difference in pronunciations of figures between RR Appendix **14** and IMO SMCP.

Section II − Distress alerting and distress calling (WRC-07)

32.11 *B − Transmission of a distress alert or a distress call* (WRC-07)

B1 − Transmission of a distress alert or a distress call by a ship station or a ship earth station (WRC-07)

MOD

32.12 § 8 Ship-to-shore distress alerts or calls are used to alert rescue coordination centres via coast stations or coast earth stations that a ship is in distress. These alerts are based on the use of transmissions via satellites (from a ship earth station or a satellite EPIRB) and terrestrial services (from ship stations~~ and EPIRBs~~). (WRC-~~07~~23)

Reasons: Terrestrial VHF EPRIRB is no longer in operation.

32.20 *C − Receipt and acknowledgement of distress alerts and distress calls* (WRC-07)

C1 − Procedure for acknowledgement of receipt of distress alerts or a distress call (WRC-07)

MOD

32.21A 2) When acknowledging receipt of a distress alert sent by DSC[8], the acknowledgement in the terrestrial services shall be made by DSC~~,~~ or radiotelephony~~ or narrow-band direct-printing telegraphy as appropriate to the circumstances,~~ on the associated distress and safety frequency in the same band in which the distress alert was received, taking due account of the directions given in the most recent versions of Recommendations ITU-R M.493 and ITU-R M.541. (WRC-~~07~~23)

Reasons: NBDP has been deleted by the IMO from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, acknowledging receipt of a distress alert by NBDP should be excluded. However, acknowledge receipt by DSC or radiotelephony should be retained.

MOD

32.23 § 15 ~~1) ~~When acknowledging by radiotelephony the receipt of a distress alert or a distress call from a ship station or a ship earth station, the acknowledgement should be given in the following form, taking into account Nos. **32.6** and **32.7**:

– the distress signal "MAYDAY";
– the name followed by the call sign, or the MMSI or other identification of the station sending the distress message;
– the words "THIS IS";
– the name and call sign or other identification of the station acknowledging receipt;
– the word "RECEIVED";
– the distress signal "MAYDAY". (WRC-~~12~~23)

Reasons: Editorial changes of numbering due to the suppression of RR No. **32.24**.

SUP

32.24

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, the acknowledging receipt of a distress alert by NBDP is not effective.

C3 − Receipt and acknowledgement by a ship station or ship earth station (WRC-07)

MOD

32.31 2) However, in order to avoid making unnecessary or confusing transmissions in response, a ship station, which may be at a considerable distance from the incident, receiving an HF distress alert, shall not acknowledge it but shall observe the provisions of Nos. **32.36** to ~~**32.38**~~ **32.37**, and shall, if the distress alert is not acknowledged by a coast station within five minutes, relay the distress alert, but only to an appropriate coast station or coast earth station (see also Nos. **32.16** to **32.19H**). (WRC-~~07~~23)

Reasons: NBDP has been deleted from the GMDSS with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. If the provision of RR No. **32.38** is deleted, this provision number should be amended.

MOD

32.34A § 21A However, unless instructed to do so by a coast station or a rescue coordination centre, a ship station may only send an acknowledgement by DSC in the event that:

a) no acknowledgement by DSC from a coast station has been observed; and

b) no other communication by radiotelephony ~~or narrow-band direct-printing telegraphy~~ to or from the vessel in distress has been observed; and

c) at least five minutes have elapsed and the distress alert by DSC has been repeated (see No. **32.21A.1**). (WRC-~~07~~23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, distress communication by NBDP is not effective.

32.36 *D − Preparations for handling of distress traffic*

SUP

32.38

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, coast stations and ship stations need not set watch on the NBDP frequencies for GMDSS. Radio watch on the associated frequency by radiotelephony is regulated by RR No. **32.37**.

Section III − Distress traffic

32.39 *A − General and search and rescue coordinating communications*

SUP

32.43

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, distress traffic by NBDP is not appropriate.

SUP

32.44

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, distress traffic by NBDP is not effective.

MOD

32.47 ~~*a)*~~ in radiotelephony, the signal SEELONCE MAYDAY, pronounced as the French expression “silence, m’aider”; (WRC-23)

Reasons: Editorial changes of numbering due to the suppression of RR No. **32.48**.

SUP

32.48

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, distress related traffic by NBDP is not effective.

MOD

32.52 § 32 ~~1)~~ In radiotelephony, the message referred to in No. **32.51** should consist of the following taking into account Nos. **32.6** and **32.7**:

– the distress signal “MAYDAY”;

– the words “ALL STATIONS”, spoken three times;

– the words “THIS IS”;

– the name of the station sending that message, spoken three times;

– the call sign or other identification of the station sending the message;

– the time of handing in of the message;

– the MMSI (if the initial alert has been sent by DSC), the name and the call sign of the mobile station which was in distress;

– the words “SEELONCE FEENEE” pronounced as the French words “silence fini”. (WRC-~~12~~23)

Reasons: Editorial changes of numbering due to the suppression of RR No. **32.53**.

SUP

32.53

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, there is no need to announce by NBDP that the distress traffic has been finished.

32.54 *B − On-scene communications*

MOD

32.56 2) Control of on-scene communications is the responsibility of the unit coordinating search and rescue operations[10]. Simplex communications shall be used so that all on-scene mobile stations may share relevant information concerning the distress incident. ~~If direct-printing telegraphy is used, it shall be in the forward error-correcting mode.~~ (WRC-23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. On-scene communications are distress traffic between the mobile unit in distress and assisting mobile units. Therefore, on-scene communications using NBDP is not appropriate.

MOD

32.57 § 34 1) The preferred frequencies in radiotelephony for on-scene communications are 156.8 MHz and 2 182 kHz. ~~The frequency 2 174.5 kHz may also be used for ship-to-ship on-scene communications using narrow-band direct-printing telegraphy in the forward error correcting mode.~~ (WRC-23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, ship-to-ship on-scene communications using NBDP is not appropriate.

MOD

32.59 § 35 The selection or designation of on-scene frequencies is the responsibility of the unit coordinating search and rescue operations[10]. Normally, once an on-scene frequency is established, a continuous aural ~~or teleprinter~~ watch is maintained by all participating on-scene mobile units on the selected frequency. (WRC-23)

Reasons: Except NBDP, all the frequencies for on-scene communications identified in the RR Nos. **32.57** and **32.58** are the frequencies for radiotelephony. Therefore, teleprinter watch is not required to maintain.

32.60 *C − Locating and homing signals*

MOD

32.61 § 36 1) Locating signals are radio transmissions intended to facilitate the finding of a mobile unit in distress or the location of survivors. These signals include those transmitted by searching units, and those transmitted by the mobile unit in distress, by survival craft, by ~~float-free EPIRBs, by~~ satellite EPIRBs, by radar SARTs and by ~~search and rescue radar transponders~~AIS-SARTs to assist the searching units. (WRC-23)

Reasons: Editorial changes to the name of EPIRB and SART. AIS-SART is also GMDSS equipment and transmit locating signal.

2/1.11/5.1.5 For Method A, proposed modification for RR Article 33

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section II − Urgency communications

MOD

33.8 § 2 1) In a terrestrial system, urgency communications consist of an announcement, transmitted using digital selective calling, followed by the urgency call and message transmitted using radiotelephony~~, narrow-band direct-printing~~, or data. The announcement of the urgency message shall be made on one or more of the distress and safety calling frequencies specified in Section I of Article **31** using either digital selective calling and the urgency call format, or if not available, radio telephony procedures and the urgency signal. Announcements using digital selective calling should use the technical structure and content set forth in the most recent version of Recommendations ITU-R M.493 and ITU-R M.541. A separate announcement need not be made if the urgency message is to be transmitted through the maritime mobile-satellite service. (WRC-~~07~~23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, urgency communications by NBDP are not appropriate.

MOD

33.12 § 6 ~~1)~~ The urgency call should consist of the following, taking into account Nos. **32.6** and **32.7**:

– the urgency signal "PAN PAN", spoken three times;
– the name of the called station or "ALL STATIONS", spoken three times;
– the words "THIS IS";
– the name of the station transmitting the urgency message, spoken three times;
– the call sign or any other identification;
– the MMSI (if the initial announcement has been sent by DSC),

followed by the urgency message or followed by the details of the channel to be used for the message in the case where a working channel is to be used.

In radiotelephony, on the selected working frequency, the urgency call and message consist of the following, taking into account Nos. **32.6** and **32.7**:

– the urgency signal "PAN PAN", spoken three times;
– the name of the called station or "ALL STATIONS", spoken three times;
– the words "THIS IS";
– the name of the station transmitting the urgency message, spoken three times;
– the call sign or any other identification;

– the MMSI (if the initial announcement has been sent by DSC);

– the text of the urgency message. (WRC-~~12~~23)

Reasons: Editorial change to the number of provision.

SUP

33.13

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, urgency communications by NBDP are not appropriate.

SUP

33.17

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, urgency communications by NBDP are not appropriate.

SUP

33.18

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore urgency communications by NBDP are not appropriate.

Section III − Medical transports

MOD

33.20 § 11 1) For the purpose of announcing and identifying medical transports which are protected under the above-mentioned Conventions, the procedure of Section II of this Article is used. The urgency call shall be followed ~~by the addition of the single word MEDICAL in narrow-band direct-printing and~~ by the addition of the single word MAY-DEE-CAL pronounced as in French "médical", in radiotelephony. (WRC-~~07~~23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Medical advice communication belongs to GMDSS in RR Article **33**. Therefore, urgency communications for medical advice by NBDP are not appropriate.

Section IV − Safety communications

MOD

33.31 § 15 1) In a terrestrial system, safety communications consist of a safety announcement, transmitted using digital selective calling, followed by the safety call and message transmitted using radiotelephony ~~narrow-band direct-printing~~ or data. The announcement of the safety message shall be made on one or more of the distress and safety calling frequencies specified in Section I of Article **31** using either digital selective calling techniques and the safety call format, or radiotelephony procedures and the safety signal. (WRC-~~07~~23)

Reasons: NBDP has been deleted from the GMDSS., with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, safety communications by NBDP are not appropriate.

MOD

33.35 § 19 ~~1)~~ The complete safety call should consist of the following, taking into account Nos. **32.6** and **32.7**:

– the safety signal “SECURITE”, spoken three times;

– the name of the called station or “ALL STATIONS”, spoken three times;

– the words “THIS IS”;

– the name of the station transmitting the safety message, spoken three times;

– the call sign or any other identification;

– the MMSI (if the initial announcement has been sent by DSC),

followed by the safety message or followed by the details of the channel to be used for the message in the case where a working channel is to be used.

In radiotelephony, on the selected working frequency, the safety call and message should consist of the following, taking into account Nos. **32.6** and **32.7**:

– the safety signal “SECURITE”, spoken three times;

– the name of the called station or “ALL STATIONS”, spoken three times;

– the words “THIS IS”;

– the name of the station transmitting the safety message, spoken three times;

– the call sign or any other identification;

– the MMSI (if the initial alert has been sent by DSC);

– the text of the safety message. (WRC-~~12~~23)

Reasons: Editorial changes of numbering due to the suppression of RR No. **33.36**.

SUP

33.36

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, safety communications by NBDP are not appropriate.

SUP

33.37

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, safety communications by NBDP are not appropriate.

SUP

33.38

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, safety communications by NBDP are not appropriate.

Section V − Transmission of maritime safety information[2]

33.39 *A − General*

ADD

33.40*bis* The transmission of maritime safety information using either the NAVTEX system and/or the NAVDAT system is the responsibility of the administration which shall inform the IMO in order to update the IMO Master Plan of shore-based facilities for the GMDSS (GMDSS Master Plan). (WRC-23)

Reasons: The administrations could broadcast MSI using either the NAVTEX or NAVDAT system but shall inform the IMO in order to update the GMDSS Master Plan, this can be made by updating the GMDSS Master Plan module for the IMO GISIS (Global Integrated Ship Information System) an online system accessed via the IMO website, this is a means for mariners to know how MSI is broadcast.

MOD

33.41 § 22 The mode and format of the transmissions mentioned in Nos. **33.43**, **33.45**, **33.46**, **33.46A2** and **33.48** shall be in accordance with the relevant ITU-R Recommendations. (WRC-23)

Reasons: Reference to the new NAVDAT section in RR No. **33.46A2.**

33.42 *B − International NAVTEX system*

MOD

33.43 § 23 Where ~~Maritime~~ maritime safety information ~~shall be~~is transmitted using the international NAVTEX system, taking into account No. **33.40*bis***, by means of narrow-band direct-printing telegraphy with forward error correction, ~~using~~ the frequency 518 kHz ~~in accordance with the international NAVTEX system~~shall be used (see Appendix **15**). (WRC-23)

Reasons: Rewording of this provision taking into account RR No. **33.40*bis***.

ADD

33.46A1 *D − International NAVDAT system*

ADD

33.46A2 § 25 Where maritime safety information is transmitted using the international NAVDAT system, taking into account No. **33.40*bis***, the frequency 500 kHz and/or 4 226 kHz shall be used (see Appendix **15**). (WRC-23)

Reasons: Introduction of a new section for the NAVDAT.

MOD

33.47 *~~D~~E − High seas maritime safety information*

Reasons: Editorial renumbering due to the introduction of the new NAVDAT section.

MOD

33.48 § ~~25~~26 Maritime safety information which is transmitted by means of narrow-band direct-printing telegraphy with forward error correction ~~using~~uses the frequencies 4 210 kHz, 6 314 kHz, 8 416.5 kHz, 12 579 kHz, 16 806.5 kHz, 19 680.5 kHz, 22 376 kHz and 26 100.5 kHz. Maritime safety information which is transmitted by means of the NAVDAT system uses the frequencies 6 337.5 kHz, 8 443 kHz, 12 663.5 kHz, 16 909.5 kHz and 22 450.5 kHz. (WRC-23)

Reasons: Introduction of the HF frequencies used for the NAVDAT, see RR Appendix **17** and Recommendation ITU-R M.2058.

MOD

33.49 *~~E~~F − Maritime safety information via satellite*

Reasons: Editorial renumbering due to the introduction of the new NAVDAT section.

MOD

33.50 § ~~26~~27 Maritime safety information may be transmitted via satellite in the maritime mobile-satellite service using the frequency bands 1 530-1 545 MHz and 1 621.35-1 626.5 MHz (see Appendix **15**). (WRC-~~19~~23)

Reasons: Editorial renumbering due to the introduction of the new NAVDAT section. Paragraphs Nos. **33.51** to **33.53** to be renumbered.

2/1.11/5.1.6 For Method A, proposed modification for RR Article 34

ARTICLE 34

Alerting signals in the global maritime distress and safety system (GMDSS)

MOD

Section I − ~~Emergency~~ Satellite emergency position-indicating radiobeacon (EPIRB) ~~and satellite EPIRB~~ signals (WRC-23)

Reasons: Editorial changes to the name of EPIRB.

2/1.11/5.1.7 For Method A, proposed modification for RR Article 47

ARTICLE 47

Operator's certificates

Section III − Conditions for the issuing of certificates

MOD

TABLE **47-1** (WRC-23)

Requirements for radio electronic and operator's certificates

The relevant certificate is issued to a candidate who has given proof of the technical and professional knowledge and qualifications enumerated below, as indicated by an asterisk in the appropriate box	**1st-class radio electronic certificate**	**2nd-class radio electronic certificate**	**General operator's certificate**	**Restricted operator's certificate**
Knowledge of the principles of electricity and the theory of radio and of electronics sufficient to meet the requirements specified below:	*	*		
Theoretical knowledge of GMDSS radiocommuni-cation equipment, including narrow-band direct-printing telegraph and radiotelephone transmitters and receivers, digital selective calling equipment, ship earth stations, satellite emergency position-indicating radio beacons, marine antenna systems, radio equipment for survival craft together with all auxiliary items, including power supplies, as well as general knowledge of the principles of other equipment generally used for radionavigation, with particular reference to maintaining equipment in service.	*			
General theoretical knowledge of GMDSS radiocommunication equipment, including narrow-band direct-printing telegraph and radiotelephone transmitters and receivers, digital selective calling equipment, ship earth stations (including telegraphy), satellite emergency position-indicating radio beacons, marine antenna systems, radio equipment for survival craft together with all auxiliary items, including power supplies, as well as general knowledge of the principles of other equipment generally used for radionavigation, with particular reference to maintaining equipment in service.		*		
Practical knowledge of the operation and knowledge of the preventive maintenance of the equipment indicated above.	*	*		
Practical knowledge necessary for the location and repair (using appropriate testing equipment and tools) of faults in the equipment mentioned above which may occur during a voyage.	*			
Practical knowledge necessary for effecting repairs in the case of faults in the equipment indicated above, using the means available on board and, if necessary, replacing modular units.		*		

TABLE **47-1** (***end***)

The relevant certificate is issued to a candidate who has given proof of the technical and professional knowledge and qualifications enumerated below, as indicated by an asterisk in the appropriate box	1st-class radio electronic certificate	2nd-class radio electronic certificate	General operator's certificate	Restricted operator's certificate
…				
Ability to send and to receive correctly by radiotelephone~~y~~ and ~~direct-printing~~ telegraphy with ship earth station.	*	*	*	
Ability to send and to receive correctly by radiotelephone.	*	*	*	*
…				

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Therefore, knowledge on NBDP operation is not required by GMDSS operators. Ability to send and receive correctly by radiotelephone is essential for all GMDSS operators.

2/1.11/5.1.8 For Method A, Proposed modification for RR Article 51

ARTICLE 51

Conditions to be observed in the maritime services

Section I − Maritime mobile service

51.39 *CA − Ship stations using narrow-band direct-printing telegraphy*

MOD

51.40 § 17 1) All ship stations using narrow-band direct-printing telegraphy equipment for general traffic ~~shall~~ should be able to send and receive on ~~the~~ frequenc~~y~~ies designated for ~~distress traffic by~~ narrow-band direct-printing telegraphy in the frequency bands in which they are operating. (WRC-23)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15**. Voluntary carriage of sending and receiving equipment for general traffic is still possible.

MOD

51.41 2) The characteristics of the narrow-band direct-printing equipment ~~shall~~ should be in accordance with the most recent versions of Recommendations ITU-R M.476, ~~5 and~~ ITU-R M.625~~-4. The characteristics should also be in accordance with the most recent version of Recommendation~~ and ITU-R M.627. (WRC-~~15~~23)

Reasons: NBDP has been deleted from the GMDSS. with the exception of MSI on certain frequencies which are contained in RR Appendix **15**.

51.42 CA1 − Bands between 415 kHz and 535 kHz

MOD

51.44 *a)* send and receive class F1B or J2B emissions for general traffic on the working frequencies necessary to carry out their service; (WRC-23)

Reasons: Since NBDP is not use anymore for distress, for MSI solely the reception is needed.

MOD

51.49 § 20 All ship stations equipped with narrow-band direct-printing telegraphy apparatus for general traffic to work in the authorized bands between 4 000 kHz and 27 500 kHz ~~shall~~ should be able to send and receive class F1B or J2B emissions on working frequencies in each of the HF maritime mobile bands necessary to carry out their service.

All ship stations equipped with narrow-band direct-printing telegraphy apparatus for MSI reception to work in the authorized bands between 4 000 kHz and 27 500 kHz shall be able to receive class F1B or J2B emissions on working frequencies in each of the HF maritime mobile bands necessary to carry out their service. (WRC-23)

Reasons: NBDP receiving only is still required for MSI reception.

ADD

51.49*bis* *Cbis – Ship stations using the automatic connection system* (WRC-23)

ADD

51.49*ter* The characteristics of the automatic connection system should be in accordance with the most recent versions of Recommendation ITU-R M.493 and Recommendation ITU-R M.541. (WRC-23)

Reasons: Introduction of the ACS.

Section I − Maritime mobile service

ADD

51.64A1 *E − Ship stations receiving data transmissions* (WRC-23)

ADD

51.64A2 E1 − Bands between 415 kHz and 526.5 kHz (WRC-23)

ADD

51.64A3 § 24*bis* All ship stations equipped with NAVDAT apparatus for receiving digital data transmissions in the authorized bands between 415 kHz and 535 kHz shall be capable of receiving class W7D emission on 500 kHz, if complying with the provisions of Chapter VII. (WRC-23)

ADD

51.64A4 E2 − Bands between 4 000 kHz and 27 500 kHz (WRC-23)

ADD

51.64A5 § 24*ter* All ship stations equipped with NAVDAT apparatus for receiving digital data transmissions in the authorized bands between 4 000 kHz and 27 500 kHz shall be capable of receiving class W7D emission, if complying with the provisions of Chapter VII. (WRC-23)

Reasons: These provisions are added in order to stipulate the required class of emissions for NAVDAT in accordance with Recommendations ITU-R M.2010 and ITU-R M.2058.

2/1.11/5.1.9 For Method A, proposed modification for RR Article 52

ARTICLE 52

Special rules relating to the use of frequencies

Section I − General provisions

52.4 *B − Bands between 415 kHz and 535 kHz*

MOD

52.6 § 3 1) In the maritime mobile service, no assignments shall be made on the frequency 518 kHz other than for transmission by coast stations of meteorological and navigational warnings and urgent information to ships by means of automatic narrow-band direct-printing telegraphy (International NAVTEX System). In the maritime mobile service, no assignments shall be made on the frequency 500 kHz other than for transmission by coast stations of meteorological and navigational warnings and urgent information to ships by means of the International NAVDAT System. (WRC-23)

Reasons: Protection of the frequency for the international NAVDAT system.

52.12 *D − Bands between 4 000 kHz and 27 500 kHz*

ADD

52.13A § 6*bis* In the maritime mobile service, no assignments shall be made on the frequency 4 226 kHz other than for transmission by coast stations of meteorological and navigational warnings and urgent information to ships by means of the International NAVDAT System. (WRC-23)

Reasons: Protection of the frequency for the international NAVDAT system.

Section III − Use of frequencies for narrow-band direct-printing telegraphy

52.96 *B − Bands between 415 kHz and 535 kHz*

MOD

52.97 § 45 All ship stations equipped with narrow-band direct-printing apparatus for general traffic to work in the authorized bands between 415 kHz and 535 kHz ~~shall~~should be able to send and receive class F1B emissions as specified in No. **51.44**. Additionally, ship stations complying with the provisions of Chapter **VII** shall be able to receive class F1B emissions on 518 kHz (see No. **51.45**). (WRC-23)

Reasons: NBDP receiving only is still required for NAVTEX reception.

52.102 *D − Bands between 4 000 kHz and 27 500 kHz*

MOD

52.103 § 47 All ship stations equipped with narrow-band direct-printing telegraph apparatus for general traffic to work in the authorized bands between 4 000 kHz and 27 500 kHz ~~shall~~ should be able to send and receive class F1B emissions as specified in No. **51.49**.

All ship stations equipped with narrow-band direct-printing telegraph apparatus for MSI reception to work in the authorized bands between 4 000 kHz and 27 500 kHz shall be able to receive class F1B emissions as specified in No. **51.49**.

The assignable frequencies are indicated in Appendi~~x~~ces **15** and **17**. (WRC-23)

Section IV − Use of frequencies for digital selective-calling

52.110 *A – General*

MOD

52.111 § 50 The provisions described in this Section are applicable to calling and acknowledgement, when digital selective-calling techniques are used, except in cases of distress, urgency and safety, to which the provisions of Chapter **VII** apply. When the automatic connection system is used, the provisions of Section IV*bis* should apply. (WRC-23)

Reasons: Introduction of the ACS.

52.157 *E − Bands between 156 MHz and 174 MHz*

E3 − Watch

52.162 § 73 Ship stations equipped with apparatus for digital selective-calling to work in the authorized bands between 156 MHz and 174 MHz should, while at sea, maintain an automatic digital selective-calling watch on the frequency 156.525 MHz (see also No. **31.17**).

ADD

Section IV*bis* − Use of frequencies for the automatic connection system (WRC-23)

ADD

52.xx0 *A – General* (WRC-23)

ADD

52.xx1 § y0 The automatic connection system (ACS) means automatic connection function using DSC for shore-to-ship, ship-to-shore or ship-to-ship communication with the most appropriate working frequency (or channel) in the MF and HF bands of the maritime mobile service.

The procedure for ACS shall not interrupt a reliable watch on a 24-hour basis on appropriate DSC distress alerting frequencies unless the equipment is transmitting.

When an ACS is utilized, it should be in accordance with the most recent versions of Recommendation ITU-R M.493 and Recommendation ITU-R M.541. (WRC-23)

ADD

52.xx2 *B – Bands between 1 606.5 kHz and 4 000 kHz* (WRC-23)

ADD

52.xx3 § y1 The ACS frequency used for transmitting and receiving for both ship stations and coast stations is 2 174.5 kHz. (WRC-23)

ADD

52.xx4 *C – Bands between 4 000 kHz and 27 500 kHz* (WRC-23)

ADD

52.xx5 § y2 The ACS frequencies used for transmitting and receiving for both ship stations and coast stations are 4 177.5 kHz, 6 268 kHz, 8 376.5 kHz, 12 520 kHz and 16 695 kHz. (WRC-23)

Reasons: Introduction of the ACS.

Section VII – Use of frequencies for data transmissions (WRC-12)

52.261 *A – General* (WRC-12)

52.262 Frequencies assigned to coast stations for data transmissions shall be indicated in the List of Coast Stations and Special Service Stations (List IV). This List shall also indicate any other useful information concerning the service performed by each coast station. (WRC-12)

ADD

52.262A1 *B − Bands between 415 kHz and 526.5 kHz* (WRC-23)

ADD

B1 − Mode of operation of stations (WRC-23)

ADD

52.262A2 The class of emissions to be used for data transmissions in the bands between 415 kHz and 526.5 kHz should be in accordance with the most recent version of Recommendation ITU-R M.2010. Coast stations as well as ship stations should use radio systems specified in the most recent version of Recommendation ITU-R M.2010. (WRC-23)

Reasons: The frequency usages for MF NAVDAT system need to be included.

MOD

52.263 *~~B~~C – Bands between 4 000 kHz and 27 500 kHz* (WRC-~~12~~23)

MOD

~~B~~C1 – Mode of operation of stations (WRC-~~12~~23)

MOD

52.264 The class of emissions to be used for data transmissions in ~~this section~~the bands between 4 000 kHz and 27 500 kHz should be in accordance with the most recent version of Recommendation ITU-R M.1798 or the most recent version of Recommendation ITU-R M.2058. Coast stations as well as ship stations should use radio systems specified in the most recent version of Recommendation ITU-R M.1798 or the most recent version of Recommendation ITU-R M.2058. (WRC-~~15~~23)

Reasons: The frequency usages for HF NAVDAT system need to be included.

ADD

52.265A1 Coast stations employing the class of emissions in accordance with the most recent version of Recommendation ITU-R M.2058 in the frequency bands between 4 000 kHz and 27 500 kHz shall not exceed a mean power in the following values:

Band	*Maximum mean power*	
4 MHz	5 kW	
6 MHz	5 kW	
8 MHz	10 kW	
12 MHz	10 kW	
16 MHz	10 kW	
18/19 MHz	10 kW	
22 MHz	10 kW	(WRC-23)

Reasons: Introduction of the maximum mean power for the NAVDAT system by the coast station in the HF bands.

ADD

ARTICLE 54*bis*

Automatic Connection System

ADD

54*bis*.1 § 1 1) The automatic connection system (ACS) using digital selective calling in MF and HF bands is designed to ensure reliable access to the required radio links for the mariner. (WRC-23)

ADD

54*bis*.2 2) The ACS should be in accordance with the most recent versions of Recommendation ITU-R M.541 and Recommendation ITU-R M.493. (WRC-23)

Reasons: Introduction of the ACS.

2/1.11/5.1.10 For Method A, proposed modification for RR Appendix 14

MOD

APPENDIX 14 (REV.WRC-~~07~~23)

Phonetic alphabet and figure code

(See Articles ~~30~~32 and 57) (WRC-~~07~~23)

Reasons: This is an editorial mistake. Articles referring to RR Appendix **14** are RR Articles **32** (**32.7**) and **57** (**57.7**) instead of RR Articles **30** and **57**.

2/1.11/5.1.11 For Method A, proposed modification for RR Appendix 15

2/1.11/5.1.11.1 For Method A, proposed modification for RR Appendix 15, Table 15-1

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

MOD

TABLE 15-1 (WRC-~~07~~23)

Frequencies below 30 MHz

Frequency (kHz)	Description of usage	Notes
490	MSI	The frequency 490 kHz is used exclusively for maritime safety information (MSI). (WRC-03)
500	MSI	The frequency 500 kHz is used exclusively by the international NAVDAT system (see Resolution **[A111] (WRC-23)**).
518	MSI	The frequency 518 kHz is used exclusively by the international NAVTEX system.
~~*2 174.5~~	~~NBDP-COM~~	
*2 182	RTP-COM	The frequency 2 182 kHz uses class of emission J3E. See also No. **52.190**.
*2 187.5	DSC	
3 023	AERO-SAR	The aeronautical carrier (reference) frequencies 3 023 kHz and 5 680 kHz may be used for intercommunication between mobile stations engaged in coordinated search and rescue operations, and for communication between these stations and participating land stations, in accordance with the provisions of Appendix **27** (see Nos. **5.111** and **5.115**).
*4 125	RTP-COM	See also No. **52.221**. The carrier frequency 4 125 kHz may be used by aircraft stations to communicate with stations of the maritime mobile service for distress and safety purposes, including search and rescue (see No. **30.11**).
~~*4 177.5~~	~~NBDP-COM~~	
*4 207.5	DSC	
4 209.5	MSI	The frequency 4 209.5 kHz is exclusively used for NAVTEX-type transmissions (see Resolution **339 (Rev.WRC-07)**).
4 210	MSI-HF	By means of narrow-band direct-printing telegraphy.

4 226	MSI	The frequency 4 226 kHz is exclusively used for the international NAVDAT system (see Resolution **[A111] (WRC-23)**).
5 680	AERO-SAR	See note under 3 023 kHz above.
*6 215	RTP-COM	See also No. **52.221**.
~~*6 268~~	~~NBDP-COM~~	
*6 312	DSC	

TABLE 15-1 (*end*)   (WRC-~~07~~23)

Frequency (kHz)	**Description of usage**	**Notes**
6 314	MSI-HF	By means of narrow-band direct-printing telegraphy.
6 337.5	MSI-HF	By means of the NAVDAT system.
*8 291	RTP-COM	
~~*8 376.5~~	~~NBDP-COM~~	
*8 414.5	DSC	
8 416.5	MSI-HF	By means of narrow-band direct-printing telegraphy.
8 443	MSI-HF	By means of the NAVDAT system.
*12 290	RTP-COM	
~~*12 520~~	~~NBDP-COM~~	
*12 577	DSC	
12 579	MSI-HF	By means of narrow-band direct-printing telegraphy.
12 663.5	MSI-HF	By means of the NAVDAT system.
*16 420	RTP-COM	
~~*16 695~~	~~NBDP-COM~~	
*16 804.5	DSC	
16 806.5	MSI-HF	By means of narrow-band direct-printing telegraphy.
16 909.5	MSI-HF	By means of the NAVDAT system.
19 680.5	MSI-HF	By means of narrow-band direct-printing telegraphy.
22 376	MSI-HF	By means of narrow-band direct-printing telegraphy.
22 450.5	MSI-HF	By means of the NAVDAT system.
26 100.5	MSI-HF	By means of narrow-band direct-printing telegraphy.

Legend:

AERO-SAR These aeronautical carrier (reference) frequencies may be used for distress and safety purposes by mobile stations engaged in coordinated search and rescue operations.

DSC These frequencies are used exclusively for distress and safety calls using digital selective calling in accordance with No. **32.5** (see Nos. **33.8** and **33.32**).   (WRC-07)

MSI In the maritime mobile service, these frequencies are used exclusively for the transmission of maritime safety information (MSI) (including meteorological and navigational warnings and urgent information) by coast stations to ships, by means of narrow-band direct-printing telegraphy or the NAVDAT system.   (WRC-23)

MSI-HF In the maritime mobile service, these frequencies are used exclusively for the transmission of high seas MSI by coast stations to ships, by means of narrow-band direct-printing telegraphy or the NAVDAT system.   (WRC-23)

~~**NBDP-COM** These frequencies are used exclusively for distress and safety communications (traffic) using narrow-band direct-printing telegraphy.~~

RTP-COM These carrier frequencies are used for distress and safety communications (traffic) by radiotelephony.

* Except as provided in these Regulations, any emission capable of causing harmful interference to distress, alarm, urgency or safety communications on the frequencies denoted by an asterisk (*) is prohibited. Any emission causing harmful interference to distress and safety communications on any of the discrete frequencies identified in this Appendix is prohibited. (WRC-07)

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15** and NAVDAT has been introduced in the GMDSS.

2/1.11/5.1.11.2 For Method A, proposed modification for RR Appendix 15, Table 15-2

2/1.11/5.1.11.2.1 For Method A, Alternative A1 for RR Appendix 15, Table 15-2

MOD

TABLE 15-2 (WRC-~~19~~23)

Frequencies above 30 MHz (VHF/UHF)

TABLE 15-2 (*end*) (WRC-~~19~~23)

Frequency (MHz)	**Description of usage**	**Notes**
…		
~~*~~1 645.5-1 646.5	SAT-COM~~D&S-OPS~~	Use of the band 1 645.5-1 646.5 MHz (Earth-to-space) is limited to transmission of distress, urgency and safety ~~operations~~communications, and for non-distress communication purposes, from earth stations operating in the GMDSS (see No. **5.375**). (WRC-23)
…		

Reasons: The frequency band 1 645.5-1 646.5 MHz is no longer used by EPIRBs and 1.6 GHz EPIRBs are no longer part of the GMDSS. The band would be available for use for the GMDSS and, on a non-priority basis, for general maritime radiocommunications. The availability of this band as an addition to the current SAT-COM band 1 626.5-1 645.5 MHz would provide additional capacity in the Earth-to-space direction for communications by ships. Furthermore, the exception provided by the reference to (*) no longer applies.

2/1.11/5.1.11.2.2 For Method A, Alternative A2 for RR Appendix 15 Table 15-2

MOD

TABLE 15-2 (WRC-~~19~~23)

Frequencies above 30 MHz (VHF/UHF)

TABLE 15-2 (*end*) (WRC-~~19~~23)

Frequency (MHz)	**Description of usage**	**Notes**
…		

*1 645.5-1 646.5	SAT-COMD&S-OPS	Use of the band 1 645.5-1 646.5 MHz (Earth-to-space) is limited to distress, urgency and safety operations (see No. **5.375**). (WRC-23)
…		

Reasons: The frequency band had been assigned limited to the distress alerting by EPIRB (Inmarsat E). As this service has been ceased, this frequency band should be used limited to distress, urgency and safety communication.

2/1.11/5.1.11.2.3 For Method A, Alternative A3 for RR Appendix 15 Table 15-2

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

NOC

TABLE 15-2 (WRC-19)

Frequencies above 30 MHz (VHF/UHF)

Reasons: The frequency band 1 645.5-1 646.5 MHz (Earth-to-space) change of use from EPIRBs to other applications is not in the scope of the AI and requires further studies to ensure proper and efficient use of this valuable frequency band. It has become known recently that this frequency band has been unused for many years and it is prudent to carry out proper studies to make best use of the band.

2/1.11/5.1.12 For Method A, proposed modification for RR Appendix 17

APPENDIX 17 (REV.WRC-19)

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

MOD

PART A – Table of subdivided bands (WRC-~~19~~23)

…

Band (MHz)	**4**	**6**	**8**	**12**	**16**	**18/19**	**22**	**25/26**
Limits (kHz)	4 221	6 332.5	8 438	12 658.5	16 904.5	19 705	22 445.5	26 122.5
Frequencies assignable for wide-band systems, facsimile, special and data transmission systems and direct-printing telegraphy systems *m) p) s) pp) ppp)*								
Limits (kHz)	4 351	6 501	8 707	13 077	17 242	19 755	22 696	26 145

Frequencies assignable to coast stations for telephony, duplex operation *a) t)*	**4 352.4** to **4 436.4** *29 f. 3 kHz*	**6 502.4** to **6 523.4** *8 f. 3 kHz*	**8 708.4** to **8 813.4** *36 f. 3 kHz*	**13 078.4** to **13 198.4** *41 f. 3 kHz*	**17 243.4** to **17 408.4** *56 f. 3 kHz*	**19 756.4** to **19 798.4** *15 f. 3 kHz*	**22 697.4** to **22 853.4** *53 f. 3 kHz*	**26 146.4** to **26 173.4** *10 f. 3 kHz*
Limits (kHz)	4 438	6 525	8 815	13 200	17 410	19 800	22 855	26 175

...

j) For the use of the assigned frequencies 4 177.5 kHz, 6 268 kHz, 8 376.5 kHz, 12 520 kHz and 16 695 kHz in these sub-bands by ship and coast stations for the automatic connection system (ACS)~~distress and safety purposes, by NBDP telegraphy, see Article **31**~~. (WRC-23)

...

pp) The frequency bands 4 221-4 231 kHz, 6 332.5-6 342.5 kHz, 8 438-8 448 kHz, 12 658.5-12 668.5 kHz, 16 904.5-16 914.5 kHz and 22 445.5-22 455.5 kHz may also be used by the NAVDAT system, on condition that the use of NAVDAT system transmitting stations is limited to coast stations operating in accordance with the most recent version of Recommendation ITU-R M.2058. (WRC-19)

ppp) The frequency 4 226 kHz is an exclusive frequency for the International NAVDAT system (see Articles **33** and **52**). (WRC-23)

q) These frequency bands may be used by narrow-band direct-printing applications by administrations, subject to not claiming protection from other stations in the maritime mobile service using digitally modulated emissions.

...

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI on certain frequencies which are contained in RR Appendix **15** and the new ACS system will utilize the frequencies previously used by NBDP for distress and safety communications. Similar footnote with *o)* for NAVTEX is added for the NAVDAT.

PART B – Channelling arrangements (WRC-15)

MOD

Section II – Narrow-band direct-printing telegraphy (paired frequencies)

1 Each coast station which uses paired frequencies is assigned one or more frequency pairs from the following series; each pair consists of a transmitting and a receiving frequency.

2 The speed of the narrow-band direct-printing telegraphy and data systems shall not exceed 100 Bd for FSK and 200 Bd for PSK.

Table of frequencies for two-frequency operation by coast stations (kHz)

Channel No.	4 MHz band		6 MHz band		8 MHz band	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
1	4 210.5	4 172.5	6 314.5	6 263	~~8 376.5~~	~~8 376.5~~
2	4 211	4 173	6 315	6 263.5	8 417	8 377
3	4 211.5	4 173.5	6 315.5	6 264	8 417.5	8 377.5
4	4 212	4 174	6 316	6 264.5	8 418	8 378
5	4 212.5	4 174.5	6 316.5	6 265	8 418.5	8 378.5
6	4 213	4 175	6 317	6 265.5	8 419	8 379
7	4 213.5	4 175.5	6 317.5	6 266	8 419.5	8 379.5
8	4 214	4 176	6 318	6 266.5	8 420	8 380
9	4 214.5	4 176.5	6 318.5	6 267	8 420.5	8 380.5
10	4 215	4 177	6 319	6 267.5	8 421	8 381
11	~~4 177.5~~	~~4 177.5~~	~~6 268~~	~~6 268~~	8 421.5	8 381.5
12	4 215.5	4 178	6 319.5	6 268.5	8 422	8 382
13	4 216	4 178.5	6 320	6 269	8 422.5	8 382.5
14			6 320.5	6 269.5	8 423	8 383
15					8 423.5	8 383.5

Table of frequencies for two-frequency operation by coast stations (kHz)

Channel No.	12 MHz band		16 MHz band		18/19 MHz band	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
1	12 579.5	12 477	16 807	16 683.5		
2	12 580	12 477.5	16 807.5	16 684		
3	12 580.5	12 478	16 808	16 684.5		
4	12 581	12 478.5	16 808.5	16 685		
5	12 581.5	12 479	16 809	16 685.5		
6	12 582	12 479.5	16 809.5	16 686		
7	12 582.5	12 480	16 810	16 686.5	19 684	18 873.5
8	12 583	12 480.5	16 810.5	16 687	19 684.5	18 874
9	12 583.5	12 481	16 811	16 687.5	19 685	18 874.5
10	12 584	12 481.5	16 811.5	16 688	19 685.5	18 875
11	12 584.5	12 482	16 812	16 688.5	19 686	18 875.5
12	12 585	12 482.5	16 812.5	16 689	19 686.5	18 876
13	12 585.5	12 483	16 813	16 689.5	19 687	18 876.5
14	12 586	12 483.5	16 813.5	16 690	19 687.5	18 877
15	12 586.5	12 484	16 814	16 690.5	19 688	18 877.5
16	12 587	12 484.5	16 814.5	16 691	19 688.5	18 878
17	12 587.5	12 485	16 815	16 691.5	19 689	18 878.5
18	12 588	12 485.5	16 815.5	16 692	19 689.5	18 879
19	12 588.5	12 486	16 816	16 692.5	19 690	18 879.5
20	12 589	12 486.5	16 816.5	16 693	19 690.5	18 880
21	12 589.5	12 487	16 817	16 693.5		
22	12 590	12 487.5	16 817.5	16 694		
23	12 590.5	12 488	16 818	16 694.5		
24	12 591	12 488.5	~~16 695~~	~~16 695~~		
25	12 591.5	12 489	16 818.5	16 695.5		
26	12 592	12 489.5	16 819	16 696		
27	12 592.5	12 490	16 819.5	16 696.5		
28	12 593	12 490.5	16 820	16 697		
29	12 593.5	12 491	16 820.5	16 697.5		
30	12 594	12 491.5	16 821	16 698		

Channel No.	12 MHz band		16 MHz band		18/19 MHz band	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
31	12 594.5	12 492	16 821.5	16 698.5		
32	12 595	12 492.5				
33	12 595.5	12 493				
34	12 596	12 493.5				
35	12 596.5	12 494				
36	12 597	12 494.5				
37	12 597.5	12 495				
38	12 598	12 495.5				
39	12 598.5	12 496				
40	12 599	12 496.5				
41	12 599.5	12 497				
42	12 600	12 497.5				
43	12 600.5	12 498				
44	12 601	12 498.5				
45	12 601.5	12 499				

Table of frequencies for two-frequency operation by coast stations (kHz)

Channel No.	12 MHz band (*end*)	
	Transmit	Receive
46	12 602	12 499.5
47	12 602.5	12 500
48	12 603	12 500.5
49	12 603.5	12 501
50	12 604	12 501.5
51	12 604.5	12 502
52	12 605	12 502.5
53	12 605.5	12 503
54	12 606	12 503.5
55	12 606.5	12 504
56	12 607	12 504.5
57	12 607.5	12 505
58	12 608	12 505.5
59	12 608.5	12 506
60	12 609	12 506.5
61	12 609.5	12 507
62	12 610	12 507.5
63	12 610.5	12 508
64	12 611	12 508.5
65	12 611.5	12 509
66	12 612	12 509.5
67	12 612.5	12 510
68	12 613	12 510.5
69	12 613.5	12 511
70	12 614	12 511.5
71	12 614.5	12 512
72	12 615	12 512.5
73	12 615.5	12 513
74	12 616	12 513.5
75	12 616.5	12 514

76 77 78 79 80	12 617 12 617.5 12 618 12 618.5 12 619	12 514.5 12 515 12 515.5 12 516 12 516.5
81 82 83 84 85	12 619.5 12 620 12 620.5 12 621 12 621.5	12 517 12 517.5 12 518 12 518.5 12 519
86 87 88 89 90	12 622 ~~12 520~~ 12 622.5 12 623 12 623.5	12 519.5 ~~12 520~~ 12 520.5 12 521 12 521.5
91 92	12 624 12 624.5	12 522 12 522.5

...

Reasons: Introduction of the ACS in RR Appendix **17** using the frequencies of NBDP previously used for distress.

2/1.11/5.1.13 For Method A, proposed modification for Resolution 18 (Rev.WRC-15)

MOD

RESOLUTION 18 (REV.WRC-~~15~~23)

Relating to the procedure for identifying and announcing the position of ships and aircraft of States not parties to an armed conflict

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

…

resolves

1 that the frequencies for urgency signal and messages specified in the Radio Regulations may be used by ships and aircraft of States not parties to an armed conflict for self-identification and establishing communications; the transmission will consist of the urgency or safety signals, as appropriate, described in Article **33** followed by the addition of the single word “NEUTRAL” pronounced as in French “neutral” in radiotelephony~~ and, if available on board ships and aircraft, by the addition of the single group “NNN” in radiotelegraphy~~; as soon as practicable, communications shall be transferred to an appropriate working frequency;

…

Reasons: NBDP has been deleted from the GMDSS, with the exception of MSI reception on certain frequencies which are contained in RR Appendix **15**. The frequencies for NBDP-COM in RR Appendix **15** are withdrawn.

2/1.11/5.1.14 For Method A, proposed modification for Resolution 349 (Rev.WRC-19)

MOD

RESOLUTION 349 (REV.WRC-~~19~~23)

Operational procedures for cancelling false distress alerts in the Global Maritime Distress and Safety System

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

noting

that the International Maritime Organization (IMO) is referring ~~has developed similar~~ to this operational procedure~~s~~ to cancel false distress alerts in their documentation,

…

ANNEX TO RESOLUTION 349 (REV.WRC-~~19~~23)

Cancelling of false distress alerts

If a distress alert is inadvertently transmitted, the following steps shall be taken to cancel the distress alert.

1 VHF digital selective calling

1) ~~Reset the equipment immediately;~~Follow the instructions on the radio screen, if applicable, or

Switch off and switch on after 10 seconds, and follow the instructions on the radio screen, if applicable;

2) If the DSC equipment is capable of cancellation, start the distress self-cancel operation ~~cancel the alert~~ in accordance with the most recent version of Recommendation ITU-R M.493;

3) Set to channel 16; and

4) Transmit a broadcast message to "All Stations" giving the ship's name, call sign and maritime mobile service identity (MMSI), and cancel the false distress alert~~.~~;

Example of message:

– the words "ALL STATIONS", spoken three times;

– the words "THIS IS";

– the name of the vessel, spoken three times;

– the call sign or other identification;

– the MMSI;

– the words "PLEASE CANCEL MY DISTRESS ALERT OF" followed by the time in UTC.

2 MF digital selective calling

1) ~~Reset the equipment immediately;~~Follow the instructions on the radio screen, if applicable, or

Switch off and switch on after 10 seconds, and follow the instructions on the radio screen, if applicable;

2) If the DSC equipment is capable of cancellation, start the distress self-cancel operation ~~cancel the alert~~ in accordance with the most recent version of Recommendation ITU-R M.493;

3) Tune for radiotelephony transmission on 2 182 kHz; and

4) Transmit a broadcast message to "All Stations" giving the ship's name, call sign and MMSI, and cancel the false alert~~.~~;

For example of message see section 1.

3 HF digital selective calling

1) ~~Reset the equipment immediately;~~Follow the instructions on the radio screen, if applicable, or

Switch off and switch on after 10 seconds, and follow the instructions on the radio screen, if applicable;

2) If the DSC equipment is capable of cancellation, start the distress self-cancel operation ~~cancel the alert~~ in accordance with the most recent version of Recommendation ITU-R M.493;

3) Tune for radiotelephony on the distress and safety frequency in each frequency band in which a false distress alert was transmitted (see Appendix **15**); and

4) Transmit a broadcast message to "All Stations" giving the ship's name, call sign and MMSI, and cancel the false alert on the distress and safety frequency in each frequency band in which the false distress alert was transmitted~~.~~;

For example of message see section 1.

Reasons: Expression of "implement distress self-cancel operation" is more explicit and specific than the expression of "cancel the alert".

4 Ship earth station

Notify the appropriate rescue coordination centre that the alert is cancelled by sending a distress priority message. Provide ship name, call sign and ship earth station identity with the cancelled alert message.

Example of message by telegraphy:

– NAME, CALL SIGN, IDENTITY NUMBER, POSITION;

– Cancel my distress;

– Alert of DATE, TIME UTC;

– =Master+

Example of message by radiotelephony:

– the words "ALL STATIONS", spoken three times;

– the words "THIS IS";

– the name of the vessel, spoken three times;
– the call sign or other identification;
– the identity number/MMSI;
– the words "PLEASE CANCEL MY DISTRESS ALERT OF" followed by the time in UTC.

5 Satellite ~~Emergency~~ emergency position indicating radiobeacon (EPIRB)

If for any reason an EPIRB is activated inadvertently or accidentally, immediately stop the inadvertent transmission and contact the appropriate rescue coordination centre through a coast station or land earth station and cancel the distress alert.

6 General

Notwithstanding the above, ships may use additional appropriate means available to them to inform the appropriate authorities that a false distress alert has been transmitted and should be cancelled.

No action will normally be taken against any ship or mariner for reporting and cancelling a false distress alert. However, in view of the serious consequences of false alerts, and the strict ban on their transmission, authorities may take actions in cases of repeated violation.

Reasons: This addendum is intended as guidance to the mariner. The upcoming IMO Resolution MSC.514(105) on avoidance of false distress alerts refers directly to Resolution **349 (Rev.WRC-19)**, which is included in the ITU-R Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services (Maritime Manual).

2/1.11/5.1.15 For Method A, proposed modification for Resolution 354 (WRC-07)

MOD

RESOLUTION 354 (REV.WRC-~~07~~23)

Distress and safety radiotelephony procedures for 2 182 kHz

The World Radiocommunication Conference (~~Geneva, 2007~~Dubai, 2023),

…

ANNEX TO RESOLUTION 354 (REV.WRC-~~07~~23)

Distress and safety radiotelephony procedures for 2 182 kHz*

PART A1 – GENERAL

…

* Distress and safety communications include distress, urgency and safety calls and messages.

§ 4 The abbreviations and signals of Recommendation ITU-R M.1172 and the Phonetic Alphabet and Figure Code in Appendix **14** should be used where applicable[2].

§ 5 Distress, urgency and safety communications may also be made using digital selective calling and satellite techniques ~~and/or direct-printing telegraphy~~, in accordance with the provisions specified in Chapter **VII** and relevant ITU-R Recommendations. (WRC-23)

…

Reasons: NBDP has been deleted from the GMDSS. In order to avoid potential confusion, it is necessary to remind the mariners and administrations of the difference in pronunciations of figures in RR Appendix **14** and IMO SMCP.

PART A2 − FREQUENCIES FOR DISTRESS AND SAFETY

…

Section II − Protection of distress and safety frequencies

…

B − 2 182 kHz

§ 6 1) Except for transmissions authorized on the carrier frequency 2 182 kHz and on the frequencies 2 174.5 kHz, 2 177 kHz, 2 187.5 kHz and 2 189.5 kHz, all transmissions on the frequencies between 2 173.5 kHz and 2 190.5 kHz are forbidden (see No. **5.110** for 2 174.5 kHz, Nos. **52.130** to **52.136** for 2 177 kHz and 2 189.5 kHz and also Appendix **15** for 2 182 kHz and 2 187.5 kHz).

2) To facilitate the reception of distress calls, all transmissions on 2 182 kHz should be kept to a minimum.

Reasons: NBDP distress and safety communication has been deleted from the GMDSS. References to related footnotes in RR are also added to clearly indicate the usage of concerned frequencies to avoid any confusion.

2/1.11/5.1.16 For Method A, proposed draft new Resolution [A111] (WRC-23)

ADD

DRAFT NEW RESOLUTION [A111] (WRC-23)

Coordination of NAVDAT services

The World Radiocommunication Conference (Dubai, 2023),

---

2 The use of the Standard Marine Communication Phrases (SMCP) and, where language difficulties exist, the International Code of Signals, both published by the International Maritime Organization, is also recommended. It needs to be noted that the pronunciations for figures in Appendix **14** and IMO SMCP are different. (WRC-23)

considering

a) that the International Maritime Organization (IMO) has established procedures to coordinate the operational aspects of NAVDAT services, such as allocation of transmitter identification and time schedules, in the planning stages for transmissions on the international frequencies 500 kHz and/or 4 226 kHz and also on the other frequencies which are defined in No. **5.79** and Appendix **15**;

b) that coordination in the frequencies 500 kHz and/or 4 226 kHz and other frequencies which are defined in No. **5.79** and Appendix **15**, is essentially operational,

resolves

to invite administrations to apply the procedures established by IMO, taking into account the IMO NAVDAT Manual, for coordinating the use of the international frequencies 500 kHz and/or 4 226 kHz and also of the other frequencies which are defined in No. **5.79** and Appendix **15**,

instructs the Secretary-General

to invite IMO to provide ITU with information on a regular basis on operational coordination for NAVDAT services on the international frequencies 500 kHz and/or 4 226 kHz and also on the other frequencies which are defined in No. **5.79** and Appendix **15**,

instructs the Director of the Radiocommunication Bureau

to publish this information in the *List of Coast Stations and Special Service Stations* (List IV) (see No. **20.7**).

Reasons: New Resolution for the coordination of the NAVDAT services identical to the one for the NAVTEX (Resolution **339 (Rev.WRC-07)**).

2/1.11/5.1.17 For Method A, proposed suppression of Resolution 361 (Rev.WRC-19)

SUP

RESOLUTION 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-23 agenda item 1.11 covered by *resolves* 1 (modernization of the GMDSS).

2/1.11/5.2 For Method B (Issue B): E-Navigation

NOC

ARTICLE 5

Frequency allocations

Reasons: E-navigation does not need additional frequency allocations to operate.

SUP

RESOLUTION 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-23 agenda item 1.11 covered by *resolves* 2 (e-navigation).

2/1.11/5.3 For Issue C: Introduction of additional satellite systems into the global maritime distress and safety system

2/1.11/5.3.1 For Issue C, Method C1: NOC

Reasons:

Alternative 1

The conditions for making changes under *resolves* 3 have not been met.

1) Despite recognition by the IMO, the outstanding implementation items necessary for the commencement of GMDSS service, including frequency coordination of the candidate geostationary-satellite network, are required to be completed. Frequency coordination by the notifying administration, which is under the purview of ITU, is required to be completed before WRC-23 as per Resolution **361 (Rev.WRC19)**.

   Among the outstanding implementation issues that the candidate geostationary-satellite system network operator needs to complete prior to WRC-23 are completion of the necessary regulatory actions to safeguard the availability and full protection of the spectrum this system proposes to use for GMDSS services. This includes solving the issue of Article **9** frequency coordination with other systems before the candidate geostationary-satellite network's operator can commence GMDSS service. Thus, it needs to complete coordination with the HIBLEO-2, and HIBLEO-X and HIBLEO-4 satellite systems.

2) GMDSS spectrum needs for the candidate geostationary-satellite network have not been identified. Resolution **361 (Rev.WRC-19)** invites the ITU-R to, among other things, determine the GMDSS spectrum needs. However, this has not been determined.

3) Frequency coordination under Article **9** of the Radio Regulations has not been completed.

   Provisions of Article **9** of the Radio Regulations require successful effect coordination in order to provide any degree of protection from harmful interference for the satellite GMDSS system from existing MSS satellite systems with the earlier date of receipt operating in the same frequency bands. The administration responsible for the proposed additional satellite GMDSS system has not completed RR Article **9** satellite coordination successfully and the assignment of the candidate geostationary satellite networks are recorded under No. **11.41** of the Radio Regulations, and consequently the proposed network is not entitled to protection from harmful interference from any recorded assignments which were the basis of the unfavourable finding. Further, in the case of harmful interference to any recorded assignment of other notified satellite networks operating in the frequency bands considered, which was the basis for unfavourable finding the candidate geostationary-satellite network would be required to immediately eliminate this harmful interference.

Alternative 2

Assignment to be used for GMDSS need to successfully coordinate with assignments referred to in No. **9.27** of the Radio Regulations under relevant provisions of Articles **9** and **11** of the Radio Regulations and the associated Rules of Procedures.

2/1.11/5.3.1.1 For Method C1, proposed NOC for RR Articles

NOC

ARTICLES

2/1.11/5.3.1.2 For Method C1, proposed NOC for RR Appendices

NOC

APPENDICES

2/1.11/5.3.1.3 For Method C1, proposed suppression to Resolution 361 (Rev.WRC-19)

SUP

RESOLUTION 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-23 agenda item 1.11 covered by *resolves* 3.

2/1.11/5.3.2 For Issue C, Method C2

2/1.11/5.3.2.1 For Method C2, proposed modification for RR Article 5

2/1.11/5.3.2.1.1 For Method C2 Alternative approach A1 for RR Article 5

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

5.364 The use of the band 1 610-1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. **9.11A**. A mobile earth station operating in either of the services in this band shall not produce a peak e.i.r.p. density in excess of −15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **5.366** (to which No. **4.10** applies), unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed −3 dB(W/4 kHz). Stations of the mobile-satellite service shall not claim protection from stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. **5.366** and stations in the fixed service operating in accordance with the provisions of No. **5.359**. GMDSS stations operating in the maritime mobile-satellite services in the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz shall not claim protection from stations operating in accordance with the provisions of No. **5.367.** Administrations responsible for the coordination of mobile-satellite networks shall make all practicable efforts to ensure protection of stations operating in accordance with the provisions of No. **5.366**. (WRC-23)

Reasons: To keep the status between GMDSS stations operating in the MMSS and AMS(R)S in the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz.

MOD

5.368 The provisions of No. **4.10** do not apply with respect to the radiodetermination-satellite and mobile-satellite services in the frequency band 1 610-1 626.5 MHz. However, No. **4.10** applies in the frequency band 1 610-1 626.5 MHz with respect to the aeronautical radionavigation-satellite service when operating in accordance with No. **5.366**, the aeronautical mobile satellite (R) service when operating in accordance with No. **5.367**, and in the frequency bands [1 610.00-1 610.5/1 610.18-1 618.34] MHz (Earth-to-space) and 1 621.35-1 626.5 MHz with respect to the maritime mobile-satellite service when used for GMDSS. (WRC-~~19~~23)

Reasons: RR No. **4.10** applies to MMSS (Earth-to-space) in the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz for GMDSS providing safety services.

2/1.11/5.3.2.1.2 For Method C2 Alternative approach A2 for RR Article 5

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

NOC

5.364

Reasons: If RR No. **5.368** is no change, no need to modify RR No. **5.364**.

NOC

5.368

Reasons: Do not expand the application of item RR No. **4.10** on MMSS in the frequency band 1 610.18-1 621.35 MHz to uphold the existing priority of the ARNS and AMS(R)S systems.

2/1.11/5.3.2.2 For Method C2 proposed modification for RR Article 33

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section V − Transmission of maritime safety information[2]

33.49 *E − Maritime safety information via satellite*

MOD

33.50 § 26 Maritime safety information may be transmitted via satellite in the maritime mobile-satellite service using the frequency bands 1 530-1 545 MHz, ~~and~~ 1 621.35-1 626.5 MHz and [2 483.59-2 499.91 MHz/2 499.5-2 500 MHz] (see Appendix **15**). (WRC-~~19~~23)

Reasons: To include the frequency band [2 483.59-2 499.91/2 499.5-2 500] MHz as being available for transmitting maritime safety information via satellite.

Section VII − Use of other frequencies for safety (WRC-07)

MOD

33.53 § 28 Radiocommunications for safety purposes concerning ship reporting communications, communications relating to the navigation, movements and needs of ships and weather observation messages may be conducted on any appropriate communications frequency, including those used for public correspondence. In terrestrial systems, the frequency bands 415-535 kHz (see Article **52**), 1 606.5-4 000 kHz (see Article **52**), 4 000-27 500 kHz (see Appendix **17**) and 156-174 MHz (see Appendix **18**) are used for this function. In the maritime mobile-satellite service, frequencies in the frequency bands 1 530-1 544 MHz, [1 610.00-1 610.5 MHz/1 610.18-1 618.34 MHz] (Earth-to-space), 1 621.35-1 626.5 MHz, ~~and~~ 1 626.5-1 645.5 MHz and [2 483.59-2 499.91 MHz/2 499.5-2 500 MHz] are used for this function as well as for distress alerting purposes (see No. **32.2**). (WRC-~~19~~23)

Reasons: To apply RR No. **33.53** to the frequency bands [1 610.00-1 610.5/1 610.18-1 618.34] MHz and [2 483.59-2 499.91/2 499.5-2 500] MHz for use by mobile-satellite service systems approved by the International Maritime Organization to participate in the Global Maritime Safety and Distress System.

2/1.11/5.3.2.3 For Method C2, proposed modification for RR Appendix 15

2/1.11/5.3.2.3.1 For Method C2 Alternative approach A1 for RR Appendix 15

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

MOD

TABLE 15-2 (*end*) (WRC-~~19~~23)

Frequency (MHz)	Description of usage	Notes
...	...	...
[1 610.00-1 610.5/ 1 610.18-1 618.34]	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...
[2 483.59-2 499.91/ 2 499.5-2 500]	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band [2 483.59-2 499.91/2 499.5-2 500] MHz is used for distress and safety purposes in the space-to-Earth direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...

...

Reasons: To add the frequency bands [1 610.00-1 610.5/1 610.18-1 618.34] MHz in the Earth-to-space direction and [2 483.59-2 499.91/2 499.5-2 500] MHz in the space-to-Earth direction as being available for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS).

2/1.11/5.3.2.3.2 For Method C2 Alternative approach A2 for RR Appendix 15

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

MOD

TABLE 15-2 (*end*) (WRC-~~19~~23)

Frequency (MHz)	Description of usage	Notes
...	...	...
[1 610.00-1 610.5/ 1 610.18-1 618.34]	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service. The provisions of No. **4.10** do not apply with respect to the maritime mobile-satellite services in the frequency band [1 610.00-1 610.5/1 610.18-1 618.34] MHz in the Earth-to-space direction.
...	...	...
[2 483.59-2 499.91/ 2 499.5-2 500]	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band [2 483.59-2 499.91/2 499.5-2 500] MHz is used for distress and safety purposes in the space-to-Earth direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...

...

Reasons: To add the frequency bands [1 610.00-1 610.5/1 610.18-1 618.34] MHz in the Earth-to-space direction and [2 483.59-2 499.91/2 499.5-2 500] MHz in the space-to-Earth direction as being available for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS).

2/1.11/5.3.2.4 For Method C2 proposed suppression of Resolution 361 (Rev.WRC-19)

SUP

RESOLUTION 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-23 agenda item 1.11 covered by *resolves* 3.

2/1.11/5.3.3 For Issue C, Method C3

2/1.11/5.3.3.1 For Method C3, proposed modification for RR Article 5

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

5.364 The use of the band 1 610-1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. **9.11A**. A mobile earth station operating in either of the services in this band shall not produce a peak e.i.r.p. density in excess of −15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **5.366** (to which No. **4.10** applies), unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed −3 dB(W/4 kHz). Stations of the mobile-satellite service shall not claim protection from stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. **5.366** and stations in the fixed service operating in accordance with the provisions of No. **5.359**. GMDSS stations operating in the maritime mobile-satellite services in the frequency band 1 610.18-1 621.35 MHz shall not claim protection from stations operating in accordance with the provisions of No. **5.367**. Administrations responsible for the coordination of mobile-satellite networks shall make all practicable efforts to ensure protection of stations operating in accordance with the provisions of No. **5.366**. (WRC-23)

Reasons: To keep the status between GMDSS stations operating in the MMSS and AMS(R)S in the band 1 610.18-1 621.35 MHz.

MOD

5.368 The provisions of No. **4.10** do not apply with respect to the radiodetermination-satellite and mobile-satellite services in the frequency band 1 610-1 626.5 MHz. However, No. **4.10** applies in the frequency band 1 610-1 626.5 MHz with respect to the aeronautical radionavigation-satellite service when operating in accordance with No. **5.366**, the aeronautical mobile satellite (R) service when operating in accordance with No. **5.367**, and in the frequency bands 1 610.18-1 621.35 MHz (Earth-to-space) and 1 621.35-1 626.5 MHz with respect to the maritime mobile-satellite service when used for GMDSS. (WRC-~~19~~23)

Reasons: RR No. **4.10** applies to MMSS (Earth-to-space) in the band 1 610.18-1 621.35 MHz for GMDSS providing safety services.

2/1.11/5.3.3.2 For Method C3, proposed modification for RR Article 33

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section V − Transmission of maritime safety information[2]

33.49 *E − Maritime safety information via satellite*

MOD

33.50 § 26 Maritime safety information may be transmitted via satellite in the maritime mobile-satellite service using the frequency bands 1 530-1 545 MHz, ~~and~~ 1 621.35-1 626.5 MHz and 2 483.59-2 499.91 MHz (see Appendix **15**). (WRC-~~19~~23)

Reasons: To include the frequency band 2 483.59-2 499.91 MHz as being available for transmitting maritime safety information via satellite.

Section VII − Use of other frequencies for safety (WRC-07)

MOD

33.53 § 28 Radiocommunications for safety purposes concerning ship reporting communications, communications relating to the navigation, movements and needs of ships and weather observation messages may be conducted on any appropriate communications frequency, including those used for public correspondence. In terrestrial systems, the frequency bands 415-535 kHz (see Article **52**), 1 606.5-4 000 kHz (see Article **52**), 4 000-27 500 kHz (see Appendix **17**) and 156-174 MHz (see Appendix **18**) are used for this function. In the maritime mobile-satellite service, frequencies in the frequency bands 1 530-1 544 MHz, 1 610.18-1 621.35 MHz (Earth-to-space), 1 621.35-1 626.5 MHz, ~~and~~ 1 626.5-1 645.5 MHz and 2 483.59-2 499.91 MHz are used for this function as well as for distress alerting purposes (see No. **32.2**). (WRC-~~19~~23)

Reasons: To apply RR No. **33.53** to the frequency bands 1 610.18-1 621.35 MHz and 2 483.59-2 499.91 MHz for use by mobile-satellite service systems approved by the International Maritime Organization to participate in the Global Maritime Safety and Distress System.

2/1.11/5.3.3.3 For Method C3, proposed modification for RR Appendix 15

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

MOD

TABLE 15-2 (*end*) (WRC-~~19~~23)

Frequency (MHz)	Description of usage	Notes
...	...	...
1 610.18-1 621.35	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band 1 610.18-1 621.35 MHz is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...
2 483.59-2 499.91	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band 2 483.59-2 499.91 MHz is used for distress and safety purposes in the space-to-Earth direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...

...

Reasons: To add the frequency bands 1 610.18-1 621.35 MHz in the Earth-to-space direction and 2 483.59-2 499.91 MHz in the space-to-Earth direction as being available for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS).

2/1.11/5.3.3.4 For Method C3, proposed suppression of Resolution 361 (Rev.WRC-19)

SUP

RESOLUTION 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-23 agenda item 1.11 covered by *resolves* 3.

2/1.11/5.3.3.5 For Method C3, Example for a new Resolution

ADD

DRAFT NEW RESOLUTION [B111-METHOD C3] (WRC-23)

The mitigation and elimination for the harmful interference between GSO MSS system for GMDSS and non-GSO MSS system in the frequency bands 1 610.18-1 621.35 MHz and 2 483.59-2 499.91 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that WRC-19 decided that WRC-23 consider regulatory provisions to support the introduction of additional satellite systems for the global maritime distress and safety system (GMDSS), taking into consideration the activities of the International Maritime Organization (IMO), based on the results of ITU-R studies;

b) that it is necessary to ensure the availability and protection of the assignment of the existing and new GMDSS systems;

c) that the geostationary-satellite orbit (GSO) mobile-satellite service (MSS) system, operating in the frequency bands 1 610.18-1 621.35 MHz in the Earth-to-space direction and 2 483.59-2 499.91 MHz in the space-to-Earth direction, is being considered to provide distress and safety communications for GMDSS;

d) that the MSS (Earth-to-space) is allocated in the frequency band 1 610.0-1 626.5 MHz on a primary basis, subject to coordination under No. **9.11A**;

e) that the MSS (space-to-Earth) is allocated in the frequency band 2 483.5-2 500 MHz on a primary basis, subject to coordination under No. **9.11A**,

recognizing

a) that, based on the Rules of Procedure relating to No. **9.6**, coordination is a two-way process. This fact was confirmed by the World Administrative Radio Conference on the use of the geostationary-satellite orbit (WARC-ORB), and confirmed by WRC-97 to be included in the Radio Regulations;

b) that it is a usual practice that, at the stage of coordination, the level of interference and the condition thereof for the assignments recorded in the Master International Frequency Register (MIFR) are used as a basis to require protection from the subsequent assignment;

c) that a mitigation technique and its associated details are useful tools to be mutually agreed by the concerned parties in order to avoid harmful interference,

resolves

1 that the incoming assignment pertaining to satellite network(s)/system(s) shall take into account the criteria and conditions based on which the assignment pertaining to existing/incumbent satellite network(s)/system(s) have been coordinated;

2 that, for the implementation of *resolves* 1, the level of interference referred to in *recognizing b)* above shall be taken into account in the process of coordination;

3 that, during the process of coordination, the mitigation technique and its associated details shall be mutually agreed by the concerned administration;

4 that No. **4.10** shall be applied where required.

2/1.11/5.3.4 For Issue C, Method C4

2/1.11/5.3.4.1 For Method C4, proposed modification for RR Article 5

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

NOC

5.364

MOD

5.368 The provisions of No. **4.10** do not apply with respect to the radiodetermination-satellite and mobile-satellite services in the frequency band 1 610-1 626.5 MHz. However, No. **4.10** applies in the frequency band 1 610-1 626.5 MHz with respect to the aeronautical radionavigation-satellite service when operating in accordance with No. **5.366**, the aeronautical mobile satellite (R) service when operating in accordance with No. **5.367**, and in the frequency bands 1 614.4225-1 621.35 MHz (Earth-to-space) and 1 621.35-1 626.5 MHz with respect to the maritime mobile-satellite service when used for GMDSS. (WRC-~~19~~23)

Reasons: RR No. **4.10** applies to MMSS (Earth-to-space) in all or part of the frequency band 1 614.4225-1 621.35 MHz for GMDSS providing safety services.

2/1.11/5.3.4.2 For Method C4, proposed modification for RR Article 33

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section V − Transmission of maritime safety information[2]

33.49 *E − Maritime safety information via satellite*

MOD

33.50 § 26 Maritime safety information may be transmitted via satellite in the maritime mobile-satellite service using the frequency bands 1 530-1 545 MHz, ~~and~~ 1 621.35-1 626.5 MHz and [2 483.59-2 500] MHz (see Appendix **15**). (WRC-~~19~~23)

Reasons: To include all or part of the frequency band 2 483.59-2 500 MHz (space-to-Earth) as being available for transmitting maritime safety information via satellite.

Section VII − Use of other frequencies for safety (WRC-07)

MOD

33.53 § 28 Radiocommunications for safety purposes concerning ship reporting communications, communications relating to the navigation, movements and needs of ships and weather observation messages may be conducted on any appropriate communications frequency, including those used for public correspondence. In terrestrial systems, the frequency bands 415-535 kHz (see Article **52**), 1 606.5-4 000 kHz (see Article **52**), 4 000-27 500 kHz (see Appendix **17**) and 156-174 MHz (see Appendix **18**) are used for this function. In the maritime mobile-satellite service, frequencies in the frequency bands 1 530-1 544 MHz, [1 614.4225-1 621.35 MHz] (Earth-to-space), 1 621.35-1 626.5 MHz, ~~and~~ 1 626.5-1 645.5 MHz and [2 483.59-2 500 MHz] (space-to-Earth) are used for this function as well as for distress alerting purposes (see No. **32.2**). (WRC-~~19~~23)

Reasons: To apply RR No. **33.53** to all of part of the frequency band 1 614.4225-1 621.35 MHz (Earth-to-space), and all or part of the frequency band 2 483.59-2 500 MHz (space-to-Earth) for use by mobile-satellite service systems approved by the International Maritime Organization to participate in the Global Maritime Safety and Distress System.

2/1.11/5.3.4.3 For Method C4, proposed modification for RR Appendix 15

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

MOD

TABLE 15-2 (*end*) (WRC-~~19~~23)

Frequency (MHz)	Description of usage	Notes
...	...	...
[1 614.4225-1 621.35]	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band [1 614.4225-1 621.35 MHz] is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...
[2 483.59-2 500]	SAT-COM	In addition to its availability for routine non-safety purposes, the frequency band [2 483.59-2 500] MHz is used for distress and safety purposes in the space-to-Earth direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band over non-safety communication within the same satellite system.
...	...	...

...

Reasons: To add all or part of the frequency band 1 614.4225-1 621.35 MHz in the Earth-to-space direction and all or part of the frequency band 2 483.59-2 500 MHz in the space-to-Earth direction as being available for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS).

2/1.11/5.3.4.4 For Method C4, proposed suppression of Resolution 361 (Rev.WRC-19)

SUP

RESOLUTION 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-23 agenda item 1.11 covered by *resolves* 3.

CHAPTER 3

Science issues

(Agenda items 1.12, 1.13, 1.14)

CONTENTS

Agenda item 1.12

1.12 to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution ***656 (Rev.WRC-19)****;*

Resolution **656 (Rev.WRC-19)** – *Possible secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders in the range of frequencies around 45 MHz*

3/1.12/1 Executive summary

This agenda item seeks a new secondary allocation to the Earth exploration-satellite service (EESS) (active) for spaceborne radar sounders within a range of frequencies around 45 MHz while taking into account the protection of incumbent services including those in adjacent bands. Studies to support this agenda item have been developed in PDN Report ITU-R RS.[SPACEBORNE VHF RADAR SOUNDER]. Specifically, this Report contains the results of compatibility studies, based on the proposed EESS (active) radar characteristics provided in Recommendation ITU-R RS.2042 and the characteristics of the incumbent services as provided by the responsible Working Parties.

Five methods have been proposed:

– Method A1 proposes to establish a new global secondary allocation to the EESS (active) in the frequency band 40-50 MHz. It also proposes a new footnote in the Table of Frequency Allocations of RR Article **5** that references a proposed new WRC Resolution to protect incumbent in-band and adjacent-band services.

– Method A2 proposes to establish a new global secondary allocation to the EESS (active). This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article **5**. This footnote would also include relevant technical conditions, such as the power flux-density at the surface of the Earth, to address the protection of incumbent services in the frequency band 40-50 MHz.

– Method B proposes to establish a new global secondary allocation to the EESS (active). This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article **5**. In addition, this footnote would address the protection of the secondary radiolocation service in the frequency bands 42-42.5 MHz and 46-68 MHz.

– Method C proposes to establish a global secondary allocation to the EESS (active) in the frequency band 40-50 MHz in the Table of Frequency Allocations of RR Article **5**.

– Method D proposes no change to the Radio Regulations (Articles and Appendices).

The five methods propose the suppression of Resolution **656 (WRC-19)**.

3/1.12/2 Background

A secondary allocation to the EESS (active) for spaceborne radar sounders in the frequency range 40-50 MHz will enable the collection of scientific data from space-based ground-penetrating radar (GPR) type missions. The radar returns from such sounder emissions will result in sub-surface data with a vertical resolution of 5-7 m. Such scientific data can be used to determine the thickness, inner structure, and thermal stability of ice sheets, as well as the occurrence, distribution, and dynamics of aquifers in desert environments.

3/1.12/3 Summary and analysis of the results of ITU-R studies

The results of sharing studies between a spaceborne very high frequency (VHF) radar sounder operating over the frequency range 40-50 MHz, as characterized in PDR Recommendation ITU-R RS.2042-1, and incumbent services in and around this band are provided in PDN Report ITU-R RS.[SPACEBORNE VHF RADAR SOUNDER]. A list of the affected incumbent services in and around the frequency band 40-50 MHz, along with the recommended interference protection criterion (IPC) interferer-to-noise power spectral density (PSD) ratio *I*/*N* threshold, channel bandwidth (BW), and relevant ITU-R Recommendations, are provided in Table 3/1.12-1.

TABLE 3/1.12-1

Incumbent services operating in and adjacent to the 40-50 MHz frequency band

Service	40-50 MHz in/out-of-band status, Service category (primary (P) or secondary (S))	Interference protection criterion (IPC) *I*/*N* threshold limit (dB)[(8)]	Channel bandwidth (BW) (kHz)	Relevant ITU-R Recommendations / Reports
Fixed	In-band, (P)	−6	16, 36[(1)]	Rec. ITU-R F.758-7
Mobile	In-band, (P)	−6, −10[(2)]	16, 25/75	Rec. ITU-R M.1808-1
Broadcasting	In-band, (P)	−20	96[(3)], 130/180[(4)], 7 000/8 000[(4)]	Rec. ITU-R BT.1895-0
Radiolocation	In-band, (S)	−6	125[(5)], 0.5/1.5[(6)], 200 – 2 200[(7)]	Report ITU-R M.2435-0, Recs. ITU-R M.1461-2, M.1874-1, M.1226-0
Space research	In-band, (S)	−6	1	Recs. ITU-R SA.1016-1, ITU-R SA.363-5
Amateur	Out-of-band, (P)	−6	1 072, 0.5, 2.7, 6, 9, 12, 16	Report ITU-R M.2478-0, Rec. ITU-R M.1732-2

(1) The channel BW values for the fixed service were provided by the relevant contributing group. For a worst-case scenario, the larger BW value of 36 kHz is used in the sharing studies.

(2) In Recommendation ITU-R M.1808-1, an *I*/*N* threshold value of −6 dB is nominally advocated, with the more stringent value of −10 dB reserved for applications with greater protection requirements, such as public protection and disaster relief (PPDR). In this report, both threshold values are considered in the sharing studies.

(3) The value of 96 kHz represents the channel bandwidth of the Digital Radio Mondiale (DRM) Mode E orthogonal frequency division multiplex (OFDM) system parameterized in Recommendation ITU-R BS.1114-12.

(4) Over the 47-68 MHz frequency range (Band I for the VHF broadcasting service), the Stockholm 1961 (ST61) Agreement Plan contains 377 sound broadcasting stations with bandwidths of 130 and 180 kHz, as well as 768 recorded analogue and television (TV) stations with bandwidths of 7 and 8 MHz.

(5) The channel BW value of 125 kHz was obtained from Report ITU-R M.2435-0. This value is used for the generic sharing studies with the radiolocation service.

(6) The channel BW values of 500 Hz and 1 500 Hz respectively correspond to the receiver intermediate frequency (IF) 3 dB BW for oceanographic radar Systems 4 and 9 described in Recommendation ITU-R M.1874-1. These values are used for sharing studies between the spaceborne VHF radar sounder and oceanographic radar systems operating over the frequency range 3-50 MHz.

(7) The channel BW value range 0.2-2.2 MHz corresponds to the necessary BW range stipulated for wind profiler radar (WPR) systems operating in band in the vicinity of 50 MHz as described in Recommendation ITU-R M.1226-0.

(8) Some values do not have a percentage of time associated with the IPC. In these cases, 100% was assumed for studies.

Compatibility of a characteristic spaceborne VHF radar sounder with respect to each incumbent service impacted is given in terms of:

– the maximum observed interference exceedance level (IEL), which is defined as the difference between the observed *I*/*N* and the relevant recommended Interference Protection Criterion (IPC);

– the percentage of time in which the IPC of the incumbent service is exceeded. Note: The percentage of time applied in the incumbent service studies should not necessarily be construed as a characterization of how much the incumbent IPC may be exceeded since in some cases the incumbent IPC is not specified as a percentage of time (e.g. applies 100% of the time). The exceedance of the IPC is provided only for reference purposes.

Dynamic radio-frequency interference (RFI) simulations were conducted in PDN Report ITU-R RS.[SPACEBORNE VHF RADAR SOUNDER], using a characteristic spaceborne VHF radar sounder as described in PDR Recommendation ITU-R RS.2042-1.

For all the incumbent services under consideration, the potential for Interference Exceedance Level (IEL) has been firstly assessed using the radar sounder peak power (not accounting for pulse duty cycle).

Taking into account that spaceborne VHF radar sounders are pulsed radar systems, the IEL was also characterized for the most representative scenarios, using the radar sounder mean power.

In the 40-50 MHz frequency range interference-to-noise protection thresholds must consider external noise levels which vary by operating location and are defined for urban, residential and rural environments. The rural noise environment was used for the purpose of these studies.

Table 3/1.12-1 contains the information relevant for the primary and secondary incumbent services.

No agreement was reached regarding the applicability of peak or mean power in the studies in order to assess the protection of the incumbent services.

3/1.12/3.1 Compatibility with the fixed service operating in the 40-50 MHz range

Sharing and compatibility studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and the fixed service operating in the frequency range 40-50 MHz. The IPC of fixed service stations is given in Recommendation ITU-R F.758-7.

Under Study A, for a channel BW of 36 kHz and an *I*/*N* IPC threshold limit of −6 dB, the probability of exceedance of the IPC is 0.019% of the time for the rural scenario (i.e. the scenario with highest probability of exceedance), for the peak power-based analysis. When considering the radar sounder mean power-based analysis, the study results show no exceedance of the IPC.

Under Study B, the FS IPC (*I*/*N* = −6 dB) is exceeded for 0.056% of the time when considering peak power, with a maximum IEL of 24.6 dB.

3/1.12/3.2 Compatibility with the mobile service in the 40-50 MHz range

Sharing and compatibility studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and the mobile service operating in the 40-

50 MHz range. The IPC of mobile service stations is given in Recommendation ITU-R M.1808-1. According to Recommendation ITU-R M.1808-1, nominally, an I/N value of −6 dB can be used to determine the impact of interference. For applications with greater protection requirements, such as public protection and disaster relief (PPDR), an I/N value of −10 dB can be used. Both cases of I/N IPC thresholds were considered for the sake of completeness.

Under Study A, for a channel BW of 75 kHz and an I/N IPC threshold limit of −10 dB, the probability of exceedance of the IPC is 0.034% of the time for the peak power-based analysis for the rural scenario (i.e. the scenario with highest probability of exceedance). An I/N IPC threshold limit of −6 dB leads to a probability of exceedance of 0.016% of the time. When considering the radar sounder mean power-based analysis, the study results show no exceedance of the IPC.

Under Study B, an $I/N = -6$ dB is exceeded for 0.052% of the time when considering peak power, with a maximum IEL of 22.3 dB. Additionally, an $I/N = -10$ dB is exceeded for 0.074% of the time when considering peak power, with a maximum IEL of 26.3 dB.

Under Study C, for a channel BW of 75 kHz and an I/N IPC threshold limit of −6 dB, the probability of exceedance of the IPC is 0.031% of the time for the mean power-based analysis, for the rural scenario.

Another static study, submitted to the CPM, shows that, when considering the radar sounder mean power, there might be an exceedance of the −6 dB IPC by up to 9 dB when considering a mobile receiver located at low to mid absolute latitudes. This study also shows that the IPC is not exceeded when considering a mobile receiver located at high latitudes, due to higher ionospheric attenuations.

3/1.12/3.3 Compatibility with the broadcasting service in the frequency range 40-50 MHz (47-50 MHz and 44-47 MHz, RR No. 5.162)

Primary allocations to the broadcasting service exist in Regions 1 and 3 over the frequency range 47-50 MHz, and additionally in Australia for 44-47 MHz under RR No. **5.162**. Both Digital Radio Mondiale (DRM) and the Stockholm Plan of 1961 (ST61) television (TV) broadcast receivers were considered in the ITU-R studies.

Sharing and compatibility studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and the broadcasting service operating in the frequency ranges 47-50 MHz and 44-47 MHz (RR No. **5.162**). The IPC of broadcasting service stations is given in Recommendation ITU-R BT.1895-0.

Under Study A, when considering the most representative case related to broadcasting (DRM receiver with −0.05 dBi gain), the probability of exceedance of the IPC is 0.128% for the peak power-based analysis for the rural scenario (i.e., the scenario with highest probability of exceedance). When considering the radar sounder mean power-based analysis, the probability of exceedance of the IPC drops to 0.046%.

Under Study B, the IPC ($I/N = -20$ dB) for DRM receivers is exceeded for 0.138% of time when peak power is considered, with a maximum IEL of 39.9 dB. Concerning ST61 TV receivers, the IPC ($I/N = -20$ dB) is exceeded for 0.096% of time when peak power is considered, with a maximum IEL of 31.7 dB.

3/1.12/3.4 Compatibility with the radiolocation service within the frequency range 40-50 MHz and in adjacent frequency bands

3/1.12/3.4.1 Compatibility with radiolocation service other than oceanographic radars and wind profiler radars

Sharing and compatibility studies have been performed between the spaceborne VHF radar sounder emission described in Recommendation ITU-R RS.2042-1 and the radiolocation service operating in the frequency range 41-44 MHz (RR No. **5.161**). The IPC of radiolocation service stations is given in Recommendation ITU-R M.1461-2.

Under Study A, for a channel BW of 125 kHz and an *I*/*N* IPC threshold limit of −6 dB, the probability of exceedance of the IPC is 0.047% of the time for the peak power-based analysis for the rural scenario (i.e. the scenario with highest probability of exceedance). When considering the radar sounder mean power-based analysis, the probability of exceedance of the IPC drops to 0.003%.

Under Study B, the IPC (*I*/*N* = −6 dB) is exceeded for 0.087% of time when peak power is considered, with a maximum IEL of 28.6 dB.

3/1.12/3.4.2 Compatibility with oceanographic radar systems operating in the radiolocation service at 42 MHz

A secondary radiolocation service allocation in the frequency range 42-42.5 MHz in Region 1, limited to oceanographic radars operating in accordance with Resolution **612 (Rev.WRC-12)**, exists under RR No. **5.132A**.

Sharing and compatibility studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and the oceanographic radar System 9, characterized in Recommendation ITU-R M.1874-1, operating at a centre frequency of 42 MHz. The IPC of radiolocation service stations is given in Recommendation ITU-R M.1461-2.

Under Study A, for a channel BW of 1.5 kHz and an *I*/*N* IPC threshold limit of −6 dB, there is no exceedance of the IPC for all scenarios.

Under Study B, the IPC (*I*/*N* = −6 dB) is exceeded for 0.023% of the time when considering peak power, with a maximum IEL value of 13.1 dB.

3/1.12/3.4.3 Compatibility with wind profiler radar systems operating in the radiolocation service near 50 MHz

In accordance with RR No. **5.162A**, the secondary allocation to the radiolocation service over the frequency range 44-47 MHz in all Regions and over the frequency range 47-50 MHz for Regions 1 and 3 is limited to the operation of wind profiler radars in accordance with Resolution **217 (WRC-97)**. Such systems in the vicinity of 50 MHz are described in Recommendation ITU-R M.1226-0.

Compatibility and sharing studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and a representative wind profiler radar. The IPC of radiolocation service stations is given in Recommendation ITU-R M.1461-2.

Under Study A, for a channel BW of 2.2 MHz and an *I*/*N* IPC threshold limit of −6 dB, when assuming an antenna pattern consistent with Recommendation ITU-R M.1226-0 and that the wind profiler radar is always pointed at zenith, the probability of exceedance of the IPC is 0.52% of the time for the peak power-based analysis for the rural scenario (i.e. the scenario with highest probability of exceedance). When considering the radar sounder mean power-based analysis, the probability of exceedance of the IPC drops to 0.2%.

Under Study B, assuming a worst-case receiver antenna gain pattern orientation, the IPC ($I/N = -6$ dB) is exceeded for 0.081% of the time when considering peak power, with a maximum IEL of 68.4 dB.

Under Study C, when considering the radar sounder peak power-based analysis, with WPR operating in the adjacent band at 55 MHz, the probability of exceedance of the IPC drops to 0%.

Due to the operation of spaceborne radar sounder and the existing WPR operating in the frequency range 40-50 MHz on a secondary basis, it is considered that coexistence may be achieved through case-by-case bilateral coordination.

3/1.12/3.5 Compatibility with the space research service in frequency ranges 39.986-40.02 MHz and 40.98-41.015 MHz

Sharing and compatibility studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and the space research service operating in the frequency ranges 39.986-40.02 MHz and 40.98-41.015 MHz. The IPC of space research service stations is given in Recommendation ITU-R SA.1016-1.

Under Study A, for a channel BW of 1 kHz and an I/N IPC threshold limit of −6 dB, there is no exceedance of the IPC for all scenarios.

Under Study B, the IPC ($I/N = -6$ dB) is exceeded for 0.011% of the time when considering peak power, with a maximum IEL of 17.1 dB.

3/1.12/3.6 Amateur in adjacent frequency band (50-54 MHz)

Compatibility studies have been performed between the spaceborne VHF radar sounder described in Recommendation ITU-R RS.2042-1 and the amateur service operating in the frequency range 50-54 MHz. The IPC of amateur service stations is given in Recommendation ITU-R M.1732-3.

Under Study A, for an out-of-band attenuation factor of 20 dB and an I/N IPC threshold limit of −6 dB, the probability of exceedance of the IPC is 0.028% of the time for the peak power based analysis for the rural scenario (i.e. the scenario with highest probability of exceedance). When considering the radar sounder mean power based analysis, the study results show no exceedance of the IPC.

Under Study B, the IPC ($I/N = -6$ dB) is exceeded for 0% of the time when considering peak power, with a maximum IEL of −3.27 dB. An out-of-band attenuation value of 20 dB was assumed in the study.

3/1.12/3.7 Analysis of suitable power flux-density levels for spaceborne radar sounders for the protection of incumbent services

Taking into account the results of the studies provided in the previous sections, this section proposes to determine the required pfd levels for the protection of the incumbent services.

Using the equation given in RR No. **21.16.8**, the mean pfd of the radar sounder is determined to be −136 dB(W/(m² · 4 kHz)) (assuming free-space losses). This value may be applied as a limit below 64° latitude (in both hemispheres), to be met 100% of the time.

As summarized in the previous sections, compliance to this pfd level would protect some of the incumbent services under consideration.

In addition, studies considering one single radar sounder have shown that in order to provide additional protection to the mobile service, and *de facto* to the other services in band and in adjacent bands, the pfd would need to be reduced by 9 dB (level of exceedance of the IPC at low latitudes), leading to −136 – 9 = −145 dB(W/(m² · 4 kHz)) below 64° latitude.

This study also suggests that due to ionospheric attenuation, the pfd levels mentioned above might be relaxed above 64°latitude. This requires additional consideration, in particular on the variability in time of the levels of ionospheric attenuation.

*Views were expressed that, based on Recommendation ITU-R P.531, the ionospheric losses for the latitudes higher than 64 deg. can occur only during a very small period of time and only in the day-time when the spaceborne radars are not operating (see Resolution **656 (Rev.WRC-19)**) and this effect could not be taken into account. The pfd limit is not dependent on any attenuation, since it is defined based on the protection criteria of terrestrial stations.*

However, applying this pfd 100% of the time would prevent any possibility of operating those radar sounders, while the mobile service can continue to operate even in the presence of this level of interference, provided it is limited in time. This study also suggests to apply this new set of pfd limits, that may be exceeded for 0.05% of the time when one single radar sounder is in operation, and 0.1% of the time when several radar sounders are in operation. In the latter case, sharing of the 0.1% allowance between space agencies operating those sensors may be done through relevant consultation discussions.

3/1.12/4 Methods to satisfy the agenda item

3/1.12/4.1 Method A1

This method proposes to establish a new global secondary allocation to the EESS (active) in the frequency band 40-50 MHz. It also proposes a new footnote in the Table of Frequency Allocations of RR Article **5** that references a proposed new WRC Resolution to protect incumbent in-band and adjacent-band services.

The new WRC Resolution includes four different options under its *resolves* part, noting that these different options are not necessarily mutually exclusive.

Finally, Resolution **656 (Rev.WRC-19)** would be consequentially suppressed.

3/1.12/4.2 Method A2

This method proposes to establish a new global secondary allocation to the EESS for active emissions. This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article **5**.

This footnote would also include relevant technical conditions, such as the power flux-density at the surface of the Earth, to address the protection of incumbent services in the frequency band 40-50 MHz.

Finally, Resolution **656 (Rev.WRC-19)** would be consequentially suppressed.

3/1.12/4.3 Method B

This method proposes to establish a new global secondary allocation to the EESS for active emissions. This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article **5**.

In addition, this footnote would address the protection of the secondary radiolocation service in the frequency bands 42-42.5 MHz and 46-68 MHz.

Finally, Resolution **656 (Rev.WRC-19)** would be consequentially suppressed.

3/1.12/4.4 Method C

This method proposes to establish a new global secondary allocation to the EESS for active emissions over the frequency band 40-50 MHz in the Table of Frequency Allocations of RR Article **5**.

Resolution **656 (Rev.WRC-19)** would be consequentially suppressed.

Views were expressed that this Method C should be deleted since it does not take into account the protection of incumbent services, and therefore does not satisfy WRC-23 agenda item 1.12. However, a view was expressed to retain this method.

3/1.12/4.5 Method D

This method proposes no change to the Radio Regulations, except for the suppression of Resolution **656 (Rev.WRC-19)**.

Views were expressed that current sharing and compatibility studies have not fully demonstrated incumbent services could be protected from potential harmful interference from the operation of spaceborne radar sounders in the frequency band 40-50 MHz.

3/1.12/5 Regulatory and procedural considerations

3/1.12/5.1 For Methods A1, A2 and B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

27.5-40.98 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
39.986-40~~.02~~ FIXED MOBILE Space research		**39.986-40** FIXED MOBILE RADIOLOCATION 5.132A Space research
~~39.986~~40-40.02 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Space research		**40-40.02** FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Space research

40.02-40.98	FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.150

MOD

40.98-47 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
40.98-41.015	FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Space research 5.160 5.161	
41.015-42	FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.160 5.161 5.161A	
42-42.5 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Radiolocation 5.132A 5.160 5.161B	**42-42.5** FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.161	
42.5-44	FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.160 5.161 5.161A	
44-47	FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.162 5.162A	

MOD

47-75.2 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
47-50 BROADCASTING Earth exploration-satellite (active) ADD 5.A112 5.162A 5.163 5.164 5.165	**47-50** FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112	**47-50** FIXED MOBILE BROADCASTING Earth exploration-satellite (active) ADD 5.A112 5.162A

3/1.12/5.1.1 For Method A1

ADD

5.A112-A1 The use of the frequency band 40-50 MHz by the Earth exploration-satellite service (active) shall be in accordance with Resolution **[A112-METHOD-A1] (WRC-23)**.

The provisions of this footnote in no way diminish the obligation of the Earth exploration-satellite service (active) to operate as a secondary service in accordance with Nos. **5.29** and **5.30**. (WRC-23)

ADD

DRAFT NEW RESOLUTION [A112-METHOD-A1] (WRC-23)

Use of the frequency range 40-50 MHz allocated to the Earth exploration-satellite service (active) for spaceborne radar sounders

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that spaceborne active sensors operating in the Earth exploration-satellite service (EESS) (active), described in Recommendation ITU-R RS.2042-1, can provide unique information on the physical properties of the Earth, such as characteristics of polar ice sheets and subterranean fossil aquifers in desertic environments;

b) that spaceborne active remote sensing requires specific frequency ranges depending on the physical phenomena to be observed;

c) that worldwide, periodic measurements of subsurface water/ice deposits require the use of spaceborne radar sounder active sensors;

d) that the measurement of reflectivity from subsurface scattering layers as deep as 10 m to 100 m for shallow aquifers and groundwater conduits, and on the order of 5 km for basal interface topography and ice-sheet thickness, is necessary;

e) that spaceborne radar sounders operating in the EESS (active) are intended to be operated from polar orbits, only in either uninhabited, sparsely populated or remote areas of the globe, with particular focus on deserts and polar ice fields;

f) that the 40-50 MHz frequency range is preferable to satisfy all operational requirements for such spaceborne radar sounder active sensors,

recognizing

a) that, given the complexity of the EESS (active) instruments implementation in these low frequencies, very few such platforms are expected to be in orbit at the same time; consequently, aggregate interference from multiple spaceborne radar sounders into incumbent services is not anticipated and could be mitigated by coordination between the operators of such instruments;

b) that measurements by these radar sounders are only possible when the total electron content of the ionosphere is near its daily minimum, which normally occurs in a few hours' window centred approximately at 4 a.m. local time;

c) that No. **21.16.8** provides the equation to determine mean pfd values for EESS (active);

Note: *recognizing c)* does not apply to Option 2.

d) that coordination between operators of EESS (active) systems and operators of wind profiler radars in the 40-50 MHz band may be needed on a case-by-case basis to ensure coexistence between the corresponding stations,

resolves

Note: Various options are proposed below. Options 2, 3 and 4 are based on proposals submitted to CPM. Further consideration would be required to assess all four options for the protection of existing services.

Views were expressed that Options 2 and 3 are based on proposals and studies that have not been reviewed and agreed by the ITU-R Study Groups and do not take into account the protection of existing services.

Some administrations expressed their view that none of the four options have reached an agreement in ITU-R. However, the proponents of option 3 stress the fact that the related provisions are based on relevant technical studies and have been designed in such a way to ensure protection of incumbent services.

Option 1:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that, for the purpose of protecting the in-band and adjacent-band services, the pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed [TBD]/[−156 dB(W/(m^2 · 4 kHz))] for more than [TBD]/[0.0002%] of time, developed for clear-sky conditions. The limits above take into account the 3 dB aggregate loss due to polarization mismatch for the concerned services;

3 that the spaceborne radar sounder systems in the frequency range 40-50 MHz should only operate in a few hours' window centred approximately at 4 a.m. local time.

End of Option 1

Option 2:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that the following conditions shall apply to stations operating in the EESS (active) in the frequency band 40-50 MHz on a secondary basis:

2.1 not claim protection from stations operating in the radiolocation service in the frequency bands 42-42.5 MHz or 46-50 MHz. No. **5.43A** does not apply;

2.2 not claim protection from stations operating in the space research service in the frequency bands 40-40.02 MHz or 40.98-41.015 MHz. No. **5.43A** does not apply;

2.3 operations are permitted when the subsatellite[1] point is located within any of the following areas:

a) the spherical cap formed by latitudes between 72 and 90 degrees North;

b) the spherical cap formed by latitudes between 60 and 90 degrees South;

c) the quadrangle formed by latitudes between 59 and 72 degrees North and longitudes between 25 and 55 degrees West;

3 that stations in the EESS (active) operating in areas outside of those provided in *resolves* 2.3 shall not transmit without prior agreement of directly overlapped and neighbouring administrations.

End of Option 2

Option 3:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that, for the purpose of providing protection to the in-band and adjacent-band services, the mean pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed the following limits, under free-space propagation conditions:

pfd (dB(W/(m^2 · 4 kHz)))	Latitude (degrees)
−145	0 < |Latitude| ≤ 64
[between −145 and −138]	Latitude > 64
−138	Latitude <-64

3 that the limits provided in *resolves* 2 may be exceeded for no more than 0.05% of the time, while not exceeding the following maximum pfd levels, under free-space propagation conditions:

pfd (dB(W/(m^2 · 4 kHz)))	Latitude (degrees)
−136	0 < |Latitude| ≤ 64
[between −136 and −129]	Latitude > 64
[−129]	Latitude<-64

[1] The subsatellite point is defined as the location of the projection of the satellite's nadir-pointing vector onto the Earth's surface.

4 that, if more than one system is in operation, administrations shall ensure collectively that the limits in *resolves* 2 are not exceeded for more than 0.1% of the time and shall have consultations accordingly;

5 that the spaceborne radar sounder systems in the frequency range 40-50 MHz should only operate in a few hours' window centred approximately at 4 a.m. local time,

invites the ITU Radiocommunication Sector

to regularly review the number and characteristics of spaceborne radar sounders and the application of *resolves* 4 by concerned Member States.

End of Option 3

Option 4:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that, for the purpose of protecting the in-band and adjacent-band services, the pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed [TBD]/[−156 dB(W/(m^2 · 4 kHz))] for more than [TBD]/[0.0002%] of time, developed for clear-sky conditions, and the transmit peak power shall not exceed [TBD]/[20 dBW]. The limits above take into account the 3 dB aggregate loss due to polarization mismatch for the concerned services;

3 that the spaceborne radar sounder systems in the frequency range 40-50 MHz should only operate in a few hours' window centred approximately at 4 a.m. local time.

End of Option 4

3/1.12/5.1.2 For Method A2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

3/1.12/5.1.2.1 For Method A2, Option 1

ADD

5.A112-A2-Opt1 The Earth exploration-satellite service (active) is limited to spaceborne radar sounder systems, and the power flux-density at the surface of the Earth produced by emissions from transmitting stations in the frequency band 40-50 MHz shall not exceed [TBD]/[−156 dB(W/(m^2 · 4 kHz))] for more than [TBD]/[0.0002%] of time. Coordination between operators of the Earth exploration-satellite service (active) systems and operators of wind profiler radars in the 40-50 MHz band may be needed on a case-by-case basis to ensure coexistence between the corresponding stations. (WRC-23)

3/1.12/5.1.2.2 For Method A2, Option 2

ADD

5.A112-A2-Opt2 The Earth exploration-satellite service (active) is limited to spaceborne radar sounder systems, and the power flux-density at the surface of the Earth produced by emissions from transmitting stations in the frequency band 40-50 MHz shall not exceed [xxx dB(W/(m^2 · 4 kHz))] for more than [xxx%] of time and the transmit peak power shall not exceed [20 dBW]. Coordination between operators of the Earth exploration-satellite service (active) systems and operators of wind profiler radars in the 40-50 MHz band may be needed on a case-by-case basis to ensure coexistence between the corresponding stations. (WRC-23)

3/1.12/5.1.3 For Method B

ADD

5.A112-B The Earth exploration-satellite service (active) is limited to spaceborne radar sounder systems. Active spaceborne sensors in the Earth exploration-satellite service shall not cause harmful interference to, nor claim protection from stations in the radiolocation service operating in the frequency bands 42-42.5 MHz and 46-68 MHz. (WRC-23)

3/1.12/5.2 For Method C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

27.5-40.98 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
39.986-40~~.02~~ FIXED MOBILE Space research		**39.986-40** FIXED MOBILE RADIOLOCATION 5.132A Space research
~~39.986~~40-40.02 FIXED MOBILE Earth exploration-satellite (active) Space research		**40-40.02** FIXED MOBILE Earth exploration-satellite (active) Space research

40.02-40.98	FIXED MOBILE Earth exploration-satellite (active) 5.150

MOD

40.98-47 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
40.98-41.015	FIXED MOBILE Earth exploration-satellite (active) Space research 5.160 5.161	
41.015-42	FIXED MOBILE Earth exploration-satellite (active) 5.160 5.161 5.161A	
42-42.5 FIXED MOBILE Earth exploration-satellite (active) Radiolocation 5.132A 5.160 5.161B	**42-42.5** FIXED MOBILE Earth exploration-satellite (active) 5.161	
42.5-44	FIXED MOBILE Earth exploration-satellite (active) 5.160 5.161 5.161A	
44-47	FIXED MOBILE Earth exploration-satellite (active) 5.162 5.162A	

MOD

47-75.2 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
47-50 BROADCASTING Earth exploration-satellite (active) 5.162A 5.163 5.164 5.165	**47-50** FIXED MOBILE Earth exploration-satellite (active)	**47-50** FIXED MOBILE BROADCASTING Earth exploration-satellite (active) 5.162A

3/1.12/5.3 Method D

NOC

ARTICLES

NOC

APPENDICES

3/1.12/5.4 For Methods A1, A2, B, C and D

SUP

RESOLUTION 656 (REV.WRC-19)

Possible secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders in the range of frequencies around 45 MHz

Agenda item 1.13

1.13 to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with Resolution ***661 (WRC-19)****;*

Resolution **661 (WRC-19)** – *Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz*

3/1.13/1 Executive summary

Resolution **661 (WRC-19)** invites ITU-R to investigate and identify all relevant scenarios that need to be considered in assessment of a possible upgrade to the allocation to the space research service to primary status in the frequency band 14.8-15.35 GHz, and to conduct and complete such studies in time for WRC-23 so as to determine any associated technical and regulatory conditions to ensure protection of the current use and future development of the existing primary services. WRC-23 agenda item 1.13 calls for examination, on the basis of the results of studies by the ITU Radiocommunication Sector, of the possibility of upgrading the secondary status of the allocation to the space research service (SRS) to primary status.

Five methods have been proposed:

– Method A proposes no change to the Radio Regulations (RR) and maintains the status of the SRS allocation as secondary;

– Method B proposes to make regulatory changes to the RR to upgrade the secondary allocation to the space research service (space-to-space) in the frequency band 14.8-15.35 GHz to primary status. This includes two alternatives to modify the RR Article **5** Table of Frequency Allocations in the frequency band 14.8-15.35 GHz to upgrade the secondary SRS (space-to-space) allocation to primary and retain the secondary allocation to SRS (space-to-Earth) and (Earth-to-space). The method also seeks to modify Table **21-4** in RR Article **21** to add a row to specify power flux-density (pfd) limits for SRS (space-to-space) in the frequency band;

– Method C includes a modification to the RR Article **5** Table of Frequency Allocations in the frequency band 14.8-15.35 GHz to upgrade the secondary SRS allocation, except SRS active and SRS passive applications, to primary and also modify Table **21-4** in RR Article **21** to add rows to specify pfd limits for SRS (space-to-Earth) and (space-to-space) in the frequency band 14.8-15.35 GHz. Table A of Annex 2 to RR Appendix **4** is modified to add commitment to follow regulatory provisions to protect the radio astronomy service (RAS). Tables 7b and 8c of Annex 7 to RR Appendix **7** are modified to add parameters for determination of coordination distances around SRS earth stations. Elements for a new WRC Resolution are proposed to upgrade the status of the existing assignments recorded in the Master International Frequency Register (MIFR) with the original date of receipt, subject to conformity with the new conditions of the allocation of the frequency band 14.8-15.35 GHz to the space research service;

– Method D proposes to upgrade the status of the SRS allocation to primary, with provisions to avoid imposing constraints on the current use and future development of existing systems of primary services, including the aeronautical mobile service (AMS). It also provides further protection to the RAS. This method also avoids the usage of deep-space missions in that frequency band because the impact of those missions was not studied;

– Method E allows upgrading of the SRS and provides provisions to both protect and avoid constraints on primary services for the fixed service (FS) and mobile service (MS) in the frequency band 14.8-15.35 GHz, as well as RAS in the adjacent frequency band 15.35-15.4 GHz. There are three sub-methods, as follows:

- Method E1: While this method allows the upgrading of the SRS it shall be ensured with provisions to avoid imposing constraints on existing and future systems of primary services in the frequency band 14.8-15.35 GHz and to ensure the protection of all primary services in the frequency band as well as the RAS in the adjacent frequency band 15.35-15.4 GHz and footnote to avoid the usage of passive and active sensors and deep space missions with primary status in that frequency band because the impact of those missions was not studied. Finally, Resolution **661 (Rev.WRC-19)** would be consequentially suppressed.
- Method E2: Although this method is proposing the upgrading of the SRS, the current studies of the impact of AMS on SRS earth stations led to a large horizontal separation distance to avoid exceeding the SRS threshold which would impose constraints on the AMS systems. Furthermore, the current studies also show that harmful interference could be caused to stations of the helicopter television transmission systems (HTTS) and RAS using the frequency band 15.35-15.40 GHz by stations of the SRS.

  This method also includes modifications to Table **21-4** in RR Article **21** to add a row to specify pfd limits for the SRS (space-to-Earth) and (space-to-space) in order to protect the existing systems of primary services in the frequency band 14.8-15.35 GHz.

  It is also proposed to have a pfd limit in order to protect the AMS, HTTS and RAS operated in neighbouring countries.

  The method limits the usage of the SRS for near-Earth missions avoiding the upgrade of all other subsets of the SRS (SRS (passive), SRS (active) and SRS (deep space)) missions in that frequency band because the impact of those missions was not studied.

  This method adds a footnote to state that the SRS shall not claim protection from existing fixed service and the mobile service.
- Method E3: This method proposes to make regulatory changes to the RR to upgrade the secondary allocation to the SRS in the frequency band 14.8-15.35 GHz into primary status and to protect the existing primary FS and MS in the same frequency band and services in the adjacent frequency band. The regulatory provisions contained in this Method E3 are considered based on the study of protection criteria derived by *I/N* concept with respect to systems in the FS and MS including AMS allocated in the frequency band 14.8-15.35 GHz. The method also avoids the usage of passive and active sensors and deep space missions with primary status in that frequency band because the impact of that mission was not studied. This method also proposes a footnote to state that the space research service shall not cause harmful interference to the RAS.

All these methods support the suppression of Resolution **661 (WRC-19)**.

3/1.13/2 Background

The frequency band 14.8-15.35 GHz is currently allocated on a primary basis to the FS and the MS, and on a secondary basis to the SRS. Within the SRS, the frequency band is expected to be used for high-speed science data return from space science missions to a limited number of earth stations located globally. Additionally, the frequency band is also currently used in two capacities by Data

Relay Satellite (DRS) systems operated by multiple administrations. These uses include forward feeder uplinks from DRS earth stations to relay satellites in the geostationary-satellite orbit (GSO), as well as inter-satellite return links to relay data from non-GSO space science spacecraft (including crewed space vehicles and stations) through DRS satellites to the Earth.

The space research satellite requirements for use of the frequency band are expected to continue to increase in the coming years as a result of increasing numbers of robotic science satellites and crewed vehicles, limited bandwidth and/or increasing congestion in other SRS frequency bands, and increasing science mission data transport needs.

The purpose of this agenda item is to explore the feasibility of establishing a regulatory framework to provide for the operation of SRS systems in this frequency band on a primary basis, consistent with not causing harmful interference to nor constraining the operation of systems operating in other primary services in the frequency band.

3/1.13/3 Summary and analysis of the results of ITU-R studies

3/1.13/3.1 Services allocated in the frequency band 14.8-15.35 GHz and adjacent frequency bands as applicable

TABLE 3/1.13/3-1

Allocations in the frequency band 14.8-15.35 GHz and adjacent frequency bands

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.5-14.75	FIXED FIXED-SATELLITE (Earth-to-space) 5.509B 5.509C 5.509D 5.509E 5.509F 5.510 MOBILE Space research 5.509G	
14.75-14.8 FIXED FIXED-SATELLITE (Earth-to-space) 5.510 MOBILE Space research 5.509G		**14.75-14.8** FIXED FIXED-SATELLITE (Earth-to-space) 5.509B 5.509C 5.509D 5.509E 5.509F 5.510 MOBILE Space research 5.509G
14.8-15.35	FIXED MOBILE Space research 5.339	
15.35-15.4	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.511	

3/1.13/3.2 Characteristics of the space research service in the frequency band 14.8-15.35 GHz

Annex 1 of Recommendation ITU-R SA.2141-0, *Characteristics of space research service systems in the frequency range 14.8-15.35 GHz*, provides representative technical and operational characteristics for SRS systems in this frequency band. Table 1 of this Annex provides typical characteristics for SRS (space-to-Earth) links for spacecraft in various different orbits, including non-GSO, GSO, highly elliptical orbits (HEO), and Lagrangian orbits (L1/L2), while this table does not provide the antenna patterns for SRS (space-to-Earth) links. Table 2 of this Annex provides characteristics of SRS uplinks, based on existing DRS feeder uplinks, and Table 3 of this Annex provides characteristics of DRS inter-orbit return links.

In all studies of interference into the SRS, Recommendation ITU-R SA.1743 was not used in order to apportion the protection criteria of the SRS.

All studies were performed considering the characteristics of near-Earth missions. No study was performed considering deep space missions or SRS passive/active missions.

3/1.13/3.3 Characteristics of incumbent services in the frequency band 14.8-15.35 GHz and adjacent frequency bands

The characteristics of systems in the FS, the land mobile service (LMS), the RAS, and the AMS operating in the frequency band 14.8-15.35 GHz and in adjacent bands are documented in preliminary draft new (PDN) Report ITU-R SA.[15 GHz SRS SHARING].

Helicopter television transmission systems (HTTS) are operated in one country in the MS in the frequency band 14.5-15.35 GHz to transmit real-time television signals and data taken/collected by a television camera or sensors from a helicopter to the receiving stations on the ground or a ship, and there is no link from ground station to helicopters. The HTTS receiving station antenna always tracks the HTTS transmitting station on board the helicopter. The antenna of the HTTS receiving station can be pointing to higher elevation angle in order to track the HTTS transmitting station on board helicopter. These systems are used by national governmental agencies and local governments for governmental services, including public protection, disaster relief and maritime safety. In the events of national disasters, live videos of the disaster situation enable governmental agencies to promptly understand the situation and take immediate and appropriate measures according to the situation.

The technical and operational characteristics of HTTS for the purpose of sharing and compatibility studies are provided in section 3.2.3 of PDN Report ITU-R SA.[15 GHz SRS SHARING].

3/1.13/3.4 Sharing with the services in the frequency band 14.8-15.35 GHz

Use cases for the SRS in the frequency band 14.8-15.35 GHz include direct downlinks (from a variety of orbit types), SRS uplinks including DRS feeder uplinks, and SRS inter-orbit links including DRS return links. For each of these, studies are required with a number of potential victim services, both in-band and out-of-band (OoB).

3/1.13/3.4.1 SRS sharing with the FS

The characteristics of FS systems in the frequency range 14.4-15.35 GHz are given in Table 3 of PDN Report ITU-R SA.[15 GHz SRS SHARING]. The analyses described in this section are based on the parameters of fixed systems employing quadrature amplitude modulation (QAM) as these are the most common. In Table 3, the characteristics of 128-QAM FS systems are taken from Recommendation ITU-R F.758-7 currently in force, and the parameters for the 4-QAM – 4096-QAM FS systems have been added to the table based on information provided by the relevant contributing group concerning ongoing revisions to Recommendation ITU-R F.758. For the purpose of sharing and compatibility studies, the key difference between these parameter sets is the noise figure value (8 dB for the 128-QAM systems and 5 dB for the 4-QAM – 4096-QAM ones) as well as the associated system noise temperature value. Sharing studies performed for the FS used both noise figures values and presented results for each.

From the FS characteristics provided by the relevant contributing group containing the highest order modulations, all studies included both noise figure values. However, only a few of the studies included the highest antenna gain.

The other key factor for in-band sharing studies is the fixed station antenna gain. Some studies are performed for a set of representative values including 31.9 dBi, 35 dBi, and 49 dBi.

3/1.13/3.4.1.1 SRS downlinks sharing with the FS

Section 4.1.1 of PDN Report ITU-R SA.[15 GHz SRS SHARING] documents studies performed to assess the feasibility of sharing between SRS downlinks and FS systems in the frequency band 14.8-15.35 GHz. These studies address both interference from the SRS into FS systems and interference from the FS into the SRS.

SRS (s-E) interference into the FS

A static analysis of in-band interference from SRS downlinks to fixed stations was performed to determine whether the FS protection criteria levels would be exceeded for any link geometry for any percentage of time. The analysis used fixed wireless system characteristics from Recommendation ITU-R F.758-7 and calculated pfd protection masks for the FS stations for each of the four values of FS antenna gain considered. These masks were calculated using both the 5 dB and 8 dB FS noise figure values as identified in PDN Report ITU-R SA.[15 GHz SRS SHARING]. The FS protection pfd masks were then compared with the SRS pfd limit mask in Recommendation ITU-R SA.1626-1 to determine whether a possibility of interference exists.

For this comparison, the SRS pfd limit curve was plotted for three cases based on the relative locations of the fixed station and the SRS earth station. The first case considered the geometry where the stations are co-located. In the second geometry, the fixed station is located some 273 km further along the ground track of the SRS satellite orbit than is the SRS earth station. Finally, in the third case, the fixed station is located 503 km away from the SRS earth station in the direction of the SRS satellite orbital track. This distance was chosen such that the SRS spacecraft is directly in the boresight of the fixed station antenna when it reaches 5-degrees elevation (as seen from the SRS earth station) and begins transmitting the downlink signal. It is therefore considered to represent the worst-case interference geometry scenario.

The SRS downlink pfd limit given in Recommendation ITU-R SA.1626-1 is sufficient to protect FS systems with an 8 dB noise figure for angles of arrival above the 5-degree SRS minimum when they are co-located with an SRS earth station. However, for FS systems with the alternative 5-dB noise figure value it is shown that the SRS pfd limit is not adequate to protect the FS for angles of arrival in the range of 5° to ~7°.

Based on this finding, additional analyses are needed to assess the feasibility of FS sharing with downlinks from each of the SRS mission types.

It should be noted that the pfd limits given in Recommendation ITU-R SA.1626-1 are specified at angles of arrival even less than 5°. This static analysis demonstrated that an SRS downlink compliant with the ITU-R SA.1626-1 pfd limit could potentially exceed the prescribed power limit component of the protection criteria for the FS given in Recommendation ITU-R F.758.

However, this scenario would occur at a low percentage of time necessitating the need to conduct dynamic studies for comparison against the power and percentage of time aspect of the criteria.

Based on this result, it was deemed necessary to perform more detailed studies of interference from the SRS downlink to the FS receivers. These analyses considered two cases: one for SRS non-GSO downlinks and one for SRS GSO downlinks.

In the case of interference from non-GSO SRS downlinks, a series of dynamic analyses were performed to assess the statistical distribution of interference from a single non-GSO SRS link into fixed stations. The characteristics of the SRS non-GSO were primarily drawn from Recommendation ITU-R SA.2141-0. These included an altitude of 800 km, a transmit antenna gain of 32.9 dBi, a bandwidth of 400 MHz, and a peak equivalent isotropically radiated power (e.i.r.p.) density of 14.4 dBW/MHz. An inclination angle of 45°, typical for SRS spacecraft, was assumed for a downlink to an SRS earth station located in White Sands, New Mexico, USA. For this analysis, the interference levels seen by a number of fixed stations located in the vicinity of the SRS earth station were measured. The fixed station locations considered were at distances of 50 km, 200 km, or 450 km from the SRS station at azimuth angles ranging from 0° to 315° in increments of 45°.

Views:

Some administrations are of the view: It should be noted that this analysis assumed the case of only a single low Earth orbit (LEO) SRS satellite. Thus it does not consider the cases of SRS satellites in higher altitude orbits (highly elliptical orbits (HEO) and L1/L2) or an aggregation of multiple SRS satellites. The higher altitude orbit or the aggregation may increase the percentage of the interfered-with time.

In addition, this analysis is performed with the specific location of White Sands Complex which is surrounded by hills and mountains near the earth station and thus would underestimate the interference into FS receiving station compared with flat land.

The statistical distribution of the received interference was calculated for each fixed station location for three different values of FS antenna gain (31.9 dBi, 35 dBi, and 49 dBi). These were compared to the long-term FS protection criteria from Recommendation ITU-R F.758-7 and an assumed short-term FS protection criterion based on that given in Recommendation ITU-R F.1495-2 for the FS in frequency bands around 40 GHz. Note that it was necessary to use an assumed short-term protection criterion for the FS in this frequency band because there is no ITU-R Recommendation which defines one.

Views:

Some administrations are of the view that this analysis used the value of 3 dB for the apportionment, even though the value of 6 or 10 dB is recommended in Recommendation ITU-R F.758-7.

Finally, a series of static calculations were performed to assess the power spectral density level of interference from a GSO SRS downlink into fixed stations. For this analysis, the interference was calculated as a function of the distance between the SRS earth station and the fixed station, where the FS station is either co-located with the SRS station or located further away from the SRS space station (such that the elevation angle from the FS station to the SRS GSO is less than or equal to the elevation angle from the SRS earth station). Received interference power spectral density results were determined using FS antenna gains of 31.9 dBi and 35 dBi.

It should be noted that some of the above studies regarding the impact of GSO/non-GSO SRS on the FS did not take into account some of the characteristics of fixed links which use higher modulation schemes (above 128-QAM), hence the results of the above studies may lead to an underestimation of the protection levels required for the FS for these systems.

Views:

Some administrations are of the view: This analysis does not take into account the FS antenna gain of 49 dBi, hence the results of the above studies may lead to an underestimation of the protection levels required for the FS.

It should be also noted that the studies assumed that the FS receiving station antennas point toward the horizon, and did not consider the case which the antennas point above the horizon. When the FS receiving station antenna is pointing above the horizon, the interference pfd level from the SRS space station will increase, and may exceed the protection criteria of the FS if the pfd limits given in Recommendation ITU-R SA.1626-1 will be applied.

Based on the results of the studies and the considerations, the studies should not be considered as the worst-case studies and are not sufficient to conclude that the limits given in Recommendation ITU-R SA.1626-1 ensure the protection of the fixed service in the band 14.8-15.35 GHz.

Some administrations are of the view that pfd levels, produced at the Earth's surface by SRS space stations in HEO (satellite apogee around 300 000 km) or at L1/L2 points (with distance to Earth over 1 000 000 km) would be negligible compared to pfd levels, produced at the Earth's surface by SRS space stations in LEO. Therefore, assessment of aggregate interference from SRS space stations in LEO, HEO and at L1/L2 points would not change conclusions for sharing studies, based on SRS space stations in LEO. This view is based on the assumption that Recommendation ITU-R SA.2141-0 is applied to the characteristics of SRS space stations.

Assessment of separation distances between SRS earth stations and FS using specific locations is reasonable due to limited number of associated earth stations per SRS satellite network (usually not more than 1 or 2 specific locations). The fact that specific locations could be surrounded by hills and mountains does not automatically lead to conclusion that interference into FS receiving stations would be underestimated and required separation distances would be longer for flat land deployment scenario, taking into account possible local clutter, vegetation loss at the FS site, propagation conditions, like diffraction on mountain peaks, as well as possible scenarios, involving interference into main beam of FS stations, located in mountain terrain.

Recommendation ITU-R F.758-7 does not specify the apportionment factor for I/N value, which is defined as maximum aggregate I/N from all other co-primary services. WP 5B has not provided any guidance on that matter during the study period and did not raise concern on application of 3 dB apportionment factor, used in some studies.

Working Party 5B did not specify elevation angles of maximum directivity for fixed links, as part of technical parameters to be used for sharing and compatibility studies. The majority of FS links, notified to ITU BR in the band 14.4-14.5 GHz, operate with tilt angles close to 0°, therefore studies using this value should be representative. Stations of the fixed service operate within the frequency band 14.4-15.35 GHz, as specified in Recommendation ITU-R F.758-7; conditions of RR No. 21.2 would still apply for FS stations for the lower parts of the band, 14.4-14.5 GHz, therefore in-line events between receiving antennas of FS stations and transmitting GSO space stations would not represent a typical case. Protection criterion for FS links takes into account possibility of in-line events, I/N may exceed threshold level of −10 dB for 20% of time. Static worst-case analysis, assuming main-beam to main-beam event, is not sufficient to conclude that the limits given in Recommendation ITU-R SA.510-3 would not ensure the protection of the FS in the band 14.8-15.35 GHz.

FS interference into the SRS (s-E)

One study in PDN Report ITU-R SA.[15 GHz SRS SHARING] examined the potential for interference from fixed stations, located in the vicinity of the White Sands Complex (WSC) SRS earth station. WSC is one of a small number of existing SRS earth stations worldwide and is located approximately 85 km from an international border. The study defined a contour around WSC outside of which a fixed station would be incapable of causing excess interference to an SRS downlink to WSC. It was shown that this contour did not extend to the international border. This analysis is performed with the specific location of WSC where is surrounded by hills and mountains near to the earth station. Therefore, the result of this analysis cannot be generalized.

The SRS earth station interference threshold is exceeded for all FS emission bandwidth with a directive antenna for a significant angle leading to a large separation horizontal distance.

The results are even worse with SRS earth station with a low elevation angle. For most cases, the gain of an FS station receiving antenna in the direction of an SRS earth station will be less than 36.6 dBi, and with the off-axis angle of SRS earth station increases, the interference power density will drop from −160 dB/Hz to −215 dB/Hz but still it will not respect the protection criterion of the SRS earth station given in Recommendation ITU-R SA.609. In this case also it was shown that the FS will also have an impact on SRS earth stations.

3/1.13/3.4.1.2 SRS (E-s) uplinks sharing with the FS

SRS (E-s) interference into the FS

PDN Report ITU-R SA.[15 GHz SRS SHARING] contains the results of sharing assessments between the GSO SRS (Earth-to-space) and the FS, which apply to the whole frequency range 14.8-15.35 GHz. The propagation mode (1) in Appendix **7** of the RR which accounts the effects like attenuation, duction, tropospheric scatter, gaseous absorption and site shielding is considered in the analysis.

The worst-case analysis leads to a maximum required basic transmission loss between the DRS earth station and the FS station when considering that the DRS earth station is pointing straight at the victim FS station. In order not to overestimate the coordination distance between the DRS earth station and the FS station, a more realistic scenario is that the elevation angle of the DRS earth station is normally greater than 10°, and the direction of the victim FS station may not exactly point towards the direction of the transmitting DRS earth station, so that there will be an angle between the two kinds of stations, which will lead to an off-axis angle in the direction of the DRS earth station referred to its main-lobe axis.

With the different off-axis angles of the DRS earth station, the coordination distance may range from about 26 km to 122 km. For 95% of the cases, the coordination distance would be less than 40 km.

Views:

Some administrations are of the view: It should be noted that the worst-case analysis leads to a maximum required basic transmission loss between the DRS earth station and the FS station when considering that the DRS earth station is pointing straight at the victim FS station, or the elevation angle of the DRS earth station is 5° pursuant to No. ***21.15*** *of the RR.*

It should be pointed out that the coordination distance can be further reduced when taking into account actual terrain, the location of the station and other shielding features.

Considering the sharing results, no additional constraints will be placed on the use of FS systems in the frequency band 14.8-15.35 GHz under this agenda item.

FS interference into the SRS (E-s)

Two scenarios were considered for this study: static studies and dynamic studies.

From the static studies it was determined that the SRS space station interference threshold is exceeded for the case in which the FS equipped with a directive antenna with the narrowest bandwidth for FS emission and when the FS in within the 5° cone of the SRS space station cone. It was assessed that the capability of coexistence with a directive antenna for the FS would depend on the probability to have main-main beam configuration between the SRS space station and the FS.

Since the static studies have shown possible interference then a dynamical study has also been performed. From these second studies it was determined that the protection criterium of the SRS space stations will be exceeded by maximum 5% of time (Recommendation ITU-R SA.609 gives a maximum of 0.1% exceedance of protection criterium). Considering these findings, it was shown that SRS space stations will be perturbed by the FS in certain cases.

3/1.13/3.4.1.3 SRS inter-orbit links sharing with the FS

SRS (s-s) interference into the FS

Dynamic simulation analyses similar to that described in section 3/1.13/3.4.1.1 were performed to assess the statistical distribution of interference from SRS inter-orbit links to fixed stations operating in the frequency band 14.8-15.35 GHz. In all cases studied, the levels of interference to fixed stations were found to be within the protection criteria limits.

Two scenarios were considered for the geometry of the SRS links. In the first, a non-GSO SRS satellite transmits to a GSO spacecraft. This is representative of inter-orbit return links of existing data relay satellite networks currently operating in this frequency band, and the characteristics of these links are provided in Recommendation ITU-R SA.2141. In the second scenario, the direction of transmission is reversed, from the GSO relay satellite to the non-GSO SRS. Existing data relay satellite networks operate inter-orbit forward links in this direction in frequency bands between 13.4 GHz and 13.8 GHz. The key characteristics (DRS antenna gain, transmit power density and antenna pattern) of these existing DRS forward links are provided in Recommendation ITU-R SA.1414-2 and used for this analysis.

For both directions of transmission, the dynamic analyses assessed the statistics of the interference from the inter-satellite links to fixed stations. The GSO data relay satellite was located at 41° East longitude and communicated with an SR satellite in an 800 km altitude, 45-degree inclination orbit. For these analyses, the technical characteristics of the fixed stations were modelled exactly as was done for the analysis of SRS downlink interference described in section 3/1.13/3.4.1.1 above. The analysis assessed the statistical distribution of received interference power levels at 100 fixed station locations located globally to ensure that the worst-case geometry was considered. These were compared to the specified long-term and assumed short-term FS protection criteria (as discussed in section 3/1.13/3.4.1.1 above).

Views:

Some administrations are of the view: It should be also noted that the studies assumed that the FS receiving station antennas point toward the horizon, and did not consider the case in which the antennas point above the horizon. When the FS receiving station antenna is pointing above the horizon, the interference pfd level from the SRS space station will increase, and may exceed the protection criteria of the FS if the pfd limits given in Recommendation ITU-R SA.510-3 will be applied.

This analysis used the value of 3 dB for the apportionment, even though the value of 6 or 10 dB is recommended in Recommendation ITU-R F.758-7.

This study did not take into account some of the characteristics of fixed links which use higher modulation schemes (above 128-QAM) and higher receiving antenna gain (49 dBi), hence the results of the studies may lead to an underestimation of the protection levels required for the FS for these systems.

Based on the results of the studies and the considerations, this study should not be considered as the worst-case studies and are not sufficient to conclude that the limits given in Recommendation ITU-R SA.510-3 ensure the protection of the FS in the band 14.8-15.35 GHz.

*Some administrations are of the view: that WP 5B did not specify elevation angles of maximum directivity for fixed links, as part of technical parameters to be used for sharing and compatibility studies. Majority of FS links, notified to ITU BR in the band 14.4-14.5 GHz band, operate with tilt angles close to 0°, therefore studies using this value should be representative. Protection criterion for FS links takes into account possibility of in-line events, interference-to-noise ratio (*I/N*) may exceed threshold level of −10 dB for 20% of time. Static worst-case analysis, assuming main-beam to main-beam event, is not sufficient to conclude that the limits given in Recommendation ITU-R SA.510-3 would not ensure the protection of the fixed service in the band 14.8-15.35 GHz.*

Some administrations are of the view that: Recommendation ITU-R F.758-7 does not specify the apportionment factor for I/N *value, which is defined as maximum aggregate* I/N *from all other co-primary services. WP 5B has not provided any guidance on that matter during the study period and did not raise concern on application of 3 dB apportionment factor, used in some studies.*

3/1.13/3.4.2 SRS sharing with the LMS

The characteristics of land mobile systems operating in the frequency band 14.8-15.35 GHz are documented in Recommendation ITU-R M.2068-0. This Recommendation provides six distinct sets of characteristics for different types of land mobile systems. It also provides the protection criteria for LMS systems which requires that the aggregate received interference I/N be ≤ −6 dB.

3/1.13/3.4.2.1 Non-GSO SRS downlinks sharing with the land mobile service

SRS (s-E) interference into the LMS

Section 4.2.1.1 of PDN Report ITU-R SA.[15 GHz SRS SHARING] documents one study performed to assess the feasibility of sharing between SRS downlinks and the LMS in the frequency band 14.8-15.35 GHz. The study, which considered each of the sets of presentative LMS system characteristics provided in Recommendation ITU-R M.2068-0 and examined a wide variety of link geometries, calculated the maximum interference power spectral density levels from a non-GSO SRS downlink into land mobile stations. Interference power spectral density (PSD) levels calculated exceeded the LMS protection criteria levels.

In this study, the LMS station was assumed to be located a fixed distance from the SRS earth station further along the path of the SRS satellite sub-satellite point. Finite separation distances between the stations ranging from 50 km to 550 km, were considered and plots of the SRS downlink interference power density at the LMS receiver input as a function of the SRS earth station antenna elevation angle were provided.

Views:

Some administrations are of the view: For both LEO and HEO satellites, interference PSD levels calculated exceeded the LMS protection criteria levels, based on another study performed to assess the feasibility of sharing between SRS downlinks of LEO and HEO satellite and the LMS in the frequency band 14.8-15.35 GHz.

It should be also noted that the studies assumed that the LMS receiving station antennas point toward the horizon, and did not consider the case which the antennas point above the horizon. When the LMS receiving station antenna is pointing above the horizon, the interference pfd level from the SRS space station will increase, and may exceed the protection criteria of the LMS if the pfd limits given in Recommendation ITU-R SA.1626-1 will be applied.

Based on the results of the studies and the considerations, the studies should not be considered as the worst-case studies and are not sufficient to conclude that the limits given in Recommendation ITU-R SA.1626-1 ensure the protection of the FS in the frequency band 14.8-15.35 GHz.

Some administrations are of the view that: WP 5A did not specify elevation angles of maximum directivity for mobile links, as part of technical parameters to be used for sharing and compatibility studies. According to Recommendation ITU-R M.2068-0 selection of MS antenna locations on elevated terrain is desirable to mitigate the effects of, e.g. foliage and buildings, etc., and maximize communication distances, in which case pointing towards horizon would represent typical case, which was used in some of the studies.

Dynamic analysis

A separate dynamic analysis was performed to assess the time distribution levels of interference from SRS downlinks to LMS stations. For this analysis, three SRS non-GSO spacecraft were simulated using the characteristics given in Recommendation ITU-R SA.2141 and having orbital inclination angles of 22°, 51.6° and 77.6° respectively. A simulation analysis was performed to calculate the time distribution of the aggregate interference from the downlinks from all three non-GSO spacecraft to an SRS earth station at White Sands Complex, NM (USA) into LMS stations positioned at 100 randomly selected locations throughout the US. The complementary cumulative distribution function (CCDF) curves for the received interference levels for each of the six LMS reference system types were produced. The maximum received interference levels in these results did not exceed the LMS protection criteria.

Views:

Some administrations are of the view: It should be noted that this analysis assumed the case of only three LEO SRS satellites. Thus it does not consider the cases of SRS satellites in higher altitude orbits (HEO and L1/L2). The higher altitude orbit may increase the percentage of the interfered-with time.

Based on the results of the study and the considerations, the above study should not be considered as the worst-case study and is not sufficient to conclude that the limits given in Recommendation ITU-R SA.1626-1 ensure the protection of the FS in the band 14.8-15.35 GHz.

Some administrations are of the view that: pfd levels, produced at the Earth's surface by SRS space stations in HEO (satellite apogee around 300 000 km) or at L1/L2 points (with distance to Earth over 1 000 000 km) would be negligible compared to pfd levels, produced at the Earth's surface by SRS space stations in LEO. Therefore, assessment of aggregate interference from SRS space stations in LEO, HEO and at L1/L2 points would not change conclusions for sharing studies, based on SRS space stations in LEO. This view is based on the assumption that Recommendation ITU-R SA.2141-0 is applied to the characteristics of SRS space stations.

LMS interference into SRS (s-E) GSO and non-GSO downlinks

One study in PDN Report ITU-R SA.[15 GHz SRS SHARING] examined the potential for interference from land mobile stations located in the vicinity of the World Standards Cooperation (WSC) SRS earth station. WSC is one of a small number of existing SRS earth stations worldwide, and is located approximately 85 km from an international border. The study defined a contour around WSC outside of which an LMS station would be incapable of causing excess interference to an SRS downlink to WSC. It was shown that this contour did not extend to the international border. This analysis is performed with the specific location of White Sands Complex where is surrounded by hills and mountains near to the earth station. Therefore, the result of this analysis cannot be generalized.

3/1.13/3.4.2.1*bis* GSO SRS downlinks sharing with the land mobile service

A sharing study between the LMS and GSO SRS (space-to-Earth) is conducted based on the assumptions that since the motion of the LMS stations is slow relative to that of the SRS satellite, the LMS stations are assumed to be stationary, that the specifications of six LMS stations are the same as those used in the sharing study of non-GSO sharing with the LMS, and that the pfd limits defined in Recommendation ITU-R SA.1626-1 applied for the GSO SRS. The interference study result demonstrates that at some part of angle of arrival, the GSO SRS pfd exceeds the LMS pfd limits to protect the LMS. This means that another pfd limit, not that of Recommendation ITU-R SA.1626-1, should be developed to protect the LMS.

3/1.13/3.4.2.2 SRS (E-s) uplinks sharing with the LMS

No studies have been performed to date.

3/1.13/3.4.2.3 SRS (s-s) inter-orbit links sharing with the LMS

SRS non-GSO-to-GSO inter-orbit link interference into the LMS

Recommendation ITU-R SA.510-3 provides limits for the pfd on the Earth's surface for SRS space-to-space links. These limits, specified in a 4 kHz reference bandwidth, can be considered as equivalent to the Recommendation ITU-R SA.1626 pfd limits given in a 1 MHz reference bandwidth for SRS downlinks and are applicable so all SRS space-to-space links regardless of direction (e.g. non-GSO to GSO or GSO to non-GSO). The study in section 3/1.13/3.4.2.1 above on the interference caused by SRS downlink can apply to the interference caused by these links, and therefore it is concluded that the interference from these links into LMS receivers is beneath the protection criteria threshold.

3/1.13/3.4.3 SRS sharing with the AMS

Sharing studies involving the AMS were performed taking into account the various types of links used by these systems in the frequency band 14.8-15.35 GHz. These include transmissions from ground stations to aircraft, from aircraft to ground stations, and between aircraft. Recommendation ITU-R M.2089-0 provides typical system characteristics for AMS ground and air systems with multiple sets of representative system characteristics provided for each. This Recommendation also provides the protection criteria for AMS systems which requires that the I/N ratio of the aggregate interference seen by the by the AMS receiver be ≤ -6 dB.

For interference analyses involving AMS systems, a number of values for the aircraft altitude were assumed. These included 5 km, 10 km, and 19.8 km.

In addition, it should be noted that the MS including AMS is not taken into account by "Protection of fixed service/mobile service stations from interference from SRS space stations" (Section 5, Annex 1) in Recommendation ITU-R SA.1626-1. Section 5, Annex 1 to this Recommendation performs the sharing study between GSO/non-GSO SRS satellites and the FS only.

3/1.13/3.4.3.1 SRS (s-E) downlinks sharing with the AMS

The technical characteristics of SRS downlinks in the frequency band 14.8-15.35 GHz are provided in Recommendation ITU-R SA.2141-0.

SRS (s-E) downlinks sharing with the AMS (ground-to-air)

A dynamic analysis was performed to assess the potential for interference from an SRS non-GSO downlink into an AMS uplink. In this analysis, an AMS aircraft was assumed to operate in the vicinity of an SRS earth station and a variety of cases were considered with respect to the AMS aircraft altitude, flight path, antenna pointing and antenna gain pattern. For each case, a statistical distribution of the power density of the interference from the SRS downlink to each of the six AMS representative systems was calculated. These maximum interference PSD levels for all of the AMS representative systems were found to be beneath the protection criteria level.

Views:

Some administrations are of the view: It should be noted that this analysis assumed the case of only a single LEO SRS satellite. Thus it does not consider the cases of SRS satellites in higher altitude orbits (HEO and L1/L2) or an aggregation of multiple SRS satellites. The higher altitude orbit or the aggregation may increase the percentage of the interfered-with time.

Some administrations are of the view: That pfd levels produced at the Earth's surface by SRS space stations in HEO (satellite apogee around 300 000 km) or at L1/L2 points (with distance to Earth over 1 000 000 km) would be negligible compared to pfd levels, produced at the Earth's surface by SRS space stations in LEO. Therefore, assessment of aggregate interference from SRS space stations in LEO, HEO and at L1/L2 points would not change conclusions for sharing studies, based on SRS space stations in LEO. This view is based on the assumption that Recommendation ITU-R SA.2141-0 is applied to the characteristics of SRS space stations.

Static worst-case analysis, assuming main-beam to main-beam event, involving links with aircraft stations, is not sufficient to conclude that the pfd limits given in Recommendation ITU-R SA.1626-1 would not ensure the protection of the AMS in the band 14.8-15.35 GHz.

A second dynamic analysis was performed for this scenario in which the AMS were modelled as transitioning back and forth between major cities within the US. A total of 75 AMS aircraft were modelled, each with its own flight path in the US (e.g. back and forth between San Diego, CA, and Dallas, TX) and the statistical distribution of interference power seen by each was determined. Approximately 1/3 of the AMS A/C flight paths were chosen to pass near to WSC, NM, where the SRS earth station was located. For these, the AMS A/C links were assumed to be operated with a ground station co-located with the WSC earth station, and the A/C antenna was pointed towards this location. For the remaining 50 aircraft, the AMS link was assigned to operate with an airport or regional air traffic control centre along the path of the flight The analysis was performed to characterize the statistical distribution of interference into the uplink to the AMS A/C operating at 5 km, 10 km, and 19.8 km altitudes. AMS system characteristics were taken from PDN Report ITU-R SA.[15 GHz SRS SHARING] and included representative systems 1, 2a, 2b, 3, 4a, 4b, and 6. The analysis produced CCDF curves for each of these scenarios. Analysis results demonstrated that the AMS protection criteria thresholds were not exceeded for any of the cases, systems, or flight paths considered.

Views:

Some administrations are of the view: It should be noted that this analysis assumed the case of only a single LEO SRS satellite. Thus it does not consider the cases of SRS satellites in higher altitude orbits (HEO and L1/L2) or an aggregation of multiple SRS satellites. The higher altitude orbit or the aggregation may increase the percentage of the interfered-with time.

A third analysis was also performed, which was static. Static analysis has been conducted for SRS downlinks sharing with the AMS (ground-to-air), which shows that the interference received at AMS receiving aircraft station can exceed the protection criteria at some part of angle of arrival, when SRS downlink transmit power is assumed to be of the same levels as the pfd limits given in Recommendation ITU-R SA.1626-1. SRS pfd limits given in Recommendation ITU-R SA.1626-1 do not sufficiently protect the AMS aircraft receiving station.

Views:

Some administrations are of the view: Based on the results of the studies and the considerations, the studies should not be considered as the worst-case studies and is not sufficient to conclude that the limits given in Recommendation ITU-R SA.1626-1 ensure the protection of the FS in the band 14.8-15.35 GHz.

SRS (s-E) downlinks sharing with the AMS (air-to-ground)

Static analysis has been conducted for SRS downlinks sharing with the AMS (air-to-ground), which shows that the interference received at the AMS receiving ground station can exceed the protection criteria at some part of angle of arrival, when SRS downlink transmit power is assumed to be of the same levels as the pfd limits given in Recommendation ITU-R SA.1626-1.

Dynamic analysis has also been conducted, which shows that exceedance events (pfd limit of non-GSO SRS satellite in Recommendation ITU-R SA.1626-1 > AMS protection criteria) consisting of three LEOs, one HEO and one L2 orbit non-GSO SRS satellites as interferer occur less than 0.3% (0°) and 0.6% (15°) of the 365-day period, excluding for AMS System 4b whose exceedance events occur approximately 13% (0°) and 19% (15°). The continuous interference duration of time study indicates that continuous interference durations of how many seconds non-GSO SRS satellites takes to pass the area (angle) where pfd limits given in Recommendation ITU-R SA.1626-1 exceeds the AMS protection criteria under the worst case are more than 50 seconds for three LEO satellites, and more than 900 seconds for L2 orbit satellite. Such duration of continuous interference from non-GSO SRS satellite are too long to be accepted.

The study assumes that the pfd level produced by SRS space stations at AMS station is the same level as the limit in Recommendation ITU-R SA.1626-1 and also that five SRS satellites operating co-frequency, simultaneously transmit continuously to SRS earth station in a single location.

Multiple SRS (s-E) downlinks sharing with the AMS

A dynamic analysis was performed to assess aggregate interference from multiple SRS downlinks, including GSO and HEO and L2 satellites, into AMS ground and aircraft stations with omnidirectional antenna. The study shows that there were a number of exceedance events, lasting 22 hours at the longest per event in AMS aircraft and ground stations and that one of these AMS stations will receive unacceptable interference at 90.4% of the time. Thus these results demonstrate that pfd masks defined in Recommendation ITU-R SA.1626-1 will not protect AMS stations with omnidirectional antennas due to the aggregate interference from multiple SRS downlinks.

3/1.13/3.4.3.2 SRS (s-E) sharing with the HTTS

Static analysis has been conducted for sharing with the HTTS, which shows that the interference received at HTTS receiving station can exceed the protection criteria of -140.77 dB(W/(m^2 · MHz)) by 14.8 dB for GSO and 16.8 dB for non-GSO downlink respectively, when the HTTS receiving antenna is pointing to the horizon and SRS downlink transmit power is assumed to be of the same levels as the pfd limits given in Recommendation ITU-R SA.1626. This means that limits given in Recommendation ITU-R SA.1626-1 will not protect HTTS at some part of angle of arrival of emission from SRS satellites.

Dynamic analysis has also been conducted, which shows that exceedance events (pfd limit of non-GSO SRS satellite in Recommendation ITU-R SA.1626-1 > HTTS protection criteria) consisting of three LEOs, one HEO and one L2 orbit non-GSO SRS satellites as interferer occur less than 0.17% (0°) and 0.74% (15°) of the 365-day period.

The continuous interference duration of time study indicates that continuous interference durations of how many seconds non-GSO SRS satellites take to pass the area (angle) where pfd limits given in Recommendation ITU-R SA.1626-1 exceed the HTTS protection criteria of -140.77 dB(W/(m^2 · MHz)) under the worst case are around 70 seconds for three LEO satellites, and 1 228 seconds for L2 orbit satellite. Such duration of continuous interference from non-GSO SRS satellite are too long to meet the protection criteria.

In addition, it should be noted that the MS is not taken into account by "Protection of fixed service/mobile service stations from interference from SRS space stations" (Section 5, Annex 1) in Recommendation ITU-R SA.1626-1. Section 5, Annex 1 to this Recommendation performs the sharing study between GSO/non-GSO SRS satellites and the FS only.

Based on the above analysis, Recommendation ITU-R SA.1626 pfd masks would not provide sufficient protection for HTTS under the worst-case scenario. In order to protect HTTS from SRS downlink and space-to-space link, limit given by the HTTS protection criteria of -141 dB(W/(m^2 · MHz)) (maximum integer below -140.77 dB(W/(m^2 · MHz))) on SRS space station is needed.

An alternative possible method of regulatory measures could be taken into account of the propagation distance between HTTS transmitting station to receiving station corresponding to elevation angle of the HTTS receiving station.

SRS (E-s) uplink sharing with HTTS link (helicopter-to-ground/ship)

The required separation distance is 96 km at least, under the characteristics of SRS transmitting earth station provided in Recommendation ITU-R SA.2141, for protection of HTTS receiving station from interference from SRS uplink. This result means that SRS earth station may cause harmful interference into HTTS receiving station located in foreign country.

Although No. **11.9** of the Radio Regulations stipulates that notification shall be made for a frequency assignment to a land station for reception from mobile stations or other assignments, receiving land stations cannot be notified as there is no Notice Form available, and then no HTTS receiving land station is registered in the Master Register. For this reason, the procedure of coordination between SRS earth stations and HTTS receiving land station under Article **9** of the Radio Regulations cannot be established. In addition, an operating administration of SRS transmitting earth station is difficult to know which administration operates HTTS and other receiving land station. Therefore, it is necessary to apply a hard limit on SRS transmitting earth stations at the border of any other country. In this regard, the pfd limit value on SRS transmitting earth stations in the frequency band 14.8-15.35 GHz should be -140.77 dB(W/(m^2 · MHz)).

HTTS link (helicopter-to-ground/ship) sharing with SRS (s-E) downlink

The required separation distance is 79 km at least, under the characteristics given by typical HTTS transmitting station for protection of SRS receiving earth station from interference from HTTS link. This result means that HTTS transmitting station may cause interference into SRS receiving earth stations located in neighbouring country.

Transmitting mobile stations cannot be notified according to No. **11.14** of the Radio Regulations, and then no HTTS transmitting station is registered in the Master Register. For this reason, procedure of coordination between HTTS transmitting stations and SRS receiving earth stations under Article **9** of the Radio Regulations cannot be established. In addition, an operating administration of SRS receiving earth station is difficult to know which administration operates HTTS and other transmitting mobile station. In order to maintain HTTS operation and not to impose operational constraints on HTTS transmitting stations, the condition that SRS receiving earth station in the frequency band 14.8-15.35 GHz shall not claim protection from any HTTS transmitting stations is necessary.

SRS (s-E) downlinks sharing with the AMS (air-to-air)

No studies have been performed to date.

3/1.13/3.4.3.3 SRS (E-s) uplinks sharing with the AMS

No studies have been performed to date.

3/1.13/3.4.3.4 SRS (s-s) inter-orbit links sharing with the AMS

An analysis was performed for this scenario in which the interference from SRS non-GSO-to-GSO inter-orbit links into AMS uplinks was assessed. For this analysis, the AMS A/C were modelled as transitioning back and forth between major cities within the US. A total of 75 AMS aircraft were modelled, each with its own flight path, and the statistical distribution of interference power seen by each was determined. The AMS A/C links were assumed to be operated with a ground station located at an airport or air traffic control centre along the route. The SRS non-GSO was assumed to be in an 800 km altitude orbit at 44° inclination. The analysis was performed to characterize the statistical distribution of interference into the uplink to the AMS A/C operating at 5 km, 10 km, and 19.8 km altitudes. AMS system characteristics were taken from PDN Report ITU-R SA.[15 GHz SRS SHARING] and included representative systems 1, 2a, 2b, 3, 4a, 4b and 6. The analysis produced CCDF curves for each of these scenarios. Analysis results demonstrated that the AMS protection criteria thresholds were not exceeded for any of the cases, systems, or flight paths considered.

Views:

Some administrations are of the view: It should be noted that this analysis assumed the case of only a single LEO SRS satellite. Thus it does not consider the cases of SRS satellites in higher altitude orbits (HEO and L1/L2) or an aggregation of multiple SRS satellites. The higher altitude orbit or the aggregation may increase the percentage of the interfered-with time.

Based on the results of the study and the considerations, the above study should not be considered as the worst-case studies and is not sufficient to conclude that the limits given in Recommendation ITU-R SA.510-3 ensure the protection of the FS in the band 14.8-15.35 GHz.

Some administrations are of the view: That based on Recommendation ITU-R SA.2141-0 only low-Earth orbiting user satellites would be used for inter-orbit links of DRS networks. Pfd levels, produced at the Earth's surface by SRS space stations, operating in the downlink direction, in HEO (satellite apogee around 300 000 km) or at L1/L2 points (with distance to Earth over 1 000 000 km) would be negligible, compared to space stations in LEO, operating inter-orbit links.

3/1.13/3.4.3.5 AMS impact on SRS (E-s) space station receiver

The SRS space station interference threshold is exceeded for the case in which the AMS station equipped with an omnidirectional antenna with the narrowest bandwidth for AMS emission and when the AMS is within the 5° cone of the SRS space station cone.

It was also assessed that the capability of coexistence with a directive antenna for the AMS station would depend on the probability to have main-main beam configuration between the SRS space station and AMS station. Dynamic studies were also performed to determine if an AMS aircraft could interfere with an SRS space station and it was determined that for one AMS system the exceedance of protection criterium was of 2.62% of time while the maximum exceedance needed to be of maximum 0.1% as stipulated in Recommendation ITU-R SA.609. This indicates that for one case the SRS space station will be perturbed by AMS aircraft.

3/1.13/3.4.3.6 AMS impact on SRS (s-E) earth station receiver

The SRS earth station interference threshold is exceeded for all AMS emission bandwidth with an omnidirectional antenna for a significant angle leading to a large separation horizontal distance.

The results are even worse with SRS earth station with a low elevation angle.

Considering these results, dynamic studies were also performed as it was determined that, for at least one AMS aircraft system, the exceedance of protection criterium was exceeded by 26.7% of time while the maximum exceedance needs to be of 0.001% of the time for manned missions, and 0.1% of the time for all other near-Earth space research missions as stipulated in Recommendation ITU-R SA.609. This indicates that the limits indicated on Recommendation ITU-R SA.609 would not be sufficient to protect the SRS earth stations from AMS aircraft.

3/1.13/3.4.3.7 Aeronautical ground stations impact on SRS (E-s) space station receiver

Dynamic studies were performed on determining the impact of AMS ground stations on SRS downlink. From the studies it was concluded that for at least one type of AMS ground station the exceedance of the protection criterium was of 26.14% of time while the maximum exceedance needed to be of maximum 0.1% as stipulated in Recommendation ITU-R SA.609. This indicates that, for at least one case, AMS ground stations can interfere with SRS space stations.

3/1.13/3.4.4 Analysis of the result of sharing studies

3/1.13/3.4.4.1 Analysis of the pfd masks in Recommendation ITU-R SA.1626-1

Several studies, static and dynamic, were performed as described above in section 3/1.13/3.4 to determine worst-case pfd levels corresponding to the interference criteria:

– some of these studies found that the Recommendation ITU-R SA.1626-1 pfd levels are sufficient to protect existing primary services;

– other studies found that these pfd levels are not sufficient to protect existing primary services. These studies demonstrate that, in order for the SRS in this band to be upgraded from the secondary allocation into primary status, more stringent pfd masks than those in Recommendation ITU-R SA.1626-1 need to be developed to ensure protection of the existing services.

3/1.13/3.4.4.2 Analysis of regulatory aspects

The studies also addressed regulatory situations, specifically as to the applicability of coordination procedures for transborder interference between stations in the LMS/AMS and SRS earth stations. Based on the above-mentioned studies, the following aspects should be taken into account when making a decision on WRC-23 agenda item 1.13.

1) There is no specific notification and registration procedure for frequency assignments of LMS mobile and AMS aircraft stations in this frequency band pursuant to RR No. **11.14**. Such a situation does not provide the possibility for such mobile and aircraft stations to be recognized and identified as a frequency assignment with which coordination is required under RR No. **9.27**, and for receiving LMS/AMS stations to claim protection against subsequent assignments from another country, or for transmitting LMS/AMS stations to counter requests from another country which seek protection of its subsequent assignments.

2) There is no specific notice form available for frequency assignments of receiving land/aeronautical stations in the LMS/AMS for notification and registration, although RR No. **11.9** stipulates that notification shall be made for a frequency assignment to a land station for reception from mobile stations. Such situation does not provide the

possibility for such receiving land/aeronautical stations to be recognized and identified as a frequency assignment with which coordination is required under RR No. **9.27** and to claim protection against subsequent assignments from another country.

Considering these studies, other measures than coordination procedure under RR Article **9** need to be applied to protect the existing primary services and not impose adverse effects on them.

Views:

Some administrations are of the view: That compatibility between SRS earth stations and LMS or AMS ground stations is covered by application of RR Nos. ***9.17*** *and* ***9.18*** *and could be ensured by bilateral agreements on cross-border coordination between administrations. Compatibility between SRS earth stations and AMS aircraft stations through bilateral coordination between administrations in case the distance between SRS earth stations and AMS aircraft station, located within national airspace, is less than predetermined coordination distance of 500 km. The use of the band 148-153.50 MHz by AMS aircraft stations within international airspace is not subject to international recognition and interference protection.*

Some administrations are of the view: that stations in some classes of station in LMS and AMS do not have notification and registration procedure as explained in this section, and such stations are not covered by application of RR Nos. ***9.17*** *and* ***9.18****. Therefore those stations are not protected under such coordination procedure.*

Some administrations are of the view: that the 500 km of predetermined coordination distance is defined today in Table 10 of Appendix ***7****. However, it has to be noted that, during the cycle of WRC-19, the predetermined distance between the SRS station and aeronautical mobile in the band 2 200-2 290 MHz was changed from 500 to 880 km (see Table 10), changing dramatically the coordination procedure and imposing important constraints to AMS.*

3/1.13/3.5 SRS compatibility with primary services in the adjacent frequency bands

3/1.13/3.5.1 SRS compatibility with the RAS in the adjacent frequency band 15.35-15.4 GHz

The RAS is allocated on a primary basis globally in the frequency band 15.35-15.4 GHz. This frequency band is a passive band, identified in RR No. **5.340**. Table 1 and Table 2 of Recommendation ITU-R RA.769 provide guidance on the harmful level of interference to the RAS stations from systems of other services. Furthermore, Recommendation ITU-R RA.1513 provides guidance on the acceptable percentage of interference to RAS stations. In the case of RAS stations operating in the passive only band in the frequency band 15.35-15.4 GHz, the spectral pfd is −233 dB(W/(m^2 · Hz)) to be exceeded no more than 2% of the time.

Compatibility of SRS and RAS operations was not established by studies.

3/1.13/3.5.1.1 SRS (s-E) downlinks compatibility with the RAS in the adjacent frequency band 15.35-15.4 GHz

In one study, the characteristics of RAS systems in the frequency range 15.35-15.4 GHz are given in Table 3.3.1 of PDN Report ITU-R SA.[15 GHz SRS SHARING]. The SRS service that was simulated was for a random set of satellites that exceeds the envisioned amount of satellites that would be operating at a given time. Simulations were conducted using a worst case of unfiltered QPSK signal so the resulting interference would be lower in practice because the SRS downlinks use filtering techniques to reduce OoB emissions. The simulations were conducted using the epfd methodologies described in Recommendation ITU-R S.1586-1 and compared against the prescribed protection criteria in Recommendation ITU-R RA.769-2. The protection criteria states that the level

−202 dBW should not be exceeded for more than 2% of the time for a 98% data availability. The simulation showed that for all cells the −202 dBW level was exceeded for less than 2% of the time for Green Bank and Jansky VLA. The low number of RAS stations and envisioned low number of SRS ground stations show compatibility should be feasible if administrations take into consideration the placement of SRS earth stations.

Other studies for compatibility with RAS in the adjacent frequency band 15.35-15.4 GHz were conducted with GSO stations and non-GSO systems of the SRS in the space-to-Earth direction. For the GSO case, with an interference threshold as per Recommendation ITU-R RA.769 (with additional 15 dB protection for GSO) and the available characteristics for SRS systems, an OoB suppression level of 54.3 dB in the 15.35-15.4 GHz is needed. For the non-GSO case it was not possible to conduct an epfd simulation owing to the lack of non-GSO system characteristics, therefore a simplified study was conducted assuming one non-GSO station would be visible at all times at a radio astronomy site. The study resulted in a necessary OoB suppression of 58.3 dB in the frequency band 15.35-15.4 GHz.

The results of these studies show that compatibility between SRS in 14.8-15.35 GHz and the RAS in 15.35-15.4 GHz may be possible with sufficient OoB suppression levels. Protection of the RAS, as a primary adjacent service, must be ensured if the SRS is elevated to primary status.

A sensitivity analysis was conducted showing a range of necessary OoB suppression to achieve compatibility as a function of orbital parameters of non-GSO stations and separation of RAS and SRS earth stations.

Two studies indicated that 54 and 58 dB OoB attenuations were required for GSO and non-GSO downlink operation of one satellite, respectively, based on generic parameters. Another study for the non-GSO case examined three pointing scenarios for radio astronomy operations at one site and concluded that use of unfiltered QPSK transmission with approximately 18 dB OoB attenuation met the radio astronomy protection threshold 2% of the time.

3/1.13/3.5.1.2 SRS (E-s) uplinks compatibility with the RAS in the adjacent frequency band 15.35-15.4 GHz

Compatibility between uplinks of SRS terrestrial stations in 14.8-15.35 GHz and radio astronomy stations operating in 15.35-15.4 GHz were not conducted owing to the lack of information about OoB emissions of terrestrial stations, but this scenario could be managed at national level through site specific studies considering the protection criteria for the RAS in Recommendation ITU-R RA.769.

3/1.13/3.5.1.3 SRS (s-s) inter-orbit links compatibility with the RAS in the adjacent frequency band 15.35-15.4 GHz

No studies have been conducted owing to the lack of technical parameters for SRS inter-orbit links.

3/1.13/3.5.2 Compatibility with the FS in the adjacent frequency band 14.3-14.8 GHz

The FS is allocated on a primary basis globally in frequency bands in the frequency range 14.4-14.8 GHz. It is also allocated on a primary basis in Regions 1 and 3 in the frequency band 14.3-14.4 GHz. Table 5 of Recommendation ITU-R F.758-7 provides guidance on the permissible long-term I/N ratios for interference to fixed wireless systems from systems of other services operating in adjacent frequency bands. In the case of interference from SRS links in the frequency band 14.8-15.35 GHz to fixed systems operating in this frequency range, the I/N value given in this table is −20 dB, to be exceeded no more than 20% of the time.

Since this limit differs from the −10 dB I/N value applicable to the FS for in-band interference cases (see section 3/1.13/3.4.1), separate analyses of OoB interference from the SRS into fixed systems in this frequency band were performed.

3/1.13/3.5.2.1 SRS (s-E) downlinks compatibility with FS in the adjacent frequency band 14.3-14.8 GHz

A dynamic analysis was performed to assess the statistical distribution of interference from a non-GSO SRS downlink into fixed stations operating in an adjacent frequency band. As in the analysis of SRS non-GSO downlink in-band interference into fixed stations, the characteristics of the SRS non-GSO were primarily drawn from Recommendation ITU-R SA.2141-1.

The SRS non-GSO was assumed to transmit at a centre frequency of 15.0 GHz such that the lower edge of its necessary bandwidth would lie exactly at the 14.8 GHz band edge. The simulation assessed the statistical distribution of interference into fixed stations located in the vicinity of the SRS earth stations. Fixed stations were assumed to be located at distances from the SRS earth station of 50 km, 200 km, or 450 km. Several azimuth angles from the SRS earth station to the fixed station were analysed. These ranged from 0° to 315° in increments of 45°.

The fixed station characteristics were taken from Recommendation ITU-R F.758-7. Table 9 of this Recommendation provides a range of possible values for the bandwidth of fixed stations in the frequency range 14.4-15.35 GHz. To simulate the worst case, the lowest value of 2.5 MHz was considered. A fixed station centre frequency of 14.79875 GHz was assumed such that the fixed station receive frequency band would lie immediately adjacent to the SRS transmit frequency band. As for the studies of SRS interference into fixed stations in-band, several values of FS antenna gain were considered. These included 31.9 dBi, 35 dBi, and 49 dBi.

The level of OoB attenuation of the SRS signal was determined based on the SRS signal characteristics provided in Recommendation ITU-R SA.2141-0. Table 1 of this Recommendation indicates that SRS downlinks use QPSK or 8-PSK modulation. In the case of unfiltered QPSK modulation, the peak of the first sidelobe of the SRS downlink signal which is in-band with the FS transmission is approximately 13.5 dB down from the SRS main lobe peak and the associated interference PSD level should not exceed the OoB FS protection criteria.

3/1.13/3.5.2.2 SRS (E-s) uplinks compatibility with FS in the adjacent frequency band 14.3-14.8 GHz

No studies have been performed to date.

3/1.13/3.5.2.3 SRS (s-s) inter-orbit links compatibility with FS in the adjacent frequency band 14.3-14.8 GHz

An analysis similar to that described in section 3.4.2.1 was performed to assess the statistical distribution of interference from SRS inter-orbit links to fixed stations operating in the adjacent band. Two scenarios were considered for the geometry of the SRS links. In the first, a non-GSO SRS satellite transmits to a GSO spacecraft. This is representative of inter-orbit return links of existing data relay satellite networks currently operating in this band. In the second scenario, the direction of transmission is reversed, from the GSO relay satellite to the non-GSO SRS. Existing data relay satellite networks operate these inter-orbit forward links in bands between 13.4 GHz and 13.8 GHz and the characteristics of these links are provided in Recommendation ITU-R SA.1414. For the analysis of the forward inter-orbit link, the characteristics of these systems are adapted for the different frequency band.

For both directions of transmission, a dynamic analysis was performed to assess the statistics of the interference from the inter-satellite links to fixed stations. For these analyses, the fixed stations were modelled exactly as was described in section 3/1.13/3.4.1.1.

3/1.13/4 Methods to satisfy the agenda item

The following methods are considered under this agenda item and may be applied to the frequency band 14.8-15.35 GHz.

Several studies were performed to determine pfd levels corresponding to the interference criteria, and the results of those studies have diverging results, which are reflected by the various methods to resolve the agenda item.

Some of studies carried out by ITU-R show that the pfd limits described in Recommendations ITU-R SA.1626-1 (for space-to-Earth) and ITU-R SA.510-3 (for space-to-space) do not provide sufficient protection of the incumbent terrestrial services.

All studies were performed considering the characteristics of near-Earth missions, whereas some methods below propose to upgrade SRS (all subsets), some subsets, or a subset of SRS.

All the methods support the suppression of Resolution **661 (WRC-19)**.

3/1.13/4.1 Method A: No change

This method corresponds to "no change" to the Radio Regulations except the suppression of Resolution **661 (WRC-19)**.

Reasons: If the proposed methods do not prevent harmful interference to the incumbent services and do not protect systems of primary services in the frequency band 14.8-15.35 GHz, then it would be appropriate to have no change to the Radio Regulations.

3/1.13/4.2 Method B

Method B: This method proposes to make regulatory changes to RR to upgrade the secondary allocation to the space research service (space-to-space) in the frequency band 14.8-15.35 GHz to primary status. This includes two alternatives to modify the RR Article **5** Table of Frequency Allocations in the frequency band 14.8-15.35 GHz to upgrade the secondary SRS (space-to-space) allocation to primary and retain the secondary allocation to SRS (space-to-Earth) and (Earth-to-space). The method also seeks to modify Table **21-4** in RR Article **21** to add a row to specify pfd limits for SRS (space-to-space) in the frequency band based on Recommendation ITU-R SA.510-3.

3/1.13/4.3 Method C

Method C includes a modification to the RR Article **5** Table of Frequency Allocations in the frequency band 14.8-15.35 GHz to upgrade the secondary SRS allocation, except SRS active and SRS passive applications, to primary and also modify RR Table **21-4** in RR Article **21** to add rows to specify pfd limits for SRS (space-to-Earth) and (space-to-space) in the frequency band 14.8-15.35 GHz based on Recommendations ITU-R SA.1626-1 and ITU-R SA.510-3. Table A of Annex 2 to RR Appendix **4** is modified to add commitment to follow regulatory provisions to protect the RAS. Additionally, Tables 7b and 8c of Annex 7 to RR Appendix **7** are modified to add parameters for determination of coordination distances around SRS earth stations. Elements for a new WRC Resolution are proposed to upgrade the status of the existing assignments recorded in the MIFR with the original date of receipt, subject to conformity with the new conditions of the allocation of the frequency band 14.8-15.35 GHz to the space research service.

3/1.13/4.4 Method D: Upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS with provisions to avoid imposing constraints on existing systems of primary services in the frequency band 14.8-15.35 GHz

Although this method is proposing the upgrading of the SRS, the current studies of the impact of AMS on SRS earth stations led to a large horizontal separation distance to avoid exceeding the SRS threshold which would impose constraints on the AMS systems. Furthermore, the current studies also show that harmful interference could be caused to stations of the HTTS and RAS using the frequency band 15.35-15.40 GHz by stations of the SRS.

This method also includes modifications to Table **21-4** in RR Article **21** to add a row to specify pfd limits for the SRS (space-to-Earth) and (space-to-space) in order to protect the existing systems of primary services in the frequency band 14.8-15.35 GHz.

It is also proposed to have a pfd limit in order to protect the AMS, HTTS and RAS operated in neighbouring countries.

The method limits the usage of the SRS for near-Earth missions avoiding the upgrade of all other subsets of the SRS (SRS (passive), SRS (active) and SRS (deep space)) missions in that frequency band because the impact of those missions was not studied.

3/1.13/4.5 Method E: Upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS with provisions to both protect and avoid imposing constraints on existing and future systems of primary services in the frequency band 14.8-15.35 GHz and to ensure the protection of all primary services in the same frequency band and the radio astronomy service in the adjacent frequency band 15.35-15.4 GHz

This method allows upgrading of the SRS and provides provisions to both protect and avoid constraints on primary services for the FS and MS in the frequency band 14.8-15.35 GHz, as well as RAS in the adjacent frequency band 15.35-15.4 GHz. There are three sub-methods, as follows:

Method E1: While this method allows the upgrading of the SRS it shall be ensured with provisions to avoid imposing constraints on existing and future systems of primary services in the frequency band 14.8-15.35 GHz and to ensure the protection of all primary services in the frequency band as well as the RAS in the adjacent frequency band 15.35-15.4 GHz and footnote to avoid the usage of passive and active sensors and deep space missions with primary status in that frequency band because the impact of those missions was not studied. Finally, Resolution **661 (Rev.WRC-19)** would be consequentially suppressed.

Method E2: Although this method is proposing the upgrading of the SRS, the current studies of the impact of AMS on SRS earth stations led to a large horizontal separation distance to avoid exceeding the SRS threshold which would impose constraints on the AMS systems. Furthermore, the current studies also show that harmful interference could be caused to stations of the HTTS and RAS using the frequency band 15.35-15.40 GHz by stations of the SRS.

This method also includes modifications to Table **21-4** in RR Article **21** to add a row to specify pfd limits for the SRS (space-to-Earth) and (space-to-space) in order to protect the existing systems of primary services in the frequency band 14.8-15.35 GHz.

It is also proposed to have a pfd limit in order to protect the AMS, HTTS and RAS operated in neighbouring countries.

The method limits the usage of the SRS for near-Earth missions avoiding the upgrade of all other subsets of the SRS (SRS (passive), SRS (active) and SRS (deep space)) missions in that frequency band because the impact of those missions was not studied.

This method adds a footnote to state that the SRS shall not claim protection from existing FS/MS stations.

Method E3: This method proposes to make regulatory changes to the RR to upgrade the secondary allocation to the SRS in the frequency band 14.8-15.35 GHz into primary status and to protect the existing primary FS and MS in the same frequency band and services in the adjacent frequency band. The regulatory provisions contained in this Method E3 are considered based on the study of protection criteria derived by *I/N* concept with respect to systems in the FS and MS including AMS allocated in the frequency band 14.8-15.35 GHz. The method also avoids the usage of passive and active sensors and deep space missions with primary status in that frequency band because the impact of that mission was not studied. This method also proposes a footnote to state that the space research service shall not cause harmful interference to the RAS.

3/1.13/5 Regulatory and procedural considerations

3/1.13/5.1 For Method A

NOC

ARTICLES

NOC

APPENDICES

SUP

RESOLUTION 661 **(**WRC-19**)**

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

Reasons: This Resolution is no longer necessary.

3/1.13/5.2 For Method B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

For Method B, Alternative 1:

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH (space-to-space) Space research (Earth-to-space) (space-to-Earth) 5.339	

For Method B, Alternative 2:

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH (space-to-space) ADD 5.A113 Space research (Earth-to-space) (space-to-Earth) 5.339	

ADD

5.A113 Stations in space research service (space-to-space) operating on a primary basis in the frequency band 14.8-15.35 GHz shall not claim protection from stations in the fixed and mobile services. No. **5.43A** does not apply. (WRC-23)

For Method B:

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD

TABLE 21-4 (*continued*) (Rev.WRC-~~19~~23)

<table>
<tr><th rowspan="2">Frequency band</th><th rowspan="2">Service*</th><th colspan="4">Limit in dB(W/m²) for angles of arrival (δ) above the horizontal plane</th><th rowspan="2">Reference bandwidth</th></tr>
<tr><th>0°-5°</th><th colspan="2">5°-25°</th><th>25°-90°</th></tr>
<tr><td>…</td><td>…</td><td>…</td><td colspan="2">…</td><td>…</td><td>…</td></tr>
<tr><td>11.7-12.5 GHz (Region 1)
12.5-12.75 GHz (Region 1 countries listed in Nos. 5.494 and 5.496)
11.7-12.7 GHz (Region 2)
11.7-12.75 GHz (Region 3)</td><td>Fixed-satellite (space-to-Earth) (non-geostationary-satellite orbit) [25]</td><td>-124</td><td colspan="2">$-124 + 0.5(\delta - 5)$</td><td>-114</td><td>1 MHz</td></tr>
<tr><td>12.2-12.75 GHz [7] (Region 3)
12.5-12.75 GHz [7] (Region 1 countries listed in Nos. 5.494 and 5.496)</td><td>Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)</td><td>-148</td><td colspan="2">$-148 + 0.5(\delta - 5)$</td><td>-138</td><td>4 kHz</td></tr>
<tr><td rowspan="2">13.4-13.65 GHz (Region 1)</td><td rowspan="2">Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)</td><td>0°-25°</td><td>25°-80°</td><td>80°-84°</td><td>84°-90°</td><td rowspan="2">4 kHz</td></tr>
<tr><td>$-159 + 0.4\delta$ [19]</td><td>-149 [19]</td><td>$-149 - 0.5(\delta - 80)$ [19]</td><td>-151 [19]</td></tr>
<tr><td rowspan="2">14.8-15.35 GHz</td><td rowspan="2">Space research (space-to-space)</td><td>0°-5°</td><td colspan="2">5°-25°</td><td>25°-90°</td><td rowspan="2">1 MHz</td></tr>
<tr><td>-124</td><td colspan="2">$-124 + 0.5(\delta - 5)$</td><td>-114</td></tr>
<tr><td rowspan="2">17.7-19.3 GHz [7, 8]</td><td rowspan="2">Fixed-satellite (space-to-Earth) Meteorological-satellite (space-to-Earth)</td><td>0°-5°</td><td colspan="2">5°-25°</td><td>25°-90°</td><td rowspan="2">1 MHz</td></tr>
<tr><td>-115 [14, 15]
or
$-115 - X$ [13]</td><td colspan="2">$-115 + 0.5(\delta - 5)$ [14, 15]
or
$-115 - X + ((10 + X)/20)(\delta - 5)$ [13]</td><td>-105 [14, 15]
or
-105 [13]</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
</table>

SUP

RESOLUTION 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

3/1.13/5.3 For Method C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH ADD 5.B113 ADD 5.C113 5.339	

ADD

5.B113 The allocation of the frequency band 14.8-15.35 GHz to the space research service on a primary basis is limited to satellite systems operating in the space-to-space, space-to-Earth and Earth-to-space directions. Other uses of the frequency band by the space research service are on a secondary basis. The use of the frequency band 14.8-15.35 GHz by the space research service satellite networks or systems with frequency assignments recorded prior to 15 December 2023 is subject to the provisions of Resolution **[A113] (WRC-23)**. (WRC-23)

ADD

5.C113 Stations of the space research service, operating in the band 14.8-15.35 GHz in the space-to-Earth and space-to-space directions shall not cause harmful interference to stations of RAS using the frequency band 15.35-15.40 GHz. The equivalent power flux-density produced in the frequency band 15.35-15.40 GHz by all space stations of a non-GSO satellite system in the space research service (space-to-Earth, space-to-space) operating in the frequency band 14.8-15.35 GHz shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2. The power flux-density produced in the frequency band 15.35-15.40 GHz by a space station of a GSO satellite network in the space research service (space-to-Earth, space-to-space) operating in the frequency band 14.8-15.35 GHz shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2. (WRC-23)

ADD

DRAFT NEW RESOLUTION [A113] (WRC-23)

Upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

[…]

instructs the Director of the Radiocommunication Bureau

in reviewing the findings under No. **11.50** of the frequency assignments of space research service satellite networks or systems in the frequency band 14.8-15.35 GHz, recorded in the MIFR prior to 15 December 2023, the status of the assignments should be upgraded without submission of a new filing by the notifying administration, the original date of receipt of the recorded assignment should be kept, subject to conformity with the new conditions of the allocation of the frequency band 14.8-15.35 GHz to the space research service examined by the Bureau. The Bureau shall ask the notifying administration whether the characteristics of the assignment will comply with the new conditions for the compatibility with the radio astronomy service in the band 15.35-15.4 GHz. If the notifying administration does not respond to the Bureau's inquiry or if the conditions of the allocation of the frequency band 14.8-15.35 GHz to the space research service are not met, the Bureau shall propose the deletion of the assignment from the MIFR to the notifying administration. If the administration requests to retain the assignment with its characteristics unchanged and states that it will be operated in accordance with No. **4.4**, the assignment shall be kept in the MIFR for information purposes under the conditions of No. **8.5**.

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD

TABLE **21-4** (*continued*) (Rev.WRC-~~19~~23)

Frequency band	**Service***	**Limit in dB(W/m²) for angles of arrival (δ) above the horizontal plane**			**Reference bandwidth**
		0°-5°	**5°-25°**	**25°-90°**	
…	…	…	…	…	…
14.8-15.35 GHz	Space research (space-to-space)	**[0°-5°**	**[5°-25°**	**[25°-90°**	[1 MHz]
		−124]	−124 + 0.5(δ − 5)]	−114]	
	Space research (space-to-Earth) (geostationary-satellite orbit)	**[0°-5°**	**[5°-25°**	**[25°-90°**	[1 MHz]
		−126]	−126 + 0.5(δ − 5)]	−116]	
		[0°-5°	**[5°-25°**	**[25°-90°**	[1 MHz]

	Space research (space-to-Earth) (non-geostationary-satellite orbit)	−124]	−124 + 0.5(δ − 5)]		−114]	
…	…	…	…	…	…	…

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

Footnotes to Tables A, B, C and D

[2] The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Items in Appendix	*A – GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
...	...	...	...	...	...	...	...	...	...	...	...	...
A.17.f.1	commitment to follow the equivalent power flux-density (epfd) produced at the site of a radio astronomy station in the frequency band 15.35-15.4 GHz, as defined in No. **5.B113** Required only for non-geostationary-satellite systems operating in the space research service (space-to-Earth, space-to-space) in the frequency band 14.8-15.35 GHz					+					A.17.f.1	
A.17.f.2	commitment to follow the power flux-density (pfd) produced at the site of a radio astronomy station in the frequency band 15.35-15.4 GHz, as defined in No. **5.B113** Required only for geostationary-satellite systems operating in the space research service (space-to-Earth, space-to-space) in the frequency band 14.8-15.35 GHz				+						A.17.f.2	
...	...	...	...	...	...	...	...	...	...	...	...	...

APPENDIX 7 (REV.WRC-19)

Methods for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105 GHz

ANNEX 7

System parameters and predetermined coordination distances for determination of the coordination area around an earth station

3 Horizon antenna gain for a receiving earth station with respect to a transmitting earth station

MOD

TABLE 7b (Rev.WRC-~~15~~23)

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		**Fixed-satellite, mobile-satellite**	**Aero-nautical mobile-satellite (R) service**	**Aero-nautical mobile-satellite (R) service**	**Fixed-satellite**	**Fixed-satellite**	**Fixed-satellite**	**Fixed-satellite**		**Earth exploration-satellite, space operation, space research**		**Fixed-satellite, mobile-satellite, meteorological-satellite**		**Fixed-satellite**		**Fixed-satellite**		**Fixed-satellite**	**Space research**		**Fixed-satellite** [3]	**Fixed-satellite**	**Fixed-satellite** [3]
Frequency bands (GHz)		2.655-2.690	5.030-5.091	5.030-5.091	5.091-5.150	5.091-5.150	5.725-5.850	5.725-7.075		7.100-7.250		7.900-8.400		10.7-11.7		12.5-14.8		13.75-14.3	14.8-15.35		15.43-15.65	17.7-18.4	19.3-19.7
Receiving terrestrial service designations		Fixed, mobile	Aeronautical radio-navigation	Aeronautical mobile (R)	Aeronautical radio-navigation	Aeronautical mobile (R)	Radiolocation	Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Radiolocation radionavigation (land only)	Fixed, mobile		Aeronautical radionavigation	Fixed, mobile	Fixed, mobile
Method to be used		§ 2.1	§ 2.1, § 2.2	§ 2.1, § 2.2			§ 2.1	§ 2.1		§ 2.1, § 2.2		§ 2.1		§ 2.1		§ 2.1, § 2.2		§ 2.1	§ 2.1, § 2.2			§ 2.1, § 2.2	§ 2.2
Modulation at terrestrial station [1]		A						A	N	A	N	A	N	A	N	A	N	−	A	N		N	N
Terrestrial station interference parameters and criteria	p_0 (%)	0.01						0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.01	0.005		0.005	0.005
	n	2						2	2	2	2	2	2	2	2	2	2	1	2	2		2	2
	p (%)	0.005						0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025	0.01	0.005	0.0025		0.0025	0.0025
	N_L (dB)	0						0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
	M_s (dB)	26 [2]						33	37	33	37	33	37	33	40	33	40	1	33	40		25	25
	W (dB)	0						0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
Terrestrial station parameters	G_x (dBi) [4]	49 [2]	6	10	6	6		46	46	46	46	46	46	50	50	52	52	36	52	52		48	48
	T_e (K)	500 [2]						750	750	750	750	750	750	1 500	1 100	1 500	1 100	2 636	1 500	1 100		1 100	1 100
Reference bandwidth	B (Hz)	4×10^3	150×10^3	37.5×10^3	150×10^3	10^6		4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	10^7	4×10^3	10^6		10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−140	−160	−157	−160	−143		−131	−103	−131	−103	−131	−103	−128	−98	−128	−98	−131	−128	−98		−113	−113

1 A: analogue modulation; N: digital modulation.

2 The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 5 725-7 075 MHz may also be used to determine a supplementary contour with the exception that G_x = 37 dBi.

3 Feeder links of non-geostationary satellite systems in the mobile-satellite service.

4 Feeder losses are not included.

5 Actual frequency bands are 7 190-7 250 MHz for the Earth exploration-satellite service, 7 100-7 155 MHz and 7 190-7 235 MHz for the space operation service and 7 145-7 235 MHz for the space research service.

...

MOD

TABLE 8c (Rev.WRC-23~~15~~)

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Fixed-satellite		Fixed-satellite, radio-determination satellite	Fixed-satellite	Fixed-satellite		Meteorological-satellite[7, 8]	Meteorological-satellite[9]	Earth exploration-satellite[7]	Earth exploration-satellite[9]	Space research[10]		Fixed-satellite		Broadcasting-satellite		Space research	Broadcasting-satellite	Fixed-satellite[7]
													Deep space								
Frequency bands (GHz)			4.500-4.800		5.150-5.216	6.700-7.075	7.250-7.750		7.450-7.550	7.750-7.900	8.025-8.400	8.025-8.400	8.400-8.450	8.450-8.500	10.7-12.75 13.4-13.65[7]		12.5-12.75[12]		14.8-15.35	17.7-17.8	17.7-18.8 19.3-19.7
Transmitting terrestrial service designations			Fixed, mobile		Aeronautical radionavigation	Fixed, mobile	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile	Fixed	Fixed, mobile
Method to be used			§ 2.1		§ 2.1	§ 2.2	§ 2.1		§ 2.1, § 2.2	§ 2.2	§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2		§ 1.4.5		§ 2.2	§ 1.4.5	§ 2.1
Modulation at earth station[1]			A	N		N	A	N	N	N	N	N	N	N	A	N	A	N	N		N
Earth station interference parameters and criteria	p_0 (%)		0.03	0.005		0.005	0.03	0.005	0.002	0.001	0.083	0.011	0.001	0.1	0.03	0.003	0.03	0.003	0.1		0.003
	n		3	3		3	3	3	2	2	2	2	1	2	2	2	1	1	2		2
	p (%)		0.01	0.0017		0.0017	0.01	0.0017	0.001	0.0005	0.0415	0.0055	0.001	0.05	0.015	0.0015	0.03	0.003	0.05		0.0015
	N_L (dB)		1	1		1	1	1	–	–	1	0	0	0	1	1	1	1	[TBD]		1
	M_s (dB)		7	2		2	7	2	–	–	2	4.7	0.5	1	7	4	7	4	[TBD]		6
	W (dB)		4	0		0	4	0	–	–	0	0	0	0	4	0	4	0	[TBD]		0
Terrestrial station parameters	E (dBW) in B[2]	A	92[3]	92[3]		55	55	55	55	55	55	55	25[5]	25[5]	40	40	55	55	[TBD]		35
		N	42[4]	42[4]		42	42	42	42	42	42	42	−18	−18	43	43	42	42	[TBD]	40	40
	P_t (dBW) in B	A	40[3]	40[3]		13	13	13	13	13	13	13	−17[5]	−17[5]	−5	−5	10	10	[TBD]		−10
		N	0	0		0	0	0	0	0	0	0	−60	−60	−2	−2	−3	−3	[TBD]	−7	−5
	G_x (dBi)		52[3, 4]	52[3, 4]		42	42	42	42	42	42	42	42	42	45	45	45	45	[TBD]	47	45
Reference bandwidth[6]	B (Hz)		10^6	10^6		10^6	10^6	10^6	10^7	10^7	10^6	10^6	1	1	10^6	10^6	27×10^6	27×10^6	1		10^6
Permissible interference power	$P_r(p)$ (dBW) in B					−151.2			−125	−125	−154[11]	−142	−220	−216			−131	−131	−216		

...

SUP

RESOLUTION 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

3/1.13/5.4 For Method D: Upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS with provisions to avoid imposing constraints on existing systems of primary services in the frequency band 14.8-15.35 GHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH ADD 5.D113 ADD 5.E113 ADD 5.F113 ADD 5.G113 ADD 5.H113 5.339	

ADD

5.D113 In the frequency band 14.8-15.35 GHz, the stations operated in the space research service shall not claim protection from aircraft stations operated in the mobile service. Nos. **5.43A** and **9.18** do not apply. (WRC-23)

ADD

5.E113 The power flux-density produced by an earth station in the space research service shall not exceed −145.6 dB(W/(m^2 · 1 MHz)), at the border of the territory of a neighbouring administration, to protect operating stations in the aeronautical mobile service in the frequency band 14.8-15.35 GHz. No. **9.17** does not apply. (WRC-23)

ADD

5.F113 Harmful interference shall not be caused to stations of the radio astronomy service using the frequency band 15.35-15.40 GHz by stations of the space research service (No. **29.13** applies). The equivalent power flux-density produced in the frequency band 15.35-15.40 GHz by all space stations of a non-GSO satellite system in the space research service (space-to-Earth) (space-to-space) operating in the frequency band 14.8-15.35 GHz shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2, using the methodology given in Recommendation ITU-R M.1583-1, and the radio astronomy antenna pattern described in Recommendation ITU-R RA.1631-0.

The power flux-density produced in the frequency band 15.35-15.40 GHz by a space station of a GSO satellite network in the space research service (space-to-Earth) (space-to-space) operating in the frequency band 14.8-15.35 GHz shall be in compliance with the protection criteria provided in Recommendation ITU-R RA.769-2. (WRC-23)

ADD

5.G113 In order to protect the radio astronomy service in the frequency band 15.35-15.4 GHz, a space research station operating in the Earth-to-space direction in the frequency band 14.8-15.35 GHz shall not exceed the power flux-density level of −156 dB(W/m^2) in a 50 MHz bandwidth in the frequency band 15.35-15.4 GHz, at any radio astronomy station observing in the frequency band 15.35-15.4 GHz for more than 2 per cent of the time. (WRC-23)

ADD

5.H113 The allocation of the frequency band 14.8-15.35 GHz to the space research service on a primary basis is limited to satellite systems operating in the space-to-space, space-to-Earth and Earth-to-space directions at distances from the Earth less than 2 × 10^6 km. Other uses of the frequency band by the space research service are on a secondary basis. (WRC-23)

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD

TABLE **21-4** (*continued*) (Rev.WRC-~~19~~23)

Frequency band	Service*	Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	5°-25°	25°-90°	
…	…	…	…	…	…

11.7-12.5 GHz (Region 1) 12.5-12.75 GHz (Region 1 countries listed in Nos. **5.494** and **5.496**) 11.7-12.7 GHz (Region 2) 11.7-12.75 GHz (Region 3)	Fixed-satellite (space-to-Earth) (non-geostationary-satellite orbit) [25]	−124	−124 + 0.5(δ − 5)		−114	1 MHz
12.2-12.75 GHz [7] (Region 3) 12.5-12.75 GHz [7] (Region 1 countries listed in Nos. **5.494** and **5.496**)	Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)	−148	−148 + 0.5(δ − 5)		−138	4 kHz
13.4-13.65 GHz (Region 1)	Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)	**0°-25°**	**25°-80°**	**80°-84°**	**84°-90°**	4 kHz
		−159 + 0.4δ [19]	−149 [19]	−149 − 0.5(δ − 80) [19]	−151 [19]	
14.8-15.35 GHz	Space research (space-to-space)	−145.6				1 MHz
	Space research (space-to-Earth)	−145.6				1 MHz
17.7-19.3 GHz [7, 8]	Fixed-satellite (space-to-Earth) Meteorological-satellite (space-to-Earth)	**0°-5°**	**5°-25°**		**25°-90°**	1 MHz
		−115 [14, 15] or −115 − *X* [13]	−115 + 0.5(δ − 5) [14, 15] or −115 − *X* + ((10 + *X*)/20) (δ − 5) [13]		−105 [14, 15] or −105 [13]	
…	…	…	…		…	…

SUP

RESOLUTION 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

3/1.13/5.5 For Method E

3/1.13/5.5.1 For Method E1: Upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS with provisions to avoid imposing constraints on existing and future systems of primary services in the frequency band 14.8-15.35 GHz and adjacent band to ensure the protection of all primary services in the same frequency band and the radio astronomy service in the adjacent frequency band 15.35-15.4 GHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH ADD 5.J113 ADD 5.K113 5.339	

ADD

5.J113 The frequency band 14.8-15.35 GHz is also allocated to the space research service on a primary basis. However, the space research service in the frequency band 14.8-15.35 GHz shall not cause harmful interference to, nor claim protection from, existing and future stations of the fixed and mobile services in the frequency band 14.8-15.35 GHz. In the frequency band 14.8-15.35 GHz the space research service shall not cause harmful interference to the radio astronomy service in the adjacent frequency band 15.35-15.4 GHz, and No. **5.43** does not apply. (WRC-23)

ADD

5.K113 The allocation of the frequency band 14.8-15.35 GHz to the space research service on a primary basis is limited to satellite systems operating in the space-to-space, space-to-Earth and Earth-to-space directions at distances from the Earth less than 2×10^6 km. Other uses of the frequency band by the space research service are on a secondary basis. (WRC-23)

SUP

RESOLUTION 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

3/1.13/5.5.2 For Method E2: Upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS with provisions to avoid imposing constraints on existing systems of primary services in the frequency band 14.8-15.35 GHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH ADD 5.L113 ADD 5.M113 ADD 5.N113 ADD 5.O113 ADD 5.P113 5.339	

ADD

5.L113 In the frequency band 14.8-15.35 GHz, stations in the space research service shall not claim protection from stations in the fixed service and the mobile service. Nos. **5.43A** and **9.18** do not apply. (WRC-23)

ADD

5.M113 The power flux-density produced by an earth station in the space research service shall not exceed −145.6 dB(W/(m^2 · 1 MHz)), at the border of the territory of a neighbouring administration, to protect operating stations in the aeronautical mobile service in the frequency band 14.8-15.35 GHz. No. **9.17** does not apply. (WRC-23)

ADD

5.N113 Harmful interference shall not be caused to stations of the radio astronomy service using the frequency band 15.35-15.40 GHz by stations of the space research service (No. **29.13** applies). The equivalent power flux-density produced in the frequency band 15.35-15.40 GHz by all space stations of a non-GSO satellite system in the space research service (space-to-Earth) (space-to-space) operating in the frequency band 14.8-15.35 GHz shall be in compliance with the protection criteria provided in Recommendations ITU-R RA.769-2 and ITU-R RA.1513-2, using the methodology given in Recommendation ITU-R M.1583-1, and the radio astronomy antenna pattern described in Recommendation ITU-R RA.1631-0.

The power flux-density produced in the frequency band 15.35-15.40 GHz by a space station of a GSO satellite network in the space research service (space-to-Earth) (space-to-space) operating in the frequency band 14.8-15.35 GHz shall be in compliance with the protection criteria provided in Recommendation ITU-R RA.769-2. (WRC-23)

ADD

5.O113 In order to protect the radio astronomy service in the frequency band 15.35-15.4 GHz, a space research station operating in the Earth-to-space direction in the frequency band 14.8-15.35 GHz shall not exceed the power flux-density level of −156 dB(W/m^2) in a 50 MHz bandwidth in the frequency band 15.35-15.4 GHz, at any radio astronomy station observing in the frequency band 15.35-15.4 GHz for more than 2 per cent of the time. (WRC-23)

ADD

5.P113 The allocation of the frequency band 14.8-15.35 GHz to the space research service on a primary basis is limited to satellite systems operating in the space-to-space, space-to-Earth and Earth-to-space directions at distances from the Earth less than 2 × 10^6 km. Other uses of the frequency band by the space research service are on a secondary basis. (WRC-23)

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD

TABLE **21-4** (*continued*) (Rev.WRC-~~19~~23)

Frequency band	Service*	Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	5°-25°	25°-90°	
…	…	…	…	…	…

11.7-12.5 GHz (Region 1) 12.5-12.75 GHz (Region 1 countries listed in Nos. **5.494** and **5.496**) 11.7-12.7 GHz (Region 2) 11.7-12.75 GHz (Region 3)	Fixed-satellite (space-to-Earth) (non-geostationary-satellite orbit) [25]	-124	$-124 + 0.5(\delta - 5)$		-114	1 MHz
12.2-12.75 GHz [7] (Region 3) 12.5-12.75 GHz [7] (Region 1 countries listed in Nos. **5.494** and **5.496**)	Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)	-148	$-148 + 0.5(\delta - 5)$		-138	4 kHz
13.4-13.65 GHz (Region 1)	Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)	**0°-25°**	**25°-80°**	**80°-84°**	**84°-90°**	4 kHz
		$-159 + 0.4\delta$ [19]	-149 [19]	$-149 - 0.5(\delta - 80)$ [19]	-151 [19]	
14.8-15.35 GHz	Space research (space-to-space)	-145.6				1 MHz
	Space research (space-to-Earth)	-145.6				1 MHz
17.7-19.3 GHz [7, 8]	Fixed-satellite (space-to-Earth) Meteorological-satellite (space-to-Earth)	**0°-5°**	**5°-25°**		**25°-90°**	1 MHz
		-115 [14, 15] or $-115 - X$ [13]	$-115 + 0.5(\delta - 5)$ [14, 15] or $-115 - X + ((10 + X)/20)(\delta - 5)$ [13]		-105 [14, 15] or -105 [13]	
...	...	...	...		...	...

SUP

RESOLUTION 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

3/1.13/5.5.3 For Method E3: Upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS with provisions to avoid imposing constraints on existing systems of primary services in the frequency band 14.8-15.35 GHz

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

NOC

5.339 The bands 1 370-1 400 MHz, 2 640-2 655 MHz, 4 950-4 990 MHz and 15.20-15.35 GHz are also allocated to the space research (passive) and Earth exploration-satellite (passive) services on a secondary basis.

MOD

14.5-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14.8-15.35	FIXED MOBILE ~~Space research~~SPACE RESEARCH ADD 5.Q113 ADD 5.R113 ADD 5.S113 ADD 5.T113 5.339	

ADD

5.Q113 In the band 14.8-15.35 GHz, the stations in the space research service shall not claim protection from stations in the fixed and mobile service. Nos. **5.43A** and **9.18** do not apply. (WRC-23)

ADD

5.R113 The power flux-density produced by an earth station in the space research service shall not exceed −145.6 dB(W/(m^2 · MHz)) at the border of the territory of any other administration. No. **9.17** does not apply. (WRC-23)

ADD

5.S113 The allocation of the frequency band 14.8-15.35 GHz to the space research service on a primary basis is limited to satellite systems operating in the space-to-space, space-to-Earth and

Earth-to-space directions at distances from the Earth less than 2×10^6 km. Other uses of the frequency band by the space research service are on a secondary basis. (WRC-23)

ADD

5.T113 The frequency band 14.8-15.35 GHz is also allocated to the space research service on a primary basis. However the space research service in the frequency band 14.8-15.35 GHz shall not cause harmful interference to the radio astronomy service in the 15.35-15.4 GHz band and No. **5.43** does not apply. (WRC-23)

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD

TABLE **21-4** (*continued*) (Rev.WRC-~~19~~23)

<table>
<tr><th rowspan="2">Frequency band</th><th rowspan="2">Service*</th><th colspan="4">Limit in dB(W/m²) for angles of arrival (δ) above the horizontal plane</th><th rowspan="2">Reference bandwidth</th></tr>
<tr><th>0°-5°</th><th colspan="2">5°-25°</th><th>25°-90°</th></tr>
<tr><td>…</td><td>…</td><td>…</td><td colspan="2">…</td><td>…</td><td>…</td></tr>
<tr><td>11.7-12.5 GHz (Region 1)
12.5-12.75 GHz (Region 1 countries listed in Nos. 5.494 and 5.496)
11.7-12.7 GHz (Region 2)
11.7-12.75 GHz (Region 3)</td><td>Fixed-satellite (space-to-Earth) (non-geostationary-satellite orbit) [25]</td><td>−124</td><td colspan="2">−124 + 0.5(δ − 5)</td><td>−114</td><td>1 MHz</td></tr>
<tr><td>12.2-12.75 GHz [7] (Region 3)
12.5-12.75 GHz [7] (Region 1 countries listed in Nos. 5.494 and 5.496)</td><td>Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)</td><td>−148</td><td colspan="2">−148 + 0.5(δ − 5)</td><td>−138</td><td>4 kHz</td></tr>
<tr><td rowspan="2">13.4-13.65 GHz (Region 1)</td><td rowspan="2">Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)</td><td>0°-25°</td><td>25°-80°</td><td>80°-84°</td><td>84°-90°</td><td rowspan="2">4 kHz</td></tr>
<tr><td>−159 + 0.4δ [19]</td><td>−149 [19]</td><td>−149 − 0.5(δ − 80) [19]</td><td>−151 [19]</td></tr>
<tr><td>14.8-15.35 GHz</td><td></td><td colspan="4">0°-90°</td><td>1 MHz</td></tr>
</table>

	Space research (space-to-space) (space-to-Earth)	−145.6			
17.7-19.3 GHz [7, 8]	Fixed-satellite (space-to-Earth) Meteorological-satellite (space-to-Earth)	**0°-5°**	**5°-25°**	**25°-90°**	1 MHz
		−115 [14, 15] or $-115 - X$ [13]	$-115 + 0.5(\delta - 5)$ [14, 15] or $-115 - X + ((10 + X)/20)(\delta - 5)$ [13]	−105 [14, 15] or −105 [13]	
…	…	…	… …	…	…

SUP

RESOLUTION 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

Agenda item 1.14

1.14 to review and consider possible adjustments of the existing or possible new primary frequency allocations to the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution ***662 (WRC-19)****;*

Resolution **662 (WRC-19)** – *Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors*

3/1.14/1 Executive summary

The objective of WRC-23 agenda item 1.14 is to review and consider possible adjustment of the existing or possible new primary frequency allocations to the Earth exploration-satellite service (EESS) (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote sensing observation requirements, ensure that the allocations to the EESS (passive) within the considered frequency range correspond to the observation requirements for satellite passive microwave sensing without unduly constraining the operation of other primary services currently allocated in this frequency range, taking into account the possible effect on the other primary services in the considered frequency range.

EESS (passive) microwave sensing mainly includes Ice Cloud Measurements and atmosphere gases measurement. The Ice Cloud Imager (ICI) instrument which is a conical scanning millimetre/sub-millimetre wave radiometer, performs measurements of cloud ice water paths and cirrus clouds operating in two symmetric spectral bands of 239.2-242.2 GHz and 244.2-247.2 GHz. The Microwave Limb Sounder (MLS) instrument continuously observes thermal emission from utilizing spectrometers of numerous channels within the frequency band 231.5-252 GHz to measure the chemical processes and compounds within Earth's atmosphere.

Compatibility studies show that, in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, the sharing between the conical scanning passive sensors (like ICI) and systems of the fixed service (FS)/mobile service (MS) is not feasible. Studies also show that limb sounding passive sensors are compatible with systems of the FS/MS in the whole frequency range 231.5-252 GHz. Further, the sharing between the fixed-satellite service (FSS) (GSO, space-to-Earth) and EESS (passive) is feasible within the whole frequency range 232-240 GHz.

Three methods are proposed:

– Method A: Addition of new primary allocations to the EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, and implementation of power limits on the FS and MS in the frequency band 239.2-241 GHz;

– Method B: Addition of new primary allocations to the EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, switch of the current FS and MS allocations in the frequency band 239.2-241 GHz to the frequency band 235-238 GHz and limitation of the EESS (passive) allocation in the 235-238 GHz to limb-sounding operations;

– Method C: No change.

3/1.14/2 Background

Per Resolution **662 (WRC-19)**, WRC-23 agenda item 1.14 calls for WRC-23 to "Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range

231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors" without unduly constraining the other primary services currently allocated in this frequency range.

The ability of EESS (passive) microwave remote sensing instruments to measure ice clouds depends on the specific microwave frequencies. The frequency band 231.5-252 GHz provides the optimal sensitivity to ice particles. The frequency band around 243.2 GHz (2 × 3 000 MHz bandwidth (BW) in the bands 239.2-242.2 GHz and 244.2-247.2 GHz) is being considered for future ICI EESS (passive) sensors. ICI data will enhance the ability of Numerical Weather Prediction (NWP) centres to initialize global and regional models with information on ice clouds, which is not well represented in the weather and climate models today. In addition, various portions of the frequency range 231.5-252 GHz play an important role in the measurement of chemical processes and compounds within Earth's atmosphere, such as nitric acid, ozone, sulphur dioxide, and isotopic oxygen.

More details on the scientific background can be found in the PDN Report ITU-R RS.[231.5-252 GHz EESS].

3/1.14/3 Summary and analysis of the results of ITU-R studies

3/1.14/3.1 Relevant ITU-R Recommendations and Reports

– The PDN Report ITU-R RS.[231.5-252 GHz EESS] is in development which compiles elements related to background on WRC-23 agenda item 1.14 as well as technical considerations and results of relevant sharing studies on the EESS (passive) with the allocated services in the frequency range 231.5-252 GHz.

– Recommendation ITU-R RS.1861.

– PDR of Recommendation ITU-R RS.1813.

– Report ITU-R F.2416-0.

3/1.14/3.2 Technical and operational characteristics of EESS (passive) systems

Characteristics of passive sensors that are, or will be, operating between 231.5 and 252 GHz are contained in Recommendation ITU-R RS.1861-1, updated in 2021. Those characteristics are also summarized in the PDN Report ITU-R RS.[231.5-252 GHz EESS] and are used in the sharing and compatibility studies summarized in the following sections.

3/1.14/3.3 Summary of the sharing and compatibility studies

3/1.14/3.3.1 FS and MS in the frequency band 231.5-241 GHz

The sharing study with the FS is developed based on the characteristics of the FS as provided by the relevant contributing group (Doc. 7C/196). Accordingly, the FS systems in the frequency range 231.5-241 GHz will be rather similar to the one in the frequency range 275-450 GHz described in Report ITU-R F.2416-0.

There are no technical characteristics for the MS in the frequency band 231.5-241 GHz in ITU-R Recommendations or Reports and no additional elements were provided during the WRC-23 preparation. In the absence of such characteristics, it is assumed that the conclusions reached for the FS would also apply to the MS.

3/1.14/3.3.1.1 Sharing FS/MS with conical scanning passive sensors

One study focused on the sharing and compatibility with conical scanning ICI instruments. The characteristics of such passive microwave sensors that will be operated in the frequency bands

239.2-242.2 GHz and 244.2-247.2 GHz are based on sensor T1 in Recommendation ITU-R RS.1861-1 (section 6.20).

According to the preliminary conclusion of this sharing study, FS deployment will not be compatible with conical scanning passive sensors, like ICI, operating in any portion of the frequency band 231.5-252 GHz. A negative margin of −34 dB would have to be overcome (e.g. by imposing power/e.i.r.p. limits) to meet the protection criteria of such conical scanning instruments.

In the absence of any available characteristics for the MS in the frequency range 231.5-252 GHz, sharing studies cannot be performed. However, it is anticipated that the conclusions reached for the FS with conical scanning passive sensors would also apply to the MS.

In addition, since a new primary allocation to the EESS (passive) is proposed in the frequency band 239.2-242.2 GHz, the adjacent frequency band compatibility has been assessed with the existing FS and MS allocations within the frequency band 238-239.2 GHz. Relevant analyses have shown that, based on FS characteristics in frequency bands above 100 GHz, FS unwanted emissions above 239.2 GHz would be compatible with EESS (passive) protection requirements.

3/1.14/3.3.1.2 Sharing FS/MS with limb sounding passive sensors

Two studies focused on the sharing and compatibility with EESS (passive) limb sounding instruments and lead to similar conclusion.

In the first study, the characteristics of such passive microwave sensors that will be operated in the frequency band 231.5-252 GHz are based on sensor T2 in Recommendation ITU-R RS.1861-1 (section 6.20). The results of this study show that FS deployment would be compatible with limb sounding operations.

The second study shows that potential FS operations in the frequency range 235-238 GHz exhibit sizeable positive interference margin (> 14 dB) toward in-band limb sounding applications of the EESS (passive). Sharing between the FS and EESS (passive) is feasible throughout the entire frequency range 235-238 GHz.

3/1.14/3.3.1.3 Assessment of the sharing studies and possible solutions to facilitate sharing between FS/MS and passive sensors

In order to avoid undue constraints on the FS and MS in the frequency band 239.2-241 GHz (1.8 GHz of BW), the existing FS and MS allocations could be shifted to the frequency band 235-238 GHz (3 GHz of BW).

With such a shift the potential of interference to the EESS (passive) could be avoided and no constraints would have to be placed on the FS and MS services. On the contrary, the FS and MS would gain 1.2 GHz of additional primary allocations, and the two frequency ranges 231.5-235 GHz (3.5 GHz of BW) and 238-241 GHz (3 GHz of BW) would be transformed into one block of contiguous allocations in the frequency range 231.5-239.2 GHz (7.7 GHz of contiguous BW).

In addition, the sharing studies as described in sections 3/1.14/3.3.1.2 and 3/1.14/3.3.8 confirm that such a shift would not negatively affect the existing services in the frequency band 235-238 GHz.

Sharing between limb sounding passive sensors and the FS/MS is considered feasible in the frequency band 235-238 GHz. Thus, there would be neither an impact on the current allocation to the EESS (passive) and space research service (SRS) (passive) in the frequency band 235-238 GHz, nor any limitations required for the FS/MS to protect the EESS (passive) and SRS (passive).

To ensure that there will be no potential future impact to the FS/MS in the frequency band 235-238 GHz, the existing allocation to the EESS (passive) in this frequency band could be limited for use by limb sounding passive sensors only.

3/1.14/3.3.2 FSS (space-to-Earth) in the frequency band 232-240 GHz

One study focused on the sharing and compatibility with the EESS (passive). The characteristics of passive microwave sensors are based on sensors T1 and T2 given by Recommendation ITU-R RS.1861-1. Study result shows that for almost all scenarios, under the worst-case assumptions, the EESS (passive) could be sufficiently protected. Therefore, current FSS (GSO, space-to-Earth) operations would not adversely impact potential EESS (passive) operations in the frequency band 232-240 GHz. Sharing between the FSS (GSO, space-to-Earth) and EESS (passive) is feasible throughout the entire frequency range 232-240 GHz.

3/1.14/3.3.3 EESS (passive) and SRS (passive) in the frequency band 235-252 GHz

No sharing and compatibility studies are performed as by nature the SRS (passive) will be compatible with the EESS (passive).

3/1.14/3.3.4 Radiolocation service in the frequency band 238-248 GHz

No sharing and compatibility studies are performed as there are no technical characteristics for the radiolocation service in the frequency band 238-248 GHz in ITU-R Recommendations or Reports.

3/1.14/3.3.5 Radionavigation and radionavigation-satellite services in the frequency band 238-240 GHz

No sharing and compatibility studies are performed as there are no technical characteristics available for the radionavigation and radionavigation satellite services in the frequency band 238-240 GHz in ITU-R Recommendations or Reports.

3/1.14/3.3.6 Radio astronomy service in the frequency band 241-252 GHz

The radio astronomy service is a passive service and will therefore by nature be compatible with the EESS (passive).

3/1.14/3.3.7 Amateur and amateur-satellite services in the frequency band 248-250 GHz

No compatibility studies are performed between the EESS (passive) and the primary amateur and amateur-satellite services in the frequency band 248-250 GHz. The frequency separation is considered sufficient to protect a possible new EESS (passive) allocation below 247.2 GHz.

3/1.14/3.3.8 EESS (active) in the frequency band 237.9-238 GHz

One of the possible methods under agenda item 1.14 includes a shifting of the existing FS and MS allocations in the frequency band 239.2-241 GHz to the frequency band 235-238 GHz. In this frequency range, there is an allocation to the EESS (active) through RR No. **5.563B** in the frequency band 237.9-238 GHz, limited to Cloud Profiler Radars.

Sharing studies between the FS/MS and EESS (active) have shown that both services will be fully protected.

3/1.14/4 Methods to satisfy the agenda item

3/1.14/4.1 Method A - Addition of new primary allocations to the EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz and implementation of power limits on the FS and MS in the frequency band 239.2-241 GHz

Considering the results of the sharing studies reported in section 3/1.14/3.3.1.1, this method would imply limitations to the FS and MS to which the bands are allocated in order to facilitate sharing with the EESS (passive) in the frequency band 239.2-241 GHz.

Note: This method may not be in conformity with Resolution **662 (WRC-19)** since it imposes constraints on the FS and the MS.

3/1.14/4.2 Method B - Addition of new primary allocations to the EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, and possible adjustment of the current FS and MS allocations in the frequency band 239.2-241 GHz

In order to avoid undue constraints on the FS and MS in the frequency band 239.2-241 GHz (1.8 GHz of BW), in accordance with Resolution **662 (WRC-19)**, the existing FS and MS allocations could be shifted to the frequency band 235-238 GHz (3 GHz of BW).

With such a shift, the potential of interference to the EESS (passive) could be avoided and no constraints would have to be placed on the FS and MS. On the contrary, the FS and MS would gain 1.2 GHz of additional primary allocations, and the two frequency ranges 231.5-235 GHz (3.5 GHz of BW) and 238-241 GHz (3 GHz of BW) would be transformed into one block of contiguous allocations in the frequency range 231.5-239.2 GHz (7.7 GHz of contiguous BW). Since there is no FS/MS stations deployment at present, this shift has no impact on the future usage of the FS/MS.

In addition, such a shift would not negatively affect the existing services in the frequency band 235-238 GHz.

Finally, this method proposes some limitation to the existing EESS (passive) allocation in the frequency band 235-238 GHz in order to ensure that there will be no potential future impact to the FS and MS in the frequency band 235-238 GHz. This could be done by limiting the existing allocation to the EESS (passive) in this frequency band for use by limb sounding passive sensors only and/or by introducing a condition that the EESS (passive) in the frequency band 235-238 GHz shall not claim protection from stations of the FS and the MS.

Consensus could not be reached on whether or not shifting the allocation to the FS and MS from the band 239.2-241 GHz to the band 235-238 GHz imposes undue constraints on the FS and the MS.

3/1.14/4.3 Method C – No change

3/1.14/5 Regulatory and procedural considerations

3/1.14/5.1 For Method A

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

200-248 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
232-235	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	
235-238	EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) SPACE RESEARCH (passive) 5.563A 5.563B	
238-~~240~~239.2	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE	
~~238~~239.2-240	EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE ADD 5.A114	
240-241	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE RADIOLOCATION ADD 5.A114	
241-~~248~~242.2	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite ~~5.138~~ 5.149	
~~241~~242.2-~~248~~244.2	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite 5.138 5.149	

~~241~~244.2-~~248~~247.2	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite 5.138 5.149
~~241~~247.2-248	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite ~~5.138~~ 5.149

ADD

5.A114 Emissions from stations in the fixed and the mobile services shall be limited to [TBD] dBW and [TBD] dBW, respectively, to ensure protection of the Earth exploration-satellite service (passive). (WRC-23)

Note: An e.i.r.p. density of 3 dBW/GHz was proposed to the FS in a contribution to CPM23-2 [see Doc. CPM23-2/62].

SUP

RESOLUTION 662 (WRC-19)

Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors

3/1.14/5.2 For Method B

The table in section 3/1.14/5.2.5 illustrates the appropriate regulatory and procedural considerations under Method B.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

200-248 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
232-235	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	
235-238	EARTH EXPLORATION-SATELLITE (passive) ADD 5.B114 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE SPACE RESEARCH (passive) 5.563A 5.563B	
238-~~240~~239.2	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE	
~~238~~239.2-240	~~FIXED~~EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) ~~MOBILE~~ RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE	
240-241	~~FIXED~~EARTH EXPLORATION-SATELLITE (passive) ~~MOBILE~~ RADIOLOCATION	
241-~~248~~242.2	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite ~~5.138~~ 5.149	
~~241~~242.2-~~248~~244.2	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite 5.138 5.149	
~~241~~244.2-~~248~~247.2	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite 5.138 5.149	

247.2-248	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite ~~5.138~~ 5.149

3/1.14/5.2.1 For Method B, Option 1

ADD

5.B114-Opt1 The use of the frequency band 235-238 GHz by the Earth exploration-satellite service (passive) is limited to the operation of limb sounding passive sensors. (WRC-23)

3/1.14/5.2.2 For Method B, Option 2

ADD

5.B114-Opt2 In the frequency band 235-238 GHz, stations in the Earth exploration-satellite service (passive) shall not claim protection from stations of the fixed and mobile services. (WRC-23)

3/1.14/5.2.3 For Method B, Option 3

ADD

5.B114-Opt3 The use of the frequency band 235-238 GHz by the Earth exploration-satellite service (passive) is limited to the operation of limb sounding passive sensors. In this band, stations in the Earth exploration-satellite service (passive) shall not claim protection from stations of the fixed and mobile services. (WRC-23)

3/1.14/5.2.4 For Method B

SUP

RESOLUTION 662 (WRC-19)

Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors

3/1.14/5.2.5 Illustration of the concept of Method B

231.5-232 GHz	**232-235 GHz**	**235-238 GHz****	**238-239.2 GHz**	**239.2-240 GHz**	**240-241 GHz**	**241-242.2 GHz**	**242.2-244.2 GHz***	**244.2-247.2 GHz***	**247.2-248 GHz**	**248-250 GHz**	**250-252 GHz (5.340)**
				EESS (passive) 239.2-242.2 GHz				EESS (passive) 244.2-247.2 GHz			
		EESS (passive) RR No. **5.B114**									EESS (passive)
		SRS (passive)									SR (passive)
						RAS	RAS	RAS	RAS		RAS
FIXED	FIXED	FIXED	FIXED	~~FIXED~~	~~FIXED~~						
MOBILE	MOBILE	MOBILE	MOBILE	~~MOBILE~~	~~MOBILE~~						
	FSS (s-E)	FSS (s-E)	FSS (s-E)	FSS (s-E)							
			RADIOLOC	RADIOLOC	RADIOLOC	RADIOLOC	RADIOLOC	RADIOLOC	RADIOLOC		
			RADIONAV	RADIONAV							
			RADIONAV-SAT	RADIONAV-SAT							
										AMATEUR	
										AMATEUR-SAT	
Radioloc	Radioloc										
						Amateur	Amateur	Amateur	Amateur		
						AmateurSat	AmateurSat	Amateur-Sat	AmateurSat		
		** RR No. **5.563B**: The band 237.9-238 GHz is allocated to EESS (active) for spaceborne cloud radars only					* RR No. **5.138**: The band 244-246 GHz is designated for ISM applications.				

3/1.14/5.3 For Method C

<u>NOC</u>

ARTICLES

<u>NOC</u>

APPENDICES

SUP

RESOLUTION 662 (WRC-19)

Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors

CHAPTER 4

Satellite issues

(Agenda items 1.15, 1.16, 1.17, 1.18, 1.19, 7)

CONTENTS

Agenda item 1.15

1.15 to harmonize the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally, in accordance with Resolution ***172 (WRC-19)****;*

Resolution **172 (WRC-19)** – *Operation of earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space)*

Note: The understanding of this agenda item is that it addresses the operation of earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space), consistent with the title of Resolution **172 (WRC-19)**.

There are several areas in which there is no consensus either on the text or how to proceed with the implementation of the draft new Resolution contained in Section 4/1.15/5.2. Consequently the text below is not consistent with *resolves* 9 of Resolution **172 (WRC-19)** as shown below.

4/1.15/1 Executive summary

WRC-23 agenda item 1.15 considers *the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally*. The studies under this agenda item considered only two types of earth station in motion (ESIM): aeronautical (A-ESIM) and maritime (M-ESIM), depending on the type of platform on which they are installed. Studies have been carried out on sharing and compatibility between ESIM and terrestrial as well as space services allocated in the frequency bands above. The studies carried out so far have identified provisions to protect such services and guidelines to assist an administration wishing to authorize ESIM to operate on the territory under its jurisdiction. For this agenda item, two methods have been identified:

– Method A: This method proposes no changes to the RR and suppression of Resolution **172 (WRC-19)** due to the existence of various uncertainties in the implementation of several courses of action referred to in the potential Resolution associated with Method B.

– Method B: This method proposes to add a new footnote No. **5.A115** in RR Article **5** and a reference to a new WRC Resolution providing the conditions for the operation of ESIM and protection of the services to which the frequency bands are allocated, and consequential suppression of Resolution **172 (WRC-19)**.

4/1.15/2 Background

ITU has addressed earth stations on aircraft and vessels at previous WRCs.

WRC-23 agenda item 1.15 calls for studies on the possible operation of A-ESIM and M-ESIM communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space). The use of the frequency band 12.75-13.25 GHz by geostationary-satellite networks in the fixed-satellite service is subject to RR Appendix **30B**, which contains a worldwide fixed-satellite service allotment Plan and assignments in the List and has its own regulatory procedures and technical criteria.

In RR Appendix **30B**, the explicit agreement of an administration for the inclusion partially or wholly of its territory in the service area of a proposed RR Appendix **30B** assignment (§ 6.6 of RR

Appendix **30B**) is required. A review by the BR of the service areas of the RR Appendix **30B** assignments recorded in the MIFR showed that generally the service areas of RR Appendix **30B** networks are non-contiguous and the number of countries in these service areas ranges from one to fifty countries. Additionally, § 6.16 of RR Appendix **30B** provides that an administration may at any time exclude its territory from the service area of an RR Appendix **30B** assignment. Therefore, A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz need to have the capability to restrict operations as discussed below in Section 3.2 to territories of those administrations where agreement under § 6.6 of RR Appendix **30B** has been obtained and authorization for such operations has been granted. Also, a distinctive aspect of RR Appendix **30B** is the existence of a Reference situation for all Plan allotments and assignments in the List.

Moreover, for the operation of A-ESIM and M-ESIM, the technical, operational and regulatory provisions including responsibilities of administrations and entities responsible for the operation, authorization and the interference management system of these earth stations need to be defined.

4/1.15/3 Summary and analysis of the results of ITU-R studies

4/1.15/3.1 User requirements of A-ESIM and M-ESIM operating with GSO FSS satellites

A-ESIM and M-ESIM routes may in some cases and under certain circumstances be out of reach of terrestrial networks and must rely on satellite connectivity. In addition, ships and airplanes need automating data processes and digitalizing their operations.

4/1.15/3.2 Control and monitoring of ESIMs

The three elements consisting of interference management mechanism, switching facility for ON/OFF function and the functions of NCMC and their relations with each other are critical elements for the proper operation of ESIMs. Therefore, the text provided below requires careful consideration by administrations.

The only administration that could notify ESIM is the same administration notifying the GSO satellite network with which ESIM communicates. Therefore, the notifying administration of the GSO satellite network is responsible for the compliance of ESIM with all relevant regulatory and administrative provisions, including cases of interferences. The notifying administration of the GSO satellite network is also responsible for ensuring that ESIMs operate only in territories for which their operations are authorized by the administration having the jurisdiction on that territory.

Upon receipt of an interference report from the affected administration, the notifying administration of the GSO satellite network responsible for the operation of ESIMs shall work with the NCMC to resolve the unacceptable interference.

Should unacceptable interference occur to station(s) in the territory of an administration other than the notifying administration of the satellite network under which the ESIM would operate.

View 1 was expressed that the notifying administration of the satellite network with which the ESIM communicates gathers all information about an interference case from the affected administration and resolves the case of interference. The affected administration is invited to provide any available information to the best of their abilities without any additional burden.

View 2 was expressed that the course of action of how to address an interference case should be described more in detail, one possible example is provided below. This text below needs to be carefully examined, verified and validated to ensure that its application would contribute to the resolution of interference, taking into account that there is no time element associated with the steps in the text.

i) Interference occurrence to station(s) in the territory of an administration other than the notifying administration of the satellite network under which the ESIM would operate.

ii) The affected administration, in cooperation with the notifying administration of the satellite network under which the ESIM would operate, detects the location of the source of the interference.

iii) The affected administration informs the notifying administration of the satellite network under which the ESIM would operate.

iv) The notifying administration of the satellite network under which the ESIM would operate shall request immediately to the point of contact for the NCMC all available information necessary to resolve the interference case.

v) The NCMC commands the ESIM to disable the transmission or reduce the interference to an acceptable level.

vi) The notifying administration of the satellite network under which the ESIM would operate informs the affected administration about the actions taken in iv).

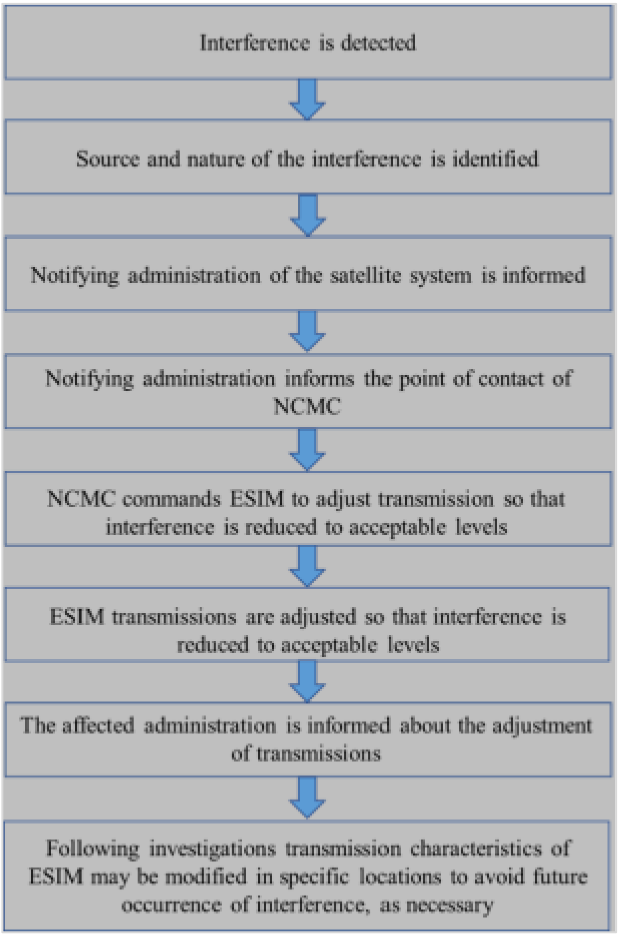
vii) The notifying administration of the satellite network under which the ESIM would operate investigates the root cause of the unacceptable interference and takes action from the following options based on the reason of the interference:

   a) request the NCMC to make transmission level adjustment, frequency or modulation change, antenna pointing accuracy change or others;

   b) submit to the BR, for information purposes only, the result of the investigation and interference analysis.

FIGURE 4/1.15/3-2

Proposed ESIM interference mitigation process



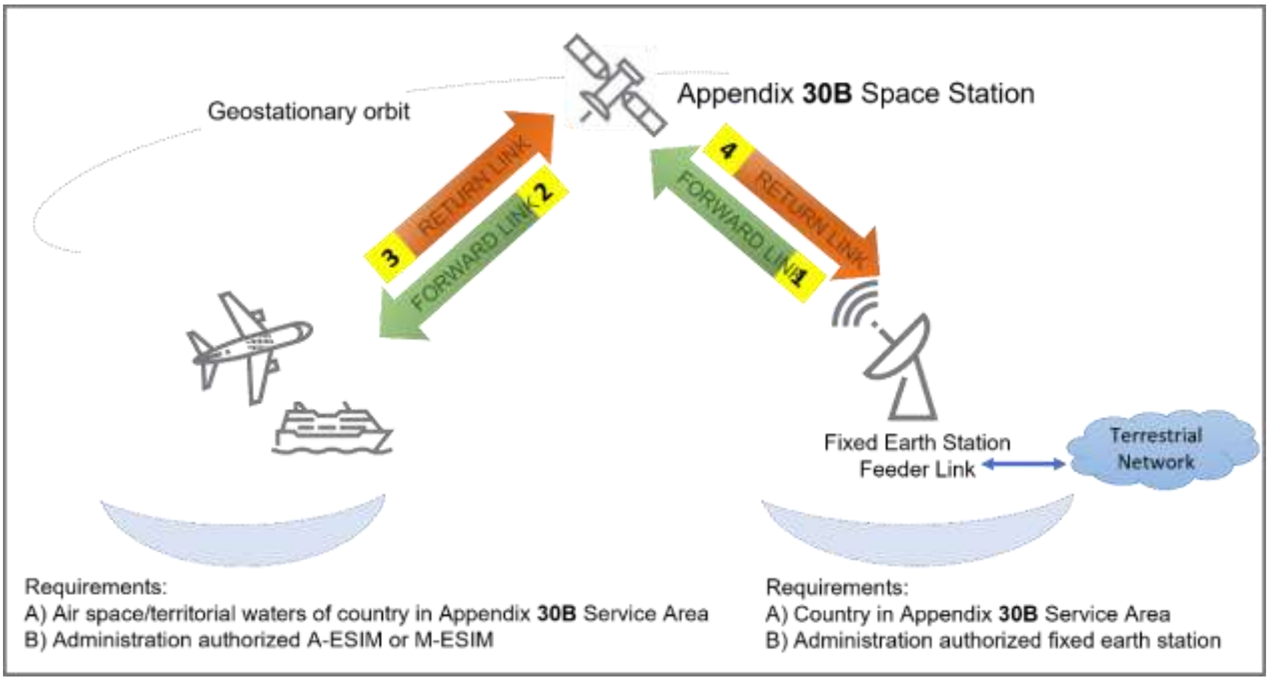
4/1.15/3.3 System overview and responsibility of the entities involved in the operation of A-ESIM and M-ESIM

4/1.15/3.3.1 System overview

From a system configuration perspective, the communications from A-ESIM and M-ESIM communicating with a GSO FSS satellite involve the transmission links depicted in Figure 4/1.15/3-4.

FIGURE 4/1.15/3-4

System operation in the context of operation under RR Appendix 30B



Operation of these links under the regulatory procedures of RR Appendix **30B** requires the following:

a) that the administration had a filing recorded in the List or MIFR with favourable finding (see also *recognizing g)* and *resolves* 2 of the draft new Resolution **[A115] (WRC-23)**);

b) that the satellite has coverage of the relevant location of the earth station;

c) that the territory of administration is in the service area of the RR Appendix **30B** GSO network; and

d) that authorization has been obtained from the administration in whose territory, national airspace and territorial waterways the earth stations operate.

For condition c) above, it is necessary for an administration to explicitly agree to be in the service area of that network. For additional clarification, this is depicted in Figure 4/1.15/3-4, where the blue shaded area represents the territory, territorial waters and airspace of a given administration that has explicitly agreed to be in the service area of a network.

The operation of link 3 is the subject of WRC-23 agenda item 1.15.

The operation of links 1 and 4, i.e. signals to/from fixed earth stations and the RR Appendix **30B** network, are currently covered and allowed under RR Appendix **30B** network ITU filing. The status of these links and their function will not be different if the RR Appendix **30B** satellite also communicates with A-ESIM and M-ESIM, which is being studied under WRC-23 agenda item 1.15.

Link 2 operations in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz may be used for reception at an A-ESIM and M-ESIM to provide broadband service to the end user on aircraft and vessels. Such operation is subject to not claiming protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated as indicated in *considering e)* of Resolution **172 (WRC-19)**.

Link 3 operations in the frequency band 12.75-13.25 GHz (Earth-to-space) are for transmission from an A-ESIM or M-ESIM to a GSO RR Appendix **30B** space station. This link has the potential to cause interference to other RR Appendix **30B** FSS allotments and assignments as well as other services allocated in the band in addition to services in the adjacent bands, including terrestrial services.

4/1.15/3.3.2 Responsibility of the entities involved in the operation of ESIM

For the operation of A-ESIM and M-ESIM the responsibilities of the entities involved was studied. It was agreed that the most practical and pragmatic way with which ESIM could be notified is under the provisions of Annex 1 of draft new Resolution **[A115] (WRC-23)**. In accordance with these provisions, the only administration that could notify an ESIM is the same administration as the one notifying the GSO network with which the ESIM communicates.

4/1.15/3.4 Operation of A-ESIM and M-ESIM communicating with GSO FSS satellites in the frequency band 12.75-13.25 GHz

As mentioned in *recognizing c)* of Resolution **172 (WRC-19)**, A-ESIM and M-ESIM need to protect the existing services to which the frequency band 12.75-13.25 GHz is allocated as well as services in adjacent frequency bands and not adversely affect assignment of those services and their future development.

The frequency band 12.75-13.25 GHz is allocated on a primary basis to the fixed-satellite (FSS) (Earth-to-space), fixed and mobile services, and on a secondary basis to the space research (deep space) (space-to-Earth) service globally.

In the adjacent frequency band 13.25-13.4 GHz A-ESIM and M-ESIM shall protect Earth exploration-satellite (active), aeronautical radionavigation and space research (active) services.

The following sections describe how A-ESIM and M-ESIM need to protect assignments of services to which the frequency band 12.75-13.25 GHz is allocated and in adjacent frequency bands as called for in Resolution **172 (WRC-19)**.

4/1.15/3.5 Sharing with terrestrial services (fixed and mobile services)

The use of A-ESIM and M-ESIM within the territory of one administration needs to protect terrestrial services in the territories of other administrations.

Studies carried out under WRC-23 agenda item 1.15, focused on the following scenarios:

4/1.15/3.5.1 Sharing between A-ESIM and terrestrial services

Studies have been considered on the protection of the terrestrial services from A-ESIM. All studies except one used a similar approach which included simulations of multiple A-ESIM and examined the long-term and short-term protection criteria to protect terrestrial stations. These studies demonstrated that the pfd levels provided below, if met at the surface of the Earth by emissions from a single A-ESIM operating at altitudes from 0 km and up to 10 km, allow to meet the protection criteria for terrestrial services.

-123.5 dB(W/(m^2 · 1 MHz))	for	$\theta \leq 5°$
$-128.5 + \theta$ dB(W/(m^2 · 1 MHz))	for	$5° < \theta \leq 40°$
-88.5 dB(W/(m^2 · 1 MHz))	for	$40° < \theta \leq 90°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon). These limits take into account only free-space attenuation and no polarization mismatch was considered.

One of these studies considered aircraft altitudes up to 12 km, which increases the number of A-ESIM considered in the simulation. Atmospheric gases attenuation along the path from the earth station to the terrestrial station was not taken into account. For altitudes above 10 km, this study showed a slight exceedance to the long-term protection criteria for a fixed station with a 29 dBi gain antenna. To address this slight exceedance, this study considered that the above mask would need to be 6 dB more stringent for aircraft at altitudes above 10 km and up to 12 km in order to meet the protection criteria. It was agreed that further simulations should be performed to address this case.

Another study employed a static methodology to derive an A-ESIM pfd mask to protect the terrestrial station based on an I/N value of −10 dB not to be exceeded from a single A-ESIM. This study considered the parameters of a fixed service station with highest maximum antenna gain provided by the ITU-R expert group, taking into account worst-case scenario. It concluded that the pfd mask not to be exceeded from emission of earth stations on aircraft in the frequency band 12.75-13.25 GHz should be:

$-152.1654 + 52.2324 \cdot \theta^2$ dB(W/(m^2 · 1 MHz))	for $0° \leq \theta < 0.5620°$
-135.6654 dB(W/(m^2 · 1 MHz))	for $0.5620° \leq \theta < 0.8017°$
$-133.2654 + 25 \log_{10}(\theta)$ dB(W/(m^2 · 1 MHz))	for $0.8017° \leq \theta < 48°$
-91.2654 dB(W/(m^2 · 1 MHz))	for $48° \leq \theta \leq 90°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

One study considered the two different pfd masks and verified whether they would ensure that the protection criteria for the FS are met. This statistical study considered the impact of multiple A-ESIM into FS receivers and took into account both the long- and short-term FS protection criteria. This study considered the pfd mask below:

$-152.1654 + 52.2324 \cdot \theta 2$ dB(W/(m^2 · 1 MHz))	for $0° \leq \theta < 0.5620°$
-135.6654 dB(W/(m^2 · 1 MHz))	for $0.5620° \leq \theta < 0.8017°$
$-133.2654 + 25 \log 10(\theta)$ dB(W/(m^2 · 1 MHz))	for $0.8017° \leq \theta < 48°$
-91.2654 dB(W/(m^2 · 1 MHz))	for $48° \leq \theta \leq 90°$

This study demonstrated that the above pfd mask does not adequately protect the FS with exceedance of the short-term protection criteria in some cases.

The study also showed that the following pfd mask ensures the protection of the FS:

-123.5 dB(W/(m^2 · 1 MHz))	for		$\theta \leq 5°$
$-128.5 + \theta$ dB(W/(m^2 · 1 MHz))	for	$5° <$	$\theta \leq 40°$
-88.5 dB(W/(m^2 · 1 MHz))	for	$40° <$	$\theta \leq 90°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon). These limits take into account only free space attenuation and no polarization mismatch was considered.

In considering the above studies it should be recognized that there are no overall results of different studies available, thus these should be carefully considered by administration when deciding on their preferred method as contained in Section 4.

4/1.15/3.5.2 Sharing between M-ESIM and terrestrial services

Technical studies addressed how the short- and long-term protection requirements of the terrestrial services can be met by determining a minimum distance from the low-water mark as officially recognized by the coastal State within which the M-ESIM transmission is subject to the prior agreement of that administration. All studies used the same worst-case assumption of a maximum M-ESIM power of 8W within the receive bandwidth of the terrestrial service terminal and, for determination of distances required to meet the FS short-term protection criterion, followed the methodology described in Recommendation ITU-R SF.1650-1.

One study, based on the propagation model of Recommendation ITU-R P.452, addressed the protection of the FS, and demonstrated that the maximum distance is driven by the short-term protection criterion of the FS station. According to this study, the required distance to meet the short-term protection criterion of the FS, for M-ESIM antennas with a discrimination angle of 10°, is 190 km from the low-water mark as officially recognized by the coastal State. In comparison, the same study showed that the distance required meet the FS long-term protection criterion is 86 km.

One study calculated the minimum distance required to meet the short-term protection criterion of the FS but used the propagation model of Recommendation ITU-R P.620 instead. It concluded that the required distances to meet the short-term protection criterion of the FS, for M-ESIM antennas with discrimination angles of 10°, 20° and 35° are, respectively, 218 km, 211 km and 190 km from the low-water mark as officially recognized by the coastal State.

One study, based on the propagation model of Recommendation ITU-R P.452, demonstrated that the minimum distance from the low-water mark as officially recognized by the coastal State required to meet the short-term protection criterion of the FS is 195.21 km for the case of 10° M-ESIM antenna discrimination angle. For 36° antenna discrimination angle, the distance varies from 155.84 km to 150.7 km, noting that Recommendation ITU-R SF.1650-1 indicates that "10° discrimination only occurs in the improbable case for which the FSR and ESV azimuths are aligned, and the ESV operates at the minimum elevation angle". This study has been updated. The new study considered the various protection distances from M-ESIM to protect the FS obtained in the different studies performed. These protection distances vary depending on the assumptions taken, namely on the antenna minimum elevation and the number of vessels passes considered in a year. The new study considered both short-term and long-term protection criteria to derive the protection distance. The protection distance ranges between 86 and 190 km. Based on these considerations, this study proposes to use the single value of 133 km as protection distance.

One study addressed the protection of the MS using the technical characteristics of the broadcast auxiliary services (BAS) that operate in the mobile service as described in Recommendation ITU-R M.1824-1. It also calculated distances from the low-water mark as officially recognized by the coastal State required to meet short- and long-term protection criteria of the BAS and showed that the largest required distance to meet the BAS protection criteria is 99.8 km, about half the distance required to protect the fixed services on land. Consequently, protecting the FS will automatically protect the MS operating in the same frequency band.

One study calculated the separation distance to meet the long-term and short-term protection criteria for FS stations, assuming M-ESIM antennas operating at 20-degree elevation. The separation distances presented in this study range from 65.8 km to 182 km.

It is proposed to adopt a minimum distance, based on the above studies, from the low-water mark as officially recognized by the coastal State within which the M-ESIM transmission is subject to the prior agreement of that administration, if such a method to satisfy agenda item 1.15 of WRC-23 is adopted by the Conference.

In considering the above studies it should be recognized that there are no overall results of different studies available, thus these should be carefully considered by administration when deciding on their preferred method as contained in Section 4.

4/1.15/3.6 Sharing with space services

4/1.15/3.6.1 RR Appendix 30B allotment and frequency assignments

As mentioned in *recognizing j)* of Resolution **172 (WRC-19)**, there are established criteria in Annex 4 to RR Appendix **30B** comprising single-entry and aggregate values to protect RR Appendix **30B** allotments/assignments, so the A-ESIM and M-ESIM communicating with GSO space stations shall ensure protection of, and not impose undue constraints on them and their future development. Examination of the proposed RR Appendix **30B** assignment in accordance with Annex 4 of RR Appendix **30B** is conducted for the test points submitted by the notifying administration. For further information on this, see the procedure described in Annex 1 to the draft new Resolution **[A115] (WRC-23)**.

Technical characteristics of A-ESIM and M-ESIM communicating with a GSO space station in the FSS shall comply with the envelope characteristics of the Appendix **30B** notified earth stations associated with the satellite network (with supporting assignment) (see also *resolves* 2 of the draft new Resolution **[A115] (WRC-23)**), with which the ESIMs communicate, and with the coordination agreements between administrations, which apply only to the agreed service area, which may include only territories of administrations that have given their explicit agreement to this.

4/1.15/3.6.2 Non-geostationary FSS satellite systems

A number of studies addressed the protection of non-GSO FSS satellite systems from A-ESIM and M-ESIM operating in the frequency band 12.75-13.25 GHz. One study focused only on regulatory issues, and the others developed various operational off-axis e.i.r.p. density masks and maximum on-axis e.i.r.p. levels that ESIMs would need to meet. Through consideration of these various proposals, a single mask and level are contained in Annex 3 of the draft new Resolution **[A115] (WRC-23)**.

4/1.15/3.6.3 Earth exploration-satellite service, space research service in frequency band 13.25-13.4 GHz

The ITU-R studied the compatibility between A-ESIM and M-ESIM communicating with GSO FSS networks in the frequency band 12.75-13.25 GHz and EESS (active) in the frequency band 13.25-13.75 GHz. A comparative analysis was performed from the results of in-band studies between GSO FSS (Earth-to-space) and EESS (active) in the frequency band 13.25-13.75 GHz (see Report ITU-R S.2365). It was concluded that even though Recommendation ITU-R RS.2105 contains further typical EESS (active) system characteristics that were not considered by the analyses in Report ITU-R S.2365, there will not be a compatibility issue between EESS (active) in the frequency band 13.25-13.75 GHz from A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz due to the relatively large amount of signal attenuation from FSS emissions into the EESS (active) band.

The frequency band 13.25-13.4 GHz is allocated to the SRS (active) as well. The SRS (active) was not identified as potentially affected, so there is no need to perform any compatibility study with this service.

4/1.15/3.6.4 Aeronautical radionavigation systems in the frequency band 13.25-13.4 GHz

Two studies on the protection of the aeronautical radionavigation service (ARNS) were performed. Both studies considered protection of ARNS radars 3, 4, 6 and 7 in Table 1 of Recommendation ITU-R M.2008-1. One of the studies addressed the aggregate interference from A-ESIM to an airplane equipped with an ARNS radar in Approach 1, Approach 2, Holding and Landing scenarios as defined by the contributing group. In this study the polarization mismatch and the radar receiver feeder loss were considered to be 0 dB. The second study analysed the impact of a single A-ESIM using similar assumptions as the first study. Both studies concluded that with the assumptions taken, the *I*/*N* protection criteria of the ARNS operating in the frequency band 13.25-13.40 GHz was met for all scenarios.

An additional study addressed the potential interference from A-ESIM into ARNS radar installed on the same aircraft and concluded that ARNS protection criteria would always be met.

These studies are intended to be used to assist administration in providing authorization or in bilateral and multilateral discussion.

4/1.15/4 Methods to satisfy the agenda item

4/1.15/4.1 Method A

No changes to the Radio Regulations and suppression of Resolution **172 (WRC-19)**.

The no change method stems from the fact that, *inter alia*, the existence of various uncertainties in the implementation of several courses of action referred to in the potential Resolution associated with Method B. In particular, the manner in which interference will be managed and removed as called for in that Resolution.

4/1.15/4.2 Method B

Add a new footnote in RR Article **5** that refers to a new WRC Resolution with complete technical, operational and regulatory conditions for the operation of A-ESIM and M-ESIM communicating with GSO space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space) while ensuring protection of allocated services *inter alia* protection of terrestrial services with both a minimum distance from the low-water mark and maximum e.i.r.p. density towards the horizon for M-ESIM, and pfd mask(s) for A-ESIM and consequential suppression of Resolution **172 (WRC-19)**.

However, Method B may solely be pursued under the explicit conditions that all shortcomings, deficiencies, and incomplete operational and regulatory obstacles referred to above are totally removed.

4/1.15/5 Regulatory and procedural considerations

4/1.15/5.1 For Method A

NOC

ARTICLES

NOC

APPENDICES

SUP

RESOLUTION 172 (WRC-19)

Operation of earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space)

4/1.15/5.2 For Method B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

11.7-13.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
12.75-13.25	FIXED FIXED-SATELLITE (Earth-to-space) 5.441 ADD 5.A115 MOBILE Space research (deep space) (space-to-Earth)	

ADD

5.A115 The operation of earth stations in motion on board aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be subject to the application of Resolution **[A115] (WRC-23)**. (WRC-23)

ADD

DRAFT NEW RESOLUTION [A115] (WRC-23)

There are several areas on which there are no consensus either on the text or how to proceed with the implementation of this Resolution. Consequently, the text below is not consistent with *resolves* 9 of Resolution **172 (WRC-19)** as shown below.

9 to ensure that the results of ITU-R studies are agreed by Member States taking into account the required consensus on this matter;

Use of the frequency band 12.75-13.25 GHz by earth stations in motion on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that WARC Orb-88 established an Allotment Plan for the use of the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz;

b) that WRC-07 revised the regulatory regime governing the use of the frequency bands referred to in *considering a)* above;

c) that the objective of providing broadband mobile satellite communications may also be met by allowing earth stations in motion (ESIMs), on aircraft (A-ESIMs) and vessels (M-ESIMs), to communicate with the geostationary space stations of a fixed-satellite service network in the frequency bands 12.75-13.25 GHz (Earth-to-space) and the associated downlink frequency bands of that satellite, thus for example the frequency bands 10.70-10.95 GHz and 11.20-11.45 GHz of Appendix **30B** may be used;

d) that the frequency band 12.75-13.25 GHz is currently allocated on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), fixed and mobile services and on a secondary basis to the space research (deep space) (space-to-Earth) service;

e) that the operation of services to which the frequency band 12.75-13.25 GHz is allocated and those in adjacent bands needs to be protected from A-ESIM and M-ESIM;

f) that the frequency band 12.75-13.25 GHz (Earth-to-space) is used by the geostationary-satellite orbit (GSO) FSS in accordance with the provisions of Appendix **30B** (No. **5.441**) and that there are many existing GSO FSS satellite networks operating in this frequency band;

g) that the objective of the procedures in Appendix **30B** is to guarantee, for all countries, equitable access to the GSO in the frequency bands of the FSS covered by this Appendix;

h) that appropriate regulatory and interference-management mechanisms, including necessary mitigation measures and associated techniques, are required for the operation of A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz (Earth-to-space) to protect other space and terrestrial services in this frequency band as well as services in adjacent frequency bands and without adversely affecting those services and their future development, taking into account the provisions of Appendix **30B** (see also *resolves further* 1 to 5 on responsibilities);

i) that, in Appendix **30B**, the frequency bands in the space-to-Earth direction corresponding to the frequency band 12.75-13.25 GHz (Earth-to-space) are 10.7-10.95 GHz and 11.2-11.45 GHz, which may be used by A-ESIM and M-ESIM, subject to not claiming protection from other services and applications of the FSS and other radiocommunication services to which the frequency band is allocated;

j) that there is no publicly available information on coordination agreements reached among administrations regarding GSO FSS satellite networks except whether coordination has been completed, which is provided to, and published by, the Radiocommunication Bureau (BR);

k) that the operation of A-ESIM and M-ESIM requires the establishment of one or more gateway earth station facilities in one or several countries that are within the service area of the associated satellite network and that are authorized by the administration of the territory where such earth stations are located,

considering further

a) that A-ESIMs and M-ESIMs operating within the agreed service area of the satellite network with which they communicate may provide service within the territories under the jurisdiction of multiple administrations;

b) that the operation of ESIMs within the territory under the jurisdiction of administrations/countries mentioned in *considering further a)* above is subject to obtaining authorization from those administrations,

recognizing

a) that Article 44 of the ITU Constitution contains the basic principles for the use of the radio-frequency spectrum and the GSO and other satellite orbits, taking into account the needs of developing countries;

b) that administrations intending to authorize A-ESIMs and M-ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures than those contained in this Resolution;

c) that, pursuant to the relevant paragraph in Appendix **30B**, the operation of ESIM in the frequency band 12.75-13.25 GHz could be only within the service area of the Appendix **30B** network for which the explicit agreement of any administration whose territory is partially or wholly included in this service area has been obtained;

c bis) that § 6.16 of Article 6 of Appendix **30B** provides the opportunity to any administration at any time to request that its territory be excluded from the service area of any assignment governed by Appendix **30B**, therefore the service area can change;

d) that the operation of an A-ESIM and M-ESIM pertaining to and communicating with a space station of a given satellite network needs that earth station to be within the coordinated and agreed service area of that satellite under the relevant provisions of Appendix **30B**;

e) that, based on the available information in the Bureau's database in May 2022, there is no contiguous regional or worldwide coordinated and agreed service area for any satellite using the Appendix **30B** frequency band 12.75-13.25 GHz recorded in the Master International Frequency Register (MIFR);

f) that, in order for A-ESIM and M-ESIM to operate in the frequency band 12.75-13.25 GHz (Earth-to-space) of Appendix **30B** in the most efficient and operationally viable manner, having a contiguous regional or worldwide coordinated and agreed service area is an important issue to be taken into account;

g) that the administration authorizing ESIMs on the territory under its jurisdiction has the right to require that the ESIMs referred to above only use those assignments associated with GSO FSS networks which have been successfully coordinated, notified, brought into use and recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**, except those arising from the application of § 6.25 of Appendix **30B**;

h) that Resolution **170 (WRC-19)** provides the procedure to enhance equitable access to frequency bands under Appendix **30B** by developing countries;

i) that the protection of current usage and future development of Appendix **30B** in the frequency band 12.75-13.25 GHz (Earth-to-space) is a fundamental issue without any adverse effect thereto;

j) that the availability of the methodology to examine conformity to the power flux-density (pfd) limit as contained in Annex 2 to this Resolution is a fundamental and crucial element;

k) that there is need to establish regulatory, technical and recording procedures for the usage of these type of ESIMs that may differ from the current FSS Appendix **30B** Plan and List recording procedures;

l) that successful compliance with this Resolution does not oblige any administration to authorize/license A-ESIM and M-ESIM communicating with geostationary space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) to operate within the territory under its jurisdiction (see *resolves* 7);

Option 1

m) that affected administrations retain their right to directly contact the aircraft or vessel on which the ESIM operates;

n) that any administration experiencing unacceptable interference from an ESIM may request the assistance of the administration authorizing the ESIM on the territory under its jurisdiction;

Option 2

Not to add *m)* and *n)*

o) that, in accordance with Appendix **30B**, the examination of the Bureau in the frequency band 12.75-13.25 GHz (Earth-to-space) is limited to the test-points on land, it is necessary to perform the examination of A-ESIM and M-ESIM using grid points generated everywhere within the service area of A-ESIM and M-ESIM submitted under Appendix **4** (see Annex 1 to this Resolution),

recognizing further

a) that, under *resolves* 1.1.3 of this Resolution, frequency assignments to ESIMs need to be notified to the BR;

b) that, for the operation of ESIMs, notification of any frequency assignment under Annex 1 of this Resolution shall only be made by one single administration which is the notifying administration of the GSO FSS network with which ESIMs communicate;

c) that an administration authorizing the operation of ESIMs within the territory under its jurisdiction may modify and/or withdraw that authorization at any time;

d) that the three elements consisting of interference management mechanism, switching facility for on/off function and the function of NCMC and their relations with each other and sequence of actions together with estimated time for that action/function are needed for the proper and factual operation of the ESIM;

Option 1 see *resolves* 1.17, 1.1.8 and 1.19 for **Option 2**

e) the operation of A-ESIM and M-ESIM shall comply with provision No. **5.340**;

f) when the Appendix **30B** GSO FSS satellite network with which A-ESIM and M-ESIM communicate transmits in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, it shall operate under the levels that were coordinated and included in the List, and these Appendix **30B** satellite transmissions will not change to accommodate A-ESIM and M-ESIM;

g) the operation of A-ESIM and M-ESIM in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, if any, shall not adversely affect the allotments in the Plan or the assignments in the List and not claim protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated,

resolves

1 that, for any A-ESIM and M-ESIM communicating with a GSO FSS space station within the frequency band 12.75-13.25 GHz (Earth-to-space) or parts thereof, the following conditions shall apply:

1.1 with respect to space services in the frequency band 12.75-13.25 GHz and adjacent bands, A-ESIM and M-ESIM shall comply with the following conditions:

1.1.1 the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIM and M-ESIM shall not result in any changes or restrictions to the allotment in the Plan, assignments in the List of Appendix **30B**, and those recorded in the MIFR, including the assignments arising from the implementation of Resolution **170 (WRC-19)**;

1.1.2 with respect to satellite networks or systems of other administrations, the characteristics of A-ESIM and M-ESIM shall remain within the envelope of typical characteristics of notified earth stations associated with the satellite networks with which these earth stations communicate, as published by the Bureau and included in relevant International Frequency Information Circular (BR IFIC), and Annex 1 applies;

1.1.2*bis* the use of A-ESIM and M-ESIM shall not cause any interference to Appendix **30B** allotments, assignments received by the Bureau under Article 6 either in process or yet to be processed, assignments in the List, assignments notified under Article 8 of that Appendix, and assignments recorded in the MIFR as well as submission under Appendix **30B** beyond that specified in the relevant Annexes to that Appendix;

1.1.3 for the implementation of *resolves* 1.1.1, 1.1.2 and 1.1.2*bis* above, the notifying administration for the GSO FSS network with which the above-mentioned A-ESIM and M-ESIM communicate shall follow the procedure in Annex 1 of this Resolution, together with the commitment that the operation of ESIM shall be in conformity with the Radio Regulations, including this Resolution;

1.1.4 upon receipt of the notification information referred to in *resolves* 1.1.3 above, the BR shall process the submission in accordance with Annex 1 of this Resolution;

1.1.5 for the protection of non-GSO FSS systems operating in the frequency band 12.75-13.25 GHz, the above-mentioned A-ESIM and M-ESIM communicating with GSO FSS networks referred to above shall comply with the provisions contained in Annex 3 of this Resolution;

1.1.6 the notifying administration of the GSO FSS network with which the above-mentioned earth stations communicate shall ensure that the operation of these A-ESIM and M-ESIM complies with the coordination agreements for the frequency assignments of the earth station of this GSO FSS satellite network of Appendix **30B** obtained under the relevant provisions of that Appendix;

Option 2 (See *recognizing further a), b)* and *c)* for **Option1**)

1.1.7 the operation of A-ESIM and M-ESIM shall comply with provision No. **5.340**;

1.1.8 when the Appendix **30B** GSO FSS satellite network with which A-ESIM and M-ESIM communicate transmits in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, it shall operate under the levels that were coordinated and included in the List, and these Appendix **30B** satellite transmissions will not change to accommodate A-ESIM and M-ESIM;

1.1.9 the operation of A-ESIM and M-ESIM in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, if any, shall not adversely affect the allotments in the Plan nor the assignments in the List and not claim protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated;

1.2 with respect to the protection of terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations, A-ESIM and M-ESIM shall comply with the following conditions:

1.2.1 transmitting A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz (Earth-to-space) shall not cause unacceptable interference to terrestrial services to which this frequency band is allocated and that operate in accordance with the Radio Regulations, and Annex 2 to this Resolution shall apply;

1.2.2 the receiving part of the above-mentioned ESIM in their associated frequency band shall not claim protection from terrestrial services to which this frequency band is allocated and that operate in accordance with the Radio Regulations;

1.2.3 the requirement to not cause unacceptable interference to terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations shall be respected, irrespective of compliance with Annex 2 (see *resolves* 7);

1.2.4 for the application of Part II of Annex 2 as referred to in *resolves* 1.2.1 above, the BR shall examine the characteristics of A-ESIM with respect to the conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2, and publish the results of such examination in the BR IFIC;

Option 1

1.2.5 however, the compliance with the technical conditions in Annex 2 does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;

Option 1 deletes 1.2.6 and 1.2.7

Option 2

1.2.5 the compliance with the technical conditions in Annex 2 does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;

1.2.6 if the BR is unable to examine, in accordance with *resolves* 1.2.4 above, the A-ESIM with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2, the notifying administration shall send to BR a commitment that the A-ESIM shall comply with those limits;

1.2.7 the BR shall formulate a qualified favourable finding with respect to the limits contained in Part II of Annex 2 if *resolves* 1.2.6 is applied successfully, otherwise it shall formulate an unfavourable finding;

1.2.7*bis* that, after the application of *resolves* 1.2.6 and 1.2.7 successfully, once the methodology to examine the characteristics of aeronautical GSO ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2 is available, *resolves* 1.2.4 shall be applied by the Bureau;

End of Option 2

1.2.8 if administrations authorizing A-ESIM agree to pfd levels higher than the limits contained in Part II of Annex 2 within the territory under its jurisdiction, such agreement shall in no way affect other countries that are not party to that agreement;

1.2.9 the notifying administration for the GSO FSS network with which the A-ESIM and M-ESIM will communicate, taking into account the *resolves further* below, shall send to the BR, together with submission of the Appendix **4** information for the above-mentioned earth station, a commitment undertaking that, upon receiving a report of unacceptable interference, it shall immediately take all appropriate measures to eliminate that interference or reduce it to an acceptable level and follow the procedures in *resolves* 9;

1.3 with respect to the aeronautical radionavigation systems operating in the frequency band 13.25-13.4 GHz, A-ESIM and M-ESIM communicating with GSO FSS networks shall not cause unacceptable interference to the aeronautical radionavigation service (ARNS) operating in accordance with the Radio Regulations in the 13.25-13.40 GHz band;

Option 1:

2 that, for assignments of Appendix **30B** recorded in the List, only frequency assignments entered in the List under § 6.17 can be used as supporting assignments by earth stations on aircraft and vessels communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**, except assignments recorded under § 6.25 of Article 6 of the Appendix;

Option 2:

2 that only frequency assignments of Appendix **30B** recorded in the List can be used as supporting assignments by A-ESIMs and M-ESIMs communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**;

Option 3:

2 that only frequency assignments of Appendix **30B** recorded in the List can be used as supporting assignments by A-ESIMs and M-ESIMs communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B** provided that assignments recorded under § 6.25 of Article 6 used for A-ESIM and M-ESIM operations shall not cause unacceptable interference or claim protection from those assignments for which agreement was not obtained;

3 that operation of A-ESIM and M-ESIM communicating with GSO space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be within the coordinated and notified service area of the GSO FSS network with which the earth stations communicate;

4 that, for the implementation of *resolves* 3 above, the notifying administration for the GSO FSS network with which the A-ESIM and M-ESIM communicate shall ensure that necessary arrangements and switching facilities are built into the above-mentioned earth stations to cease

emissions once approaching the territory under the jurisdiction of those administrations which either are not within the notified and coordinated service area of the subject space station or have not authorized the operation over their territories;

5 that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network with which A-ESIM and M-ESIM communicate, or on the coordination requirements of that satellite network;

6 that A-ESIM and M-ESIM shall not be used or relied upon for safety-of-life applications;

7 that the operation of A-ESIM and M-ESIM within territorial waters and/or airspace under the jurisdiction of an administration shall be carried out only if a licence according to No. **18.1** of the Radio Regulations/authorization of that administration is obtained;

8 that gateway earth station facilities for A-ESIM and M-ESIM shall be within the service area of the satellite network associated to that gateway;

9 that, in the case unacceptable interference caused by A-ESIM and/or M-ESIM is reported:

Option 1:

9.1 only the notifying administration of the GSO FSS network/non-GSO FSS systems with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

Option 2:

9.1 the notifying administration of the GSO FSS network/non-GSO FSS systems with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

9.2 the notifying administration of the GSO FSS network with which the ESIMs communicate shall immediately take the required action to eliminate or reduce interference to an acceptable level;

9.3 the affected administration(s) may assist resolving or provide information that would facilitate resolving the case of unacceptable interference;

Option 1:

9.4 the administration authorizing the operation of A-ESIM and M-ESIM on territory under its jurisdiction, subject to its explicit agreement, may provide assistance, including information for the resolution of unacceptable interference;

Option 2:

9.4 the administration authorizing the operation of A-ESIM and M-ESIM on the territory under its jurisdiction shall, to the extent of its ability, cooperate to assist in the resolution of unacceptable interference, including providing information as necessary;

Option 3:

9.4 an administration that the territory of which is situated inside the service area of a satellite and has provided explicit authorization to receive the service/to be served by any type of ESIM has no obligation nor any mandate, whatsoever, to be involved directly or indirectly in detection, identification, reporting, resolution of any interference caused by the operation of the ESIM the operation of which was authorized;

9.5 the administration responsible for the aircraft or vessel on which the ESIM operates shall provide a point of contact to assist identifying the notifying administration of the satellite with which the ESIM communicates;

10 that the notifying administration of the GSO FSS satellite network with which the ESIM communicates shall ensure that:

10.1 for the operation of A-ESIM and M-ESIM, techniques are employed to maintain adequate 10 pointing accuracy with the associated GSO/non-GSO FSS satellite;

10.2 all necessary measures shall be taken so that A-ESIM and M-ESIM are subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) in order to comply with the provisions in this Resolution, and are capable of receiving and immediately acting upon, *inter alia*, "enable transmission" and "disable transmission" commands from the NCMC;

10.3 measures are taken so that the A-ESIM and/or M-ESIM do not transmit on the territory, under the jurisdiction of an administration, including its territorial waters and its national airspace, that is neither in the service area of the GSO satellite network and/or has not authorized its use on its territory;

10.4 a permanent point of contact shall be provided, in the Appendix **4** submission under Annex 1 of this Resolution and published in the special section, by the notifying administration of the GSO FSS network for the purpose of tracing any suspected cases of unacceptable interference from earth stations on aircraft and vessels and to immediately respond to such requests;

Option 1:

11 the implementation of this Resolution remains in abeyance pending an agreement to be universally reached on the issue of the interference management system, monitoring facilities' effectiveness and immediate response of MCNC, cessation of transmission over territories which have not explicitly authorized the functioning and operation of any ESIM over their territories providing satisfactory resolution of the problem, as referred to in *recognizing further d)* above,

Option 2:

11 the implementation of this Resolution is conditioned on providing a description to the administrations whose authorization is sought of interference management system(s), monitoring facilities (NCMC), dealing with the cessation of transmission over territories which have not explicitly authorized (see *resolves* 7) the functioning and operation of any ESIM over their territories in order to provide a satisfactory resolution of the problem as referred to in *recognizing further d)* above,

NOTE: Provided the description mentioned above is properly addressed and concluded, *resolves* 11 above may be deleted at WRC-23.

resolves further

1 that ESIMs shall not cause unacceptable interference to nor claim protection from other services as referred to in *resolves* 1.2.1 and 1.2.2;

2 that the notifying administration for the ESIMs shall send to the BR, when submitting the relevant Appendix **4** data, a commitment (as stipulated in *resolves* 1.2.9) that, upon receiving a report of unacceptable interference, the notifying administration for the GSO satellite network with which ESIMs communicate shall remove such interference;

3 that the commitment referred to in *resolves further* 2 shall be objective, measurable and enforceable;

4 that, in case of continued unacceptable interference despite of the commitment referred to in *resolves further* 2, the assignment causing interference shall be submitted to the Radio Regulations Board for review;

5 that compliance with the provisions contained in Annex 2 does not release the notifying administration of the GSO satellite network with which ESIMs communicate of its obligations mentioned in *resolves further* 1 above (see *resolves* 1.2.3);

6 that frequency assignments in the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIM and M-ESIM communicating with geostationary space stations in the FSS shall be notified by the notifying administration of the satellite network with which the ESIM communicates;

7 that the notifying administration of the satellite network shall ensure that ESIMs operate only in the territory under the jurisdiction of an administration from which an authorization has been obtained, taking into account *recognizing further c)* above;

8 that, for the implementation of *resolves further* 2 above, the notifying administration of the satellite network with which ESIMs communicate shall ensure that ESIMs are designed and operate so as to cease transmission in the territory of any administration from which authorization has not been obtained;

Option 1

8*bis* that, for the implementation of *resolves further* 7 and 8 above, the system shall employ the minimum capabilities listed in Annex 5;

Option 2

8*bis* is not required if Annex 5 is not maintained.

9 that, for the implementation of *resolves further* 6 above, the notifying administration responsible for the operation of A-ESIM and M-ESIM shall also be responsible for observing and complying with all relevant regulatory and administrative provisions applicable to the operation of the above-mentioned ESIMs as included in this Resolution and those contained in the Radio Regulations;

10 that the authorization for an ESIM to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the satellite network with which the ESIM communicates from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolution of interference, when required;

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution, including whether or not the responsibilities relating to the operation of A-ESIMs and M-ESIMs have been properly addressed;

3 to review, if necessary, once the methodology to examine the characteristics of A-ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2 is available;

Option 1

4 to publish the list of assignments in the Appendix **30B** ESIM brought into use with information about its service area and countries authorize such use if any; this information shall be updated regularly,

Option 2

4 to publish the list of assignments in the Appendix **30B** ESIM brought into use, with information about their service area; this information shall be updated regularly,

Note: It was agreed that the issue of identifying the notifying administration is still ambiguous and requires further discussions before taking the decision regarding this draft new resolution, in order to develop a means for the affected administration to identify the notifying administration of the satellite network space station with which the ESIM communicates.

instructs the Secretary-General

1 to bring this Resolution to the attention of the Council with a view to consider if cost recovery should be applied to ESIM;

2 to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization and of the Secretary General of the International Civil Aviation Organization.

ANNEX 1 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

PART I

Procedure to be followed by the administrations and the Bureau for submission of the earth stations in motion on aircraft and vessels operating in the frequency band 12.75-13.25 GHz (Earth-to-space) and for the protection of allotments in the Plan, assignments in the Appendix 30B List and those submitted under Articles 6 and 7 of Appendix 30B as well as under Resolution 170 (WRC-19)

Section A – Procedure for entering assignments to earth stations in motion on aircraft and vessels in the Appendix 30B ESIM List[1]

1 When an administration, or one acting on behalf of a group of named administrations, intends to use one or more Appendix **30B** assignments already included in the List and MIFR in support of the operation of A-ESIMs and M-ESIMs in the frequency band 12.75-13.25 GHz, it shall send to the Bureau, not earlier than 8 years but preferably not later than 2 years before the operation of A-ESIMs and M-ESIMs, the information specified in Appendix **4**[2].

An assignment in the Appendix **30B** ESIM List shall lapse if it is not brought into use within 8 years after the date of receipt by the Bureau of the relevant complete information specified above. A proposed assignment not included in the Appendix **30B** ESIM List within 8 years after the date of receipt by the Bureau of the relevant complete information shall also lapse.

[1] The List of assignments for earth station in motion (ESIM) in the frequency band 12.75-13.25 GHz in Appendix **30B**.

[2] Submissions may include only the frequency band 12.75-13.0 GHz or 13.0-13.25 GHz.

1*bis* If the information received by the Bureau under § 1 is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned.

2 Upon receipt of a complete notice under § 1, the Bureau shall examine it with respect to its conformity with:

a) the Table of Frequency Allocations and the other provisions[3] of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the coordination procedures;

b) Annex 3 to Appendix **30B**;

c) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the supporting Appendix **30B** assignment(s);

d) the service area of the supporting Appendix **30B** assignment(s) in respect of explicit agreements of those administrations whose territories are included in the service area[4];

e) the frequency band of the supporting Appendix **30B** assignment(s) in the List in the frequency band 12.75-13.25 GHz.

3 When the examination with respect to § 2 leads to an unfavourable finding, the relevant part of the notice shall be returned to the notifying administration with an indication of the appropriate action.

4 When the examination with respect to § 2 leads to a favourable finding, the Bureau shall use the method of Annex 4 to Appendix **30B** to determine administrations whose:

a) allotments in the Plan; or

b) assignments which appear in the List; or

c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article,

are considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s).

5 The Bureau shall publish, in a Special Section of its BR IFIC, the complete information received under § 1, together with the names of the affected administrations, the corresponding allotments in the Plan, assignments in the List and assignments for which the Bureau has previously received complete information in accordance with § 6.1 of Article 6 of Appendix **30B** and which it has examined under § 6.5 of that Article.

5*bis* The Bureau shall immediately inform the administration proposing the assignment, in the ESIM List drawing its attention to the information contained in the relevant BR IFIC and the requirement to seek and obtain the agreement of those affected administrations.

6 The Bureau shall also inform each administration listed in the Special Section of the BR IFIC published under § 5, drawing its attention to the information it contains.

7 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC

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[3] The “other provisions” shall be identified and included in the Rules of Procedure.

[4] The service area may be reduced by excluding certain countries for which explicit agreement was obtained.

referred to in § 5 shall be deemed to have not agreed to the proposed assignment in respect of its allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, according to the case for which absence of reply/comments shall construe their disagreement to the request for coordination. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to thirty days following the date on which the Bureau communicated the result of its action. In respect of its frequency assignments under Article 6 of Appendix **30B** other than those mentioned above, the same course of action outlined in § 6.10 of that Article shall apply.

8 Unless coordination is no longer required, the administration responsible for the notice published under § 5 shall seek and obtain the explicit agreement of the relevant affected administrations contained in the Special Section published under § 5 in respect of allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, as appropriate. In this specific case of explicit agreement, any request for the assistance of the Bureau shall not change it to implicit/tacit agreement.

9 If agreements have been reached in accordance with §§ 7 and 8 with administrations published under § 5, the administration responsible for the notice published under § 5 may request the Bureau to have the assignment entered into the Appendix **30B** ESIM List, indicating the final characteristics of the notice[5] together with the names of the administrations with which agreement has been reached.

9*bis* In submitting such information, noting the requirement of § 1 of Section B, the administration may also request the Bureau to examine the submission in respect of notification under Section B.

9*ter* If the information received by the Bureau under §§ 9 and 9*bis* is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned. The Bureau may also provide additional information in order to assist the notifying administration in complying with requirements under §§ 10, 12 and 13.

10 Upon receipt of a complete notice under § 9, the Bureau shall examine each assignment in the notice with respect to its conformity with:

a) the Table of Frequency Allocations and the other provisions[6] of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for obtaining coordination;

b) Annex 3 to Appendix **30B**;

c) the service area published under § 5;

d) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the assignments published under § 5, and

e) frequency band of the assignments published under § 5.

[5] Submissions may include only the frequency band 12.75-13.0 GHz or 13.0-13.25 GHz.

[6] The “other provisions” shall be identified and included in the Rules of Procedure.

11 When the examination with respect to § 10 of an assignment received under § 9 leads to an unfavourable finding, the notice shall be returned to the notifying administration with an indication that subsequent resubmission under § 9 will be considered with a new date of receipt.

12 When the examination with respect to § 10 of an assignment received under § 9 leads to a favourable finding, the Bureau shall use the method of Annex 4 to examine if there is any administration and the corresponding:

a) allotment in the Plan;

b) assignment which appears in the List at the date of receipt of the examined notice submitted under § 1;

c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article at the date of receipt of the examined notice submitted under § 1[7],

considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s) and whose agreement has not been provided under § 9.

13 The Bureau shall determine if the cumulative interference is caused to an allotment in the Plan or an assignment in the List or an assignment for which the Bureau has received complete information in accordance with Article 6 of Appendix **30B** before the date of receipt of the complete notice under § 9. The cumulative interference shall be calculated based on Appendix 1 to Annex 4 of Appendix **30B**, taking into account assignments in the Appendix **30B** ESIM List together with assignments submitted under § 9. The cumulative interference is considered as being caused when the overall aggregate $(C/I)_{aggregate}$ value is less than that resulting from the supporting Appendix **30B** assignment(s) with a tolerance of 0.25 dB (inclusive of the 0.05 dB computational precision), except for an allotment in the Plan, an assignment stemming from the conversion of an allotment into an assignment without modification, or when the modification is within the envelope characteristics of the initial allotment, as well as assignments relating to application of Article 7 of Appendix **30B** for which the 0.05 dB computational precision is applicable.

14 In the event of a favourable finding under §§ 12 and 13, the Bureau shall enter the proposed assignment in the Appendix **30B** ESIM List and publish in a Special Section of its BR IFIC the characteristics of the assignment received under § 9, together with the names of administrations with which the provisions of this procedure have been successfully applied.

15 When the examination under § 12 or § 13 leads to an unfavourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, or submission in accordance with Resolution **170 (WRC-19)**, the Bureau shall return the notice to the notifying administration. In this case, the notifying administration undertakes not to bring into use the frequency assignments until the finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, or submission in accordance with Resolution **170 (WRC-19)**, is favourable. The Bureau, in returning the notice to the notifying administration, shall indicate that the subsequent resubmission under § 9 will be considered with a new date of receipt.

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[7] Similar course of action as prescribed in footnote 7*bis* of § 6.21 of Article 6 of Appendix **30B** applies.

15*bis* When the examination under § 12 or § 13 leads to a favourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, but an unfavourable finding with respect to others, and if the notifying administration insists that the proposed assignment be included in the Appendix **30B** ESIM List, the Bureau shall enter the assignment provisionally in the Appendix **30B** ESIM List with an indication of those administrations whose assignments were the basis of the unfavourable finding. To this effect, the notifying administration shall include a signed commitment, indicating that use of an assignment provisionally recorded in the Appendix **30B** ESIM List shall not cause unacceptable interference to, nor claim protection from, those assignments for which agreement still needs to be obtained. The entry in the Appendix **30B** ESIM List shall be changed from provisional to definitive only if the Bureau is informed that all required agreements have been obtained.

15*ter* Should the assignments that were the basis of the unfavourable finding not be brought into use within the period specified in § 6.1 of Article 6 of Appendix **30B** or within the extension period under § 6.31*bis* Article 6 of Appendix **30B**, then the status of the assignment in the Appendix **30B** ESIM List shall be reviewed accordingly.

16 Should unacceptable interference be caused by an assignment entered in the Appendix **30B** ESIM List under § 15*bis* to any assignment in the List which was the basis of the disagreement, the notifying administration of the assignment entered in the Appendix **30B** ESIM List under § 15*bis* shall, upon receipt of advice thereof, immediately eliminate this unacceptable interference.

17 For the examinations referred to in Part I and Part II, the Bureau shall generate a set of uplink grid points everywhere within the service area of the relevant assignments to A-ESIMs and M-ESIMs, assuming that A-ESIMs and M-ESIMs are located at these uplink grid points.

Section B – Procedure for notification and recording in the Master Register of assignments to earth stations in motion on aircraft and vessels dealt with under this Resolution

1 Any assignment in the ESIM List for which the relevant procedure of Section A and Part II of this Annex has been successfully applied shall be notified to the Bureau using the relevant characteristics listed in Appendix **4**, not earlier than three years before the assignments are brought into use.

2 If the first notice referred to in § 1 has not been received by the Bureau within the required period mentioned in § 1 of Section A, the assignments in the Appendix **30B** ESIM List shall be cancelled by the Bureau after having informed the administration at least three months before the expiry of this period.

3 Notices not containing those characteristics specified in Appendix **4** as mandatory or required shall be returned with comments to help the notifying administration to complete and resubmit them, unless the information not provided is immediately forthcoming in response to an inquiry by the Bureau.

4 Complete notices shall be marked by the Bureau with their date of receipt and shall be examined in the date order of their receipt. Following receipt of a complete notice, the Bureau shall, as soon as possible after the date of entry of the corresponding assignment into the Appendix **30B** ESIM List or within not more than two months if the corresponding assignment has already been entered into the Appendix **30B** ESIM List, publish its contents, with any diagrams and maps and the date of receipt, in the BR IFIC, which shall constitute the acknowledgement to the notifying

administration of receipt of its notice. When the Bureau is not in a position to comply with the time-limit referred to above, it shall periodically so inform the administrations, giving the reasons thereof.

5 The Bureau shall not postpone the formulation of a finding on a complete notice unless it lacks sufficient data to reach a conclusion thereon.

6 Each notice shall be examined:

6.1 with respect to its conformity with the Table of Frequency Allocations and the other provisions[8] of these Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for obtaining coordination, which are the subject of the following subparagraph;

6.2 with respect to its conformity with the FSS Plan, the procedures for obtaining coordination and the associated provisions[9].

7 When the examination with respect to § 6.1 leads to a favourable finding, the assignment shall be examined further with respect to § 6.2; otherwise, the notice shall be returned with an indication of the appropriate action.

8 When the examination with respect to § 6.2 leads to a favourable finding, the ESIM assignment shall be recorded in the Master Register. When the finding is unfavourable, the notice shall be returned to the notifying administration, with an indication of the appropriate action.

9 In every case when a new ESIM assignment is recorded in the Master Register it shall, in accordance with the provisions of this Resolution, include an indication of the finding reflecting the status of the assignment. This information shall also be published in the BR IFIC.

10 A notice of a change in the characteristics of the ESIM assignment already recorded, as specified in Appendix **4**, shall be examined by the Bureau under § 6.1 and § 6.2, as appropriate. Any changes to the characteristics of an assignment that has been recorded and confirmed as having been brought into use shall be brought into use within eight years from the date of the notification of the modification. Any changes to the characteristics of an assignment that has been recorded but not yet brought into use shall be brought into use within the period provided for in § 1 of Section A.

11 In applying the provisions of this Section, any resubmitted notice which is received by the Bureau more than six months after the date on which the original notice was returned by the Bureau shall be considered to be a new notice.

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[8] The "other provisions" shall be identified and included in the Rules of Procedure.

[9] When an administration notifies any assignment with characteristics different from those entered in the Appendix **30B** ESIM List through successful application of the relevant procedure of Section A and Part II of this Annex, the Bureau shall undertake calculation to determine if the proposed new characteristics increase the interference level caused to other allotments in the Plan, assignments in the List, an assignment for which the Bureau has received complete information in accordance with § 6.1 of Article 6 of Appendix **30B** before the date of receipt of this notification, assignments in the Appendix **30B** ESIM List and an assignment for which the Bureau has received complete information in accordance with § 1 of Section A before the date of receipt of this notification. The increase of the interference due to characteristics different from those entered in the Appendix **30B** ESIM List will be checked by comparing the C/I ratios of these other allotments and assignments, which result from the use of the proposed new characteristics of the subject assignment on the one hand, and those obtained with the characteristics of the subject assignment in the Appendix **30B** ESIM List, on the other hand. This C/I calculation is performed under the same technical assumptions and conditions.

12 All frequency assignments notified in advance of their being brought into use shall be entered provisionally in the Master Register. Any frequency assignment provisionally recorded under this provision shall be brought into use no later than the end of the period provided for in § 1 of Section A. Unless the Bureau has been informed by the notifying administration of the bringing into use of the assignment, it shall, no later than 15 days before the end of the regulatory period established under § 1 of Section A, send a reminder requesting confirmation that the assignment has been brought into use within the regulatory period. If the Bureau does not receive that confirmation within 30 days following the period provided under § 1 of Section A, it shall cancel the entry in the Master Register and the corresponding assignment in the Appendix **30B** ESIM List.

13 When the Bureau has received confirmation that the assignment in the Appendix **30B** ESIM List has been brought into use, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC.

14 Wherever the use of a frequency assignment in the Appendix **30B** ESIM List is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When that assignment is brought back into use, the notifying administration shall so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. The date on which the assignment is brought back into use shall be no later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled from the Master Register and the Appendix **30B** ESIM List.

15 If the supporting Appendix **30B** assignment(s) is cancelled from the List, the corresponding ESIM assignment shall also be cancelled from the Appendix **30B** ESIM List and the Master Register, as appropriate.

PART II

Procedure to be followed by the administrations and the Bureau for examination and protection of one ESIM with respect to the other ESIMs

1 In the publication of the Special Section referred to in § 5 of Section A, the Bureau shall also include the names of the affected administrations, the corresponding assignments in the Appendix **30B** ESIM List and assignments for which the Bureau has previously received complete information in accordance with § 1 of Section A and which it has examined under § 4 of Section A, as appropriate.

2 In determining administrations whose assignments in the Appendix **30B** ESIM List or assignments for which the Bureau has previously received complete information in accordance with

§ 1 of Section A and which it has examined under § 4 of Section A are considered as being affected, the Bureau shall apply the principle of Annex 4 to Appendix **30B** and the following criteria:

a) orbital spacing as specified in paragraph 1.2 of Annex 4;

b) Earth-to-space single-entry carrier-to-interference as specified in paragraph 2.1 of Annex 4 or Earth-to-space single-entry carrier-to-interference (*C*/*I*) derived from the supporting Appendix **30B** assignment(s), whichever is the lowest;

c) the Earth-to-space pfd as specified in paragraph 2.2 of Annex 4.

3 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 5 of Section A shall be deemed to have agreed to the proposed assignment. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to thirty days following the date on which the Bureau communicated the result of its action.

4 Unless coordination is no longer required, taking into account the final characteristics of the notice in § 9 of Section A, should harmful interference be caused by an assignment included in Appendix **30B** ESIM List to any assignment in Appendix **30B** ESIM List identified in § 1 for which agreement has not been obtained, the notifying administration shall, upon receipt of advice thereof, immediately eliminate this harmful interference.

ANNEX 2 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

Provisions for earth stations on aircraft and vessels to protect terrestrial services in the frequency band 12.75-13.25 GHz

1 The parts below contain provisions to ensure that A-ESIM and M-ESIM do not cause unacceptable interference in neighbouring countries to terrestrial service operations when A-ESIM and M-ESIM operate in frequency bands overlapping with those used at any time by terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and operating in accordance with the Radio Regulations (see also *resolves* 1.2 of this Resolution).

PART I

Earth stations on vessels

2 The notifying administration of the GSO FSS network with which an M-ESIM communicates shall ensure compliance of the M-ESIM operating within the frequency band 12.75-13.25 GHz, or parts thereof, with both of the following conditions for the protection of terrestrial services to which the frequency band is allocated within a coastal State:

2.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which an M-ESIM can operate without the prior agreement of any administration is 133/150 km in the frequency band 12.75-13.25 GHz. Any transmissions from an M-ESIM within the minimum distance shall be subject to the prior agreement of the coastal State concerned.

2.2 The maximum earth station on vessel e.i.r.p. spectral density towards the horizon shall be limited to 12.5 dB(W/MHz). Transmissions from an M-ESIM with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State concerned.

PART II

Earth stations on aircraft

3 The notifying administration of the GSO FSS satellite network with which an A-ESIM communicates shall ensure compliance of the A-ESIM operating within the frequency band 12.75-13.25 GHz, or parts thereof, with all of the following conditions for the protection of terrestrial services to which the frequency band is allocated:

PFD MASK

Option 1

1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single A-ESIM shall not exceed:

$$\mathrm{pfd}(\theta) = -112 \quad (\mathrm{dB(W/(m^2 \cdot 14\ MHz))}) \quad \text{for} \quad \theta \leq 5°$$

$$\mathrm{pfd}(\theta) = -117 + \theta \quad (\mathrm{dB(W/(m^2 \cdot 14\ MHz))}) \quad \text{for} \quad 5° < \theta \leq 40°$$

$$\mathrm{pfd}(\theta) = -77 \quad (\mathrm{dB(W/(m^2 \cdot 14\ MHz))}) \quad \text{for} \quad 40° < \theta \leq 90°$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

2 When within line-of-sight of the territory of an administration, maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

$$\mathrm{pfd}(\theta) = -123.5 \quad \mathrm{dB(W/(m^2 \cdot MHz))} \quad \text{for} \quad \theta \leq 5°$$

$$\mathrm{pfd}(\theta) = -128.5 + \theta \quad \mathrm{dB(W/(m^2 \cdot MHz))} \quad \text{for} \quad 5° < \theta \leq 40°$$

$$\mathrm{pfd}(\theta) = -88.5 \quad \mathrm{dB(W/(m^2 \cdot MHz))} \quad \text{for} \quad 40° < \theta \leq 90°$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

Option 2

1 When within line-of-sight of the territory of an administration, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

$$\mathrm{pfd}(\theta) = -123.5 \quad \mathrm{dB(W/(m^2 \cdot MHz))} \quad \text{for} \quad \theta \leq 5°$$

$$\mathrm{pfd}(\theta) = -128.5 + \theta \quad \mathrm{dB(W/(m^2 \cdot MHz))} \quad \text{for} \quad 5° < \theta \leq 40°$$

$$\mathrm{pfd}(\theta) = -88.5 \quad \mathrm{dB(W/(m^2 \cdot MHz))} \quad \text{for} \quad 40° < \theta \leq 90°$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

2 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the aeronautical ESIM transmitter as described in Recommendation ITU-R SM.1541.

ANNEX 3 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

Provisions for earth stations in motion on aircraft and vessels to protect non-GSO FSS in the frequency band 12.75-13.25 GHz

1 In order to protect the non-GSO FSS systems referred to in *resolves* 1.1.5 of this Resolution in the frequency band 12.75-13.25 GHz, ESIMs shall not exceed the following operational limits:

a) on-axis e.i.r.p. density of 49 dB(W/1 MHz) for an ESIM with an antenna maximum gain lower than 38.5 dBi;

b) on-axis e.i.r.p. density of 54 dB(W/1 MHz) for an ESIM with an antenna maximum gain equal to or greater than 38.5 dBi but lower than 45 dBi;

c) on-axis e.i.r.p. density of 57.5 dB(W/1 MHz) for an ESIM with an antenna maximum gain equal to or greater than 45 dBi;

d) e.i.r.p. density for any off-axis angle φ which is 3° or more off the main-lobe axis of an ESIM antenna and outside 3° of the GSO arc:

Off-axis angle	*Maximum e.i.r.p. density*	
$3° \leq \varphi \leq 31.6°$	$37 - 25 \log\varphi$	dB(W/40 kHz)
$31.6° < \varphi \leq 180°$	-0.5	dB(W/40 kHz)

2 the Radiocommunication Bureau shall not make any examination or finding with respect to compliance with this Annex under either Article **9** or **11**.

ANNEX 4 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

NOTE: This methodology has been developed based on the discussions in Working Party 4A regarding the draft new Recommendation ITU-R S.[RES.169_METH] which contains a methodology for assessing compliance of A-ESIM communicating with GSO FSS satellites to meet the obligations to protect terrestrial services in Resolution **169 (WRC-19)**. Proposals to WRC-23 on agenda item may need to take into account any further progress/updates to this draft new Recommendation when considering a methodology for assessing compliance with Part 2 of Annex 1 of Resolution **[A115] (WRC-23)** for A-ESIM communicating with GSO FSS satellites. However, it should be emphasized that the discussion in the CG would lead to a satisfactory conclusion on the matter and there is no certainty that the work of the CG will be agreed at WP 4A and SG4. Consequently, actions referred to in CPM should not be based on other actions that may not be conclusive.

Methodology with respect to the examination of compliance of A-ESIM with pfd limits in Part II of Annex 2

1 Overview of the methodology

This methodology determines the off-axis e.i.r.p. spectral density ("$EIRP_C$") towards the ground for an A-ESIM transmitter communicating with a GSO FSS satellite that would ensure compliance with a set of pre-established pfd limits defined on the Earth's surface. This methodology may also be used for guidance by administrations when considering authorizing the operation of ESIMs in their territories.

The methodology then compares the computed $EIRP_C$ with a metric introduced here and named Reference off-axis e.i.r.p. towards the ground ("$EIRP_R$") of the A-ESIM. For the emission in each group of a GSO satellite network, $EIRP_R$ will be calculated by using the Appendix **4** data for that network as well as other input parameters that shall be provided by the notifying administration for that network.

Specifically, for an emission of the GSO FSS satellite network associated with an A-ESIM class of station, the $EIRP_R$ is the algebraic summation (in logarithmic terms) of the maximum input power to the antenna flange (item C.8.a.1 of Appendix **4**), the peak gain of the A-ESIM antenna (item C.10.d.3 of Appendix **4**), the maximum achievable off-axis gain isolation towards the ground of the A-ESIM antenna in the service area of the GSO network under examination and a parameter that would compensate for any difference between the emission bandwidth and the reference bandwidth of the pre-established set of pfd limits.

The operations of A-ESIM shall be evaluated over multiple predefined altitude ranges in order to establish as many $EIRP_C$ levels for comparison with $EIRP_R$.

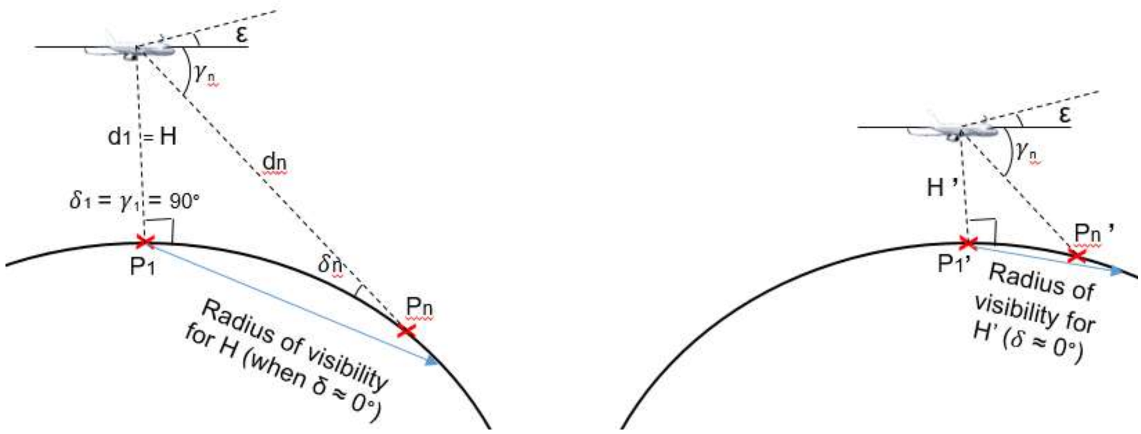
This comparison is at the basis of the methodology and examination that are described more in detail in the following section.

2 Parameters and geometry

Figure A4-1 provides a description of the geometry considered under this methodology. The figure shows an A-ESIM flying at two different altitudes and also some of the parameters used for the calculation. The model is agnostic to GSO ESIM geographical locations on Earth and assumes a spherical Earth model with a fixed radius for the calculation.

FIGURE A4-1

Geometry for the examination of compliance for two different ESIM altitudes



All the parameters required by the Bureau to carry out the examination process are listed and briefly described in Table A4-1. Additional considerations are further elaborated in section 3.

TABLE A4-1

Relevant parameters for pfd compliance examination

Parameter	Symbol	Type of parameter	Observation
Aeronautical GSO ESIM altitude	H	Established by the methodology as H_{min}= [0.02] km, H_{max}= [15] km, H_{step}= [1] km	The altitudes at which the examination is carried out range from H_{min} to H_{max} at H_{step} intervals
Angle of arrival of the incident wave on the Earth's surface	δ	Specified by the pre-established set(s) of pfd limits, variable from 0° to 90°	Pre-established set(s) of pfd should cover incident angles from 0° to 90°
Angle below the horizontal plane of the ESIM corresponding to the angle of arrival δ under examination	γ	Calculated from the geometry	This angle is calculated considering the GSO ESIM altitude H_j examined and angle of arrival δ under examination (see Fig. A.4-1)
Distance between the ESIM and the point on the ground under examination	D	Calculated from the geometry	This distance is a function of the A-ESIM altitude and the angles δ and γ
Frequency	f	Established by the methodology	To evaluate the propagation loss either at the central frequency or at the upper and lower limits of the frequency range
Atmospheric loss	L_{atm}	Calculated and established by the methodology	Based on Recommendation ITU-R P.676
Polarization loss	L_{Pol}	Fixed value	0 dB proposed as a conservative approach for the polarization loss between the polarization of A-ESIM antenna and the one used by terrestrial services
Fuselage attenuation	L_f	Report ITU-R M.2221 or other model supported by ITU-R studies (e.g. Reports and/or Recommendations)	The attenuation depends on the angle (γ) below the horizontal plane of the GSO ESIM. The value(s) could come from ITU-R studies (e.g. Reports and/or Recommendations) based on: measurements simulations
A-ESIM antenna peak gain and off-axis gain pattern	G_{max}, $G(\theta)$	Taken from the Appendix **4** data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the GSO network under examination	The A-ESIM antenna gain is used to compute $EIRP_R$
Emission bandwidth	$BW_{Emission}$	Taken from the Appendix **4** data (as part of item C.7.a) of the GSO network under examination	These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$
Reference bandwidth	BW_{Ref}	Taken from the set(s) of pre-established pfd limits	

Parameter	Symbol	Type of parameter	Observation
Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth	$EIRP_C$	$EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface	For each of the altitudes H_j, the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated with a given altitude H_j; for each altitude H_j, the lowest *EIRP* value is the one to be retained and compared with $EIRP_R$ (see section 3)
A set of pre-established pfd limits on the Earth's surface	$pfd(\delta)$	A possible outcome of the studies carried out under WRC-23 AI 1.15	The pfd limits, expressed in dB(W/m^2/BW_{Ref}), are a function of the angle of arrival δ

3 Calculation procedure

This section includes a step-to-step description of how the examination methodology would be implemented for a given group associated to the class of earth station for A-ESIM.

<u>*START*</u>

i) For the emission of the Group under consideration, compute the reference e.i.r.p. ($EIRP_R$, dB(W)) as:

$$EIRP_R = G_{Max} - G_{Isol_{Max}} + P_{Max} + 10\log_{10}(BW) \qquad (1)$$

where:

G_{Max} is the A-ESIM antenna peak gain in dBi

$G_{Isol_{Max}}$ is the maximum achievable gain isolation of the A-ESIM antenna towards the ground in dB, taking into account the pointing of the A-ESIM towards the GSO satellite within the GSO network service area

P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).

BW in Hz is:

BW_{Ref} if $BW_{emission} > BW_{Ref}$

$BW_{emission}$ if $BW_{emission} < BW_{Ref}$

ii) For each aircraft altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test the full compliance with the set(s) of pre-established pfd limits. The N angles δ_n must be comprised between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the angles δ_n will correspond to as many N points on the ground.

iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \ldots, H_{max}$, compute $EIRP_{C\_j}$ using the following algorithm:

a) Set the altitude of the A-ESIM to H_j.

b) Compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii) using the following equation:

$$\gamma_{j,n} = \arccos\left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)}\right) \quad (2)$$

where R_e is the mean earth radius.

c) Compute the distance $D_{j,n}$, in km, for $n = 1, \ldots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (3)$$

d) Compute the fuselage attenuation $L_{f\,j,n}$ (dB) applicable to each of the angles $\gamma_{j,n}$ computed in b) above.

e) Compute the atmospheric loss $L_{atm\_j,n}$ (dB) applicable to each of the distances $D_{j,n}$ computed in c) above.

f) Compute the $EIRP_{C\_j,n}$ (dB(W/BW_{Ref})), that is the maximum e.i.r.p. that can be radiated in the pfd mask's reference bandwidth by the A-ESIM towards each of the N points to be compliant with the set(s) of pre-established pfd limits, as per the following equation:

$$EIRP_{C\_j,n}(\delta_n, \gamma_n) = pfd(\delta_n) + 10\log_{10}\left(4\pi\left(D_{j,n} \cdot 1\,000\right)^2\right) + L_{f\,j,n} + L_{atm\_j,n} + L_{pol} \quad (4)$$

g) Compute the minimum $EIRP_{C\_j}$ across all values calculated at the previous step, $EIRP_{C\_j}$ = Min ($EIRP_{C\_j,n}$ (δ_n, γ_n)). The output of this last step is the maximum $EIRP_C$ that can be radiated by the A-ESIM to ensure it complies with the set(s) of pre-established pfd limits with respect to all angles δ_n at the altitude H_{j}. There will be one $EIRP_{C\_j}$ for each of the H_{j} altitudes considered.

iv) For the emissions, check whether there is at least one j for which $EIRP_{C\_j} > EIRP_R$. If the emission of the Group under examination passes the test above, the result of the Bureau's examination for that Group is ***favourable***, otherwise it is ***unfavourable***.

v) The Bureau publishes:

The finding (*favourable* or *unfavourable*) for each Group of emissions of the GSO network examined.

4 Example application of the methodology

Table A4-2 below describes the emissions included in one Group of a fictitious satellite network that are associated to the class of A-ESIM transmitting in the frequency band 12.75-13.25 GHz.

TABLE A4-2

Example A-ESIM emissions in the Group examined

Emission No.	**C7a Designation of emission**	**C8a2/C8b2 Maximum power density dB(W/Hz)**	**C8c3 Minimum power density (not used in methodology) dB(W/Hz)**	**C8e1 *C*/*N* objective (total – clear sky) (not used in methodology) dB**
1	6MD7W--	−70	−80	−5.0

Table A4-3 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A4-3

Additional assumptions

Parameter	**Notation**	**Value**	**Unit**
Test frequency	F	13.25	GHz
GSO orbital longitude	*GSO_lon*	13.0	deg
GSO service area latitude bounds	-	from 23.55 to 63.55	deg
GSO service area longitude bounds	-	from −9.72 to 30.28	deg
A-ESIM antenna peak gain	G_{max}	32.7	dBi
Antenna gain pattern	-	APEREC015V01	
\Polarization loss	L_{Pol}	0.0	dB
Fuselage attenuation model	L_f	See Table A4-4	
Atmospheric loss	L_{atm}	Recommendation ITU-R P.676	
Minimum examination altitude range	H_{min}	0.02	km
Maximum examination altitude range	H_{max}	15.0	km
Examination altitude range spacing	H_{step}	1.0	km

TABLE A4-4

Fuselage attenuation model from Report ITU-R M.2221

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	dB	for	$0° \leq \gamma \leq 10°$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	dB	for	$10° < \gamma \leq 34°$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	dB	for	$34° < \gamma \leq 50°$
$L_{fuse}(\gamma) = 35$	dB	for	$50° < \gamma \leq 90°$

TABLE A4-5

Tested pfd limits on the ground

The maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single earth station on aircraft shall not exceed:

−123.5	dB(W/(m^2 · MHz))	for	$\theta \leq 5°$
−128.5 + θ	dB(W/(m^2 · MHz))	for	$5° < \theta \leq 40°$
−88.5	dB(W/(m^2 · MHz))	for	$40° < \theta \leq 90°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

The paragraphs below represent the step-by-step application of the calculation methodology described in section 3.

START

i) For the emission in Table A4-2, the reference e.i.r.p. ($EIRP_R$, dBW) is computed and the relevant results are included in Table A4-6 below:

TABLE A4-6

Computed values of $EIRP_R$ for the Group under consideration

Emission	G_{Max}, dBi	$G_{Isol_{Max}}$ dB	P_{Max}, dB(W/Hz)	BW, MHz	$EIRP_R$, dBW
1	32.7	35.2	−70	6.0 − 12.5	−12.5

ii) Generate δ_n angles compatible with the pfd limits described in Table A4-5:

δ_n = 0°, 0.01°, 0.02°, …, 0.3°, 0.4°,…, 12.3°, 12.4°,…, 13°, 14°,…, 90°.

iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \ldots, H_{max}$, compute $EIRP_{C\_j}$. The output of this step is summarized in Table A4-7 below:

TABLE A4-7

Computed $EIRP_{C\_j}$ values (see embedded file for full results)

j	H_j	$EIRP_{C\_j,n}$ (δ_n, γ_n) dB(W/BW$_{Ref}$)				$EIRP_{C\_j}$
–	(km)	δ = 0°	δ = 0.01°	…	δ = 90°	dB(W/BW$_{Ref}$)
1	0.02	Table A.2.9_1.15.xlsx				−40.62
2	1.00					−26.84
3	2.00					−20.77
…	…					…
16	15.00					−3.27

iv) For the emission, check whether there is at least one altitude for which $EIRP_{C\_j} > EIRP_R$. The result of this step is summarized in Table A4-8 below:

TABLE A4-8

Comparison between $EIRP_{C\_j}$ and $EIRP_R$

Emission	$EIRP_R$ dB(W)	Smallest j for which $EIRP_{C\_j} > EIRP_R$	$EIRP_{C\_j} > EIRP_R$
1	−12.5	5	Yes

v) Since the emission among those included in the Group under examination passes the test detailed in iv) above, the results of the Bureau's examination for this Group are ***favourable***.

vi) The Bureau publishes:

The finding (here, favourable) for the Group of the GSO network examined.

ANNEX 5 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

Option 1:

Required ESIM software and hardware capabilities

In order to enable the ESIM to cease transmission when the conditions described are met, the ESIM network shall be designed with appropriate software or hardware capabilities. The table below describes applicable minimum software and hardware capabilities, with a justification for their requirement.

Also it is important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.

For each ESIM, the NCMC will have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and satellite system. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.

TABLE A5-1

Minimum ESIM capabilities and justification

Capability	Justification
GNSS (or other geolocation capabilities)	Required to assess ESIM's geographic location so ESIM is aware when entering the administration's territory that has not given authorization and feedback to software to cease transmissions accordingly.
Monitor loss of frequency lock	Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Monitor loss of LO signal	Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Internal power off/on/reset	Required for the ESIM to have the ability to self-power down after experiencing a fault condition, then restart or power back on when fault is resolved.

Capability	Justification
Disable/enable transmission and level adjustment	Required to cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions.
Receive and execute commands from NCMC	Required to receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions.

Furthermore, the ESIM shall have the ability to enter the states described in Table A5-2. These states are required to ensure the ESIM is in the correct radio-interface state after some event (such as an initial boot or resuming operations after a fault) and can test system functionality is correct before radiating in order to avoid any transmission errors.

TABLE A5-2

ESIM states and events[10]

ESIM state	Radio-interface state	Corresponding event
Non-valid	Emissions disabled	After power-on, until ESIM can receive commands from NCMC and no fault conditions are present After any failure/fault During system checks
Initial phase	Emissions disabled	When waiting for a transmission enable or disable command from NCMC
Transmission enabled	Carrier-off	No carrier transmitted/need for carrier to be transmitted Receive synchronization is lost Pointing threshold is exceeded
	Carrier-on	During transmission and ESIM is correctly pointed
Transmission disabled	Emissions disabled	When commanded by NCMC or ESIM automatically enters based on a “Cease Transmission” condition In locations where transmission is not permitted

Option 2:

Annex 5 is not needed and these elements can be captured in the ITU-R Reports and/or Recommendations.

[10] Heavily adapted from EN 303 979.

Agenda item 1.16

1.16 to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-geostationary fixed-satellite service earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with Resolution ***173 (WRC-19)****;*

Resolution **173 (WRC-19)** – *Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service*

There are several areas on which there is no consensus either on the text or how to proceed with the implementation of the draft new Resolution contained in Section 4/1.16/5.2. Consequently the text below is not consistent with *resolves* 5 of Resolution **173 (WRC-19)** as shown below.

4/1.16/1 Executive summary

WRC-23 agenda item 1.16 considers the use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz (space-to-Earth), 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary (non-GSO) space stations in the fixed-satellite service (FSS). The studies under this agenda item considered two types of earth stations in motion (ESIMs): aeronautical and maritime only. Studies have been carried out on sharing and compatibility between ESIM and terrestrial as well as space services allocated in the frequency bands above. For this agenda item, two methods have been identified:

– Method A proposes no changes to the RR and suppression of Resolution **173 (WRC-19)**.

– Method B proposes to add a new footnote No. **5.A116** in RR Article **5** and a reference to a new WRC Resolution providing the conditions for the operation of ESIM and protection of the services to which the frequency bands are allocated, and consequential suppression of Resolution **173 (WRC-19)**. Wherever it was not possible to achieve consensus on specific topics within method B, options are included for each of them.

4/1.16/2 Background

ESIMs under WRC-23 agenda item 1.16 are earth stations that communicate with non-geostationary-satellite orbit (non-GSO) space stations in the FSS in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space).

The ITU Radiocommunication Sector (ITU-R) has studied the main technical and operational requirements for earth stations on mobile platforms operating in non-GSO FSS systems in these frequency bands, see Report ITU-R S.2261 (09/2012). The Report describes how such earth stations operating in these frequency bands need to be designed and operated to meet the existing technical and/or operational requirements applicable to non-GSO FSS earth stations.

While *resolves* 1 and 2 of Resolution **173 (WRC-19)** do not specifically refer to the type of ESIMs, *resolves* 3 of that Resolution specifically refers to aeronautical and maritime ESIMs. Therefore, technical and regulatory provisions for the operation of the abovementioned ESIMs under WRC-23 AI 1.16 are limited to aeronautical and maritime ESIMs.

ESIMs can be used to provide broadband communication services to users on mobile platforms.

There are a number of differences between GSO satellite networks and non-GSO satellite systems, including the number, the altitude and the coverage of space stations. The impact of these differences and, in particular, the interference environment resulting from the operation of non-GSO aeronautical and maritime ESIMs, has been studied in order to develop technical, operational and regulatory provisions for their operations in the frequency bands subject to Resolution **173 (WRC-19)**.

4/1.16/3 Summary and analysis of the results of ITU-R studies

4/1.16/3.1 Control and monitoring of ESIMs

The three elements consisting of interference management mechanism, switching facility for ON/OFF function and the functions of Network Control and Monitoring Center (NCMC) and their relations with each other are critical elements for the proper operation of ESIMs. Therefore, the text provided below requires careful consideration by administrations.

The only administration that could notify ESIM is the same administration notifying the non-GSO satellite system with which ESIM communicates. Therefore, the notifying administration of the non-GSO satellite system is responsible for the compliance of ESIM with all relevant regulatory and administrative provisions including cases of interferences. The notifying administration of the non-GSO satellite system is also responsible for ensuring that ESIMs operate only in territories for which their operations are authorized by the administration having the jurisdiction on that territory.

Upon receipt of an interference report from the affected administration, the notifying administration of the non-GSO satellite system responsible for the operation of ESIMs shall work with the NCMC toto resolve the unacceptable interference.

Should unacceptable interference occur to station(s) in the territory of an administration other than the notifying administration of the non-GSO satellite system under which the ESIMs operate.

View 1 was expressed that the notifying administration of the non-GSO satellite system with which the ESIMs communicate gathers all information about an interference case from the affected administration and resolves the case of interference. The affected administration is invited to provide any available information to the best of its abilities without any additional burden.

View 2 was expressed that the course of action of how to address an interference case should be described more in detail, and one possible example is provided below. The text below needs to be carefully examined, verified and validated to ensure that its application would contribute to the resolution of interference, taking into account that there is no time element associated with the steps indicated in the text.

The appropriate course of action and operational procedure on how to rapidly reduce the interference to the acceptable level or its elimination is addressed as follows:

i) Interference occurrence to station(s) in the territory of an administration other than the notifying administration of the satellite system under which the ESIM would operate.

ii) The affected administration, in cooperation with the notifying administration of the satellite system under which the ESIM would operate, detects the location of the source of the interference.

iii) The affected administration informs the notifying administration of the satellite system under which the ESIM would operate.

iv) The notifying administration of the satellite system under which the ESIM would operate shall request immediately to the point of contact for the NCMC all available information necessary to resolve the interference case.

v) The NCMC commands the ESIM to disable the transmission or reduce the interference to an acceptable level.

vi) The notifying administration of the satellite system under which the ESIM would operate informs the affected administration about the actions taken in iv).

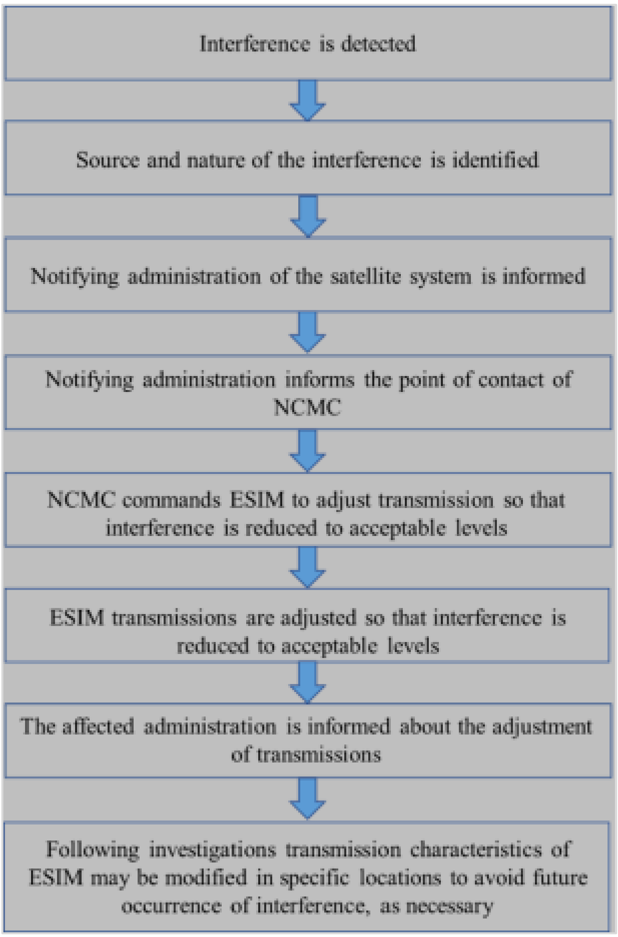
vii) The notifying administration of the satellite system under which the ESIM would operate investigates the root cause of the unacceptable interference and takes action from the following options based on the reason of the interference:

a) request the NCMC to make transmission level adjustment, frequency or modulation change, antenna pointing accuracy change or others;

b) submit to the BR, for information purposes only, the result of the investigation and interference analysis.

FIGURE 4/1.16/3-1

Proposed ESIM interference mitigation process



There were two additional questions raised in relation to the necessary measures to eliminate potential unacceptable interference from ESIMs:

1) If separate sub-constellations of satellites in a common multi-satellite non-GSO FSS system have been notified to the Radiocommunication Bureau (BR) by different administrations, then how to clearly identify the administration that should be responsible for eliminating unacceptable interference from this non-GSO system?

Answer: Since according to the draft Resolution, the notifying administration of the satellite system with which ESIM communicate is responsible in case of unacceptable interference, in case more than one administration has notified satellites in a single NGSO constellation each of the notifying administrations is responsible to eliminate of any unacceptable interference from ESIMs that have been authorized to operate.

2) How to clearly identify a potential source of unacceptable interference if two (or more) non-GSO satellite systems simultaneously operate ESIMs within the authorized territory of an administration?

Answer: If two (or more) non-GSO satellite systems simultaneously operate ESIMs within the authorized territory of an administration, the notifying administration responsible for that interference will be identified during the investigation that will be initiated following the report of interference. For example, one way to identify the responsible notifying administration is to contact all administrations that are responsible for ESIMs operations in that territory and seek confirmation of their involvement or not in the interference event.

4/1.16/3.2 Services with allocations in these bands

In accordance with Resolution **173 (WRC-19)**, ESIMs communicating with non-GSO FSS space stations should protect the existing services to which the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz, 27.5-29.1 GHz and 29.5-30 GHz are allocated, in addition to protecting the Earth exploration-satellite service (EESS) (passive) and space research service (SRS) (passive) in the adjacent frequency bands.

The following table summarizes the services which should be protected from the operation of non-GSO ESIMs in the concerned frequency bands.

TABLE 4/1.16/3-1

Frequency range (GHz)	Non-GSO ESIMs direction of transmission	Service allocation		Existing provisions in the RR relevant to sharing between non-GSO FSS and other allocated services (for information purposes)
		Terrestrial services	Space services	
17.7-17.8	space-to-Earth	FIXED		Article **21**
		MOBILE		Article **21**
			GSO FSS (space-to-Earth)	No. **22.2**
			GSO FSS (Earth-to-space)	No. **22.2**
			BSS	No. **22.2**
			Non-GSO FSS (space-to-Earth)	No. **9.12**
17.8-18.4	space-to-Earth	FIXED		Article **21**
		MOBILE		Article **21**
			GSO FSS (space-to-Earth)	Nos. **22.5C** and **22.5CA**
			GSO FSS (Earth-to-space)	Applicable parts of Nos. **22.2** and **22.5F**
			Non-GSO FSS (space-to-Earth)	No. **9.12**
			Meteorological-satellite service	No. **5.519**
18.4-18.6	space-to-Earth	FIXED		Article **21**
		MOBILE		Article **21**
			GSO FSS (space-to-Earth)	Article **22**, No. **22.2**
			Non-GSO FSS (space-to-Earth)	No. **9.12**

Frequency range (GHz)	Non-GSO ESIMs direction of transmission	Service allocation		Existing provisions in the RR relevant to sharing between non-GSO FSS and other allocated services (for information purposes)
		Terrestrial services	Space services	
18.6-18.8	Not applicable		EESS (passive) SRS (passive) (secondary allocation in Regions 1 and 3)	Nos. **5.522B, 21.16.2**
18.8-19.3	space-to-Earth	FIXED		Article **21**
		MOBILE		Article **21**
			GSO FSS (space-to-Earth)	No. **9.12A**
			Non-GSO FSS (space-to-Earth)	No. **9.12**
19.7-20.2	space-to-Earth		GSO FSS (space-to-Earth)	Article **22**, No. **22.2**
			Non-GSO FSS (space-to-Earth)	No. **9.12**
			MSS (secondary allocation in Regions 1 and 3)	No relevant provision
		FIXED	Additional primary allocation in some countries	No. **5.524**
		MOBILE	Additional primary allocation in some countries	No. **5.524**
27.5-28.5	Earth-to-space	FIXED		No relevant provision
		MOBILE		No relevant provision
			GSO FSS (Earth-to-space)	Article **22**, No. **22.2**
			Non-GSO FSS (Earth-to-space)	No. **9.12**
28.5-28.6	Earth-to-space	FIXED		No relevant provision
		MOBILE		No relevant provision
			GSO FSS (Earth-to-space)	Article **22**, No. **22.2**
			Non-GSO FSS (Earth-to-space)	No. **9.12**
			Earth exploration-satellite service	No relevant provision
28.6-29.1	Earth-to-space	FIXED		No relevant provision
		MOBILE		No relevant provision
			GSO FSS (Earth-to-space)	No. **9.12A**
			Non-GSO FSS (Earth-to-space)	No. **9.12**
			Earth exploration-satellite service	No relevant provision
29.5-30	Earth-to-space		GSO FSS (Earth-to-space)	Article **22**, No. **22.2**
			Non-GSO FSS (Earth-to-space)	No. **9.12**
			Earth exploration-satellite service	No relevant provision
			MSS (secondary allocation in Regions 1 and 3)	No relevant provision
		Fixed	Additional secondary allocation in some countries	No. **5.542**
		Mobile	Additional secondary allocation in some countries	No. **5.542**

4/1.16/3.3 Sharing with terrestrial services (fixed and mobile)

4/1.16/3.3.1 Frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz

There are pfd limits in RR Article **21** to protect terrestrial services from FSS space station emissions. Therefore, whether an FSS space station communicates with a stationary terminal or with an ESIM, the interference with respect to receiving fixed and mobile service stations would be unchanged as long as the applicable provisions of RR Article **21** do not change.

However, in the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz, aeronautical and maritime non-GSO ESIMs receivers shall not claim protection from terrestrial services to which the frequency bands are allocated.

4/1.16/3.3.2 Frequency band 19.7-20.2 GHz

The frequency band 19.7-20.2 GHz is allocated to fixed and mobile services on a primary basis in some countries in accordance with RR No. **5.524**.

In this frequency band, aeronautical and maritime non-GSO ESIM receivers shall not claim protection from terrestrial services to which the frequency band is allocated in RR No. **5.524**.

4/1.16/3.3.3 Frequency bands 27.5-29.1 GHz and 29.5-30 GHz

4/1.16/3.3.3.1 Frequency band 27.5-29.1 GHz

ITU-R studies showed that, when the appropriate technical and operational conditions are applied to the maritime and aeronautical non-GSO ESIMs, interference to terrestrial services in the frequency band 27.5-29.1 GHz is kept within acceptable levels. Therefore, maritime and aeronautical non-GSO ESIMs should operate under specified technical, operational and regulatory conditions to avoid causing unacceptable interference to receiving stations of terrestrial services allocated on a primary basis and operating in accordance with RR.

4/1.16/3.3.3.1.1 Sharing between aeronautical non-GSO ESIMs and terrestrial services

TABLE 4/1.16/3-2

Summary of sharing studies between non-GSO A-ESIMs and FS stations

Parameter	Study A	Study B	Study H-1	Study C	Study H-2	Study H-3	Study H-4	Study F	Study J
Type of study	Worst-case flight geometry Single entry	Worst-case flight geometry Single entry	Worst-case flight geometry Single entry	Worst-case flight geometry Aggregate effect	Worst-case flight geometry Single entry	Dynamic – Monte Carlo Single Entry	Dynamic – Monte Carlo Aggregate effect	Worst-case flight geometry Single entry	Dynamic – Air traffic data Aggregate effect
Results	Interference protection criteria not exceeded for any altitude or deployment type	Interference protection criteria not exceeded for altitude 2 km and above. The long-term protection criterion exceeded for 1 km	Interference protection criteria not exceeded	Interference protection criteria not exceeded for any of deployment scenarios	Interference protection criteria not exceeded in any altitude	Interference protection criteria not exceeded in any altitude or location	Interference protection criteria not exceeded in any altitude or location	Interference protection criteria not exceeded for any altitude	Interference protection criteria not exceeded for any of deployment scenarios

NOTE: It is understood that the category of allocation of ESIMs would match with the category of allocation of the space station with which it communicates. Furthermore, a I/N limit long-term protection criterion of −10 dB has been applied for the protection of the FS.

TABLE 4/1.16/3-3

Summary of sharing studies between non-GSO A-ESIMs and MS stations

Parameter	Study I-1	Study D	Study E - Airborne case	Study E - Ground operations case	Study I-2	Study I-3	Study I-4	Study J	Study G
Type of study	Worst-case flight geometry Single entry	Worst-case flight geometry Single entry	Worst-case geometry Single entry	Worst-case ground geometry Single entry	Worst-case flight geometry Single entry	Dynamic – Monte Carlo Single Entry	Dynamic – Monte Carlo Aggregate effect	Worst-case flight geometry Single entry	Dynamic – Air traffic data Aggregate effect
Results	Interference protection criteria not exceeded	Interference protection criteria not exceeded for altitude 2 km and above. The long-term protection criterion exceeded for 1 km	In majority of the cases the interference protection criterion is exceeded	In majority of the cases the interference protection criterion is exceeded	Interference protection criteria not exceeded in any altitude	Interference protection criteria not exceeded in any altitude or location	Interference protection criteria not exceeded in any altitude or location	Interference protection criteria not exceeded for any altitude	Interference protection criteria not exceeded for any of deployment scenarios

NOTE: It is understood that the category of allocation of ESIMs would match with the category of allocation of the space station with which it communicates. Furthermore, a I/N limit long-term protection criterion of −6 dB has been applied for the protection of the MS.

4/1.16/3.3.3.2 Sharing between maritime non-GSO ESIMs and terrestrial services

Studies analysed the interference that would be received by fixed service and mobile service stations from maritime ESIMs (M-ESIMs) operating with a non-GSO FSS constellation in the Earth-to-space direction in the frequency band 27.5-29.1 GHz considering the limits agreed in Resolution **169 (WRC-19)**.

In all cases the results show that the protection criteria of the FS and MS stations is met assuming the non-GSO M-ESIMs complies with the minimum distance from the low-water mark (70 km) agreed in Resolution **169 (WRC-19)** for protection of terrestrial service from GSO M-ESIMs.

The conditions under which Resolution **169 (WRC-19)** were agreed do not prevail for this agenda item due to the fact the type of orbit is different and number of satellites and their properties are different. To this effect, the minimum distance from the low-water mark (70 km) is not acceptable as there are no overall results of the studies performed to support such conclusions.

Some other views were expressed that the minimum distance of 70 km is justified by the studies carried out by some administrations during the study cycle.

The ITU-R examined sharing conditions between maritime non-GSO ESIMs and terrestrial services in the frequency band 27.5-29.1 GHz and concluded that there would be potential interference to receiving stations of terrestrial services from maritime non-GSO ESIMs transmitters. However, when the mitigations are applied by the maritime non-GSO ESIMs, interference is kept within acceptable levels. Therefore, maritime ESIMs should operate under specified technical, operational and regulatory conditions to avoid causing unacceptable interference to receiving stations of terrestrial services operating in accordance with RR.

NOTE: It is understood that the category of allocation of ESIMs would match with the category of allocation of the space station with which it communicates. Furthermore, a I/N limit long-term protection criterion of −10 dB has been applied for the protection of the FS.

Further information is provided in the relevant parts of draft new Resolution **[A116] (WRC-23)**.

4/1.16/3.3.4 Frequency band 29.5-30.0 GHz

This frequency band is allocated to fixed and mobile services on a secondary basis in some countries in accordance with RR No. **5.542**.

In accordance with *resolves* 2 and 3 of Resolution **173 (WRC-19)**, sharing and compatibility studies between non-GSO ESIMs in the frequency band 29.5-30 GHz and secondary allocated terrestrial services have not been carried out. Nevertheless, this does not mean that those terrestrial services mentioned in No. **5.542** should not be taken into consideration. It was agreed that these services should not be adversely affected by the operation of non-GSO ESIMs.

In order to protect fixed and mobile services in the territories of the administrations mentioned in RR No. **5.542** in this frequency band, the conditions in Annex 1 of the draft new Resolution should be applied only for the administration mentioned in RR No. **5.542** to protect the fixed and mobile services from the operations of non-GSO ESIMs

4/1.16/3.4 Sharing with space services

4/1.16/3.4.1 Fixed-satellite service

4/1.16/3.4.1.1 GSO FSS networks

4/1.16/3.4.1.1.1 Frequency band 17.7-17.8 GHz

In the frequency band 17.7-17.8 GHz, the provision of RR No. **22.2** applies, therefore, non-GSO FSS systems shall not cause unacceptable interference to and shall not claim protection from GSO FSS and BSS networks.

In addition, since in this frequency band, GSO FSS earth stations and non-GSO ESIMs are both receiving, no interference can be caused by non-GSO ESIMs into GSO FSS receiving earth stations.

4/1.16/3.4.1.1.2 Frequency bands 17.8-18.6 GHz, 19.7-20.2 GHz, 27.5-28.6 GHz and 29.5-30 GHz

RR Article **22** specifies epfd limits for non-GSO FSS systems in the frequency bands 17.8-18.6 GHz, 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), and 29.5-30 GHz (Earth-to-space) for protection of GSO networks from non-GSO systems.

Therefore, non-GSO ESIMs operating in these frequency bands shall comply with the applicable RR Article **22** epfd limits to protect GSO networks.

In addition, in accordance with the provisions of RR No. **22.2**, non-GSO satellite system shall not claim protection from GSO networks in the FSS and the BSS operating in accordance with these Regulations. RR No. **5.43A** does not apply in this case.

4/1.16/3.4.1.1.3 Frequency bands 18.8-19.3 GHz and 28.6-29.1 GHz

In the frequency bands 18.8-19.3 GHz and 28.6-29.1 GHz, non-GSO FSS systems are subject to coordination under RR No. **9.12A** with GSO FSS networks. The use of non-GSO ESIMs in these frequency bands would not change the interference environment with respect to GSO FSS networks provided non-GSO ESIMs shall be operated within the envelope of characteristics and envelope of coordination of typical earth stations of the non-GSO FSS systems as stated in *considering further d)* of Resolution **173 (WRC-19)**. It should be noted that non-GSO ESIMs shall not cause unacceptable interference to geostationary fixed-satellite service networks for which complete RR Appendix **4** notification information is considered as having been received by the Bureau prior to 18 November 1995 in accordance with the provisions of RR No. **5.523A**.

4/1.16/3.4.1.2 Non-GSO FSS systems

In the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz, 27.5-29.1 GHz, and 29.5-30 GHz non-GSO FSS systems are subject to coordination under RR No. **9.12** with other non-GSO FSS systems. The use of non-GSO ESIMs in these frequency bands would not change the interference environment with respect to non-GSO FSS systems provided non-GSO ESIMs shall be operated within the envelope of characteristics and envelope of coordination of typical earth stations of the non-GSO FSS systems as stated in *considering further d)* of Resolution **173 (WRC-19)**.

4/1.16/3.4.1.3 Broadcasting-satellite service feeder-link

4/1.16/3.4.1.3.1 Fixed-satellite service in the frequency band 17.7-18.4 GHz

In the band 17.7-18.4 GHz, non-GSO ESIMs are receiving and GSO FSS satellites with which BSS feeder link earth stations communicate are receiving. Therefore, no potential interference may be caused by non-GSO ESIMs to feeder link to the BSS.

In accordance with the provisions of RR No. **22.2**, non-GSO ESIMs shall not claim protection from BSS feeder link earth stations operating in accordance with the Radio Regulations in this band.

4/1.16/3.4.1.3.2 Fixed-satellite service in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz (see No. 5.539)

In the bands 27.5-28.6 GHz and 29.5-30 GHz, non-GSO ESIMs are transmitting and GSO FSS satellites with which BSS feeder-link earth stations communicate are receiving.

There are epfd limits specified in RR Article **22** to protect GSO FSS satellites from non-GSO systems in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz. Therefore, non-GSO ESIMs operating in these bands shall also comply with the applicable RR Article **22** epfd limits to protect GSO FSS satellites with which BSS feeder-link earth stations communicate.

4/1.16/3.4.1.3.3 Fixed-satellite service in the frequency band 28.6-29.1 GHz (*see* No. 5.539)

In the band 28.6-29.1 GHz non-GSO ESIMs are transmitting and GSO FSS satellites with which BSS feeder-link earth stations communicate are receiving.

In this frequency band, non-GSO FSS systems are subject to coordination under RR No. **9.12A** with GSO FSS networks. Non-GSO ESIMs need to be operated within the envelope of the characteristics and envelope of coordination agreements for the frequency assignments of typical earth stations of the non-GSO FSS systems initially published and included in the International Frequency Information Circular (BR IFIC) to protect GSO FSS satellites with which BSS feeder-link earth stations communicate, in this frequency band as stated in *considering further d)* of Resolution **173 (WRC-19)**. However, it should be noted that non-GSO ESIMs shall not cause unacceptable interference to geostationary fixed-satellite service networks for which complete RR Appendix **4** notification information is considered as having been received by the Bureau prior to 18 November 1995.

4/1.16/3.4.2 Broadcasting-satellite service in the frequency band 17.7-17.8 GHz in Region 2

In the band 17.7-17.8 GHz, GSO BSS earth stations and non-GSO ESIMs are both receiving; therefore, no interference can be caused by non-GSO ESIMs into the GSO BSS receiving earth stations.

In addition, in this band RR No. **22.2** applies. Therefore, non-GSO FSS systems with which ESIMs communicate, shall not cause unacceptable interference to and shall not claim protection from GSO FSS and BSS.

4/1.16/3.4.3 Mobile-satellite service in the frequency bands 19.7-20.2 GHz and 29.5-30 GHz

In the band 19.7-20.2 GHz, GSO MSS earth stations and non-GSO ESIMs are both receiving; therefore, no interference can be caused by non-GSO ESIMs into the GSO MSS receiving earth stations.

Since non-GSO ESIMs shall meet the epfd limits specified in RR Article **22** in the band 29.5-30.0 GHz, there may be no unacceptable interference into GSO MSS in this band.

To date, no ITU-R Recommendations or Reports related to the characteristics of MSS systems operating in these bands have been identified.

4/1.16/3.4.4 Space-to-space communication for the Earth exploration-satellite service in the frequency band 29.95-30 GHz

In order to protect space-to-space communications for the Earth exploration-satellite service (EESS), in the frequency band 29.95-30 GHz non-GSO ESIMs should be operated within the envelope of the characteristics of typical earth stations of the non-GSO FSS systems initially published and included in the BR IFIC as stated in *considering further d)* of Resolution **173 (WRC-19)**.

4/1.16/3.4.5 Earth exploration-satellite service (passive) and space research service (passive)

4/1.16/3.4.5.1 Frequency band 18.6-18.8 GHz

The EESS (passive) is allocated on a primary basis in all three ITU Regions, while the SRS (passive) is primary in Region 2 in the frequency band 18.6-18.8 GHz; the two services are adjacent to the bands proposed for use by FSS non-GSO downlink to ESIMs. As SRS (passive) consists of sensors on board spacecraft around other planets or sensors looking towards outer space, no unacceptable interference is expected on this service.

Four compatibility studies between non-GSO FSS space stations operating in the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and EESS (passive) stations operating in the frequency band 18.6-18.8 GHz have been performed.

Study 1

The FSS downlink signal for communication with ESIMs is unchanged from the non-GSO FSS downlink signal that is used for fixed FSS earth stations. Further analysis would verify whether a non-GSO FSS earth station receiving these transmissions would alter the adjacent band FSS interference environment to the primary EESS (passive) or SRS (passive) band from what is currently permitted by the International Radio Regulations. Given the ESIMs concept of operations and technical characteristics for this agenda item, the non-GSO FSS space stations will operate in the same manner as traditional non-GSO FSS space stations (i.e. in the space-to-Earth direction with no change in transmit parameters), and ESIMs stations would only be receiving the same downlink transmissions that are also being directed to the Earth's surface in accordance with current international regulatory provisions applicable to the non-GSO FSS.

Taking the above into account, as long as the non-GSO FSS downlink signal for communication with ESIMs is unchanged from the non-GSO FSS downlink signal that is used for fixed FSS earth stations and ESIMs maintain the same operations for the non-GSO FSS systems that are currently in conformity with the international Radio Regulations, additional sharing and compatibility studies with primary EESS (passive) and SRS (passive) may not be required in this adjacent frequency band.

Study 2

The introduction of aeronautical and maritime ESIMs in the non-GSO FSS in the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz will lead to an increase of the number of FSS beams covering the oceans compared to the current situation, which is limited to coverage of fixed earth stations, e.g. located on islands and oil rigs. As a result, it will lead to an increase of the interference to EESS (passive) in the frequency band 18.6-18.8 GHz, in particular in open oceans, due to scattering over water of FSS unwanted emissions.

Based on the current studies, it has been determined that the unwanted emission pfd at the Earth's surface that would offer protection to EESS (passive) from these scattered unwanted emissions falling into the passive band would be in the range of −123 to −104 dB(W/(m^2 · 200 MHz)) for the three particular non-GSO FSS systems considered. The value depends roughly on the surface of the area illuminated on the ocean.

Study 3

This study investigates the possible changes to the current sharing environments in 18.6-18.8 GHz based on introduction of non-GSO ESIMs while considering the recently developed sea reflection model. The result showed that, for the studied case, the protection criteria of the EESS passive is not exceeded.

Furthermore, it is shown that out-of-band operation of the non-GSO FSS system considered does not degrade the sharing condition, and that the interference environment is driven by in-band interference from other primary services.

This preliminary study has shown the reflected signal from the ocean surface into the EESS passive sensors is a function of the power level and the antenna footprint. Therefore, it is appropriate to consider the signal level together with number beams and their power level averaged.

There are no overall results of these studies that one could reach a clear conclusion on the matter. This is due to the fact that each study used its preferred/selected parameters, assumption, inputs, propagation model, and other criteria involved in the sharing and compatibility studies.

Some other views were expressed sufficient studies were carried out to reach a conclusion to achieve protection of EESS (passive).

4/1.16/3.4.5.2 Frequency bands 28.5-29.1 GHz and 29.5-30 GHz (Earth-to-space)

In these bands, non-GSO ESIMs are transmitting and EESS space stations are receiving. Therefore, there is potential for interference from non-GSO ESIMs to EESS space station in these bands.

The use of non-GSO ESIMs in the frequency bands 28.5-29.1 GHz and 29.5-30 GHz would not change the current interference environment with respect to the secondary EESS in the frequency range 28.5-30 GHz, as non-GSO ESIMs should be operated within the envelope of characteristics and envelope of coordination of typical earth stations of the non-GSO FSS systems initially published and included in the BR IFIC as stated in *considering further d)* of Resolution **173 (WRC-19)**.

However, as described in *considering c)* of Resolution **173 (WRC-19)**, it needs to be ensured that no additional constraints should be imposed on the EESS in these bands.

How such assurance is established and guaranteed to be achieved.

Views were expressed that the studies that have been carried out are sufficient to ensure that no additional constraints will be imposed on the EESS in these bands.

4/1.16/3.4.6 Meteorological-satellite service in the frequency band 18-18.4 GHz (*see* No. 5.519)

In the frequency band 18-18.4 GHz, the GSO meteorological-satellite earth station and non-GSO ESIMs are both receiving. Therefore, no interference can be caused by non-GSO ESIMs into the GSO meteorological-satellite service receiving earth stations. The interference environment with respect to meteorological-satellite receiving stations would be unchanged as long as the non-GSO FSS space stations transmitting to aeronautical and maritime non-GSO ESIMs will operate in the same manner as traditional non-GSO FSS space stations (i.e. in the space-to-Earth direction with no change in transmit parameters).

4/1.16/3.4.7 Potential satellite-to-satellite links in the frequency bands 18.1-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz, 27.5-29.1 GHz and 29.5-30.0 GHz

NOTE: Provisions with regards to satellite-to-satellite links may be determined by WRC-23 under agenda item 1.17.

4/1.16/3.4.7.1 Frequency bands 18.1-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz

In these frequency bands, non-GSO ESIMs are receiving. Therefore, no interference can be caused by non-GSO ESIMs into satellite-to-satellite links.

4/1.16/3.4.7.2 Frequency bands 27.5-29.1 GHz and 29.5-30 GHz

In these frequency bands, non-GSO ESIMs characteristics should remain within the envelope characteristics of typical earth stations associated with the non-GSO FSS satellite system with which these earth stations communicate. Therefore, the coexistence of non-GSO ESIMs with potential satellite-to-satellite links should be ensured through the same measures established for the coexistence with FSS under WRC-23 AI 1.17, if any.

4/1.16/4 Methods to satisfy the agenda item

4/1.16/4.1 Method A

No changes to the Radio Regulations and suppression of Resolution **173 (WRC-19)**.

4/1.16/4.2 Method B

Add a new footnote in RR Article **5** that refers to a new WRC Resolution with technical, operational and regulatory conditions for the operation of non-GSO maritime and aeronautical ESIMs while ensuring protection of allocated services and consequential suppression of Resolution **173 (WRC-19)**.

4/1.16/5 Regulatory and procedural considerations

4/1.16/5.1 For Method A

NOC

ARTICLES

NOC

APPENDICES

SUP

RESOLUTION 173 (WRC-19)

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

4/1.16/5.2 For Method B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

15.4-18.4 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">**17.7-18.1**
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.517A
ADD 5.A116
(Earth-to-space) 5.516
MOBILE</td><td>**17.7-17.8**
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.517 5.517A
ADD 5.A116
(Earth-to-space) 5.516
BROADCASTING-SATELLITE
Mobile
5.515</td><td rowspan="2">**17.7-18.1**
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.517A
ADD 5.A116
(Earth-to-space) 5.516
MOBILE</td></tr>
<tr><td>**17.8-18.1**
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.517A
ADD 5.A116
(Earth-to-space) 5.516
MOBILE
5.519</td></tr>
<tr><td>**18.1-18.4**</td><td colspan="2">FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A
ADD 5.A116
(Earth-to-space) 5.520
MOBILE
5.519 5.521</td></tr>
</table>

MOD

18.4-22 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>**18.4-18.6**</td><td colspan="2">FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A
ADD 5.A116
MOBILE</td></tr>
<tr><td colspan="3">…</td></tr>
<tr><td>**18.8-19.3**</td><td colspan="2">FIXED
FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A
ADD 5.A116
MOBILE</td></tr>
<tr><td colspan="3">…</td></tr>
</table>

<table>
<tr><td>19.7-20.1
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116
Mobile-satellite (space-to-Earth)
5.524</td><td>19.7-20.1
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116
MOBILE-SATELLITE
(space-to-Earth)
5.524 5.525 5.526 5.527 5.528 5.529</td><td>19.7-20.1
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116
Mobile-satellite (space-to-Earth)
5.524</td></tr>
<tr><td>20.1-20.2</td><td colspan="2">FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116
MOBILE-SATELLITE (space-to-Earth)
5.524 5.525 5.526 5.527 5.528</td></tr>
</table>

MOD

24.75-29.9 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>27.5-28.5</td><td colspan="2">FIXED 5.537A
FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.539 ADD 5.A116
MOBILE
5.538 5.540</td></tr>
<tr><td>28.5-29.1</td><td colspan="2">FIXED
FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.523A 5.539 ADD 5.A116
MOBILE
Earth exploration-satellite (Earth-to-space) 5.541
5.540</td></tr>
<tr><td colspan="3">…</td></tr>
<tr><td>29.5-29.9
FIXED-SATELLITE
(Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116
Earth exploration-satellite
(Earth-to-space) 5.541
Mobile-satellite (Earth-to-space)
5.540 5.542</td><td>29.5-29.9
FIXED-SATELLITE
(Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116
MOBILE-SATELLITE
(Earth-to-space)
Earth exploration-satellite
(Earth-to-space) 5.541
5.525 5.526 5.527 5.529 5.540</td><td>29.5-29.9
FIXED-SATELLITE
(Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116
Earth exploration-satellite
(Earth-to-space) 5.541
Mobile-satellite (Earth-to-space)
5.540 5.542</td></tr>
</table>

MOD

29.9-34.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
29.9-30	FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542	

ADD

5.A116 The operation of earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service in the frequency bands 17.7-18.6 GHz (space-to-Earth), 18.8-19.3 GHz (space-to-Earth) and 19.7-20.2 GHz (space-to-Earth), 27.5-29.1 GHz (Earth-to-space) and 29.5-30 GHz (Earth-to-space) shall be subject to the application of Resolution **[A116] (WRC-23)**. (WRC-23)

ADD

DRAFT NEW RESOLUTION [A116] (WRC-23)

There are several areas in which there are no consensus either on the text or how to proceed with the implementation of this Resolution. Consequently, the text below is not consistent with *resolves* 5 of Resolution **173 (WRC-19)**.

Resolves the ITU Radiocommunication Sector to ensure that the results of ITU-R studies are agreed by Member States by consensus

Option 1:

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

Option 2:

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that there is a need for global broadband mobile satellite communications, and that some of this need could be met by allowing earth stations in motion (ESIMs) to communicate with space stations of the non-geostationary-satellite orbit (non-GSO) fixed-satellite service (FSS) operating in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth), and 27.5-29.1 GHz and 29.5-30.0 GHz (Earth-to-space);

b) that the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) are allocated to space services, and the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, and 27.5-29.1 GHz are allocated to terrestrial services on a primary basis worldwide; in the countries identified in No. **5.524** of the Radio Regulations, the frequency band 19.7-20.2 GHz is allocated to the fixed and mobile services on a primary basis; and, in the countries identified in No. **5.542** of the Radio Regulations, the frequency band 29.5-30 GHz is allocated to the fixed and mobile services on a secondary basis, and used by a variety of different systems and these existing services and their future development need to be protected, without any additional constraints, from the operation of non-GSO ESIMs;

NOTE: There should be a necessary assurance that these secondary status assignments could continue to render services which were designed for before any allocation be made to ESIM under agenda item 1.16. This assurance does not exist to date.

c) that the frequency band 18.6-18.8 GHz is allocated to the Earth exploration-satellite service (EESS) (passive) and space research service (SRS) (passive) and that these services need to be protected from operation of non-GSO FSS in the space-to-Earth direction;

Option 1:

d) that there is no specific regulatory procedure for the coordination of non-GSO ESIMs relative to terrestrial stations for these services since the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) are not allocated for the operation of non-GSO ESIMs;

Option 2:

No *considering d)* is needed

e) that regulatory procedures and interference-management mechanisms, including necessary mitigation measures, are required for the operation of non-GSO ESIMs to protect other space and terrestrial services allocated in the frequency bands mentioned in *considering a)*,

considering further

Option 1:

a) that administrations intending to authorize non-GSO ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures mutually agreed than those contained in this Resolution as long as the provisions in Annex 1 are unchanged in cross-border applications;

Option 2:

a) that administrations intending to authorize non-GSO ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures than those contained in this Resolution as long as the provisions in Annex 1 are unchanged in cross-border applications;

Option 3:

No *considering further a)* is needed

b) that aeronautical and maritime ESIMs operating within the service area of the non-GSO FSS systems with which they communicate may provide service within the territories under the jurisdiction of multiple administrations;

c) that this Resolution does not establish any technical or regulatory provisions for the operation and use of land ESIMs communicating with non-GSO FSS space stations, and any authorization of land ESIMs remains strictly a national matter, taking also into account the need to avoid cross-border interference,

recognizing

a) that the administration authorizing non-GSO ESIMs on the territory under its jurisdiction has the right to require that non-GSO ESIMs referred to above only use those assignments associated with non-GSO FSS systems which have been successfully coordinated, notified, brought into use and recorded in the Master International Frequency Register (MIFR) with a favourable finding under Articles **9** and **11**, including Nos. **11.31**, **11.32** or **11.32A**, where applicable;

b) that the provisions of No. **22.2** apply to non-GSO FSS satellite systems with which ESIMs operate in the frequency band 17.7-17.8 GHz (space-to-Earth) with respect to GSO FSS and GSO BSS networks;

c) that, under the provisions of No. **22.2**, non-GSO ESIMs in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz shall not claim protection from GSO FSS and GSO BSS networks operating in accordance with these Regulations, and non-GSO ESIMs in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz shall not cause unacceptable interference to GSO FSS and GSO BSS networks operating in accordance with the Radio Regulations, and No. **5.43A** does not apply in this case;

d) that there is no obligation for administration to authorize/license any non-GSO ESIMs to operate within the territory under its jurisdiction;

e) that, for the implementation of the relevant parts of *resolves* 1.1.2 below that a non-GSO FSS system operating in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) in compliance with the epfd limits referred to in Nos. **22.5C**, **22.5D** and **22.5F** is considered as having fulfilled its obligations under No. **22.2** with respect to any geostationary-satellite network;

f) that, with respect to GSO FSS networks, in the frequency bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) Nos. **9.12A** and **9.13** apply, and No. **22.2** does not apply;

g) that, for the use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-GSO FSS systems, No. **9.12** applies,

Option 1:

h) that affected administrations retain their right to directly contact the registrar for the aircraft or vessel on which the ESIM operates;

i) that in case of unacceptable interference, affected administrations may request the administration authorizing the ESIM to operate in the territory under its jurisdiction to provide any information, if available, on a voluntary basis in regard with interference, *It was emphasized that the proponent of this option is urged to provide details on how an affected administration could reach or contact an aircraft or vessel.*

It was also emphasized that right of administrations are not issues to be referred to in a recognizing of any Resolution, due to the fact that the Constitution of the ITU clearly defined rights and obligations of Administrations.

Option 2:

Recognizing h) and *i)* are to be deleted

recognizing further

a) that frequency assignments to non-GSO ESIMs need to be notified to the Radiocommunication Bureau (BR);

b) that the notification by different administrations of frequency assignments to be used by the same non-GSO satellite system may create difficulties to identify the responsible administration in case of unacceptable interference;

c) that, an administration authorizing the operation of ESIMs within the territory under its jurisdiction may modify or withdraw that authorization at any time,

resolves

1 that, for any aeronautical or maritime ESIM communicating with non-GSO FSS space stations in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space), or parts thereof, the following conditions shall apply:

1.1 with respect to space services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz (space-to-Earth), and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space), and in their adjacent bands in the frequency band 18.6-18.8 GHz, non-GSO ESIMs shall comply with the following conditions:

Option 1:

1.1*bis* an administration the territory of which is situated inside the service area of a non-GSO FSS satellite system and has provided explicit authorization to receive the service/to be served by any type of ESIM has no obligation nor any mandate, whatsoever, to be involved directly or indirectly in detection, identification, reporting, resolution of any interference caused by the operation of the ESIM the operation of which was authorized:

Option 2:

No *resolves* 1.1*bis* is needed

1.1.1 to prevent potential interference with respect to satellite networks or systems of other administrations non-GSO ESIMs characteristics shall remain within the envelope characteristics of typical earth stations associated with the non-GSO FSS system with which these ESIMs communicate;

1.1.1.1 for the implementation of *resolves* 1.1.1 above, the notifying administration for the non-GSO FSS system with which the non-GSO ESIMs communicate shall, in accordance with this Resolution, send to the BR Appendix **4** notification information related to the characteristics of the non-GSO ESIMs intended to communicate with that non-GSO FSS system, together with the commitment that the operation shall be in conformity with the Radio Regulations, including this Resolution;

1.1.1.2 upon receipt of the notification information referred to in *resolves* 1.1.1.1 above, the Bureau shall examine it with respect to the provisions referred to in *resolves* 1.1.1 above, including the commitment referred to in *resolves* 1.1.1.1 above, and publish the result of such examination in the International Frequency Information Circular (BR IFIC);

1.1.2 the notifying administration of the non-GSO FSS system with which the ESIMs communicate shall ensure that the operation of ESIMs complies with the coordination agreements for the frequency assignments of the typical earth station of this non-GSO FSS system obtained under the provisions of Article **9** of the Radio Regulations, taking into account *recognizing b)*;

1.1.3 notifying administration of the non-GSO FSS system with which the ESIMs communicate shall ensure that non-GSO ESIMs comply with the epfd limits referred to in Nos. **22.5C**, **22.5D** and **22.5F** for the protection of GSO FSS networks operating in the frequency bands 17.8-18.6 GHz, 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) (see *recognizing g)*);

1.1.4 non-GSO ESIMs shall not claim protection from BSS feeder-link earth stations operating in accordance with the Radio Regulations in the frequency band 17.7-18.4 GHz;

1.1.5 with respect to protection of EESS (passive) operating in the frequency band 18.6-18.8 GHz, any non-GSO FSS systems with an orbital apogee of less than 20 000 km operating in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with which aeronautical and/or maritime ESIMs communicate and for which the complete notification information has been received by the BR after 1 January 2025 shall comply with the provisions indicated in Annex 3 to this Resolution;

1.1.5.1 for the implementation of *resolves* 1.1.6 above, the notifying administration for the non-GSO FSS system with which the non-GSO ESIMs communicate shall send to the BR the relevant Appendix **4** notification information including the commitment that the operation shall be in conformity with *resolves* 1.1.6;

1.2 with respect to terrestrial services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz, 27.5-29.1 GHz and 29.5-30 GHz, non-GSO ESIMs shall comply with the following conditions:

1.2.1 receiving non-GSO ESIMs in the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (see No. **5.524**) shall not claim protection from assignments in the terrestrial services to which those frequency bands are allocated and that operate in accordance with the Radio Regulations;

1.2.2 transmitting non-GSO ESIMs in the frequency band 27.5-29.1 GHz shall not cause unacceptable interference to terrestrial services to which the frequency band is allocated and that operate in accordance with the Radio Regulations, and Annex 1 to this Resolution shall apply;

1.2.3 transmitting non-GSO ESIMs in the frequency band 29.5-30.0 GHz shall not adversely affect the operations of terrestrial services to which this frequency band is allocated on secondary basis and that operate in accordance with the Radio Regulations, and limits in Annex 1 to this Resolution shall apply with respect to administrations mentioned in No. **5.542**;

Option 1:

1.2.4 the provisions in this Resolution, including Annex 1, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO ESIMs in neighbouring countries in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 above in the frequency band 27.5-29.1 GHz and in the frequency band 29.5-30.0 GHz; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and operating in accordance with the Radio Regulations remains valid (see *resolves* 6);

Option 2:

1.2.4 the provisions in this Resolution, including Annex 1, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO ESIMs in neighbouring countries in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 above in the frequency band 27.5-29.1 GHz and in the frequency band 29.5-30.0 GHz as guidance for administrations; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and operating in accordance with the Radio Regulations remains valid (see *resolves* 6);

Option 3:

1.2.4 the provisions in this Resolution, including Annex 1, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO ESIMs in neighbouring countries in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 above in the frequency band 27.5-29.1 GHz and in the frequency band 29.5-30.0 GHz with respect to administrations mentioned in No. **5.542**; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and operating in accordance with the Radio Regulations remains valid (see *resolves* 6);

NOTE: START of a section that was not discussed in detail at CPM23-2

Scenario 1 (Applies if the relevant methodology is included in Annex 2)

1.2.5 the Bureau shall examine, in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 ~~above~~ and with the methodology in Annex 2, the characteristics of aeronautical non-GSO ESIMs with respect to the conformity with the power flux-density (pfd) limits on the Earth's surface specified in Part 2 of Annex 1 to this Resolution and publish the results of such examination in the BR IFIC;

1.2.5.1 however, the compliance with the technical conditions in Annex 1, does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;

Scenario 2 (Applies if the relevant methodology is not included in Annex 2 by the end of WRC-23)

1.2.5 the Bureau shall examine, in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 ~~above~~, the characteristics of aeronautical non-GSO ESIMs with respect to the conformity with the power flux-density (pfd) limits on the Earth's surface specified in Part 2 of Annex 1, and publish the results of such examination in the BR IFIC;

1.2.6 if the BR is unable to examine, in accordance with *resolves* 1.2.~~4~~5 ~~above~~, non-GSO aeronautical ESIMs with respect to conformity with the pfd limits specified in Part 2 of Annex 1, ~~the Bureau shall request~~ the notifying administration ~~to~~ shall send to the BR a commitment to ensure that the aeronautical non-GSO ESIMs comply with those limits;

1.2.7 the BR shall formulate a qualified favourable finding under No. **11.31** with respect to the pfd limits contained in Part 2 of Annex 1, otherwise the BR shall formulate an unfavourable finding;

1.2.8 ~~after the successful application of *resolves* 1.2.4,~~ once the methodology to examine the characteristics of aeronautical non-GSO ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 is available, *resolves* 1.2.~~5~~4 shall be applied by the Bureau;

1.2.8 after the successful application of *resolves* 1.2.~~4~~6 and 1.2.7, once the methodology to examine the characteristics of aeronautical non-GSO ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 is available, *resolves* 1.2.5 shall be applied by the Bureau;

NOTE: END of a section that was not discussed in detail at CPM23-2

1.3 that, in the case unacceptable interference caused by A-ESIM and/or M-ESIM is reported:

Option 1:

1.3.1 only the notifying administration of the non-GSO FSS system with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

Option 2:

1.3.1 the notifying administration of the non-GSO FSS system with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

1.3.2 the notifying administration of the non-GSO FSS system with which the ESIMs communicate shall immediately take the required action to eliminate or reduce interference to an acceptable level;

1.3.3 the affected administration(s) may assist resolving or provide information that would facilitate resolving the case of unacceptable interference;

Option 1:

1.3.4 the administration authorizing the operation of A-ESIM and M-ESIM on territory under its jurisdiction, subject to its explicit agreement, may provide assistance, including information for the resolution of unacceptable interference;

Option 2:

1.3.4 the administration authorizing the operation of A-ESIM and M-ESIM on the territory under its jurisdiction shall, to the extent of its ability, cooperate to assist in the resolution of unacceptable interference, including providing information as necessary;

1.3.5 the administration responsible for the aircraft or vessel on which the ESIM operates shall provide a point of contact to assist identifying the notifying administration of the satellite with which the ESIM communicates;

1.4 that the notifying administration of non-GSO FSS satellite system with which ESIMs communicate shall ensure that:

1.4.1 for the operation of A-ESIM and M-ESIM, techniques are employed to maintain adequate antenna pointing accuracy with the associated non-GSO FSS satellite;

1.4.2 all necessary measures shall be taken so that earth stations on aircraft and vessels are subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) in order to comply with the provisions in this Resolution, and are capable of receiving and immediately acting upon inter alia “enable transmission” and “disable transmission” commands from the NCMC (see Annex 4);

1.4.3 measures are taken so that the A-ESIM and/or M-ESIM do not transmit on the territory under the jurisdiction of an administration, including its territorial waters and its national airspace, that has not authorized its use;

1.4.4 the notifying administration of the non-GSO FSS system with which ESIMs communicate shall provide a permanent point of contact in the Appendix **4** submission and this shall be published in the relative special section of the BR IFIC for the purpose of tracing any suspected cases of unacceptable interference from A-ESIMs or M-ESIMs and for the purpose of immediately responding to the relevant requests;

NOTE: START of a section that was not discussed in detail at CPM23-2

2 that non-GSO ESIMs shall not be used or relied upon for safety-of-life applications;

~~3 that the operation of non-GSO ESIMs within the territory, including territorial waters and airspace, of an administration shall be carried out only if a licence according to No. **18.1** of that administration is obtained, authorized by that administration;~~

~~4~~3 that the operation of non-GSO ESIMs within the territory, including territorial waters and airspace, under the jurisdiction of any administration shall be carried out only if an authorization or a licence according to No. **18.1** ~~of~~ from that administration is obtained;

4~~5~~ that the notifying administrations of those non-GSO FSS systems with which non-GSO ESIMs in the frequency bands ~~as detailed~~ in *considering a)* above are intended to operate shall submit a commitment to the Bureau to immediately act~~take the required action~~ to eliminate or reduce the interference to an acceptable level upon receiving a report of unacceptable interference (see *resolves* 5~~6~~);

NOTE: END of a section that was not discussed in detail at CPM23-2

Option 1:

5 in case there is more than one administration involved in the notification of frequency assignments of the same non-GSO satellite system with which ESIMs communicate, those administrations shall nominate one administration as the notifying administration responsible to act on their behalf to be responsible to eliminate any unacceptable interference cases and inform the Bureau accordingly;

Option 2:

No *resolves* 5 is needed

NOTE: START of a section that was not discussed in detail at CPM23-2

Option 1

~~8~~6 that the application of this Resolution does not provide regulatory status to non-GSO ESIMs different from that derived from the non-GSO FSS satellite system with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing b)* ~~above)~~,

Option 2

~~8~~6 that the application of this Resolution does not provide regulatory status to non-GSO ESIMs different from that derived from the non-GSO FSS satellite system with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing b)* above);~~,~~

7 that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the non-GSO FSS satellite system with which non-GSO ESIMs communicate or on the coordination requirements of that satellite system;

NOTE: END of a section that was not discussed in detail at CPM23-2

Option 1:

8 the implementation of this Resolution remains in abeyance pending an agreement to be universally reached on the issue of the interference management system, monitoring facilities' effectiveness and immediate response of MCNC, cessation of transmission over territories which have not explicitly authorized the functioning and operation of any ESIM over their territories providing satisfactory resolution of the problem, as referred to in *recognizing further d)* above,

Option 2:

8 the implementation of this Resolution is conditioned on providing a description to the administrations whose authorization is sought of interference management system(s), monitoring facilities (NCMC), dealing with the cessation of transmission over territories which have not authorized (*see resolves* 3) the functioning and operation of any ESIM over their territories in order to provide a satisfactory resolution of the problem as referred to in *recognizing further d)* above,

NOTE: Provided the description mentioned above is properly addressed and concluded, *resolves* 9 above may be deleted at WRC-23

resolves further

1 that ESIMs shall not cause unacceptable interference to nor claim protection from other services as referred to *recognizing c)* and *d)* and in *resolves* 1.1.1.1, 1.1.6.1, 1.2.1 and 1.2.4;

2 that the notifying administration for the ESIMs shall send to the BR, when submitting the relevant Appendix **4** data a commitment (as stipulated in *resolves* 5) that, upon receiving a report of unacceptable interference, the notifying administration for the non-GSO system with which ESIMs communicate shall remove such interference;

3 that the commitment referred to in *resolves further* 2 shall be objective, measurable and enforceable;

4 that, in case of continued unacceptable interference despite of the commitment referred to in *resolves further* 2, the assignment causing interference shall be submitted to the Radio Regulation Board for review;

5 that compliance with the provisions contained in Annex 1 does not release the notifying administration of the non-GSO satellite system with which ESIMs communicate of its obligations mentioned in *resolves further* 1 above.

NOTE: START of a section that was not discussed in detail at CPM23-2

~~1~~6 that frequency assignments to ~~non-GSO~~ ESIMs shall be notified by the notifying administration of the non-GSO satellite system in the FSS with which ESIMs communicate;

Option 1

~~2~~7 that the notifying administration of the satellite system shall ensure that non-GSO ESIMs operate only in the territory under the jurisdiction of ~~any~~ administrations~~/country~~ from which an authorization has been obtained, taking into account *recognizing further ~~d~~c)* ~~above~~;

Option 2

~~2 that the notifying administration of the satellite system shall ensure that non-GSO ESIMs operate only in the territory under the jurisdiction of any administration/country from which an authorization has been obtained, taking into account *recognizing further d)* above;~~

~~3~~8 that~~, for the implementation of *resolves further* 2 above, the notifying administration of the satellite system in the FSS with which non-GSO ESIMs communicate shall ensure that~~ ESIMs ~~are~~shall be designed and operate so as to cease transmission over the territory of any administration/country from which authorization has not been obtained;

Option 1

9~~3*bis* that, for the implementation of *resolves further* 2 and 3 above, the system shall employ the minimum software and hardware capabilities listed in Annex 4;~~

[Editor's note: Such hardware and software requirements are not appropriate in a resolution and would be better kept in a report or recommendation if required.]

Option 2 (if Annex 4 is maintained)

9~~3*bis*~~ that, for the implementation of *resolves further* 2 above, the system shall employ the minimum software and hardware capabilities listed in Annex 4;

10~~4~~ that, for the implementation of *resolves further* 1~~ above~~, the notifying administration responsible for the operation of aeronautical and maritime non-GSO ESIMs shall also be responsible for observing and complying with all relevant regulatory and administrative provisions applicable to the operation of the ~~above-mentioned~~ ESIMs as included in this Resolution and those contained in the Radio Regulations;

Option 1

~~5~~11 that the authorization to non-GSO ESIM~~s~~ to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the non-GSO satellite system with which the non-GSO ESIM~~s~~ communicates from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations;

Option 2

~~5 that the authorization to non-GSO ESIMs to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the satellite system with which non-GSO ESIMs communicate from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations;~~

Option 1

12~~6~~ that, should an administration authorizing aeronautical non-GSO ESIMs agree to pfd levels higher than the limits contained in Part 2 of Annex 1 to this Resolution within the territory under its jurisdiction, such agreement shall not affect other countries that are not party to that agreement,

Option 2

12~~6~~ that, should an administration authorizing aeronautical and/or maritime non-GSO ESIMs agree to ~~pfd levels higher than the~~ less stringent limits than those contained ~~in Part 2 of~~ Annex 1 within the territory under its jurisdiction, such agreement shall not affect other countries that are not party to that agreement,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolution of interference, when required;

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution, including whether or not the responsibilities relating to the operation of aeronautical and maritime non-GSO ESIMs have been properly addressed;

3 not to examine, under No. **11.31**, the conformity of non-GSO FSS systems with the provisions of *resolves* 1.1.5 of this Resolution,

Option 1

~~3 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of Recommendation ITU-R S.1503 for verifying that the non-GSO FSS systems under this Resolution comply with the epfd limits specified in Article **22**,~~

Option 2

~~3~~4 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of Recommendation ITU-R S.1503 for verifying that the non-GSO FSS systems under this Resolution comply with the epfd limits specified in Article **22**;~~,~~

Option 1:

5 to publish the list of non-GSO satellite systems with which ESIM communicate brought into use with information about its service area and countries authorize such use if any; this information shall be updated regularly,

Option 2:

5 to publish the list of non-GSO satellite systems with which ESIM communicate brought into use with information about its service area; this information shall be updated regularly,

Note: It was agreed that the issue of identifying the notifying administration is still ambiguous and requires further discussions before taking the decision regarding this draft new resolution, in order to develop a means for the affected administration to identify the notifying administration of the satellite network space station with which the ESIM communicates.

invites administrations

~~to collaborate for the implementation of this Resolution, in particular for resolving interference, if any;~~

to take into consideration the relevant recommendations to employ Annex 4 procedures when licensing/authorizing the operation of earth stations in motion in their territories,

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization and of the Secretary General of the International Civil Aviation Organization.

NOTE: END of a section that was not discussed in detail at CPM23-2

ANNEX 1 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

NOTE: Annex 1 was not discussed in detail at CPM23-2

Provisions for maritime and aeronautical non-GSO ESIMs to protect terrestrial services operating in the frequency band 27.5-29.1 GHz and for the frequency band 29.5-30.0 GHz with respect to/on the territories of/in relation to administrations mentioned in No. 5.542 ~~(see No. 5.542)~~/as a guidance for administrations when considering to authorize the A-ESIM and M-ESIM in their territories

Option 1:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. ~~The provisions could also be used as a guidance for the operation of the non-GSO ESIMs in 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services.~~

Option 2:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. The provisions ~~could~~below also ~~be used as a guidance~~apply for the operation of the non-GSO ESIMs in the frequency band 29.5-30 GHz ~~in order not to adversely impact the secondary allocated terrestrial services~~with respect to administrations mentioned in No. **5.542**.

Option 3:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and that ~~operating~~operate in accordance with the Radio Regulations. The provisions in the parts below ~~could also be used as a guidance for the operation of the non-GSO ESIMs~~also apply in the frequency band 29.5-30 GHz with respect to administrations mentioned in ~~in order not to adversely impact the secondary allocated terrestrial services~~No. **5.542** of the Radio Regulations.

Option 4:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency bands 27.5-29.1 GHz and 29.5-30 GHz are~~is~~ allocated and operating in accordance with the Radio Regulations. ~~The provisions could also be used as a guidance for the operation of the non-GSO ESIMs in 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services.~~

Option 5:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. The provisions below also apply~~could also be used as a guidance~~ for the operation of the non-GSO ESIMs in the frequency band 29.5-30 GHz with respect to administrations mentioned in No. **5.542** (see *resolves* 1.2.4)~~in order not to adversely impact the secondary allocated terrestrial services~~.

Option 6:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations and for the frequency band 29.5-30.0 GHz on the territories of administrations mentioned in No. **5.542**. ~~The provisions could also be used as a guidance for the operation of the non-GSO ESIMs in 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services.~~

Option 7:

~~The provisions below could be applied for guidance to administrations to ensure aeronautical and maritime non-GSO ESIMs do not cause unacceptable interference to terrestrial services to which the frequency band 29.5-30.0 GHz is allocated and that operate in accordance with the Radio Regulations (see No. **5.542** – *Additional allocation* to the fixed and mobile services on a secondary basis in some countries).~~

Option 1:

The provisions below ~~also~~ apply in the frequency band 29.5-30.0 GHz ~~on the territories of~~with respect to administrations mentioned in No. **5.542**.

Option 2:

~~The provisions below also apply in the frequency band 29.5-30.0 GHz on the territories of administrations mentioned in No. **5.542**.~~

Part 1: Maritime non-GSO ESIMs

Option 1:

1 The notifying administration of the non-GSO FSS satellite system with which maritime ESIMs communicates shall ensure compliance of the maritime ESIMs operating within the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, or parts thereof, with both of the following conditions for the protection of terrestrial services to which the frequency bands are ~~is~~ allocated within a coastal State:

Option 2:

1 The notifying administration of the non-GSO FSS satellite system with which maritime ESIMs communicates shall ensure compliance of the maritime ESIMs ~~operating within the~~

~~frequency band 27.5-29.1 GHz, or parts thereof,~~ with both of the following conditions for the protection of terrestrial services to which the frequency band is allocated within a coastal State:

Option 1:

1.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which maritime ESIMs can operate without ~~the~~ prior agreement ~~of any administration~~ is 70 km ~~within the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz~~. Any transmissions from maritime ESIMs within the minimum distance shall be subject to the prior agreement of the coastal State(s) concerned.

Option 2:

1.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which maritime ESIMs can operate without the prior agreement of any administration is 70 km ~~within the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz~~. Any transmissions from maritime ESIMs within the minimum distance shall be subject to the prior agreement of the coastal State(s) concerned.

Option 1:

1.2 The maximum maritime ESIMs e.i.r.p. spectral density towards the territory of any coastal State ~~will~~ shall be limited to ~~12.98/~~24.44 dBW in a reference bandwidth of ~~1/~~14 MHz. Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State(s) concerned.

Option 2:

1.2 The maximum maritime ESIMs e.i.r.p. spectral density towards the territory of any coastal State shall~~will~~ be limited to 12.98~~/24.44~~ dBW in a reference bandwidth of 1~~/14~~ MHz. Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State(s) concerned.

Option 3:

1.2 The maximum maritime ESIMs e.i.r.p. spectral density towards the territory of any coastal State ~~will~~ shall be limited to [12.98/24.44] dBW in a reference bandwidth of [1/14] MHz. Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State(s) concerned.

Part 2: Aeronautical non-GSO ESIMs

Option 1:

2 The notifying administration of the non-GSO FSS satellite system with which aeronautical ESIMs communicates shall ensure compliance of the aeronautical ESIMs ~~operating within the frequency bands 27.5-29.1 GHz, or parts thereof,~~ with all of the following conditions for the protection of the terrestrial services to which the frequency band is allocated:

Option 2:

2 The notifying administration of the non-GSO FSS satellite system with which aeronautical ESIMs communicates shall ensure compliance of the aeronautical ESIMs operating within the frequency bands 27.5-29.1 GHz and 29.5-30 GHz~~, or parts thereof~~, with all of the following conditions for the protection of the terrestrial services to which the frequency bands are~~ is~~ allocated:

2.1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

Option 1:

$pfd(\theta) = -124.7$	$(dB(W/(m^2 \cdot [14] MHz)))$	for	$0° \leq \theta \leq 0.01°$
$pfd(\theta) = -120.9 + 1.9 \cdot \log\theta$	$(dB(W/(m^2 \cdot 14 MHz)))$	for	$0.01° < \theta \leq 0.3°$
$pfd(\theta) = -116.2 + 11 \cdot \log\theta$	$(dB(W/(m^2 \cdot 14 MHz)))$	for	$0.3° < \theta \leq 1°$
$pfd(\theta) = -116.2 + 18 \cdot \log\theta$	$(dB(W/(m^2 \cdot 14 MHz)))$	for	$1° < \theta \leq 2°$
$pfd(\theta) = -117.9 + 23.7 \cdot \log\theta$	$(dB(W/(m^2 \cdot 14 MHz)))$	for	$2° < \theta \leq 8°$
$pfd(\theta) = -96.5$	$(dB(W/(m^2 \cdot 14 MHz)))$	for	$8° < \theta \leq 90.0°$

Option 2:

$pfd(\theta) = -136.2$	$(dB(W/(m^2 \cdot [1] MHz)))$	for	$0° \leq \theta \leq 0.01°$
$pfd(\theta) = -132.4 + 1.9 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$0.01° < \theta \leq 0.3°$
$pfd(\theta) = -127.7 + 11 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$0.3° < \theta \leq 1°$
$pfd(\theta) = -127.7 + 18 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$1° < \theta \leq 2°$
$pfd(\theta) = -129.4 + 23.7 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$2° < \theta \leq 8°$
$pfd(\theta) = -108$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$8° < \theta \leq 90.0°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

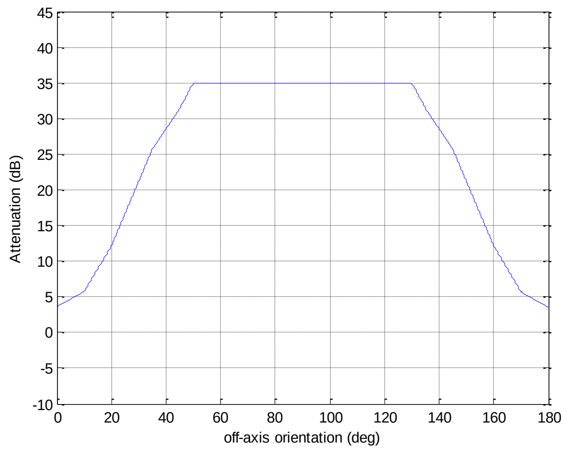
2.2 When within line-of-sight of the territory of an administration, and up to an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM~~s~~ shall not exceed:

$pfd(\theta) = -136.2$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$0° \leq \theta \leq 0.01°$
$pfd(\theta) = -132.4 + 1.9 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$0.01° < \theta \leq 0.3°$
$pfd(\theta) = -127.7 + 11 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$0.3° < \theta \leq 1°$
$pfd(\theta) = -127.7 + 18 \cdot \log\theta$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$1° < \theta \leq 12.4°$
$pfd(\theta) = -108$	$(dB(W/(m^2 \cdot 1 MHz)))$	for	$12.4° < \theta \leq 90°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

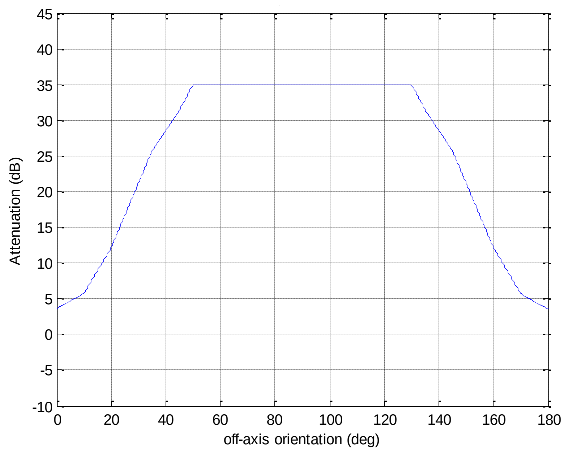
Option 1:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained ~~using free-space propagation and~~ attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, the following figure shall be used for the calculation of attenuation due to the aircraft fuselage in these bands.



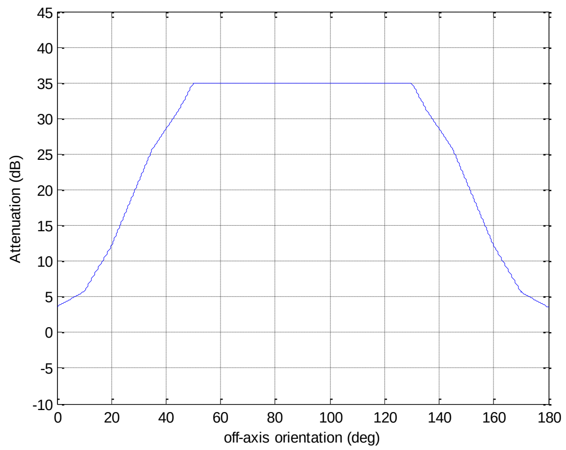
Option 2:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using ~~free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the bands 27.5-29.1 GHz and 29.5-30 GHz,~~ the following figure ~~shall be used~~ for the calculation of attenuation due to the aircraft fuselage~~ in these bands~~, unless there is an available ITU-R Recommendation to perform this calculation in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz.



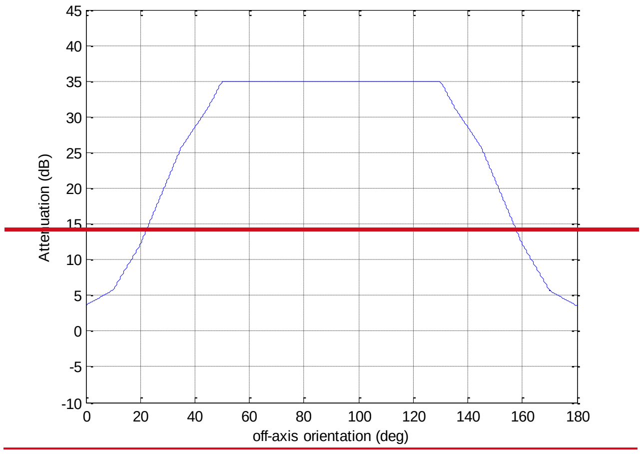
Option 3:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation incorporated by reference in the Radio Regulations to calculate attenuation due to the aircraft fuselage in the bands 27.5-29.1 GHz and 29.5-30 GHz, the following figure shall be used for the calculation of attenuation due to the aircraft fuselage in these bands.



Option 4:

~~2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the bands 27.5-29.1 GHz and 29.5-30 GHz, the following figure shall be used for the calculation of attenuation due to the aircraft fuselage in these bands.~~

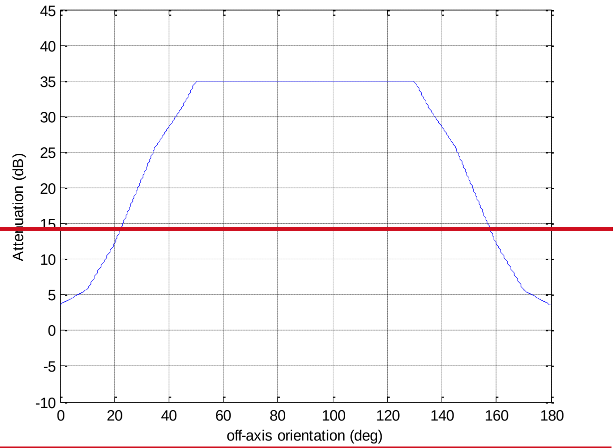


Option 5:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, the formulas in the table below~~following figure~~ shall be used for the calculation of attenuation due to the aircraft fuselage in these frequency bands.

Fuselage attenuation model from Report ITU-R M.2221

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	dB	for	$0° \leq \gamma \leq 10°$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	dB	for	$10° < \gamma \leq 34°$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	dB	for	$34° < \gamma \leq 50°$
$L_{fuse}(\gamma) = 35$	dB	for	$50° < \gamma \leq 90°$



Option 1:

2.4 ~~An a~~Aeronautical ESIMs operating in the frequency band 27.5-29.1 GHz ~~band~~, or ~~portions~~ parts thereof, within the territory of an administration that has authorized fixed-service and/or mobile-service operation in the same frequency bands shall not transmit in these frequency bands without prior agreement of that administration (see also *resolves* 3/*recognizing j)* of this Resolution).

Option 2:

2.4 An aeronautical ESIM operating in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz ~~band~~, or portions thereof, within the territory of an administration that has authorized fixed-service and/or mobile-service operation in the same frequency bands shall not transmit in these frequency bands without prior agreement of that administration ~~(see also *resolves* 3 of this Resolution)~~.

Option 1:

2.5 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the aeronautical ESIM transmitter as described in Recommendation ITU-R SM.1541.

Option 2:

~~2.5 Higher pfd levels than those provided in §§ 2.1 and 2.2 above produced by aeronautical non-GSO ESIMs on the surface of the Earth within an administration shall be subject to the prior agreement of that administration.~~

NOTE: Annex 2 was not discussed in detail at CPM23-2.

ANNEX 2 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

Methodology with respect to the examination referred to in Scenario 1 *resolves* 1.2.5

NOTE: This methodology has been developed based on the discussions in Working Party 4A regarding draft new Recommendation ITU-R S.[RES.169_METH] which contains a methodology for assessing compliance of A-ESIM communicating with GSO FSS satellites to meet the obligations to protect terrestrial services in Resolution ***169 (WRC-19)****. Proposals to WRC-23 on agenda item 1.16 including Doc. CPM23-2/175 may need to take into account any further* *progress/updates to this draft new Recommendation when considering a methodology for assessing compliance with Part 2 of Annex 1 of Resolution **[A116]** for A-ESIM communicating with non-GSO FSS satellites.*

However, it should be emphasized that the discussion in the CG would lead to a satisfactory conclusion on the matter and there is no certainty that the work of the CG will be agreed at WP 4A and SG4. Consequently, decisions of the CPM on this matter should not be based on other actions by SG4 or RA-23 that may not be conclusive.

Option 1 for the methodology:

1 Overview of the methodology

Option 1:

Aeronautical earth station in motion (A-ESIM) can operate over time at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable off-axis e.i.r.p. spectral density ("$EIRP_C$") for an A-ESIM transmitter communicating with a non-GSO FSS satellite that would ensure compliance with a set of pre-established power flux-density (pfd) limits defined on the Earth's surface. This methodology derives the $EIRP_C$ considering the relevant loss and attenuation in the geometry considered, among other things.

Option 2:

An aeronautical earth station in motion (A-ESIM) can operate over time at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable off-axis e.i.r.p. spectral density ("$EIRP_C$") for an A-ESIM transmitter communicating with a non-GSO FSS space station that ensures compliance with a set of the defined pfd limits on the Earth's surface in Annex 1 to this Resolution. This methodology derives the $EIRP_C$ considering the relevant loss and attenuation in the geometry considered, among other things.

The methodology then compares the computed $EIRP_C$ with the reference off-axis e.i.r.p. towards the ground ("$EIRP_R$") of the A-ESIMs. For each emission in each group of a non-GSO FSS satellite system, $EIRP_R$ can be calculated by using the Appendix **4** data for that system as well as other input parameters that shall be provided by the notifying administration for that system.

Specifically, for each emission in the non-GSO FSS satellite system associated with a to-be-defined non-GSO A-ESIM class of station, the $EIRP_R$ is the algebraic summation (in logarithmic terms) of the maximum input power to the antenna (item C.8.a.1 of Appendix **4**), the peak gain of the A-ESIM antenna (item C.10.d.3 of Appendix **4**), the maximum achievable off-axis gain isolation towards the ground of the A-ESIM antenna and a parameter that would compensate for any difference between the emission bandwidth and the reference bandwidth of the pre-established set of pfd limits.

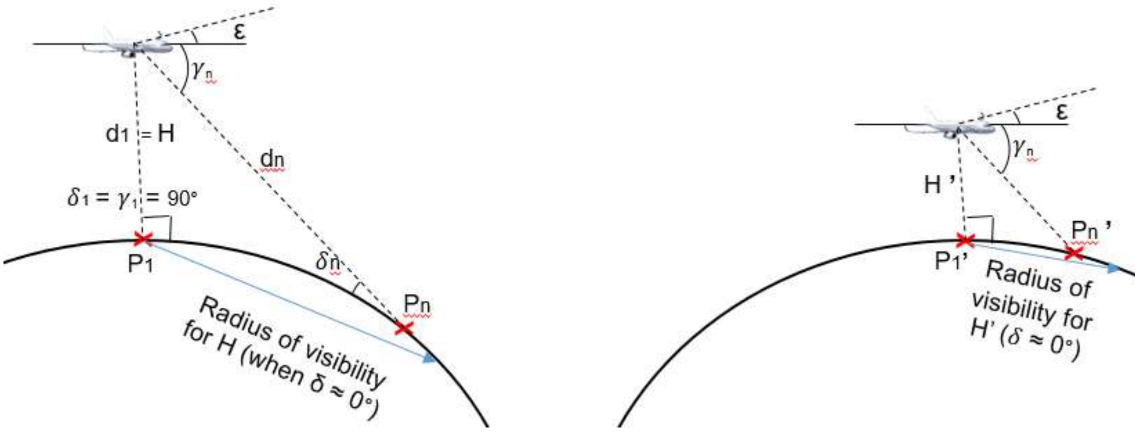
The operations of A-ESIMs shall be evaluated over multiple predefined altitude ranges in order to establish as many $EIRP_C$ levels for comparison with $EIRP_R$. This comparison is at the basis of the methodology and examination that are described more in detail in the following section. An examination by the Bureau shall apply this methodology for each altitude range, to determine whether the A-ESIM operating under a given non-GSO satellite system complies with the defined pfd limits on the Earth's surface in Annex 1 to this Resolution to ensure the protection of terrestrial services.

2 Parameters and geometry

Figure A2-1 provides a description of the geometry considered under this methodology. The figure shows A-ESIMs flying at two different altitudes and also some of the parameters used for the calculation. The model is agnostic to non-GSO ESIM geographical locations on Earth and assumes a spherical Earth model with a fixed radius for the calculation.

FIGURE A2-1

Geometry for the examination of compliance for two different ESIMs altitudes



The notifying administration for the non-GSO FSS system with which the A-ESIM communicates shall send to the Bureau the relevant characteristics of the A-ESIM intended to communicate with that non-GSO FSS network under *resolves* 1.1.3 above. All the parameters required by the Bureau to carry out the examination process are listed and briefly described in Table A2-1. Additional considerations are further elaborated in section 3.

Option 1:

TABLE A2-1

Relevant parameters for pfd limits compliance examination

Parameter	Symbol	Type of parameter	Observation
Aeronautical non-GSO ESIM altitude	*H*	Established by the methodology as: H_{min} = 0.01 km, H_{max} = [13/15] km, H_{step} = 1 km	The altitudes at which the examination is carried out range from H_{min} to H_{max} at H_{step} intervals.
Angle of arrival of the incident wave on the Earth's surface	δ	Specified by the pre-established set(s) of pfd limits, variable from 0° to 90°	Pre-established set(s) of pfd limits should cover incident angles from 0° to 90°

Parameter	Symbol	Type of parameter	Observation
Angle below the horizontal plane of the ESIMs corresponding to the angle of arrival δ under examination	γ	Calculated from the geometry	This angle is calculated considering the non-GSO ESIMs altitude H_j examined and angle of arrival δ under examination (see Fig. A.2.1)
Distance between the ESIMs and the point on the ground under examination	D	Calculated from the geometry	This distance is a function of the A-ESIMs altitude and the angles δ and γ
Frequency	f	Taken from the Appendix **4** data	To evaluate the propagation loss or at the lower limits of the frequency range
Atmospheric loss	L_{atm}	Calculated and established by the methodology	Based on Recommendation ITU-R P.676
Fuselage attenuation	L_f	See § 2.3 in Annex 1	The attenuation depends on the angle (γ) below the horizontal plane of the non-GSO ESIMs.
A-ESIM antenna peak gain and off-axis gain pattern	G_{max}, $G(\theta)$	Taken from the Appendix **4** data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the non-GSO system under examination	The A-ESIM antenna gain is used to compute $EIRP_R$
Emission bandwidth	$BW_{Emission}$	Taken from the Appendix **4** data (as part of item C.7.a) of the non-GSO system under examination	These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$
Reference bandwidth	BW_{Ref}	Taken from the set(s) of pre-established pfd limits	
Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth	$EIRP_C$	$EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface	For each of the altitudes H_j, the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated to a given altitude H_j; for each altitude H_j, the lowest e.i.r.p. value is the one to be retained and compared with $EIRP_R$ (see section 3)
A set of pre-established pfd limits on the Earth's surface	$PFD(\delta)$	Taken from Annex 1 to this Resolution	The pfd limits, expressed in dB(W/m^2/BW$_{ref}$), are a function of the angle of arrival δ

Option 2:

TABLE A2-1

Relevant parameters for pfd compliance examination

Parameter	Symbol	Type of parameter	Observation
Aeronautical non-GSO ESIM altitude	H	Established by the methodology as: H_{min} = 0.01 km, H_{max} = 15.01 km	The altitudes at which the examination is carried out range from H_{min} to H_{max} at the following altitudes: H_{min}, 1.01 km, 2.01 km, 3.00 km, 3.01 km, 4.01 km… H_{max}.
Angle of arrival of the incident wave on the Earth's surface	δ	Specified by the pre-established set(s) of pfd limits, variable from 0° to 90°	Pre-established set(s) of pfd should cover incident angles from 0° to 90°
Angle below the horizontal plane of the ESIM corresponding to the angle of arrival δ under examination	γ	Calculated from the geometry	This angle is calculated considering the non-GSO A-ESIM's altitude H_j examined and angle of arrival δ under examination (see Fig. A.2.1)
Distance between the ESIM and the point on the ground under examination	D	Calculated from the geometry	This distance is a function of the A-ESIMs altitude and the angles δ and γ
Frequency	f	Provided by the Appendix **4** data	To evaluate the propagation loss either at the centre frequency or at the upper and lower limits of the frequency range
Atmospheric loss	L_{atm}	Calculated and established by the methodology	Based on Recommendation ITU-R P.676
Fuselage attenuation	L_f	Report ITU-R M.2221-0 or other ITU-R Reports or Recommendations	The attenuation depends on the angle (γ) below the horizontal plane of the non-GSO A-ESIM. The value(s) could come from ITU-R Reports and/or Recommendations, such as Report ITU-R M.2221. Note, the model contained in Report ITU-R M.2221-0 might require updating and/or clarifications.
A-ESIM antenna peak gain and off-axis gain pattern	G_{max}, $G(\theta)$	Taken from the Appendix **4** data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the non-GSO system under examination	The A-ESIM antenna gain is used to compute $EIRP_R$
Emission bandwidth	$BW_{Emission}$	Taken from the Appendix **4** data (as part of item C.7.a) of the non-GSO system under examination	These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$
Reference bandwidth	BW_{Ref}	Taken from the set(s) of pre-established pfd limits	

Parameter	Symbol	Type of parameter	Observation
Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth	$EIRP_C$	$EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface	For each of the altitudes H_j, the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated to a given altitude H_j; for each altitude H_j, the lowest e.i.r.p. value is the one to be retained and compared with $EIRP_R$ (see section 3)

3 Calculation procedure

This section includes a step-to-step description of how the examination methodology would be implemented for a given group associated to the class of earth station for non-GSO A-ESIMs in a non-GSO satellite system.

START

Calculate *EIRP*$_R$

i) For each of the emissions included in the Group under consideration, compute the Reference EIRP ($EIRP_R$, dB(W)) as:

$$EIRP_R = G_{Max} - G_{Isol_{Max}} + P_{Max} + 10\log_{10}(BW) \quad (1)$$

where:

G_{Max} is the A-ESIM antenna peak gain in dBi

$G_{Isol_{Max}}$ is the maximum achievable gain isolation of the A-ESIM antenna towards the ground in dB when operating in the examined non-GSO system

P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).

BW in Hz is:

BW_{Ref} if $BW_{emission} > BW_{Ref}$

$BW_{emission}$ if $BW_{emission} < BW_{Ref}$

Calculate *EIRP*$_C$

ii) For each aircraft altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test the full compliance with the set(s) of pre-established pfd limits. The N angles δ_n shall be comprised between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the angles δ_n will correspond to as many N points on the ground.

iii) For each altitude $H_j = H_{min}, \ldots, H_{max}$, compute $EIRP_{C\_j}$ using the following algorithm:

a) Set the altitude of the A_ESIM to H_j

b) Compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii) using the following equation:

$$\gamma_{j,n} = \arccos\left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)}\right) \quad (2)$$

where R_e is the mean Earth radius.

c) Compute the distance $D_{j,n}$, in km, for $n = 1, \ldots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + \left(R_e + H_j\right)^2 - 2R_e\left(R_e + H_j\right)\cos\left(\gamma_n - \delta_n\right)} \tag{3}$$

d) Compute the fuselage attenuation $L_{f\,j,n}$ (dB) applicable to each of the N points on the ground as a function of the angles $\gamma_{j,n}$ computed in *b)* above

e) Compute the atmospheric loss $L_{atm\_j,n}$ (dB) applicable to each of the distances $D_{j,n}$ computed in *c)* above

f) Compute the $EIRP_{C\_j,n}$ (dB(W/BW_{Ref})), that is the maximum e.i.r.p. that can be radiated in the pfd mask's reference bandwidth by the A-ESIM towards each of the N points to be compliant with the set(s) of pre-established pfd limits, as per the following equation:

$$EIRP_{C\_j,n}\left(\delta_n, \gamma_n\right) = pfd\left(\delta_n\right) + 10\log_{10}\left(4\pi\left(D_{j,n} \cdot 1\,000\right)^2\right) + L_{f\ j,n} + L_{atm\_j,n} \tag{4}$$

g) Compute the minimum $EIRP_{C\_j}$ across all values calculated at the previous step, $EIRP_{C\_j}$ = Min ($EIRP_{C\_j,n}$ (δ_n, γ_n)). The output of this last step is the maximum $EIRP_C$ that can be radiated by the A-ESIM to ensure it complies with the set(s) of pre-established pfd limits with respect to all angles δ_n at the altitude H_j. There will be one $EIRP_{C\_j}$ for each of the H_j altitudes considered.

The output of step iii) is summarized in Table A2-2 below:

TABLE A2-2

Computed $EIRP_{C\_j}$ values

j	**H_j**	**$EIRP_{C\_j,n}$ (δ_n, γ_n) dB(W/BW_{Ref})**				**$EIRP_{C\_j}$**
-	(km)	δ = 0°	δ = 0.01°	…	δ = 90°	dB(W/BW_{Ref})
1	H_{min}	xxx	xxx	xxx	xxx	XXX
2		yyy	yyy	yyy	yyy	YYY
…	…	…	…	…	…	…
j_{max}	H_{max}	zzz	zzz	zzz	zzz	ZZZ

Compare *$EIRP_C$* and *$EIRP_R$*, and produce an examination finding

iv) For each of the emissions, check whether $EIRP_{C\_j} > EIRP_R$. The results of this check are illustrated in Table A2-3 below.

TABLE A2-3

Comparison between $EIRP_{C\_j}$ and $EIRP_R$

Group ID	Emission No.	$EIRP_R$ dB(W)	Is there at least one altitude H_j for which $EIRP_{C\_j} > EIRP_R$?	Smallest H_j for which $EIRP_{C\_j} > EIRP_R$ (km)
X	1	XXX	Yes/No	AAA
Y	2	YYY	Yes/No	BBB
…	…	…	…	…
Z	*N*	ZZZ	Yes/No	CCC

v) For the emissions included in the Group under examination which pass the test detailed in iv) above, the results of the Bureau's examination for that Group is ***favourable*** (after removing emissions that have failed the examination), otherwise it is ***unfavourable***.

vi) The Bureau shall publish:

– the finding (favourable or unfavourable) for each Group of the non-GSO system examined;

– Table A2-3, that is the output of step iii) of the algorithm.

Note: As part of standard procedure, the Bureau would publish the emissions with unfavourable findings in BR IFIC Part III-S, which concerns frequency assignments that are returned to the responsible administration.

Option 2 for the methodology:

1 Examination methodology

1.1 Introduction

An A-ESIM can operate at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable off-axis e.i.r.p. spectral density ("$EIRP_C$") for an A-ESIM transmitter communicating with a non-GSO FSS satellite and still ensure compliance with the pfd limits included in Part 2 of Annex 1 of this Resolution to protect terrestrial services, for a defined set of altitude ranges. The methodology derives the $EIRP_C$ taking into account the relevant loss and attenuation in the geometry considered.

The methodology then compares the computed $EIRP_C$ with the Reference A-ESIM off-axis e.i.r.p. towards the ground ("$EIRP_R$") under which the A-ESIM operates. The $EIRP_R$ of the non-GSO satellite system is calculated from the data included in the Appendix **4** Notification information of non-GSO satellite system with which the ESIM communicates and on the ESIM characteristics, as applicable. For the emission in each group of a non-GSO satellite system, $EIRP_R$ can be calculated by using the Appendix **4** data for that system as well as other input parameters that shall be provided by the notifying administration for that system.

The operations of A-ESIM may be evaluated over a number of predefined altitude ranges in order to establish a number of $EIRP_C$ levels. Each altitude range would have its own $EIRP_C$ such that, all other assumptions being equal, higher altitude A-ESIM operation would allow for a higher $EIRP_C$, since the distance between the A-ESIM and the chosen location on the ground is larger and so are the applicable losses and attenuations.

An examination by the Bureau would apply this methodology for each altitude range, to determine whether the A-ESIM operating under a given non-GSO satellite system would comply with the pfd limits included in Part 2 of Annex 1 of this Resolution to protect terrestrial services.

1.2 Input parameters

Considering a hypothetical non-GSO satellite system, Table 1 below describes the emissions that are examined and that are included in one Group associated to the “UO” class of e/s transmitting in the 27.5-29.5 GHz band. Tables 2 and 3 provide additional parameters.

TABLE 1

Example of a Group of applicable A-ESIM emissions (with reference to relevant RR Appendix 4 data fields)

Emission No.	C.7.a Designation of emission	$BW_{emission}$ MHz	C.8.c.3 minimum power density dB(W/Hz)	C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz)
1	6M00G7W--	6.0	−69.7	−66.0
2	6M00G7W--	6.0	−64.7	−61.0
3	6M00G7W--	6.0	−59.7	−56.0

TABLE 2

Additional example assumptions

ID	Parameter	Notation	Value	Unit
1	Frequency assignment	f	29.5	GHz
2	Reference bandwidth of pfd mask	BW_{Ref}	14.0	MHz
3	A-ESIM antenna peak gain	G_{max}	37.5	dBi
4	A-ESIM antenna gain pattern	-	As per Rec. ITU-R S.580 (see C.10.d.5.a.1)	

TABLE 3

Additional assumptions defined in the methodology

ID	Parameter	Notation	Value	Unit
9[2)]	Atmospheric attenuation	L_{atm}	Computed with Rec. ITU-R P.676	dB
10	Angle of arrival of the incident wave on the Earth’s surface	δ	Specified by the pre-established sets of pfd limits, variable from 0° to 90°	deg
11	Minimum examination altitude	H_{min}	0.01	km
12	Maximum examination altitude	H_{max}	15	km
13	Examination altitude spacing	H_{step}	1.0	km
14	Fuselage attenuation	L_f	See Table 4	dB

FIGURE 1

Geometry for the examination of compliance for two different ESIM altitudes

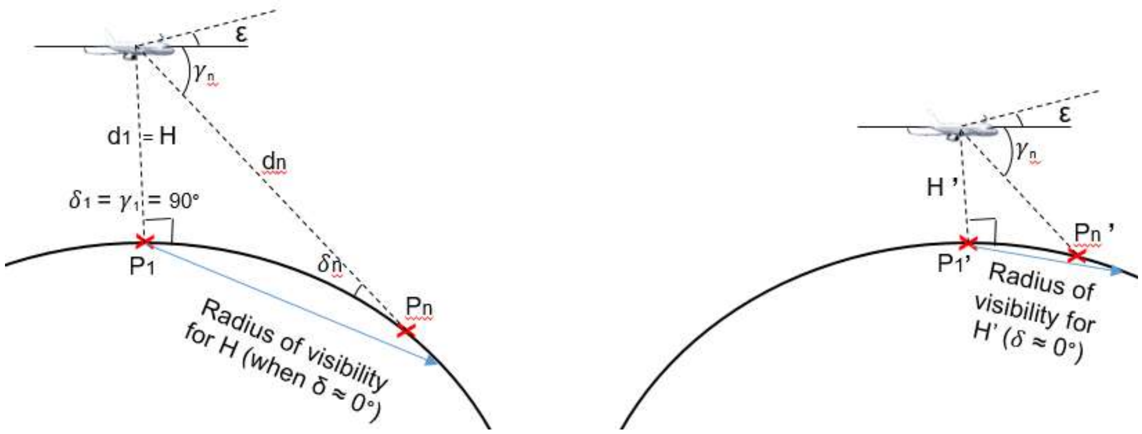


FIGURE 2

A-ESIM main beam gain points at satellite

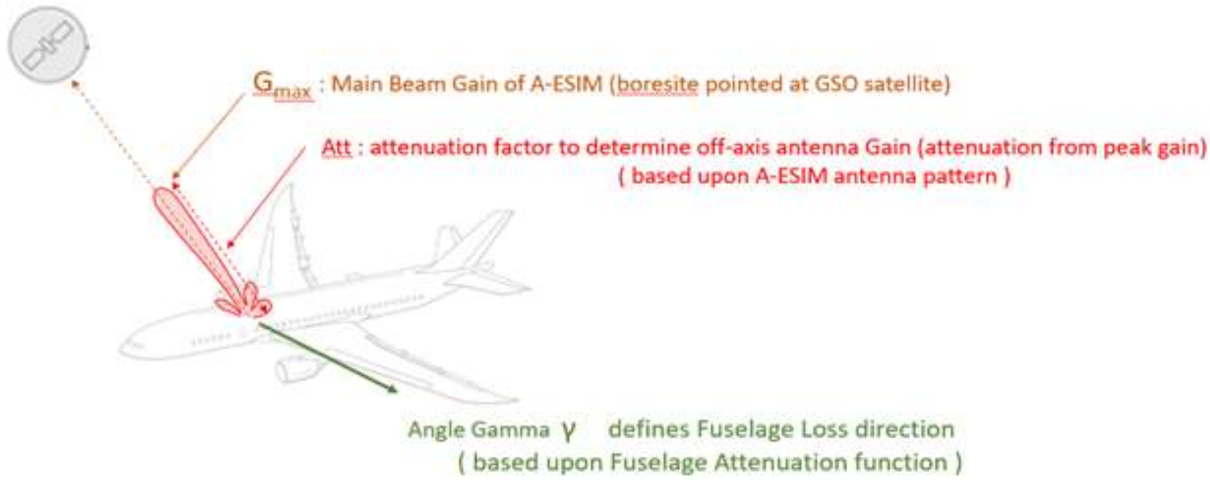


TABLE 4

Fuselage attenuation model

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	dB	for	$0° \leq \gamma \leq 10°$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	dB	for	$10° < \gamma \leq 34°$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	dB	for	$34° < \gamma \leq 50°$
$L_{fuse}(\gamma) = 35$	dB	for	$50° < \gamma \leq 90°$

Note: This example fuselage attenuation model from on Report ITU-R M.2221-0. [Additional models are being developed in WP 4A.]

TABLE 5A

Required conformance pfd mask for altitudes up to 3 km

$pfd(\delta) = -136.2$	(dB(W/(m^2 · 1 MHz)))	for	$0° \leq \delta \leq 0.01°$
$pfd(\delta) = -132.4 + 1.9 \cdot \log \delta$	(dB(W/(m^2 · 1 MHz)))	for	$0.01° < \delta \leq 0.3°$
$pfd(\delta) = -127.7 + 11 \cdot \log \delta$	(dB(W/(m^2 · 1 MHz)))	for	$0.3° < \delta \leq 1°$
$pfd(\delta) = -127.7 + 18 \cdot \log \delta$	(dB(W/(m^2 · 1 MHz)))	for	$1° < \delta \leq 12.4°$
$pfd(\delta) = -108$	(dB(W/(m^2 · 1 MHz)))	for	$12.4° < \delta \leq 90°$

TABLE 5B

Required conformance pfd mask for altitudes above 3 km

$pfd(\delta) = -124.7$	(dB(W/(m^2 · 14 MHz)))	for	$0° \leq \delta \leq 0.01°$
$pfd(\delta) = -120.9 + 1.9 \cdot \log \delta$	(dB(W/(m^2 · 14 MHz)))	for	$0.01° < \delta \leq 0.3°$
$pfd(\delta) = -116.2 + 11 \cdot \log \delta$	(dB(W/(m^2 · 14 MHz)))	for	$0.3° < \delta \leq 1°$
$pfd(\delta) = -116.2 + 18 \cdot \log \delta$	(dB(W/(m^2 · 14 MHz)))	for	$1° < \delta \leq 2°$
$pfd(\delta) = -117.9 + 23.7 \cdot \log \delta$	(dB(W/(m^2 · 14 MHz)))	for	$2° < \delta \leq 8°$
$pfd(\delta) = -96.5$	(dB(W/(m^2 · 14 MHz)))	for	$8° < \delta \leq 90.0°$

1.3 Step-by-step algorithm

This section includes a step-by-step description of how the examination methodology would be implemented.

START

i) For each aircraft altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test the full compliance with the applicable set of pfd limits. The N angles δ_n must be comprised between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the angles δ_n will correspond to as many N points on the ground.

ii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \ldots, H_{max}$, compute $EIRP_{C\_j}$ and $EIRP_{R\_j}$ using the following algorithm:

a) set the altitude of the A-ESIM to H_j

b) compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii. using the following equation:

$$\gamma_{j,n} = \arccos\left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)}\right) \tag{1}$$

where R_e is the mean earth radius.

c) Compute the distance $D_{j,n}$, in km, for $n = 1, \ldots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + \left(R_e + H_j\right)^2 - 2R_e\left(R_e + H_j\right)\cos\left(\gamma_n - \delta_n\right)} \tag{2}$$

d) Compute the fuselage attenuation $L_{f\,j,n}$ (dB) with $i = 1, \ldots, N$ applicable to each of the of the angles $\gamma_{j,n}$ computed in *b)* above

e) Compute the gaseous absorption $L_{atm\_j,n}$ (dB) with $i = 1, \ldots, N$ applicable to each of the distances Dj,n computed in *c)* above, using the applicable sections of Recommendation ITU-R P.676

f) Compute the maximum $EIRP_{C\_j,n}$ (dB(W/BW_{Ref})) that is the maximum e.i.r.p. that can be radiated by the A-ESIM at altitude H_j towards each of the angles $\gamma_{j,n}$ and still be compliant with the pfd limits indicated in Table 5, as per the following equation:

$$EIRP_{C\_j,n}(\delta_n, \gamma_n) = pfd(\delta_n) + 10\log_{10}\left(4\pi\left(D_{j,n}\cdot 1\,000\right)^2\right) + L_{f\ j,n} + L_{atm\_j,n} \tag{3}$$

g) Compute the minimum $EIRP_{C\_j}$ across all values calculated at the previous step, $EIRP_{C\_j}$ = Min ($EIRP_{C\_j,n}$ (δ_n, γ_n)). The output of this step is the maximum $EIRP_{C\_j}$ that can be safely radiated by the A-ESIM to ensure it complies with the pfd limits indicated in Table 5A or 5B, as applicable, with respect to all angles δ_n at the altitude H_j. There will be one $EIRP_{C\_j}$ for each of the H_j altitudes considered.

h) For each emission included in the Group under consideration, compute the reference e.i.r.p. ($EIRP_{R\_j,n}$ (dBW)) as:

$$EIRP_{R\_j,n} = P_{Max} + Gtx\left(\gamma_{j,n} + \varepsilon\right) + 10\log_{10}(BW) \tag{4}$$

where:

P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).

$Gtx(\gamma_{j,n} + \varepsilon)$ is the transmit antenna gain with the separation angle from the peak direction consisting of each the angle $\gamma_{j,n}$ and the elevation angle ε.

ε is the A-ESIM elevation angle towards the satellite.

BW in Hz is:

BW_{Ref} if $BW_{emission} > BW_{Ref}$

$BW_{emission}$ if $BW_{emission} < BW_{\mathrm{Ref}}$

i) Compute the $EIRP_{R\_j}$ across all values calculated at the previous step, $EIRP_{R\_j}$ = Max ($EIRP_{R\_j,n}$ (δ_n, γ_n)). Note that the $EIRP_{R\_j}$ is calculated for each emission.

The output of steps *g)* and *i)* is summarized in Table 7 below:

TABLE 7

Computed $EIRP_{C\_j}$ and $EIRP_{R\_j}$ values

H_j (km)	$EIRP_{C\_j}$ dB(W/BW_{Ref})	$EIRP_{R\_j}$ dB(W/BW_{Ref})
0.01	*TBD*	*TBD*
1.0	*TBD*	*TBD*
2.0	*TBD*	*TBD*
3.0	*TBD*	*TBD*

H_j (km)	$EIRP_{C\_j}$ dB(W/BW_{Ref})	$EIRP_{R\_j}$ dB(W/BW_{Ref})
4.0	*TBD*	*TBD*
5.0	*TBD*	*TBD*
6.0	*TBD*	*TBD*
7.0	*TBD*	*TBD*
8.0	*TBD*	*TBD*
9.0	*TBD*	*TBD*
10.0	*TBD*	*TBD*
11.0	*TBD*	*TBD*
12.0	*TBD*	*TBD*
13.0	*TBD*	*TBD*
14.0	*TBD*	*TBD*
15.0	*TBD*	*TBD*

Note: This methodology computes the e.i.r.p. backwards, upwards from the ground, starting with the power flux-density (pfd, either the one specified in Table 5A or 5B, depending on the altitude H_j, as applicable) and:

- converting it to an effective received power at the ground;
- translating back to the aircraft location based upon the slant distance and subtracting propagation losses based upon distance;
- computing and subtracting atmospheric losses based upon distance;
- computing and subtracting fuselage attenuation losses based upon the angle below the aircraft local horizon.

All to allow the A-ESIM operator to operate in compliance with an effective on-axis boresight isotropic radiated power (e.i.r.p.) that would ensure it complies with the pfd mask at the airborne A-ESIM altitude and location considered.

iv) For each of the groups, check whether there is at least one *j)* for which $EIRP_{C\_j} > EIRP_J$. The results of this check are illustrated in Table 8 below.

TABLE 8

Comparison between $EIRP_{C\_j}$ and $EIRP_{R,j}$

Group No.	**C.7.a Designation of emission**	**Lowest altitude H_j (km) for which $EIRP_{C\_j} > EIRP_{R,j}$**
1	6M00G7W--	TBD
2	6M00G7W--	TBD
3	6M00G7W--	TBD

For the emissions included in the Group under examination which pass the test detailed in iv) above, the results of the Bureau's examination for that Group is ***favourable****, after removing emissions that have failed the examination*, otherwise it is ***unfavourable***.

v) The Bureau should publish:

a) The finding (favourable or unfavourable) for the examined Group of the non-GSO system examined; and

b) the information included in Table 8, along with the comment: The operation of A-ESIM with the Emission **XXX** (Emission Code) under examination shall be possible below the altitude of **YYY** km (minimum altitude for favourable finding of that emission) referred to in Table 8 only if the appropriate mitigation techniques are used to ensure that the power flux-density produced on Earth's surface respect the limits indicated in Part 2 of Annex 1 of this Resolution on territories where those limits apply.

Note: As part of standard procedure, the Bureau would publish the emissions with unfavourable finding in BR IFIC Part III-S, which concerns frequency assignments that are returned to the responsible administration.

END

Option 1:

2 Example application of the methodology

Table A2-4 below describes the emissions included in one group of a fictitious satellite system that are associated to the class of earth station indicating the non-GSO aeronautical ESIM (A-ESIM) transmitting in the frequency band 27.5-29.1 GHz. Three different types of emissions are included in the group to cover different performance objectives of the communication link.

Option 1:

TABLE A2-4

Example A-ESIM emissions in the group examined

Emission No.	**C.7.a Designation of emission**	**C.8.a.2/C.8.b.2 Maximum power density** **dB(W/Hz)**	**C.8.c.3 Minimum power density** **dB(W/Hz)**	**C.8.e.1 *C/N* objective (total – clear sky)** **dB**
1	6MD7W--	−56.0	−69.7	−5.0
2	6MD7W--	−51.0	−64.7	0.0
3	6MD7W--	−42.0	−55.7	9.0

Table A2-5 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A2-5

Additional assumptions

Parameter	Notation	Value	Unit
Test frequency	f	29.5	GHz
A-ESIMs antenna peak gain	G_{max}	37.5	dBi
Antenna gain pattern	-	APEREC015V01	
Polarization loss	L_{Pol}	0.0	dB
Fuselage attenuation model	L_f	See Table A2-6	
Atmospheric loss	L_{atm}	Rec. ITU-R P.676	
Minimum examination altitude range	H_{min}	0.02	km
Maximum examination altitude range	H_{max}	15.0	km
Examination altitude range spacing	H_{step}	1.0	km

Option 2:

TABLE A2-4

Example A-ESIMs emissions in the Group ID No. 1

Emission No.	C.7.a Designation of emission	C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz)	C.8.c.3 Minimum power density dB(W/Hz)	C.8.e.1 C/N objective (total – clear sky) dB
1	6MD7W--	−56.0	−69.7	−5.0
2	6MD7W--	−51.0	−64.7	0.0
3	6MD7W--	−46.0	−59.7	5.0

Table A2-5 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A2-5

Additional assumptions

Parameter	Notation	Value	Unit
Test frequency	f	30.0	GHz
A-ESIMs antenna peak gain	G_{max}	37.5	dBi
Antenna gain pattern	-	Rec. ITU-R S.580	
Polarization loss	L_{Pol}	0.0	dB
Fuselage attenuation model	FA	See Table A2-6	
Atmospheric attenuation	L_{atm}	Section 2.21.2 of Rec. ITU-R P.676	
Reference atmosphere	-	"Winter high latitude" from Rec. ITU-R P.835.6	
Minimum examination altitude range	H_{min}	0.02	km
Maximum examination altitude range	H_{max}	15.0	km

Parameter	Notation	Value	Unit
Examination altitude range spacing	H_{step}	1.0	km
Altitude of the interfered with terrestrial station	H_T	0.01	km

TABLE A2-6

Fuselage attenuation model from Report ITU-R M.2221

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	dB	for	$0° \leq \gamma \leq 10°$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	dB	for	$10° < \gamma \leq 34°$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	dB	for	$34° < \gamma \leq 50°$
$L_{fuse}(\gamma) = 35$	dB	for	$50° < \gamma \leq 90°$

TABLE A2-7

Tested pfd limits on the ground

$\text{pfd}(\theta) = -124.7$ (dB(W/(m^2 · 14 MHz))) for $0° \leq \theta \leq 0.01°$

$\text{pfd}(\theta) = -120.9 + 1.9 \cdot \log\theta$ (dB(W/(m^2 · 14 MHz))) for $0.01° < \theta \leq 0.3°$

$\text{pfd}(\theta) = -116.2 + 11 \cdot \log\theta$ (dB(W/(m^2 · 14 MHz))) for $0.3° < \theta \leq 1°$

$\text{pfd}(\theta) = -116.2 + 18 \cdot \log\theta$ (dB(W/(m^2 · 14 MHz))) for $1° < \theta \leq 2°$

$\text{pfd}(\theta) = -117.9 + 23.7 \cdot \log\theta$ (dB(W/(m^2 · 14 MHz))) for $2° < \theta \leq 8°$

$\text{pfd}(\theta) = -96.5$ (dB(W/(m^2 · 14 MHz))) for $8° < \theta \leq 90.0°$

The paragraphs below represent the step-by-step application of the calculation methodology described in section 3.

START

i) For each of the emissions listed in Table A2-4, the reference e.i.r.p. ($EIRP_R$, dBW) is computed and the relevant results are included in Table A2-8 below:

Option 1:

TABLE A2-8

Computed values of $EIRP_R$ for the group under consideration

Emission No.	G_{Max} (dBi)	$G_{Isol_{Max}}$ (dB)	P_{Max} (dB(W/Hz))	*BW*, MHz	$EIRP_R$ (dBW)
1	37.5	42.4	−56.0	6.0	6.89
2			−51.0		11.89
3			−42.0		20.89

ii) Generate δ_n angles compatible with the pfd limits described in Table A2-7:

δ_n = 0°, 0.01°, 0.02°, …, 0.3°, 0.4°,…, 12.3°, 12.4°,…, 13°, 14°,…, 90°.

iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \ldots, H_{max}$, compute $EIRP_{C\_j}$. The output of this step is summarized in Table A2-9 below:

TABLE A2-9

Computed $EIRP_{C\_j}$ values
(see embedded file for full results)

j	H_j	$EIRP_{C\_j,n}$ (δ_n, γ_n) dB(W/BW_{Ref})				$EIRP_{C\_j}$
-	(km)	δ = 0°	δ = 0.01°	…	δ = 90°	dB(W/BW_{Ref})
1	0.02	Table A.2.9_full.xlsx (see Annex to this contribution)				−40.6
2	1.00					−6.04
3	2.00					0.38
…	…					…
16	15.00					17.45

iv) For each of the emissions, check whether there is at least one altitude for which $EIRP_{C\_j} > EIRP_R$. The result of this step is summarized in Table A2-10 below.

TABLE A2-10

Comparison between $EIRP_{C\_j}$ and $EIRP_R$

Emission No.	$EIRP_R$ dB(W)	smallest j for which $EIRP_{C\_j} > EIRP_R$	$EIRP_{C\_j} > EIRP_R$
1	6.89	6	Yes
2	11.89	9	Yes
3	20.89	None	No

v) Since there is at least one emission among those included in the Group under examination which passes the test detailed in iv) above, the results of the Bureau's examination for this Group is ***favourable***.

vi) The Bureau publishes:

The ***favourable*** finding for the Group of the non-GSO system examined.

Option 2:

TABLE A2-8

Computed values of $EIRP_R$ for the group under consideration

Emission No.	G_{Max} (dBi)	$GIsol_{Max}$ (dB)	P_{Max} (dB(W/Hz))	BW, MHz	$EIRP_R$ (dBW)
1	37.5	42.4	−56.0	6.0	6.89
2			−51.0		11.89
3			−46.0		16.89

i) Generate δ_n angles compatible with the pfd limits described in Table A2-7:

δ_n = 0°, 0.01°, 0.02°, …, 0.3°, 0.4°,…, 12.3°, 12.4°,…, 13°, 14°,…, 90°.

ii) For each altitude $H_j = H_{min}$, $H_{min} + H_{step}$, …, H_{max}, compute $EIRP_{C\_j}$. The output of this step is summarized in Table A2-9 below:

TABLE A2-9

Computed $EIRP_{C\_j}$ values
(see embedded file for full results)

j	***H_j***	***$EIRP_{C\_j,n}$ (δ_n, γ_n)*** **dB(W/BW_{Ref})**				***$EIRP_{C\_j}$***
-	**(km)**	**δ = 0°**	**δ = 0.01°**	**…**	**δ = 90°**	**dB(W/BW_{Ref})**
1	0.02	Table A.2.9_full.xlsx				−40.6
2	1.00					−6.04
3	2.00					0.38
…	…					…
16	15.00					17.45

iii) For each of the emissions, check whether there is at least one *j* for which $EIRP_{C\_j} > EIRP_R$. The result of this step is summarized in Table A2-10 below.

TABLE A2-10

Comparison between $EIRP_{C\_j}$ and $EIRP_R$

Group ID	**Emission No.**	***$EIRP_R$*** **dB(W)**	**Is there at least one altitude H_j for which $EIRP_{C\_j} > EIRP_R$?**	**Smallest H_j for which $EIRP_{C\_j} > EIRP_R$ (km)**
1	1	6.89	Yes	5.0
1	2	11.89	Yes	8.0
1	3	16.89	Yes	14.0

iv) Since there is at least one emission among those included in the Group under examination which passes the test detailed in iv) above, the results of the Bureau's examination for this Group is ***favourable***.

v) The Bureau shall publish:

– the ***favourable*** finding for the Group ID No. 1 of the non-GSO system examined

– Table A2-10, published for information only.

END

Option 2: suppress section 2

Option 1:

ATTACHMENT TO ANNEX 2 OF DRAFT NEW RESOLUTION [A116] (WRC-23)

An example of a satellite filing Group is provided below to facilitate the understanding of the methodology.

SECTION SPECIALE / SPECIAL SECTION / SECCIÓN ESPECIAL / 特节 / СПЕЦИАЛЬНАЯ СЕКЦИЯ / القسم الخاص — CR/C/5111

A | *A1a* Sat. Network TELSTAR-LEO | *A1f1* Notif. adm. CAN | *A1f3* Inter. sat. org. | *BR1* Date of receipt 17.09.2019 | *BR20/BR21* BR IFIC no./part 2911/

BR6a/BR6b Id. no. 119520219 | *BR3a/BR3b* Provision reference 9.6 C | *BR2* Adm. serial no. | KUI1 R

A15a EPFD compliance | *A18a* Aircraft earth station commitment

B1a/BR17 Beam designation KUI1 | *B1b* Steerable Y | *B2* Emi-Rcp R | *B3a1* Max. co-polar gain 29

B2bis.a Transmit only when visible from notified service area | *B2bis.b* Min. Elev. Angle

B3c1 Co-polar antenna pattern						
Co-polar ref. pattern	Coef. A	Coef. B				Co-polar rad. diag.
REC-1528						

List of orbital planes

7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26

B4a3a1 Angle alpha 0 | *B4a3a2* Angle beta 0

BR7a/BR7b Group id. 119740373 | *BR1* Date of receipt 17.09.2019 | *C2c* RR No. 4.4 | *BR98* For use in accordance with Res 163/164

A2b Period of valid. 50 | *A3a* Op. agency 003 | *A3b* Adm. resp. B | *BR16* Value of type C8b

BR62 Expiry date for bringing into use 17.09.2026 | *BR64* Date of receipt of 1st Res49

BR14 Special Section CR/C/5111

C4a Class of station BC | *C3a* Assigned freq. band 100000 | *C5a* Noise temperature 730 | *B4b5* Peak of pfd

C4b Nature of service CP | *C6a* Polarization type M | *C6b* Polarization angle

C11a1 Service area no. | *C11a2* Service area XAA | *C11a3* Service area diagram

C9c1 Type of multiple access 1 | *C9c2* Spectrum mask diagram 1 | *C11b* Affected region

A5/A6 Coordinations/Agreements 9.12 F | CHN CYP F G HOL ISR LIE LUX NOR NZL RUS/IK RUS USA VTN

C2a1 Assigned frequency												
27.55 27.65	GHz GHz	27.75 27.85	GHz GHz	27.95 28.05	GHz GHz	28.15 28.25	GHz GHz	28.35 28.45	GHz GHz	28.55	GHz	

A13 Ref. to Special Sections
API/C /816

	C7a Design. of emission	*C8a1/C8b1* Max. peak pwr	*C8a2/C8b2* Max. pwr dens.	*C8c1* Min. peak pwr	*C8c2* Attch.	*C8c3* Min. pwr dens.	*C8c4* Attch.	*C8e1* C/N ratio	*C8e2* Attch.
1	100MD7W--	16	-64	5		-75		9.1	
2	10M0D7W--	6	-64	-5		-75		9.1	
3	1M00D7W--	-4	-64	-15		-75		9.1	

C10b1 Assoc. earth station id.	*C10b2* Type	*C10c1* Geographical coord.		*C10c2* Ctry	*C10d1/C10d2* Cls. / Nat.			*C10d3* Max. iso. gain	*C10d4* Bmwdth		*C10d7* Ant. diameter		*C8g1* Max. aggr. pwr.	*C8g2* Aggr. bandwidth	*C8g3* Transp. bandwidth = Aggr. bandwidth
KA U1	T				1	TC	CP	45.7	0.9						

	C10d5a Co-polar antenna pattern						
C10b1 Assoc. earth station id.	Co-polar ref. pattern	Coef. A	Coef. B	Coef. C	Coef. D	Phi1	Co-polar rad. diag.
KA U1	REC-580-6						

Findings | *2D* Date of protection 17.09.2019 | *13A* Conformity with RR A- -- -- | *13B1* Prov. | *13B2* Remarks | *13B3* Date of Review

13C Remarks

Option 2: suppression of Attachment to Annex 2

ANNEX 3 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

Provisions for non-GSO FSS systems[1] transmitting to aeronautical and/or maritime ESIMs operating in or over an ocean in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with respect to EESS (passive) operating in the frequency band 18.6-18.8 GHz (in accordance with *resolves* 1.1.6)

Option 1:

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with an aeronautical or maritime ESIM shall not exceed a pfd produced at the surface of the oceans across the 200 MHz of the frequency band 18.6-18.8 GHz, of −123 dB(W/(m² · 200 MHz)). This value can be exceeded provided that the non-GSO fixed-satellite system does not exceed a pfd across the 200 MHz of the frequency band 18.6-18.8 GHz of −137 dB(W/(m² · 200 MHz)) averaged over an area of 10 000 000 km² at the surface of the oceans.

Option 2:

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz over oceans with aeronautical or maritime ESIM shall not exceed the following pfd values produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band:

−123 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes greater than 2 000 km;

−117 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes between 1 000 km and 2 000 km;

−104 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes below 1 000 km.

Option 3:

Any non-GSO fixed satellite space station operating in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with (i) an orbit apogee less than 20 000 km (ii) communicating with an aeronautical or maritime ESIM over the ocean, and (iii) for which complete notification information has been received by the Radiocommunication Bureau after 1 January 2025, shall not exceed an unwanted emission power flux-density produced at the surface of the ocean in the 18.6-18.8 GHz band, based on the following piecewise equation:

for $N \geq 10$: $pfd = min(-77 - 10 * \log(S), -110)$ dB(W/(m² · 200 MHz))

for $N < 10$: $pfd = min(-67 - 10 * \log(S) - 10 * \log(N), -110)$ dB(W/(m² · 200 MHz))

where S is the non-GSO fixed satellite space station 3 dB beam footprint area on the ground expressed in km² and N is the maximum number of co-frequency beams

[1] These provisions do not apply to non-GSO systems using orbits with an apogee less than 2 000 km that employ a frequency reuse factor of at least three.

generated by the non-GSO fixed satellite system within a 10 000 000 km^2 square on the Earth.

NOTE: Annex 4 was not discussed in detail at CPM23-2

Option 1:

ANNEX 4 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

Required/Recommended ESIM ~~software and hardware~~ capabilities

ESIM shall be designed with the following minimum capabilities:~~In order to enable the ESIM to cease transmission when the conditions described are met, the ESIM network shall be designed with appropriate software or hardware capabilities. The table below describes applicable minimum software and hardware capabilities, with a justification for their requirement.~~

In order to enable the ESIM to cease transmission when the conditions described are met, it is recommended the ESIM network ~~shall~~ be designed with appropriate ~~software or hardware~~ capabilities. ~~The table below~~Table A5.1 describes applicable ~~minimum software and hardware~~ capabilities, with a justification for their requirement.

Option 1:

~~Also, i~~It is also important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.

Option 2:

~~Also, it is important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.~~

Option 1:

For each ESIM, the NCMC ~~will~~should have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and non-GSO satellite system with which the non-GSO ESIM communicates. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.

Option 2:

~~For each ESIM, the NCMC will have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and satellite system. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.~~

Option 1:

TABLE A4-1

Minimum ESIM capabilities and justification

Capability	Justification
GNSS (or other geolocation capabilities)	~~Required t~~To assess the ESIM's geographic location so the ESIM is aware when entering an administration's territory that has not given authorization ~~and feedback to software~~ to cease transmissions accordingly.
Monitor loss of frequency lock	~~Required t~~To anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Monitor loss of LO signal	~~Required t~~To anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Internal power off/on/reset	~~Required f~~For the ESIM to have the ability to self-power down after experiencing a fault condition, then restart or power back on when fault is resolved.
Disable/enable transmission and level adjustment	~~Required t~~To cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions.
Receive and execute commands from NCMC	~~Required t~~To receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions.

Option 2:

TABLE A4-1

Minimum ESIM capabilities and justification

Capability	Justification
GNSS (or other geolocation capabilities)	Required to assess the ESIM's geographic location so the ESIM is aware when entering an administration's territory that has not given authorization and feedback to software to cease transmissions accordingly.
~~Monitor loss of frequency lock~~	~~Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.~~
~~Monitor loss of LO signal~~	~~Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.~~
Monitor and control of the transmission frequency	Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Internal power off/on/reset	Required for the ESIM to have the ability to self-power down after experiencing a fault condition, then restart or power back on when fault is resolved.
Disable/enable transmission and level adjustment	Required to cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions.
Receive and execute commands from NCMC	Required to receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions.

Option 1:

Furthermore, it is recommended the ESIM ~~shall~~ have the ability to enter the states described in Table A4-2. These states ~~are required to~~ ensure the ESIM is in the correct radio-interface state after some event (such as an initial boot or resuming operations after a fault) and can test system functionality is correct before radiating to avoid any transmission errors.

Option 2:

~~Furthermore, the ESIM shall have the ability to enter the states described in Table A4-2. These states are required to ensure the ESIM is in the correct radio-interface state after some event (such as an initial boot or resuming operations after a fault) and can test system functionality is correct before radiating to avoid any transmission errors.~~

Option 1:

TABLE A4-2

ESIM states and events[1]

ESIM state	Radio-interface state	Corresponding event
Non-valid	Emissions disabled	After power-on, until ESIM can receive commands from NCMC and no-fault conditions are present After any failure/fault During system checks
Initial phase	Emissions disabled	When waiting for a transmission enable or disable command from NCMC
Transmission enabled	Carrier-off	No carrier transmitted/need for carrier to be transmitted Receive synchronization is lost Pointing threshold is exceeded
	Carrier-on	During transmission and ESIM is correctly pointed
Transmission disabled	Emissions disabled	When commanded by NCMC or ESIM automatically enters based on a “Cease Transmission” condition In locations where transmission is not permitted

Option 2: Suppression of Table A4-2

~~[1] Heavily adapted from EN 303 979.~~

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

Footnotes to Tables A, B, C and D

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Option 1:

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.24	**COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION**										**A.24**	
A.24.a	a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution **32 (WRC-19)** is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification					+					A.24.a	
A.25	**COMPLIANCE WITH *resolves* 1.1.3 OF RESOLUTION 169 (WRC-19)**										**A.25**	
A.25.a	a commitment that the ESIM operation would be in conformity with the Radio Regulations and draft new Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.25.a	
A.26	**COMPLIANCE WITH *resolves* 4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)**										**A.26**	
A.26.a	a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the non-GSO FSS network with which ESIMs communicate shall follow the procedures in *resolves* 6 of draft new Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.26.a	
A.27	**COMPLIANCE WITH *resolves* 1.2.4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)**										**A.27**	
A.27.a	a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 to draft new Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.27.a	

Option 2:

Items in Appendix	*A – GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
...												
A.20	**COMPLIANCE WITH *resolves* 1.1.4 OF RESOLUTION 169 (WRC-19)**										**A.20**	
A.20.a	a commitment that the ESIM operation would be in conformity with the Radio Regulations and Resolution **169 (WRC-19)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **169 (WRC-19)**				+						A.20.a	
A.21	**COMPLIANCE WITH *resolves* 1.2.6 OF RESOLUTION 169 (WRC-19)**										**A.21**	
A.21.a	a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the GSO FSS network with which ESIMs communicate shall follow the procedures in *resolves* 4 of Resolution **169 (WRC-19)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **169 (WRC-19)**				+						A.21.a	
A.22	**COMPLIANCE WITH *resolves* 7 OF RESOLUTION 169 (WRC-19)**										**A.22**	
A.22.a	a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part II of Annex 3 to Resolution **169 (WRC-19)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **169 (WRC-19)**				+						A.22.a	
A.23	**COMPLIANCE WITH RESOLUTION 35 (WRC-19)**										**A.23**	
A.23.a	a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments to the non-geostationary-satellite system					**O**					A.23.a	
A.24	**COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION**										**A.24**	
A.24.a	a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution **32 (WRC-19)** is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification					+					A.24a	
A.25	**COMPLIANCE WITH *resolves* 1.1.1.1 OF RESOLUTION [A116] (WRC-23)**										**A.25**	
A.25.a	a commitment that the ESIM operation would be in conformity with the Radio Regulations and Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **[A116] (WRC-23)**					+					A.25.a	
A.26	**COMPLIANCE WITH *resolves* 1.1.5 OF RESOLUTION [A116] (WRC-23)**										**A.26**	
A.26.a	a commitment that the ESIM operation would be in conformity with the *resolves* 1.1.5 of Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **[A116] (WRC-23)**					+					A.26.a	

A.27	**COMPLIANCE WITH *resolves* 4 OF RESOLUTION [A116] (WRC-23)**										A.27	
A.27.a	a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the GSO FSS network with which ESIMs communicate shall follow the procedures in *resolves* 5 of Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **[A116] (WRC-23)**					+					A.27.a	
A.28	**COMPLIANCE WITH *resolves* 1.2.2 OF RESOLUTION [A116] (WRC-23)**										A.28	
A.28.a	a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part II of Annex 1 to Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **[A116] (WRC-23)**					+					A.28.a	

Option 3:

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.24	**COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION**										**A.24**	
A.24.a	a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution **32 (WRC-19)** is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification					+					A.24.a	
A.25	**COMPLIANCE WITH *resolves* 1.1.3 OF RESOLUTION 169 (WRC-19)**										A.25	
A.25.a	a commitment that the ESIM operation would be in conformity with the Radio Regulations and draft new Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.25.a	
A.26	**COMPLIANCE WITH *resolves* 4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)**										A.26	
A.26.a	a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the non-GSO FSS network with which ESIMs communicate shall follow the procedures in *resolves* 6 of draft new Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.26.a	
A.27	**COMPLIANCE WITH *resolves* 1.2.4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)**										A.27	
A.27.a	a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 to draft new Resolution **[A116] (WRC-23)** Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.27.a	
A.28	**COMPLIANCE WITH *resolves* 1.1.6 OF DRAFT NEW RESOLUTION [A116] (WRC-23)**										A.28	
A.28.a	an indication of whether the LEO system with which the ESIMs communicate employs a frequency reuse scheme with at least three colours. Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution **[A116] (WRC-23)**					+					A.28.a	

…

SUP

RESOLUTION 173 (WRC-19)

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

Agenda item 1.17

1.17 to determine and carry out, on the basis of ITU-R studies in accordance with Resolution ***773 (WRC-19)****, the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate;*

Resolution **773 (WRC-19)** – *Study of technical and operational issues, and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz*

"RoP associated with RR No. ***11.32*** *section 6 Examination of frequency assignments to an inter-satellite link of a geostationary space station communicating with a non-geostationary space station*

6.1 The Board noted the specific nature of inter-satellite links where one end of the link is on a GSO space station and the other on a non-GSO space station. Under RR Article ***9*** *(No.* ***9.7****) there is a requirement to effect coordination for frequency assignments of GSO networks, but there is no similar requirement for assignments of non-GSO networks. It is thus unclear whether coordination under Section II of Article* ***9*** *applies:*

a) to both ends of the inter-satellite link, i.e., to the GSO as well as to the non-GSO station of the link, thus rendering the entire link coordinated (as is the case in all other forms of coordination); or

b) only to the GSO station of the inter-satellite link, leaving the other end uncoordinated; or

c) to none of the stations of the inter-satellite link, leaving the entire inter-satellite link uncoordinated (as is the case when coordination does not apply, e.g., non-GSO networks).

6.2 In view of the above, the Board decided that, until WRC clarifies this matter, assignments in inter-satellite links between GSO and non-GSO space stations shall be treated as follows:

6.2.1 The general description of the inter-satellite link shall be sent to the Bureau for advance publication in accordance with Sub-Section IA of Article ***9****.*

6.2.2 Provisionally, these assignments shall not be considered as being subject to the coordination procedure under Section II of Article ***9****.*

6.2.3 At notification stage, no finding shall be given under RR No. ***11.32*** *(Column 13A2) and symbol "K" will be inserted in Column 13B2 with the following meaning:*

"K": this frequency assignment to an inter-satellite link of a geostationary space station communicating with a non-geostationary space station is not taken into account by the Bureau in its examination under RR No. ***11.32****."*

4/1.17/1 Executive summary

Resolves 1 of Resolution **773 (WRC-19)** resolves to invite ITU-R to develop the technical and operational characteristics of different types of space stations that plan satellite-to-satellite transmissions in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz. *Resolves* 2 of the same Resolution resolves to invite ITU-R to study the technical and operational characteristics, including spectrum requirements, off-axis e.i.r.p. values and out-of-band emission limits, for transmissions between space stations in these same frequency bands.

Sharing studies were performed with all incumbent services for all configurations of operations considered under this agenda item (i.e. operations limited within the cone of coverage of the FSS space station or operations feasible outside this cone of coverage). These studies have shown that some incumbent services could be severely impacted by satellite-to-satellite operations. Therefore, technical or regulatory solutions are required to avoid such impacts of satellite-to-satellite transmissions towards affected incumbent services.

One method is proposed to satisfy the agenda item that includes alternative approaches. Satellite-to-satellite operations can be:

– allocated through a fixed-satellite service (FSS) allocation in RR Article **5**;

– allocated through an inter-satellite service (ISS) allocation in RR Article **5**;

– allowable only within the cone of coverage of the non-GSO and GSO FSS space station;

– allowable outside the cone of coverage of the GSO FSS space station.

Method A: No changes to the Radio Regulations and suppression of Resolution **773 (WRC-19)**.

Method B proposes a Resolution to address the regulatory mechanisms to operate the satellite-to-satellite links in 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz. This method also supports no change (NOC) for the band 11.7-12.7 GHz. Within Method B there are several options that should be considered within each of the alternatives pertaining to some of the regulatory mechanisms to ensure the protection of incumbent services.

4/1.17/2 Background

There is growing interest by some members of the ITU for utilizing satellite-to-satellite links for relaying data to/from the Earth using a GSO or a non-GSO FSS service provider[22] space station that is operating at an orbital altitude greater than that of the non-GSO user space station[23] generating the data. Utilization of satellite-to-satellite links needs to be done in an appropriate manner to fully preserve the incumbent services in the planned and non-planned bands where such satellite-to-satellite service is not currently deployed. As most of these non-GSO missions are in low-Earth orbit (LEO) in the order of 300 to 900 km, the user space station download is mostly related to the short duration access they have to their respective earth stations, normally about 10 minutes per orbit. For low latency applications that require access to instrument data in near-real time (e.g. weather forecasting, disaster risk reduction), this can limit the amount of data that is made available to end users within an acceptable time delay. By utilizing inter-satellite links to relay data to the ground, data can be made available in near-real time across a much greater portion of the user space station’s orbit, enhancing the availability and value of instrument data for low latency applications.

Both small and large satellite missions would benefit from satellite-to-satellite transmission services. Even nano-satellites (1-25 kg) may carry a satellite-to-satellite transmission payload.

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[22] A service provider space station is a FSS space station transmitting in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz and 18.8-20.2 GHz (space-to-Earth), or parts thereof, towards space stations at lower altitudes and receiving in the frequency band 27.5-30 GHz (Earth-to-space), or parts thereof, from space stations at lower altitudes.

[23] A user space station is a space station transmitting in the frequency band 27.5-30 GHz (Earth-to-space), or parts thereof, towards space stations at higher altitudes and receiving in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz and 18.8-20.2 GHz (space-to-Earth), or parts thereof, from space stations at higher altitudes.

The use of the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz and 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space), or parts thereof, for transmissions between space stations should ensure compatibility with, and impose no additional regulatory or technical constraints on, services to which the frequency bands are currently allocated on a primary basis and services using adjacent frequency bands allocated on a primary basis in accordance with Resolution **773 (WRC-19)**.

4/1.17/3 Summary and analysis of the results of ITU-R studies

4/1.17/3.1 Summary of spectrum needs

The potential spectrum needs are linked to the types of space stations that appear as "end users" in terms of capacity demand. It bears noting that satellite-to-satellite traffic to be carried on these links is viewed as a part of the overall traffic carried on the service provider network, i.e. one of many users of the satellite system. Therefore, flexibility in assigning specific channels to the non-GSO user space station anywhere within the bandwidth utilized by the FSS service provider space station consistent with the results of studies for satellite-to-satellite links by WRC-23 is desired; which is why, such a need was justified based on the known and planned applications.

The estimated spectrum needs for known future space science, Earth science and human exploration missions through the year 2040, that could utilize satellite-to-satellite links for relaying data to/from the Earth, are shown in the table below and were assessed in multiple studies. The studies used various assumptions in converting the information into estimates of the total spectrum that would be required to meet the stated mission needs.

TABLE 4/1.17/3.1-1

Expected data volume requirements for known future space science, Earth science and human exploration missions

Year	Number of missions	Total data volume (Gbit/day)	Average data volume (Gbit/day)	Total data volume (Gbit/s)	Average data volume per mission (Mbit/s)		Average spectrum requirements per mission (MHz)		Total spectrum requirement (MHz) (assumes 3X frequency reuse)		Total spectrum requirement (MHz) (assumes 3X frequency reuse and polarization)	
					100% connec	33% connec	3.7 bps/Hz	2.6 bps/Hz	100% & 3.7	33% & 2.6	100% & 3.7	33% & 2.6
2025	31	175 100	5 648	2.03	65.37	196.1	17.7	75.4	183	779	91.5	389.5
2030	33	140 100	4 245	1.62	49.13	147.4	13.3	56.7	146	624	73	312
2035	39	251 400	6 446	2.91	74.61	223.8	20.2	86.1	262	1 119	131	559.5
2040	39	341 400	8 753	3.95	101.31	303.9	27.4	116.9	356	1 520	178	760

Two studies assumed that every mission would have 100% connectivity communicating with both GSO FSS networks and/or non-GSO FSS systems to relay data on a continuous basis. A third study assumed that there would be periods of time when user space stations would not be in view of a service provider space station, or that other user demands on service provider resources could limit available coverage time and thereby assumed a connectivity of 33%. In the studies, other factors such as spectral efficiency, polarization discrimination and frequency reuse were taken into consideration in arriving at the estimated total spectrum requirement. Spectral efficiencies that were assumed in these studies ranged from 2.6 bps/Hz to 3.7 bps/Hz depending on the link margin assumed (the higher the link margin assumed, the greater the spectral efficiency). In each study a frequency reuse factor of 3 was assumed. Frequency reuse factors of up to 7 are commonly implemented and would ensure more spectrum efficiency and reduce the estimated spectrum requirements.

In the short/mid-term, the highest total data volume requirement predicted to occur through 2030 is 175 Tbit/day covering 31 missions. The total spectrum requirement for these missions ranged from a low value of 183 MHz when assuming 100% connectivity, 3.7 bps/Hz and a frequency reuse factor of 3, to a high value of 779 MHz when assuming 33% connectivity, 2.6 bps/Hz and a frequency reuse factor of 3. A third study, which includes polarization discrimination for all missions, estimated total spectrum requirements could be cut in half resulting in a range of about 91.5 MHz to 389.5 MHz.

Based on current estimates and assumptions, the total data volume requirement predicted to occur through 2040 is 341 Tbit/day covering 39 missions. The total spectrum requirement for these missions ranged from a low value of 356 MHz when assuming 100% connectivity, 3.7 bps/Hz and a frequency reuse factor of 3, to a high value of 1 520 MHz when assuming 33% connectivity, 2.6 bps/Hz and a frequency reuse factor of 3. A third study, which includes polarization discrimination for all missions, estimated total spectrum requirements could be cut in half to a range of about 178 MHz to 760 MHz.

Since non-GSO user space stations are expected to be generating data through collection of information being observed or measured as part of their main mission, then it should be noted that there would be no need to identify equal amount of spectrum for use for both uplink and downlink directions. The amount of downlink spectrum to a non-GSO user space station needs is expected to be smaller.

4/1.17/3.2 Concepts of operations

NOTE: Serious concerns were expressed by some administrations in relation with the use of the "expanded cone" concept and actual and/or potential difficulty/problem, including unacceptable interference to other FSS use, which may arrive from the use of such concept. The potential drawback of the "expanded cone" concept, in addition to the complexity of the concept, is its impact on the spectrum needs.

Two concepts of operations (CONOPS) were considered in the studies conducted under agenda item 1.17 as depicted in the figure below.

From an operational point of view, as shown in the figures, two different geometrical configurations can be envisioned:

– The user space station is located within the cone of coverage of the service provider space station.

– The user space station is located outside the cone of coverage of the service provider space station.

FIGURE 4/1.17/3.2-1

Description of the "within the cone" concept for satellite-to-satellite links

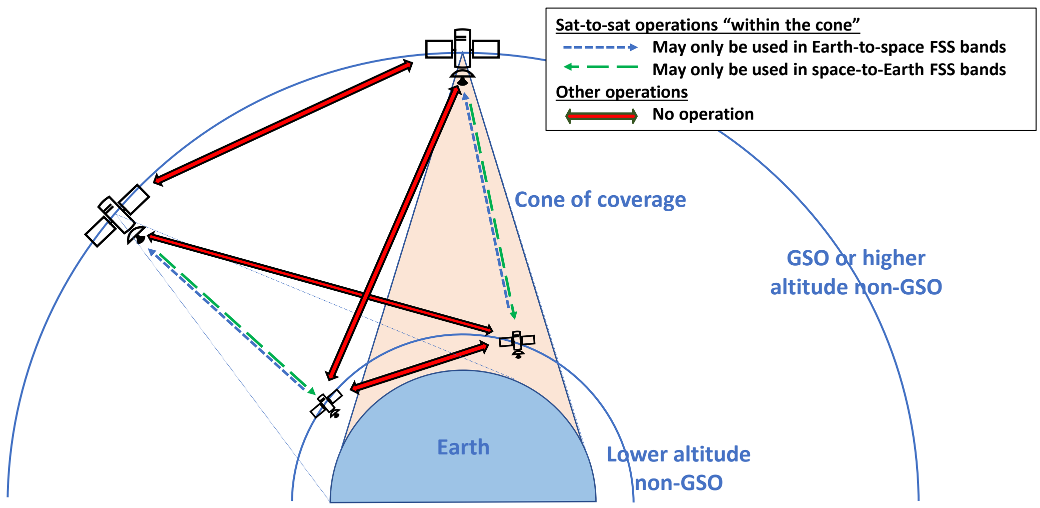
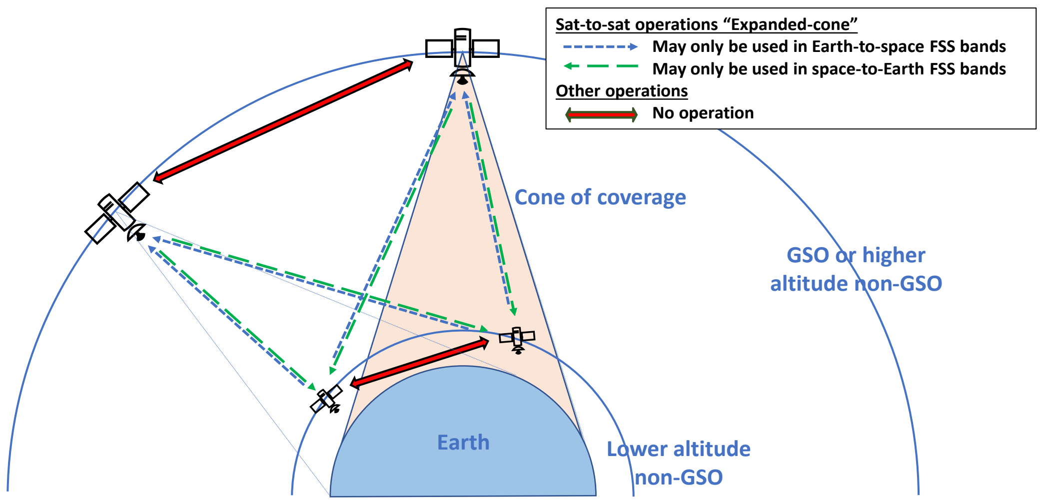


FIGURE 4/1.17/3.2-2

Description of the "expanded-cone" concept for satellite-to-satellite links



To differentiate the two CONOPS the cone of coverage is defined as follows:

Cone of coverage of a service provider: the conical volume of space defined by a cone whose apex is at the service provider space station and whose base does not extend beyond the edge of coverage of the Earth as viewed by the service provider space station.

This definition is purely geometrical and does not take into account the list of countries or geographic designations identified by each FSS filing, which could limit operation within the cone of coverage accordingly. The purely geometrical definition only serves to clearly distinguish when a non-GSO user space station falls under the "within the cone" or "outside the cone" concepts. The possible operational limitation of a non-GSO user space station, due to specific parameters of the satellite network (or system) of the service provider space station, is addressed as part of the regulatory text.

For the "within the cone of coverage" concept of operations satellite-to-satellite links operate only when the user space station is inside the cone of coverage of the service provider space station.

The concept of operation that is identified to provide satellite-to-satellite communications both "within the cone of coverage" and "outside the cone of coverage", is collectively called "expanded-cone". This concept of operation involves communications between a non-GSO user space station and the service provider space station(s) both when a non-GSO user space station is within and outside the cone of coverage of the service provider space station(s).

The potential for interference to incumbent services may differ if the satellite-to-satellite links are constrained to operate within the cone of coverage versus when satellite-to-satellite links are to operate outside the cone of coverage, particularly when such links involve transmissions beyond the edge of coverage of the Earth. Therefore, it was necessary to study each of these concepts separately against the incumbent services. Sharing studies with existing services for the "within the cone of coverage" CONOPS and for the "expanded-cone" CONOPS are summarized hereafter in section 4/1.17/3.3 and its sub-sections.

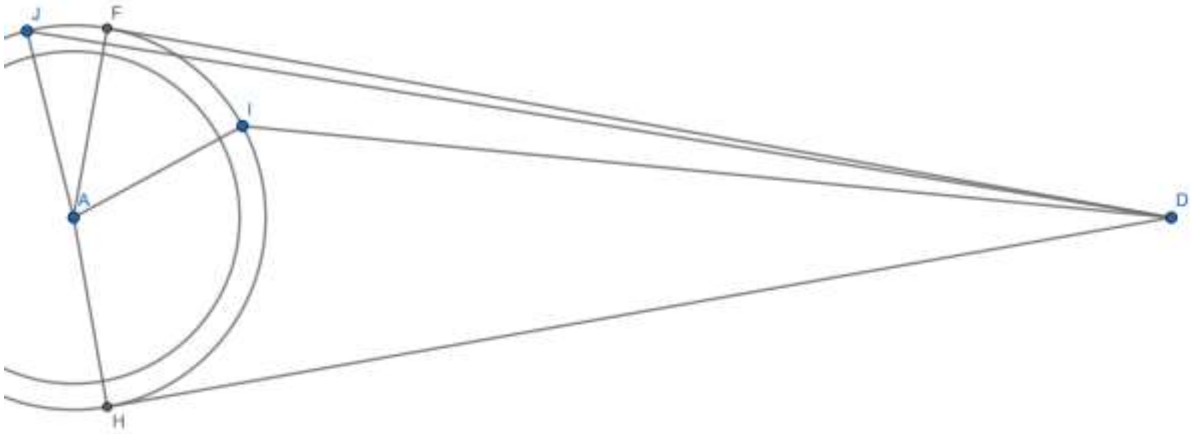
The "expanded cone" concept represents an expansion to the "within the cone" concept. Under this concept, a GSO or MEO satellite can point to satellites which are outside the cone of coverage, allowing for longer period of time of transmission than with the "within the cone" concept. To be eligible for this concept, the angle between the vector from the user space station to the Earth's centre and the vector from the user space station to the GSO/MEO service provider space station must be above 90° as shown on Figure 4/1.17/3.2-2. It should be noted that LEO to LEO links are not allowed to operate in the expanded-cone CONOPS, by imposing a minimum altitude difference of 5 000 km between two satellites if the expanded cone is used. Imposing a maximum user altitude could also be used to limit the extent to which the expanded cone may be applied.

For an LEO system orbiting at 1 000 km, at the equator, as seen from a GSO space station, with the "within the cone" concept, the maximum tracking time is around 26 minutes, whereas with the expanded cone, this time goes up to around 40 minutes, representing more than 50% of additional connectivity time.

In the below representation, the inner circle of centre A represents the Earth. Points J, F, I and H are on a circular orbit at 1 000 km. Point D is a GSO space station.

The angles $\widehat{AFD}$ and $\widehat{AHD}$ are equal to 90° and represent therefore the edge of the expanded cone. The lines DF and DH represent this edge. The angle $\widehat{AJD}$ is lower than 90° and is therefore excluded from the expanded-cone concept. The angle $\widehat{AID}$ is greater than 90° and is therefore included in the expanded concept.

FIGURE 4/1.17/3.2-3



4/1.17/3.3 Sharing studies with incumbent services in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz

4/1.17/3.3.1 The frequency band 11.7-12.7 GHz

Sharing studies were performed for the frequency bands in 11.7-12.7 GHz. Based on the results of these studies and the sharing difficulties that were found, there was no support for retaining this band in the list of suitable frequency bands under agenda item 1.17. Therefore, the summaries of the studies that were performed for 11.7-12.7 GHz have not been included herein.

4/1.17/3.3.2 The frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz

4/1.17/3.3.2.1 Sharing with the fixed and mobile service in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz

The “within the cone of coverage” concept of operations assumes the non-GSO user space station is restricted to operate in the same manner as any other user in the GSO FSS service provider network or non-GSO FSS service provider system in the (space-to-Earth) direction (from a higher orbit to a lower orbit) and would be receiving only within the notified beam of the service provider network or system. Based on the assumption that the downlink satellite-to-satellite operations would meet the current RR Article **21** levels applicable to space transmissions in RR Table **21-4**, there is no change expected in the interference environment for the fixed-service and mobile-service stations that are allocated in these frequency bands. In addition, the receiving non-GSO user space stations shall not claim protection from fixed-service and mobile-service operations.

In the case of the “expanded cone” concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower altitude satellite. Here, if the higher-altitude satellite points towards a satellite in this expanded zone, since the main beam of the service provider satellite will not be pointing towards the Earth, the terrestrial stations will experience less interference than transmissions from within the cone of coverage concept. In addition, the receiving non-GSO user space stations would be subject to not claiming protection from terrestrial operations.

4/1.17/3.3.2.2 Sharing with the GSO fixed-satellite service (Earth-to-space) limited to BSS feeder-link in the frequency bands 18.1-18.4 GHz, with the GSO fixed-satellite service (space-to-Earth) in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, with the non-GSO fixed-satellite service (space-to-Earth) other than MSS feeder link in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, with the non-GSO fixed-satellite service (Earth-to-space) limited to MSS feeder link in the frequency bands 19.3-19.6 GHz, with the GSO and non-GSO mobile-satellite service (space-to-Earth) in the frequency band 19.7-20.2 GHz and with the GSO meteorological-satellite service in the frequency band 18.1-18.4 GHz

Non-GSO user space stations do not transmit in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz as, in these bands, the transmissions are originated by GSO FSS or non-GSO FSS service provider space stations which operate in the same way whether they communicate with earth stations at fixed locations or with non-GSO user space stations. In other words, the emissions within notified and coordinated beams from GSO FSS or non-GSO FSS service provider space stations to non-GSO user space stations in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz are identical to the emissions within the same notified and coordinated beams from GSO FSS or non-GSO FSS service provider space stations to FSS earth stations and such GSO FSS or non-GSO FSS service provider space stations will comply with all relevant provisions of the Radio Regulations. Therefore, in this direction of transmission no change is expected to the interference environment for the GSO fixed-satellite service (FSS) (Earth-to-space) limited to BSS feeder links in the frequency band 18.1-18.4 GHz, for earth stations of other GSO or for non-GSO fixed-satellite service networks in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz or for FSS (Earth-to-space) feeder links to non-GSO mobile-satellite service systems, for the GSO and non-GSO mobile-satellite service ground stations in the frequency band 19.7-20.2 GHz, for the non-GSO fixed-satellite service (Earth-to-space) limited to MSS feeder link in the frequency band 19.3-19.6 GHz, and for the GSO MetSat (space-to-Earth) operations in the frequency band 18.1-18.4 GHz, accordingly that are allocated in the frequency band where non-GSO user space stations would be receiving.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, no studies have been provided to date regarding sharing with the GSO fixed-satellite service (Earth-to-space) limited to BSS feeder-link in the frequency band 18.1-18.4 GHz and with the non-GSO fixed-satellite service (Earth-to-space) limited to MSS feeder link in the frequency band 19.3-19.6 GHz. Regarding sharing with the GSO fixed-satellite service (space-to-Earth), with the non-GSO fixed-satellite service (space-to-Earth) other than MSS feeder in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, with the GSO and non-GSO mobile-satellite service (space-to-Earth) in the frequency band 19.7-20.2 GHz and with the GSO MetSat (space-to-Earth) operations in the frequency band 18.1-18.4 GHz, if the higher-altitude satellite points towards a satellite in this expanded zone, since the main beam of the service provider satellite will not be pointing towards the Earth, the earth stations will experience less interference than transmissions from within the cone of coverage concept.

4/1.17/3.3.2.3 Sharing with the fixed-satellite service (space-to-Earth) feeder links for non-GSO mobile-satellite service in the frequency bands 19.3-19.7 GHz

One study indicates that both GSO and non-GSO service provider stations operating satellite-to-satellite links would cause interference that exceeds the protection criteria of non-GSO MSS feeder links in the frequency band 19.3-19.7 GHz. One regulatory approach considers a power flux-density limit of -148 dB(W/(m^2 · MHz)) on the surface of the Earth applied to the GSO and non-GSO service provider satellites that could protect non-GSO MSS feeder links. Another approach considers that existing coordination agreements between administrations could be used instead of a hard pfd value approach. Further discussions are necessary to determine which approach may be appropriate.

A second study notes that non-GSO user space stations do not transmit in the frequency band 19.3-19.7 GHz as, in this band, the transmissions are originated by GSO FSS or non-GSO FSS service provider space stations which operate in the same way whether they communicate with earth stations at fixed locations or with non-GSO user space stations, under the "within the cone of coverage" CONOPS. The transmissions from GSO FSS or non-GSO FSS service provider space stations to non-GSO user space stations in the frequency band 19.3-19.7 GHz are identical to transmissions from GSO FSS or non-GSO FSS service provider space stations to FSS earth stations and such GSO FSS or non-GSO FSS service provider space stations will comply with all relevant provisions of the Radio Regulations ensuring protection of feeder link earth stations for non-GSO mobile-satellite service systems that are allocated in this frequency band.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, operations using the "expanded cone-of-coverage" concept of operations would cause as much or more interference than operations under the "within cone-of-coverage" concept of operations. Coordination agreements between administrations may be considered in lieu of a hard pfd value. Further discussions are necessary to determine which approach may be appropriate.

4/1.17/3.3.2.4 Compatibility with the Earth exploration-satellite service (passive) and space research service (passive) in the frequency band 18.6-18.8 GHz

SRS (passive) in the frequency band 18.6-18.8 GHz consists of sensors on board spacecraft sent around non terrestrial bodies or looking towards outer space. SRS (passive) was not identified by the contributing group as potentially affected, so there is no need to perform any compatibility study with this service.

Three compatibility studies between FSS space stations operating in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz and EESS (passive) stations operating in the frequency band 18.6-18.8 GHz have been performed.

For the first study EESS (passive) one study concluded that, based on the operational conditions considered for the within the cone of coverage concept of operations, the interference environment for the EESS (passive) in the frequency band 18.6-18.8 GHz should not be materially altered by the introduction of satellite-to-satellite links from GSO FSS and non-GSO FSS service providers operating in the (space-to-Earth) direction to non-GSO user space stations receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz from what exists today. The fact that these signals are received in space by non-GSO rather than on the Earth's ground should not affect the level of out-of-band emissions reaching the passive sensor compared to what is allowed today. This would not be expected to change if the guiding principles of the within the cone of coverage concept of operations are strictly adhered to. As a result, the same regulatory provisions applied to fixed-satellite services incumbent to the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz would need to be applied to any new inter-satellite link in the space-to-Earth direction resulting from this agenda item.

The second study considered that introduction of satellite-to-satellite links in frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz may lead to an increase of the number of FSS beams covering the oceans compared to the current situation, which is limited to coverage of fixed earth stations, e.g. located on islands and oil rigs. As a result, it may lead to an increase of the interference to the

EESS (passive) in the frequency band 18.6-18.8 GHz, in particular in open oceans, due to scattering over sea of FSS unwanted emissions.

This study has determined that the pfd at the Earth's surface that would offer protection to the EESS (passive) from these scattered unwanted emissions falling into the passive band would be in the range of −118 to −110 dB(W/(m² · 200 MHz)) for the two particular non-GSO FSS systems considered. No significant difference has been observed between the "inside the cone of coverage" and "outside the cone of coverage" scenarios.

A third study showed that for non-GSO FSS, operating space to space links, out-of-band power flux-density at the Earth's surface of −118 dB(W/(m² · 200 MHz)) within the frequency band 18.6-18.8 GHz will meet the EESS (passive) protection criteria in this frequency band.

A fourth study determined that in the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, no significant difference has been observed between the "inside the cone of coverage" and "outside the cone of coverage" scenarios.

4/1.17/3.3.3 The frequency band 27.5-30 GHz

4/1.17/3.3.3.1 Sharing with the fixed service in the frequency band 27.5-29.5 GHz

4/1.17/3.3.3.1.1 Non-GSO user-to-GSO FSS service provider sharing with the fixed service

One study demonstrated that the aggregate interference levels originating from the constellation of 100 non-GSO user space stations, when assessed in individual interference cases (e.g. LEO low inclination, LEO Sun-synchronous and MEO 70 degree inclination) communicating with a GSO FSS service provider space station in the frequency band 27.5-29.5 GHz into FS point-to-point (PTP) and point-to-multipoint (PMP) stations given in Recommendation ITU-R F.758-7 are significantly less (> 40 dB margin) than the long-term interference protection criteria of $I/N = -10$ dB not to be exceeded for more than 20% of the time for fixed service stations as defined in Recommendation ITU-R F.758-7 for each of the cases studied. The results of this study have also demonstrated that the aggregate interference levels originating from the studied constellation of 100 non-GSO user space stations for each of the interference cases considered into FS PTP and PMP stations are significantly less (> 25 dB margin) than the short-term interference protection criteria of $I/N = +9$ dB not to be exceeded for more than 0.001% of the time for fixed stations as defined in Recommendation ITU-R SF.1719 for each of the cases studied.

Another study considered that the user space stations were producing the pfd mask (−115/+0.5(θ − 5)/−105 dB(W/(m² · MHz))) on the ground. Using a system with 100 non-GSO user stations, it was demonstrated that the protection criteria as given in Recommendations ITU-R F.758-7 and ITU-R SM.1448 are respected. In a second step, the study took into account e.i.r.p. spectral density limits to show that the protection thresholds from Recommendation ITU-R SF.1719 were also met.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, a dynamic study showed, with worst-case assumptions, that sharing with the fixed service in the frequency band 27.5-29.5 GHz is feasible without any additional constraints due to this concept of operations. It bears noting that the non-GSO user space station transmitting in the frequency band 27.5-29.5 GHz, or parts thereof, shall not cause unacceptable interference to the fixed service to which the frequency band is allocated.

4/1.17/3.3.3.1.2 Non-GSO user-to-non-GSO FSS service provider sharing with the fixed service

The results of one study have demonstrated that the aggregate interference levels from a constellation of 100 non-GSO user space stations into FS PTP and PMP stations always meet, with a significant margin, the protection criteria defined in Recommendation ITU-R F.758-7. It is to be noted that the assumptions used are conservative and aim at representing a worst-case scenario.

Another study considered that the user space stations were producing the pfd mask ($-115/+0.5(\theta - 5)/-105$ dB(W/(m² · MHz))) on the ground. Using a system with 100 non-GSO user stations, it was demonstrated that the protection criteria as given in Recommendations ITU-R F.758-7 and ITU-R SM.1448 are respected. In a second step, the study took into account e.i.r.p. spectral density limits to show that protection thresholds from Recommendation ITU-R SF.1719 were also met.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower altitude satellite. Here, a dynamic study showed, with worst-case assumptions, that sharing with the fixed service in the frequency band 27.5-29.5 GHz is feasible without any additional constraints due to this concept of operations. It bears noting that the non-GSO user space station transmitting in the frequency band 27.5-29.5 GHz, or parts thereof, shall not cause unacceptable interference to the fixed service to which the frequency band is allocated.

4/1.17/3.3.3.2 Sharing with the mobile service in the frequency band 27.5-29.5 GHz

4/1.17/3.3.3.2.1 Non-GSO user-to-GSO FSS service provider sharing with the mobile service

The results of one study show that for each case under consideration there is a substantial margin compared to the −6 dB protection level for mobile service systems. The test cases for LEO 1, LEO 2, and MEO considered 100 satellites distributed throughout 10 planes. A mixed case combined satellites from each of the three previous orbits for a total of 107 satellites simulated to estimate the usage across a variety of user types. These non-GSO user satellite constellations are not intended to represent the total use of the service, but rather offer a sampling of potential users in the band. Larger user constellations could reduce the margins determined in this study if all users are simultaneously operating in a co-frequency manner. No apportionment was assumed in the results; however, it is noted that the mobile service requires that the protection criterion is not exceeded due to the interference from multiple sources.

Another study considered that the user space stations were producing the pfd mask ($-115/+0.5(\theta - 5)/-105$ dB(W/(m² · MHz))) on the ground. Using a system with 100 non-GSO user stations, it was demonstrated that the mobile service protection level of −6 dB I/N is met with in all cases studied.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, a dynamic study showed, with worst-case assumptions, that sharing with the mobile service in the frequency band 27.5-29.5 GHz is feasible without any additional constraints due to this concept of operations. It bears noting that the non-GSO user space station transmitting in the frequency band 27.5-29.5 GHz, or parts thereof, shall not cause unacceptable interference to, or claim protection from the mobile service.

4/1.17/3.3.3.2.2 Non-GSO user-to-non-GSO FSS service provider sharing with the mobile service

The results of one study demonstrate that the aggregate interference levels from the constellations under study of 100 non-GSO user space stations into MS stations always meet, with a significant margin, the protection criterion of −6 dB *I/N*. It is to be noted that the assumptions used are conservative and represent a worst-case scenario.

Another study considered that the user space stations were producing the pfd mask (−115/+0.5(θ − 5)/−105 dB(W/(m² · MHz))) on the ground. Using a system with 100 non-GSO user stations, it was demonstrated that the mobile service protection level of −6 dB *I/N* is met with in all cases studied.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, a dynamic study showed, with worst-case assumptions, that sharing with the mobile service in the frequency band 27.5-29.5 GHz is feasible without any additional constraints due to this concept of operations. It bears noting that the non-GSO user space station transmitting in the frequency band 27.5-29.5 GHz, or parts thereof, shall not cause unacceptable interference to, or claim protection from the mobile service.

4/1.17/3.3.3.3 Sharing with HAPS downlinks in the frequency band 27.9-28.2 GHz

4/1.17/3.3.3.3.1 Non-GSO user-to-GSO FSS service provider sharing with HAPS downlinks

The results of one study demonstrated that the aggregate interference levels originating from a constellation of 100 non-GSO user space stations, when assessed in individual interference cases (e.g. LEO low inclination, LEO Sun-synchronous and MEO 5 degree inclination) communicating with a GSO FSS service provider space station in the frequency band 27.9-28.2 GHz into HAPS ground stations given in Recommendation ITU-R F.1569-0 and Report ITU-R F.2439-0 are significantly less (> 40 dB margin) than the long-term interference protection criteria of *I*/*N* = −10 dB not to be exceeded for more than 20% of the time and significantly less (> 20 dB margin) than the short-term interference protection criteria of *I*/*N* = +10 dB not to be exceeded for more than 0.01% of the time for HAPS systems as defined in Report ITU-R F.2439-0 for each of the cases studied.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, a study shows that the sharing is possible with the HAPS downlinks in the frequency band 27.5-29.5 GHz for the non-GSO user-to-GSO FSS service provider with no additional constraints.

4/1.17/3.3.3.3.2 Non-GSO user-to-non-GSO FSS service provider sharing with HAPS downlinks

The results of one study have demonstrated that the aggregate interference levels originating from the constellation under study of 100 non-GSO user space stations, using worst-case scenario assumptions, meet, for each of the cases studied, both the long-term interference protection criteria of *I*/*N* = −10 dB not to be exceeded for more than 20% of the time and the short-term interference protection criteria of *I*/*N* = +10 dB not to be exceeded for more than 0.01% of the time for HAPS systems as defined in Report ITU-R F.2439-0.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, no studies have been provided to date.

4/1.17/3.3.3.4 Sharing with the GSO fixed-satellite service (Earth-to-space) in the frequency band 27.5-30 GHz

4/1.17/3.3.3.4.1 Non-GSO user-to-GSO FSS service provider sharing with other GSO FSS

The results of one study demonstrated that both the single-entry and the aggregate interference levels originating from non-GSO user satellites (LEO and MEO) were less than or equal to the interference originating from a typical earth station operating with the host GSO satellite. Moreover, the results show that a single non-GSO user satellite dominates the interference curve at low percentages of time and that the aggregation of interference from non-GSO user satellites is only apparent at high percentages of time.

A second study highlighted the need for further work on the protection of FSS GSO networks from satellite-to-satellite links from low to high altitude. As Recommendation ITU-R S.524-9 provides limits to protect GSO FSS networks, it was noted that these limits do not correspond to a 6% increase in noise temperature as recommended in other ITU-R documents. Therefore, pfd limits need to be defined to respect this threshold.

A third study indicated that a pfd level that is more restrictive than the one given in RR Article **22** may be required to protect some GSO FSS satellite networks. Aspects of this study (such as, but not limited to the G/T, the interpretation of Recommendations ITU-R S.1323 and ITU-R S.2131, the 9 dB difference between the RR Article **22** epfd limit applicable and the proposed pfd limit) have been identified for further refinement. This study identified the difficulty of specifying a single-entry pfd limit at the GSO considering the wide variation of parameters of satellite networks and satellite systems. This topic may warrant further detailed study.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, a study showed that the sharing is possible with the GSO fixed-satellite service (Earth-to-space) in the frequency band 27.5-29.5 GHz for both the non-GSO user-to-GSO FSS service provider and the non-GSO user-to-non-GSO FSS service provider (lower altitude to higher altitude) without any additional constraints.

4/1.17/3.3.3.4.2 Non-GSO user-to-non-GSO FSS service provider sharing with GSO FSS

One study demonstrated that for the studied non-GSO service provider systems, when considering the "within cone of coverage" concept of operations and following its guiding principles, the interference levels into GSO receiving space station originating from non-GSO user space stations were less than or equal to the interference originating from a typical earth station operating with the non-GSO service provider station.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, a study showed that the sharing is possible with the GSO fixed-satellite service (Earth-to-space) in the frequency band 27.5-29.5 GHz for both the non-GSO user-to-GSO FSS service provider and the non-GSO user-to-non-GSO FSS service provider (lower altitude to higher altitude) without any additional constraints.

4/1.17/3.3.3.5 Sharing with the non-GSO fixed-satellite service (Earth-to-space) in the frequency band 27.5-29.1 GHz and 29.5-30 GHz other than feeder links for non-GSO MSS

4/1.17/3.3.3.5.1 Non-GSO user-to-GSO FSS service provider sharing with non-GSO FSS other than feeder links for non-GSO MSS

One study showed that for the GSO FSS service provider and interfered-with non-GSO FSS systems under study, when considering the "within cone of coverage" concept of operations and following its guiding principles, the interference levels into the non-GSO FSS system originating from non-GSO user space stations are less than the interference originating from a typical earth station operating with the GSO FSS service provider space station.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, this study showed applicable for both operations within the cone and outside the cone of coverage.

Another study shows that for the studied GSO service provider scenarios and interfered-with non-GSO system, when considering the "within cone of coverage" concept of operations, the interference levels into the non-GSO system originating from non-GSO user space stations separated by approximately 300 km in altitude are within the protection criteria defined in the study for 35 to 75 cm user station antenna sizes with −65 dBW/Hz input power density and 8 non-GSO active user links. The impact of non-GSO user space station input power spectral density was also assessed and showed that for a 30 cm user station antenna with −54.4 dBW/Hz input power density (−17.5 dBW/Hz e.i.r.p. density) and 8 non-GSO user links, the short-term protection criteria assumed in this study is exceeded for a 300 km difference in non-GSO user space station and interfered-with non-GSO system altitudes. The study also indicates that short-term *I/N* levels exceeding 15 dB *I/N* may also occur with input power density of −65 dBW/Hz into a 75 cm antenna (on-axis e.i.r.p. density of −20.4 dBW/Hz for altitude differences less than 300 km which could result in signal loss. The study recommends: 1) to develop power and/or e.i.r.p. density limits for non-GSO user space stations separated by approximately 300 km minimum between the non-GSO user space station and the interfered-with non-GSO satellite; and 2) further study of orbit altitude differences of less than approximately 300 km between the non-GSO user space station and the interfered-with non-GSO satellite to develop an appropriate solution.

Another study provided a comparison of non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to a GSO FSS network with GSO earth stations transmitting to GSO FSS in the same frequency bands with maximum on-axis e.i.r.p. spectral density limit of −15.0 dBW/Hz. This comparison, however, did not consider possible interference impacts to all non-GSO FSS operations.

4/1.17/3.3.3.5.2 Non-GSO user-to-non-GSO FSS service provider sharing with non-GSO FSS other than feeder links for non-GSO MSS

One study demonstrated that for the non-GSO LEO FSS service provider and interfered-with systems under study, when considering the "within cone of coverage" concept of operations and following its guiding principles, the interference levels into the MEO non-GSO FSS space station originating from an LEO non-GSO user space stations were less than or equal to the interference originating from a typical earth station operating with the non-GSO service provider space station.

Another study focused on LEO non-GSO FSS as the interfered-with systems, and analysed the sensitivities to orbit altitude, power spectral density and antenna size of another LEO non-GSO system transmitting to a MEO non-GSO service provider space station. While the study proposes hard limits (derived from power levels used in scenarios for which the protection criteria was met), all cases studied highlighted infrequent short duration high interference events with *I/N* values of at least 25 dB and up to 40 dB.

A third study focused on a LEO non-GSO FSS as the interfered-with system at 1 200 km orbit, and analysed the sensitivities to power spectral density and antenna size of another LEO non-GSO system with its user space stations operating at 680 km orbit and transmitting to an LEO non-GSO service provider space station, without any limitation to the mode of operation with respect to the cone of coverage (in other words, the transmitting user space stations are only assumed to operate in compliance with a minimum elevation angle of 10 deg). Considering that the statistics for the interfered-with non-GSO FSS system indicate that the interference would be acceptable using multiple protection criteria, the study concludes that a limit equal to −20 dBW/Hz on the on-axis e.i.r.p. spectral density applicable to the LEO user space station would be sufficient to enable sharing, as it would protect third parties' non-GSO FSS systems receivers whose characteristics are compatible with the assumptions made in the study.

Another study, based on the methodology and system characteristics from the second study above, but applied to LEO user space stations communicating with LEO non-GSO service provider space stations, demonstrated that the impact into non-GSO FSS system could be quite severe even when the distance between the LEO user space station orbit and the interfered-with LEO system orbit is greater than 500 km, as per the third study. This study also further demonstrated that should a constellation of LEO user space stations communicate with a higher-altitude LEO constellation, with no other restriction except to operate within its cone, the interference statistics for the interfered-with non-GSO FSS system could be quite severe and that an e.i.r.p. density at the user space station of −20 dBW/Hz is insufficient to enable sharing, while an e.i.r.p. density of −30 dBW/Hz may still result in interference events exceeding the stated short-term protection criterion.

In the case of the "expanded cone" concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, the study showed that an e.i.r.p. spectral density limit of −20.1 dBW/Hz is sufficient to ensure protection of any receiver on board a space station of a third, potentially interfered-with LEO system operating co-frequency, for both operations within the cone and outside the cone of coverage.

Another study considered an LEO non-GSO FSS system at 1 200 km of altitude as the victim from an LEO to MEO satellite link. This study assumes an e.i.r.p. spectral density limit of −20 dBW/Hz as a hard limit. The maximum interference received in terms of *I/N* is around 30 dB, depending on the assumptions on the user space station altitude and antenna diameter. These events are reached for percentages of the time around 10^{-5} %.

Another study concluded that −20 dBW/Hz is not sufficient to protect non-GSO FSS when the orbital altitude spacing is less than about 200 km. This study, based on a constellation of satellites operating at an e.i.r.p. density value of −20 dBW/Hz at about 1 000 km altitude, showed that there were *I/N* values as high as +47 dB, which has potential for causing hardware damage to the non-GSO FSS satellite receive systems. In addition, the study showed that *I/N* levels could exceed 15 dB for up to 0.01% of the time based on continuous emission by the interfering non-GSO user space station.

Another study concluded that the potential for causing hardware damage to the non-GSO FSS satellite receive systems at these separation distances is very low, based on typical low noise amplifier LNA specification.

4/1.17/3.3.3.6 Sharing with the fixed-satellite service (Earth-to-space) feeder links to non-GSO MSS in the frequency band 29.1-29.5 GHz

One study indicates that non-GSO user space stations operating satellite-to-satellite links would cause interference that exceeds the protection criteria of non-GSO MSS feeder links in the frequency band 29.1-29.5 GHz if no mitigation techniques are employed. However, user satellites employing a transmit power equal to or lower than −70 dBW/Hz and antennas whose gain falls below the envelope described by Recommendation ITU-R S.580-6, with diameter and peak gain no smaller than 0.3 m and 36.8 dBi respectively, could protect non-GSO MSS feeder links when the non-GSO MSS feeder link protection criteria is apportioned on an individual application basis. When the protection criteria is apportioned only on a per-system basis as prescribed in Recommendation ITU-R S.1323, user satellites employing a transmit power equal to or lower than −62 dBW/Hz and antennas whose gain falls below the envelope described by Recommendation ITU-R S.580-6, with diameter and peak gain no smaller than 0.3 m and 36.8 dBi respectively, could protect non-GSO MSS feeder links.

A second study shows that for the studied GSO service provider and interfered-with non-GSO system, the I/N envelope of all studied user constellations is contained within the I/N envelope associated with a co-located on-ground station. Consequently, the introduction of satellite-to-satellite links does not result in a higher interference level than the case where the on-ground station of the interfering network and the interfered-with system are co-located. Additionally, the results show that both the on-ground stations and the user constellations do not meet the short-term protection criterion developed based on Recommendation ITU-R S.1323 with the assumptions presented in the study. In such cases, the interference levels could be mitigated by applying coordination principles contained in RR Article **9** or by defining specific hard limits.

A third study shows that for the studied GSO service provider and interfered-with non-GSO system, the I/N envelope of all user constellations considered is contained within the I/N envelope associated with a co-located on-ground station. Consequently, the introduction of satellite-to-satellite links does not result in a higher interference level with respect to a case where the on-ground station of the interfering network and the interfered-with system are co-located.

In the case of the “expanded cone” concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, operations using the “expanded cone-of-coverage” concept of operations would cause as much or more interference than operations under the “within cone-of-coverage” concept of operations.

4/1.17/3.3.3.7 Sharing with the GSO mobile satellite service (Earth-to-space) in the frequency band 29.5-30 GHz

4/1.17/3.3.3.7.1 Non-GSO user-to-GSO FSS service provider sharing with GSO MSS (Earth-to-space)

The parameters applicable to studies of GSO MSS networks are either identical or less sensitive than those for GSO FSS networks in the frequency range 29.5-30 GHz. Therefore, sharing studies performed assessing interference to other GSO FSS networks would adequately account for the case of non-GSO user-to-GSO FSS service provider sharing with GSO MSS (Earth-to-space) in the frequency band 29.5-30 GHz.

In the case of the “expanded cone” concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, no studies specific to the GSO MSS have been provided to date.

The results of the relevant sharing studies can be found in section 4/1.17/3.2.3.4.1, and also apply to sharing with GSO MSS (Earth-to-space) in the frequency band 29.5-30 GHz.

4/1.17/3.3.3.7.2 Non-GSO user-to-non-GSO FSS service provider sharing with GSO MSS (Earth-to-space)

The parameters applicable to GSO MSS networks are either identical or less sensitive than those of GSO FSS networks in the frequency band 29.5-30 GHz. Therefore, sharing studies performed to assess interference to GSO FSS networks would adequately account for the case of non-GSO user-to-non-GSO FSS service provider sharing with GSO MSS (Earth-to-space) in the frequency band 29.5-30 GHz.

In the case of the “expanded cone” concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, no studies specific to the GSO MSS have been provided to date.

The results of the relevant sharing study can be found in section 4/1.17/3.2.3.4.2, and also apply to sharing with GSO MSS (Earth-to-space) in the frequency band 29.5-30 GHz.

4/1.17/3.3.3.8 Sharing with the non-GSO mobile satellite service (Earth-to-space) in the frequency band 29.5-30 GHz

4/1.17/3.3.3.8.1 Non-GSO user-to-GSO FSS service provider sharing with non-GSO MSS (Earth-to-space)

The parameters applicable to studies of non-GSO MSS systems are either identical or less sensitive than those for non-GSO FSS systems in the frequency band 29.5-30 GHz. Therefore, sharing studies performed assessing interference to non-GSO FSS systems would adequately account for the case of non-GSO user-to-GSO FSS service provider sharing with non-GSO MSS (Earth-to-space) in the frequency band 29.5-30 GHz.

In the case of the “expanded cone” concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here, no studies specific to the non-GSO MSS have been provided to date.

The results of the relevant sharing study can be found in section 4/1.17/3.2.3.5.1, and also apply to sharing with non-GSO MSS (Earth-to-space) in the frequency band 29.5-30 GHz.

4/1.17/3.3.3.8.2 Non-GSO user-to-non-GSO FSS service provider sharing with non-GSO MSS (Earth-to-space)

The parameters applicable to studies of non-GSO MSS systems are either identical or less sensitive than those for non-GSO FSS systems in the 29.5-30 GHz range. Therefore, sharing studies performed assessing interference to non-GSO FSS systems would adequately account for the case of non-GSO user-to-non-GSO FSS service provider sharing with non-GSO MSS (Earth-to-space) in the frequency range 29.5-30 GHz.

In the case of the “expanded cone” concept of operations, an additional area to be considered is the zone defined by the within the cone edge of coverage and the tangent to the orbit of the lower-altitude satellite. Here no studies specific to the non-GSO MSS have been provided to date. The results of the relevant sharing study can be found in Section 4/1.17/3.2.3.5.2, and also apply to sharing with non-GSO MSS (Earth-to-space) in the frequency range 29.5-30 GHz.

4/1.17/4 Methods to satisfy the agenda item

4/1.17/4.1 Method A

No changes to the Radio Regulations and suppression of Resolution **773 (WRC-19)**.

4/1.17/4.2 Method B

Method B addresses the regulatory solution for space-to-space links under this Agenda for frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz. Alternatives are included depending on the type of allocation for the space-to-space links, on the concept of operation for space-to-space links with involving a GSO service provider and on the possible sharing mechanisms with non-GSO FSS system. This method only considers the "within the cone" concept for space-to-space links involving non-GSO service providers. The method proposes no change to the frequency band 11.7-12.7 GHz as the studies did not support use of the band for space-to-space links.

In the proposed regulatory text, the two alternatives on the type of allocation are referred as:

- *Alternative FSS*: addressing an FSS (space-to-space) allocation
- *Alternative ISS*: addressing an ISS allocation,

the two concept of operation for space-to-space links involving GSO service providers are referred as:

- *Alternative GSO within cone*: addressing "within the cone" concept for GSO service provider
- *Alternative GSO expanded cone*: addressing "expanded-cone" concept for GSO service provider,

and the two possible sharing mechanisms with non-GSO FSS system are referred as:

- *Alternative non-GSO FSS coordination*: addressing the sharing with non-GSO FSS through a 9.12 coordination with space-to-space emissions
- *Alternative non-GSO FSS Hard limit*: addressing the sharing with non-GSO FSS through a Hard Limits with space-to-space emissions.

Within Method B there are several options that should be considered within each of the alternatives for necessary provisions to ensure the protection of incumbent services.

The example regulatory text included with the method offers provisions in a Resolution to ensure protection of the incumbent services. The Resolution includes five Annexes as follows:

- Annex 1 to the draft Resolution addresses the concept of operation
- Annex 2 to the draft Resolution addresses the terrestrial protection
- Annex 3 to the draft Resolution addresses the EESS (passive) protection
- Annex 4 to the draft Resolution addresses the non-GSO systems protection
- Annex 5 to the draft Resolution addresses the GSO FSS networks protection.

4/1.17/5 Regulatory and procedural considerations

4/1.17/5.1 Method A: No change

<u>NOC</u>

ARTICLES

NOC

APPENDICES

SUP

RESOLUTION 773 (WRC-19)

Study of technical and operational issues and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz

4/1.17/5.2 Method B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

NOC

11.7-13.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
11.7-12.5 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492	**11.7-12.1** FIXED 5.486 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488 Mobile except aeronautical mobile 5.485	**11.7-12.2** FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492
	12.1-12.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488 5.485 5.489	5.487 5.487A

5.487 5.487A	**12.2-12.7** FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492 5.487A 5.488 5.490	**12.2-12.5** FIXED FIXED-SATELLITE (space-to-Earth) 5.484B MOBILE except aeronautical mobile BROADCASTING 5.487 5.484A
12.5-12.75 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B (Earth-to-space) 5.494 5.495 5.496	**12.7-12.75** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE except aeronautical mobile	**12.5-12.75** FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B MOBILE except aeronautical mobile BROADCASTING-SATELLITE 5.493

NOC

5.487 In the band 11.7-12.5 GHz in Regions 1 and 3, the fixed, fixed-satellite, mobile, except aeronautical mobile, and broadcasting services, in accordance with their respective allocations, shall not cause harmful interference to, or claim protection from, broadcasting-satellite stations operating in accordance with the Regions 1 and 3 Plan in Appendix **30**. (WRC-03)

MOD

15.4-18.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
18.1-18.4	FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A (Earth-to-space) 5.520 *Alternative FSS:* (space-to-space) ADD 5.A117 *Alternative ISS*: INTER-SATELLITE ADD 5.A117 MOBILE 5.519 5.521	

MOD

18.4-22 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td colspan="3">18.4-18.6
FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS
INTER-SATELLITE ADD 5.A117
MOBILE</td></tr>
<tr><td colspan="3">…</td></tr>
<tr><td colspan="3">18.8-19.3
FIXED
FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE</td></tr>
<tr><td colspan="3">19.3-19.7
FIXED
FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.517A 5.523B 5.523C 5.523D 5.523E
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE</td></tr>
<tr><td>19.7-20.1
FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
Mobile-satellite (space-to-Earth)

5.524</td><td>19.7-20.1
FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE-SATELLITE (space-to-Earth)
5.524 5.525 5.526 5.527 5.528 5.529</td><td>19.7-20.1
FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
Mobile-satellite (space-to-Earth)

5.524</td></tr>
<tr><td colspan="3">20.1-20.2
FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE-SATELLITE (space-to-Earth)
5.524 5.525 5.526 5.527 5.528</td></tr>
</table>

MOD

24.75-29.9 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>27.5-28.5</td><td colspan="2">FIXED 5.537A
FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.539
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE
5.538 5.540</td></tr>
<tr><td>28.5-29.1</td><td colspan="2">FIXED
FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.523A 5.539
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE
Earth exploration-satellite (Earth-to-space) 5.541
5.540</td></tr>
<tr><td>29.1-29.5</td><td colspan="2">FIXED
FIXED-SATELLITE (Earth-to-space) 5.516B 5.517A 5.523C 5.523E 5.535A 5.539 5.541A
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE
Earth exploration-satellite (Earth-to-space) 5.541
5.540</td></tr>
<tr><td>29.5-29.9
FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
Earth exploration-satellite (Earth-to-space) 5.541
Mobile-satellite (Earth-to-space)
5.540 5.542</td><td>29.5-29.9
FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
MOBILE-SATELLITE (Earth-to-space)
Earth exploration-satellite (Earth-to-space) 5.541
5.525 5.526 5.527 5.529 5.540</td><td>29.5-29.9
FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539
Alternative FSS:
(space-to-space) ADD 5.A117
Alternative ISS:
INTER-SATELLITE ADD 5.A117
Earth exploration-satellite (Earth-to-space) 5.541
Mobile-satellite (Earth-to-space)
5.540 5.542</td></tr>
</table>

ADD

5.A117

Alternative non-GSO FSS hard limit

Option 1: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the [*Alternative FSS*: fixed-satellite service (space-to-space)][*Alternative ISS*: inter-satellite service] Resolution **[A117-B] (WRC-23)** shall apply. Such use is not subject to coordination under No. **9.11A**. No. **4.10** does not apply. (WRC-23)

Option 2: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the [*Alternative FSS*: fixed-satellite service (space-to-space)][*Alternative ISS*: inter-satellite service] Resolution **[A117-B](WRC-23)** shall apply. Such use is limited to space research, space operation and/or Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space and is not subject to coordination under No. **9.11A**. No. **4.10** does not apply. (WRC-23)

End of alternative non-GSO FSS hard limit

Alternative non-GSO FSS coordination

Option 3: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the [*Alternative FSS*: fixed-satellite service (space-to-space)][*Alternative ISS*: inter-satellite service] Resolution **[A117-B](WRC-23)** shall apply. Such use is limited to space research, space operation and/or Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space. No. **4.10** does not apply. (WRC-23)

Option 4: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the [*Alternative FSS*: fixed-satellite service (space-to-space)][*Alternative ISS*: inter-satellite service] Resolution **[A117-B](WRC-23)** shall apply. No. **4.10** does not apply (WRC-23)

End of alternative non-GSO FSS coordination

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29.9-34.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
29.9-30	FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 *Alternative FSS:* (space-to-space) ADD 5.A117 *Alternative ISS:* INTER-SATELLITE ADD 5.A117 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542	

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD

TABLE **21-4** (Rev.WRC-~~19~~23)

<table>
<tr><th rowspan="2">Frequency band</th><th rowspan="2">Service*</th><th colspan="4">Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane</th><th rowspan="2">Reference bandwidth</th></tr>
<tr><th>0°-5°</th><th colspan="2">5°-25°</th><th>25°-90°</th></tr>
<tr><td colspan="7">...</td></tr>
<tr><td>17.7-19.3 GHz [7, 8]</td><td>Fixed-satellite (space-to-Earth)
Alternative FSS: Fixed-satellite (space-to-space)
Alternative ISS: Inter-satellite
Meteorological-satellite (space-to-Earth)</td><td>0°-5°
−115 [14, 15]
or
$-115 - X$ [13]</td><td colspan="2">5°-25°
$-115 + 0.5(\delta - 5)$ [14, 15]
or
$-115 - X + ((10 + X)/20)(\delta - 5)$ [13]</td><td>25°-90°
−105 [14, 15]
or
−105 [13]</td><td>1 MHz</td></tr>
<tr><td>17.7-19.3 GHz [7, 8]</td><td>Fixed-satellite (space-to-Earth)
Alternative FSS: Fixed-satellite (space-to-space)
Alternative ISS: Inter-satellite</td><td>0°-3°
−120 [16]</td><td>3°-12°
$-120 + (8/9)(\delta - 3)$ [16]</td><td>12°-25°
$-112 + (7/13)(\delta - 12)$ [16]</td><td>−105 [16]</td><td>1 MHz</td></tr>
<tr><td>19.3-19.7 GHz</td><td>Fixed-satellite (space-to-Earth)
Alternative FSS: Fixed-satellite (space-to-space)
Alternative ISS: Inter-satellite</td><td>0°-3°
−120 [16]</td><td>3°-12°
$-120 + (8/9)(\delta - 3)$ [16]</td><td>12°-25°
$-112 + (7/13)(\delta - 12)$ [16]</td><td>−105 [16]</td><td>1 MHz</td></tr>
</table>

TABLE **21-4** (*continued*) (Rev.WRC-~~19~~23)

Frequency band	Service*	Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	**5°-25°**	**25°-90°**	
19.3-19.7 GHz 21.4-22 GHz (Regions 1 and 3) 22.55-23.55 GHz 24.45-24.75 GHz 25.25-27.5 GHz 27.500-27.501 GHz	Fixed-satellite (space-to-Earth) Broadcasting-satellite Earth exploration-satellite (space-to-Earth) Inter-satellite Space research (space-to-Earth)	−115 [15]	$-115 + 0.5(\delta - 5)$ [15]	−105 [15]	1 MHz

Alternative 1 for the pfd mask for the protection of fixed and mobile stations					
27.5-29.5 GHz	*Alternative FSS*: Fixed-satellite (space-to-space) (non-geostationary satellite orbit) *Alternative ISS*: Inter-satellite (non-geostationary satellite orbit)	−115	−115 + 0.5(δ – 5)	−105	1 MHz
Alternative 2 for the pfd mask for the protection of fixed and mobile stations					
27.5-29.5 GHz	*Alternative FSS*: Fixed-satellite (space-to-space) (non-geostationary satellite orbit) *Alternative ISS*: Inter-satellite (non-geostationary satellite orbit)	TBD	TBD	TBD	1 MHz
...					

Note: Some administrations are of the view that the pfd mask to protect terrestrial services from emissions from space stations should only be included in Annex 2 of the Resolution along with the methodology for compliance in the frequency band 27.5-29.5 GHz.

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

[2] The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Items in Appendix	*A – GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.19.b	a commitment in accordance with *resolves* 1.5 of Resolution **156** (**WRC-15**) that the administration responsible for the use of the assignment shall implement *resolves* 1.4 of Resolution **156** (**WRC-15**) Required only for geostationary-satellite networks operating in the fixed-satellite service in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz communicating with transmitting earth stations in motion				+						A.19.b	
A.20	**COMPLIANCE WITH *resolves* 1.1.4 OF RESOLUTION 169 (WRC-19)**										**A.20**	
A.20.a	a commitment that the ESIM operation would be in conformity with the Radio Regulations and Resolution **169 (WRC-19)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **169 (WRC-19)**				+						A.20.a	
A.21	**COMPLIANCE WITH *resolves* 1.2.6 OF RESOLUTION 169 (WRC-19)**										**A.21**	
A.21.a	a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the GSO FSS network with which ESIMs communicate shall follow the procedures in *resolves* 4 of Resolution **169 (WRC-19)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **169 (WRC-19)**				+						A.21.a	
A.22	**COMPLIANCE WITH *resolves* 7 OF RESOLUTION 169 (WRC-19)**										**A.22**	
A.22.a	a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part II of Annex 3 to Resolution **169 (WRC-19)** Required only for the notification of earth stations in motion submitted in accordance with Resolution **169 (WRC-19)**				+						A.22.a	
A.23	**COMPLIANCE WITH RESOLUTION 35 (WRC-19)**										**A.23**	
A.23.a	a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments to the non-geostationary-satellite system					**O**					A.23.a	
A.24	**COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION**										**A.24**	
A.24.a	a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution **32 (WRC-19)** is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification					+					A.24.a	
A.25	**COMPLIANCE WITH RESOLUTION [A117-B] (WRC-23)**										**A.25**	
A.25.a	a commitment from the notifying administration of a non-GSO space station receiving in the frequency bands 27.5-28.6 GHz and 29.5-30.0 GHz that the equivalent power flux-density produced at any point in the geostationary-satellite orbit by emissions from all combined operations of space-to-space and Earth-to-space links shall not exceed the limits given in Table **22-2**			+		+					A.25.a	

Items in Appendix	*A – GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.25.b	a commitment from the notifying administration that, upon receiving a report of unacceptable interference, from its non-GSO space station transmitting in frequency bands (27.5-30 GHz) the notifying administration will follow the procedures in *resolves further* 2 of Resolution **[A117-B] (WRC-23)** Required only for the notification of non-GSO space stations submitted in accordance with Resolution **[A117-B] (WRC-23)**					+					A.25.b	
A.25.c.1	Exclusion zone angle (degrees), the minimum angle to the geostationary-satellite orbit at the non-geostationary space station transmitting space station at which it will operate defined at the non-geostationary transmitting space station			+		+					A25c1	
A.25.c.2	Mask pattern defined in terms of the e.i.r.p. in a 40 kHz bandwidth as a function of the off-axis angle between the non-geostationary transmitting space station boresight line and the line from the non-geostationary transmitting space station to a point on the geostationary-satellite orbit			+		+					A25c2	
A.25.d	COMPLIANCE WITH *resolves* 3.3 OF RESOLUTION **[A117-B] (WRC-23)**										A25.d	
A.25.d.1	a commitment by the notifying administration for a non-GSO FSS system with an orbital apogee of less than 20 000 km communicating with lower orbiting non-GSO space stations in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz that the pfd shall be in conformity with the pfd limits on the Earth's surface specified in Annex 3 to Resolution **[AI117-B] (WRC-23)** Required only for the notification of non-GSO space stations submitted in accordance with Resolution **[AI117-B] (WRC-23)**					+					A.25.d.1	

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TABLE C

CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY ASSIGNMENTS FOR A SATELLITE ANTENNA BEAM OR AN EARTH STATION OR RADIO ASTRONOMY ANTENNA (Rev.WRC-~~19~~23)

Items in Appendix	*C – CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY ASSIGNMENTS FOR A SATELLITE ANTENNA BEAM OR AN EARTH STATION OR RADIO ASTRONOMY ANTENNA*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
…	…											
C.11	**SERVICE AREA (S)** *For all space applications except active or passive sensors*										**C.11**	
C.11.a	the service area or areas of the satellite beam on the Earth, when the associated transmitting or receiving stations are earth stations For a space station submitted in accordance with Appendix **30**, **30A** or **30B**, the service area identified by a set of a maximum of 100 test points and by a service area contour on the surface of the Earth or defined by a minimum elevation angle *Note* – When an assignment converted from an allotment is reinstated in the Appendix **30B** Plan, the notifying administration may choose a maximum of 20 test points within its national territory for the reinstated allotment			**X**	**X**	**X**		**X**	**X**	**X**	C.11.a	
C.11.a.1	Option 1: areas of the satellite beam on the Earth, when the associated transmitting [or receiving] stations are space stations Option 2: for the case of satellite-to-satellite links in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz frequency bands, service area is described by sub-satellite points on the Earth of the transmitting space station in 27.5-30 GHz or receiving space station in 18.1-18.6 GHz, 18.8-20.2 GHz Required for space stations in the [*Alternative FSS*: FSS (space-to-space)][*Alternative ISS*: ISS] transmitting in the bands 18.1-18.6 GHz and 18.8-20.2 GHz			±		±					C.11.a.1	
…	…											

ADD

DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz for satellite-to-satellite transmissions

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that there is a need for non-geostationary-satellite orbit (non-GSO) space stations to be able to relay data to the Earth, and that part of this need could be met by allowing such non-GSO space stations to communicate with [*Alternative FSS*: fixed-satellite service (FSS)][*Alternative ISS*: inter-satellite service (ISS)] space stations operating in the geostationary-satellite orbit (GSO) and in the non-GSO in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof;

b) that the administration responsible for the notification of non-GSO space stations communicating with GSO or non-GSO space stations in the [*Alternative FSS*: FSS][*Alternative ISS*: ISS] at higher altitude does not need to be the same administration that has already notified assignments in the [*Alternative FSS*: FSS][*Alternative ISS*: ISS];

c) that imposing the hard limits necessary to protect other services would provide regulatory certainty for both notifying administrations of non-GSO space stations communicating with [*Alternative FSS*: FSS][*Alternative ISS*: ISS] space stations and potentially impacted services;

d) that there is growing interest for utilizing satellite-to-satellite links for a variety of applications;

e) that the ITU Radiocommunication Sector (ITU-R) has carried out sharing and compatibility studies between incumbent services in the frequency bands 18.1-18.6 GHz, 18.8-20.2 and 27.5-30 GHz and adjacent bands and satellite-to-satellite transmissions in the [*Alternative FSS*: FSS][*Alternative ISS*: ISS];

f) that these studies were based on certain principles, including the limitation of the use of frequency bands in a specific direction in accordance with the existing FSS allocations in these frequency bands, the use of power control and antenna-steering capabilities and compliance with applicable epfd and off-axis e.i.r.p. limits to protect incumbent services;

g) that the frequency bands 18.1-18.6 GHz (space-to-Earth), 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) are also allocated to terrestrial and space services used by a variety of different systems, and these existing services and their future development need to be protected, without the imposition of undue constraints, from the operation of satellite-to-satellite links,

recognizing

a) that any course of action taken under this Resolution with respect to satellite-to-satellite links has no impact on the coordination requirements with other services which are otherwise subject to coordination, regardless of date of receipt;

b) that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network or the non-GSO FSS system with which non-GSO space stations communicate or on the coordination requirements of that satellite network,

resolves

1 that, for a non-GSO space station subject to this Resolution communicating with a GSO or non-GSO FSS space station within the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, the following conditions shall apply:

1.1 the non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall only operate space-to-space links when its apogee altitude is lower than the minimum operational altitude of the GSO or non-GSO FSS space station it communicates with and when the off-nadir angle between this GSO or non-GSO FSS space station and the non-GSO space station it communicates with is less than or equal to θ_{Max} (as defined in Annex 1 to this Resolution);

1.2 the GSO/non-GSO FSS space station receiving in the frequency band 27.5-30 GHz and transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall only operate space-to-space links when its minimum operational altitude is higher than the apogee altitude of the non-GSO space station with which it communicates;

1.3 that the use of space-to-space links by GSO or non-GSO space stations transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz and receiving in the frequency band 27.5-30 GHz is limited to those with recorded assignments in the relevant FSS (space-to-Earth) and (Earth-to-space) allocations in these bands;

2 that for a non-GSO space station transmitting in the space-to-space direction in the frequency band 27.5-30 GHz, the following conditions shall apply:

2.1 this non-GSO space station shall only transmit when within the cone whose apex is the GSO or non-GSO receiving space station and whose angle is θ_{Max} (as defined in Annex 1 to this Resolution);

2.2 the emissions of this non-GSO space station shall remain within the envelope of the notified/recorded characteristics of the associated transmitting FSS earth stations of the GSO FSS network or non-GSO FSS system;

2.3 (*Option 1*): this non-GSO space station shall comply with the provisions contained in Annex 2 to this Resolution for protection of terrestrial services in the frequency band 27.5-29.5 GHz;

(*Option 2*): this non-GSO space station shall not cause unacceptable interference to terrestrial services in the frequency band 27.5-29.5 GHz, and Annex 2 to this Resolution shall apply;

(*Option 3*): this non-GSO space station shall not cause unacceptable interference to the terrestrial services in the frequency band 27.5-29.5 GHz, and Annex 2 to this Resolution shall apply, and in the frequency band 29.5-30 GHz, with respect to the terrestrial service on the territory of administrations listed in footnote No. **5.542**, Annex 2 shall also apply;

2.3*bis* the requirement to not cause unacceptable interference to terrestrial services shall not release the notifying administration of its obligation as contained in *resolves* 2.3 above;

2.4 *(Option 1):* this non-GSO space station shall comply with the provisions contained in Annex 4 to this Resolution;

(Option 2): this non-GSO shall not cause unacceptable interference to or otherwise impose constraints on the operation or the development of non-GSO FSS systems, and protect non-GSO FSS space stations by complying with the provisions contained in Annex 4 to this Resolution;

2.5 *Option 1:* the emissions of this non-GSO space station shall not produce a power flux-density at any point in the GSO arc greater than the power flux-density produced by earth stations associated with satellite network/system with which they communicate;

Option 2: the emissions of this non-GSO space station shall comply with the provisions contained in Annex 5 to this Resolution for protection of GSO space stations;

Option 3: shall not produce a power flux-density at any point in the GSO arc greater than the power flux-density produced by earth stations associated with the satellite network/system with which they communicate as determined in Annex 5 to this Resolution;

3 that for a space station transmitting in the space-to-space direction in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz or parts thereof, the following conditions shall apply:

3.1 this non-GSO or GSO space station shall only transmit when the non-GSO receiving space station is within the cone whose apex is the GSO or non-GSO transmitting space station and whose angle is θ_{Max} (as defined in Annex 1 to this Resolution);

3.2 the transmissions shall remain within the envelope of the notified/recorded characteristics of transmitting GSO FSS or non-GSO FSS towards its associated FSS earth stations;

3.3 with respect to the Earth exploration-satellite service (EESS) (passive) operating in the frequency band 18.6-18.8 GHz, any non-GSO FSS system with an orbital apogee of less than 20 000 km communicating with lower orbiting non-GSO space stations in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz and for which the complete notification information has been received by the Radiocommunication Bureau (BR) after 1 January 2025 shall comply with the provisions indicated in Annex 3 to this Resolution;

Alternative non-GSO FSS hard limits

3.4 for space-to-space links in the frequency band 19.3-19.7 GHz, or parts thereof,

Option 1: a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station that exceeds −148 dB(W/(m^2 · MHz));

Option 2: a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station site that exceeds −148 dB(W/(m^2 · MHz)). This limit may be exceeded at the site of a non-GSO mobile satellite gateway station of any country whose administration has so agreed as long as these limits are unchanged in cross-border applications;

Option 3: a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station that exceeds TBD dB(W/(m^2 · MHz));

Option 4: a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station site that exceeds TBD dB(W/(m^2 · MHz)). This limit may be exceeded at the site of a non-GSO mobile satellite gateway station of any country whose administration has so agreed as long as these limits are unchanged in cross-border applications;

End of Alternative non-GSO FSS Hard limits

4 that non-GSO space stations receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall not claim protection from FSS, mobile-satellite service (MSS) networks and systems and MetSat as well as terrestrial services operating in conformity with the Radio Regulations;

5 that space stations receiving space-to-space transmissions in the frequency band 27.5-30 GHz from non-GSO space stations shall, for these inter-satellite links, not claim protection from FSS and MSS networks and systems as well as terrestrial services operating in conformity with the Radio Regulations;

6 that assignments to space-to-space links in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz shall not cause unacceptable interference to nor claim protection from GSO FSS services operating in the frequency band allocated to the FSS;

7 *Option 1*: that the implementation of this Resolution is conditioned on the development of the description of interference management system(s), monitoring facilities (NCMC), dealing with the cessation of transmission in order to provide a satisfactory resolution of the problem,

Option 2: this option proposes that this *resolves* 7 is not required,

resolves further

1 that, subject to this Resolution:

a) the notifying administration of the non-GSO system choosing to operate satellite-to-satellite links and receiving in the frequency bands 27.5-28.6 GHz and 29.5-30.0 GHz shall indicate to the BR the commitment that the equivalent power flux-density produced at any point in the geostationary-satellite orbit by emissions from all combined operations of space-to-space and associated earth station transmissions shall not exceed the limits given in Table **22-2**;

b) the notifying administration of the non-GSO space station/stations transmitting in the frequency band 27.5-30 GHz towards a GSO network and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall send to the BR the relevant Appendix **4** ([*alternative non-GSO FSS hard limit:* advance publication][*alternative non-GSO FSS coordination:* coordination]) information containing the characteristics of the non-GSO space station/stations and the associated name of the notified GSO FSS network with which it intends to communicate;

c) the notifying administration of the non-GSO space station/stations transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz towards a non-GSO system and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall send to the BR the relevant Appendix **4** ([*alternative non-GSO FSS hard limit:* advance publication][*alternative non-GSO FSS coordination:* coordination]) information containing the characteristics of the non-GSO space station/stations and the associated name of the notified non-GSO FSS system(s) with which it intends to communicate;

d) the notifying administration for the non-GSO space station transmitting in the space-to-space direction in the frequency band 27.5-30 GHz shall provide to the BR, when submitting Appendix **4** data, an objective, measurable and enforceable commitment that, upon receiving a report of unacceptable interference, the notifying administration will follow the procedures in *resolves further* 2;

2 that, in case of unacceptable interference caused by a non-GSO space station transmitting in the frequency band 27.5-30 GHz or parts thereof:

a) the notifying administration for that non-GSO space station shall cooperate with an investigation on the matter and provide, to the extent of its ability, any required information on the operation of the transmitting space station and a point of contact to provide such information;

b) the notifying administration for that non-GSO space station and the notifying administration of the GSO or non-GSO space station receiving these space-to-space transmissions shall, jointly or individually, as the case may be, upon receipt of a report of unacceptable interference, take the required action to eliminate or reduce interference to an acceptable level;

c) in case of continued unacceptable interference despite of the firm commitment to remove that, the assignment causing interference shall be submitted to the Radio Regulations Board for review;

3 that the notifying administration for the GSO or non-GSO FSS receiving space-to-space transmissions in the frequency band 27.5-30 GHz shall ensure that:

a) the non-GSO space stations transmitting in these frequency bands employed techniques to maintain pointing accuracy with the associated receiving space station and avoid tracking inadvertently adjacent GSO space stations of any other notifying administration or space stations in a non-GSO system of any other notifying administration;

b) all necessary measures are taken so that non-GSO transmitting space stations in these frequency bands are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility and are capable of receiving and acting upon at least "enable transmission" and "disable transmission" commands from the NCMC or equivalent facility;

c) a permanent point of contact is provided for the purpose of tracing any cases of unacceptable interference from non-GSO transmitting space stations in these frequency bands in the [*Alternative FSS:* FSS (space-to-space)][*Alternative ISS*: ISS] service and to immediately respond to requests from the focal point;

4 that, upon examination of the information submitted by the notifying administration under *resolves further* 1*b)* or 1*c)*, if no recorded frequency assignments with typical earth stations for the relevant frequency bands can be identified for the GSO FSS network or non-GSO FSS system with which the notifying administration's non-GSO space station intends to communicate, the BR shall return the information to the notifying administration with an unfavourable finding,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolution of interference, if and when required;

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution;

3 to use the methodology given in the Appendix to Annex 2 of this Resolution when assessing compliance with the pfd limits in Annex 2;

4 to use the methodology given in Appendixes 1 to 3 to Annex 5 of this Resolution when assessing compliance with Annex 5;

5 not to examine, under No. **11.31**, the conformity of non-GSO FSS systems with the provisions of *resolves* 5 of this Resolution.

ANNEX 1 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Determination of the off-nadir angle

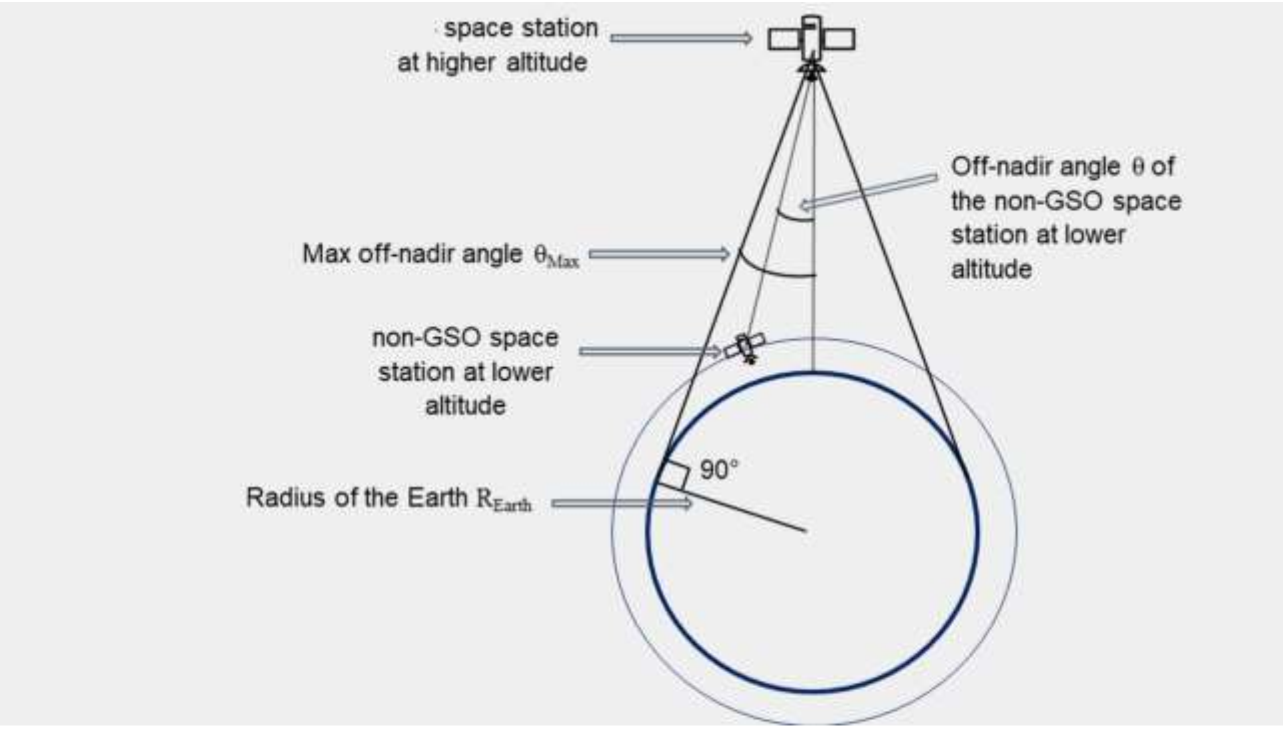
1 A non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall only communicate with a non-GSO space station when the off-nadir angle between this non-GSO space station and the non-GSO space station with which it communicates is equal to or smaller than:

$$\theta_{Max} = \sin^{-1}\left(\frac{R_{Earth}}{R_{Earth} + Alt_{Higher}}\right)$$

where

R_{Earth} = 6 378 km

Alt_{Higher} = altitude of the non-GSO space station at higher orbital altitude in km.



2 A non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall only communicate with a GSO space station when the off-nadir angle between this GSO space station and the non-GSO space station with which it communicates is equal to or smaller than:

Alternative GSO "expanded-cone"

– if the altitude of the non-GSO space station is less than 2 000 km:

$$\theta_{Max} = \sin^{-1}\left(\frac{R_{Earth} + Alt_{non-GSO}}{R_{Earth} + Alt_{GSO}}\right)$$

– if the altitude of the non-GSO space station is greater than or equal to 2 000 km:

End of Alternative GSO "expanded-cone"

$$\theta_{Max} = \sin^{-1}\left(\frac{R_{Earth}}{R_{Earth} + Alt_{GSO}}\right)$$

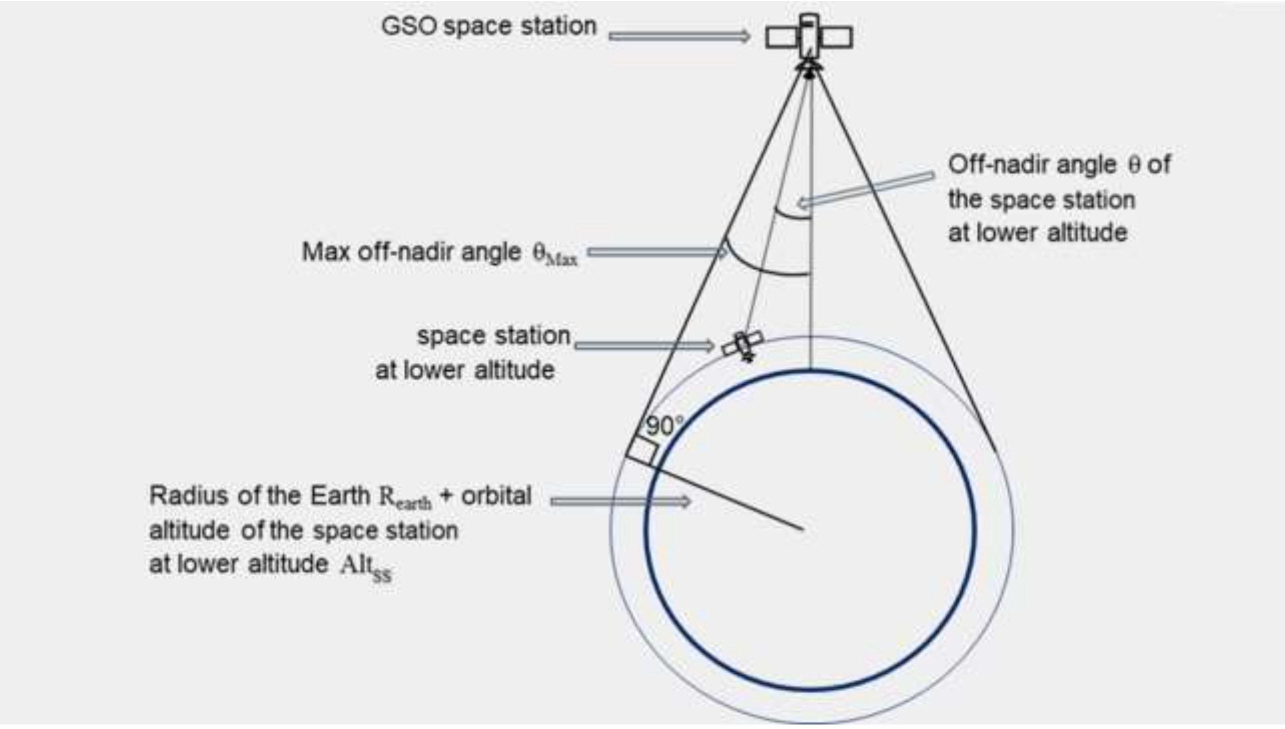
where:

R_{Earth} = 6 378 km

Alt_{GSO} = altitude of the GSO space station in km.

Alternative GSO "expanded-cone"

$Alt_{non\text{-}GSO}$ = altitude of the non-GSO space station in km.



3 If the altitude of the non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz is less than 2 000 km, the angle between the vector from this space station to the centre of the Earth and the vector between this space station and the GSO space station, shall be at least 90°.

End of Alternative GSO "expanded-cone"

4 In case the notified service area of the [*Alternative GSO "within the cone":* GSO or] non-GSO network/system at higher orbital altitude is not global, the maximum off-nadir angle θ_{Max} will vary at each azimuth according to the notified service area and there will be a specific maximum off-nadir angle associated to each azimuth based on the position in space of the FSS network/system at higher orbital altitude and the geographic coordinates (latitude, longitude) of the border of the notified service area at each azimuth, which are extracted from the Graphical Interference Management System (GIMS) database container that was submitted to the BR when notifying a specific non-global service area.

$$\theta_{Max} = \cos^{-1}\left(\frac{\left(R_{Earth} + Alt_{Higher}\right)^2 + dist^2 - R_{Earth}{}^2}{2 \times \left(R_{Earth} + Alt_{Higher}\right) \times dist}\right)$$

with:

$$dist = \sqrt{\left(X_E - X_S\right)^2 + \left(Y_E - Y_S\right)^2 + \left(Z_E - Z_S\right)^2}$$

$$X_E = R_{Earth} \times \cos\left(lat_{sab}(\varphi)\right) \times \cos\left(lon_{sab}(\varphi)\right)$$

$$Y_E = R_{Earth} \times \cos\left(lat_{sab}(\varphi)\right) \times \sin\left(lon_{sab}(\varphi)\right)$$

$$Z_E = R_{Earth} \times \sin\left(lat_{sab}(\varphi)\right)$$

$$X_S = \left(R_{Earth} + Alt_{Higher}\right) \times \cos\left(lat_{SS}\right) \times \cos\left(lon_{SS}\right)$$

$$Y_S = \left(R_{Earth} + Alt_{Higher}\right) \times \cos\left(lat_{SS}\right) \times \sin\left(lon_{SS}\right)$$

$$Z_S = \left(R_{Earth} + Alt_{SS}\right) \times \sin\left(lat_{Higher}\right)$$

where:

$lat_{sab}(\varphi)$ = latitude of the service area border for the azimuth φ

$lon_{sab}(\varphi)$ = longitude of the service area border for the azimuth φ

lat_{SS} = latitude of the sub-satellite point of the GSO/non-GSO space station

lon_{SS} = longitude of the sub-satellite point of the GSO/non-GSO space station.

ANNEX 2 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Provisions for non-GSO space stations transmitting in the frequency bands 27.5-29.1 GHz and 29.1-29.5 GHz to protect terrestrial services in the frequency band 27.5-29.5 GHz

Note: Some administrations are of the view that the pfd mask to protect terrestrial services from emissions from space stations should be included in Article 21 for compliance in the frequency band 27.5-29.5 GHz.

The maximum pfd produced at the surface of the Earth by emissions from a non-GSO space station transmitting in the frequency band 27.5-29.5 GHz shall not exceed:

Option 1

$pfd(\theta) = -115$	$(dB(W/(m^2 \cdot 1\ MHz)))$	for	$0° \le \theta \le 5°$
$pfd(\theta) = -115 + 0.5(\theta - 5)$	$(dB(W/(m^2 \cdot 1\ MHz)))$	for	$5° \le \theta \le 25°$
$pfd(\theta) = -105$	$(dB(W/(m^2 \cdot 1\ MHz)))$	for	$25° < \theta \le 90°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

End of Option 1

Option 2-1

$\text{pfd}(\theta) = -136.2$ (dB(W/(m^2 · 1 MHz))) for $0° \leq \theta \leq 0.01°$

$\text{pfd}(\theta) = -132.4 + 1.9 \cdot \log\theta$ (dB(W/(m^2 · 1 MHz))) for $0.01° < \theta \leq 0.3°$

$\text{pfd}(\theta) = -127.7 + 11 \cdot \log\theta$ (dB(W/(m^2 · 1 MHz))) for $0.3° < \theta \leq 1°$

$\text{pfd}(\theta) = -127.7 + 18 \cdot \log\theta$ (dB(W/(m^2 · 1 MHz))) for $1° < \theta \leq 2°$

$\text{pfd}(\theta) = -129.4 + 23.7 \cdot \log\theta$ (dB(W/(m^2 · 1 MHz))) for $2° < \theta \leq 8°$

$\text{pfd}(\theta) = -108$ (dB(W/(m^2 · 1 MHz))) for $8° < \theta \leq 90.0°$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

End of Option 2-1

Option 2-2

$\text{pfd}(\delta) = -124.7$ (dB(W/(m^2 · 14 MHz))) for $0° \leq \delta \leq 0.01°$

$\text{pfd}(\delta) = -120.9 + 1.9 \cdot \log\delta$ (dB(W/(m^2 · 14 MHz))) for $0.01° < \delta \leq 0.3°$

$\text{pfd}(\delta) = -116.2 + 11 \cdot \log\delta$ (dB(W/(m^2 · 14 MHz))) for $0.3° < \delta \leq 1°$

$\text{pfd}(\delta) = -116.2 + 18 \cdot \log\delta$ (dB(W/(m^2 · 14 MHz))) for $1° < \delta \leq 2°$

$\text{pfd}(\delta) = -117.9 + 23.7 \cdot \log\delta$ (dB(W/(m^2 · 14 MHz))) for $2° < \delta \leq 8°$

$\text{pfd}(\delta) = -96.5$ (dB(W/(m^2 · 14 MHz))) for $8° < \delta \leq 90°$

where δ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

End of Option 2-2

APPENDIX

To check the compliance of the non-GSO emissions with the pfd mask described in Annex 2, the following procedures shall be followed:

1) Parameter *a* is the orbital altitude (km) of the non-GSO system identified in *resolves further* 1c*)* or in *resolves further* 1*d), PSD* is the power spectral density in the reference bandwidth associated with the pfd limit, and compute the off-axis gain pattern *Gtx*(φ), with φ being the off-axis angle in the direction of the terrestrial receiver. Assume the Earth is a sphere whose radius, R_e, is 6 378 km.

2) Compute the angle, as seen from the non-GSO system transmitting in frequency range 27.5-29.5 GHz (the user space station), between the centre of the Earth and the GSO network or non-GSO systems receiving in the frequency range 27.5-29.5 GHz (the service provider space station) assuming that the user is at the edge of the cone of coverage with the formula:

$$\delta = \arcsin\left(\frac{R_e}{R_e + a}\right)$$

3) Sweep angle of arrival to the terrestrial station, θ from 0 to 90 degrees in 0.1-degree increments.

4) Compute satellite angle $\gamma = \arcsin\left(\frac{\sin(90+\theta)}{R_e + a} * R_e\right)$.

5) Compute off-axis angle φ = 180 − δ − γ.

6) Compute the gain *Gtx* in dBi towards the Earth point for each of the angles from step 5, using the user space station transmit antenna pattern.

7) Compute slant range $d = (R_e + a)\frac{\sin(90-\gamma-\theta)}{\sin(90+\theta)}$.

8) Compute the atmospheric attenuation A_{atm} in dB, for the corresponding angle of arrival, θ, using Recommendation ITU-R P.676-13 with the mean global standard atmosphere from Recommendation ITU-R P.835-6.

9) Compute the *PFD* on the ground as:

$$PFD = PSD + Gtx(\theta) - A_{atm}(\theta) - 10\times\log_{10}\left(4\pi d^2\right)$$

ANNEX 3 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Provisions for non-GSO space stations[1] links in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz towards non-GSO space stations with respect to EESS (passive) in the frequency band 18.6-18.8 GHz

[Option 1]

Non-GSO space stations operating with an orbit apogee of more than 2 000 km and less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space station as described in *resolves* 1*a)*, shall not exceed a power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band of −118 dB(W/(m² · 200 MHz)).

Non-GSO space stations operating with an orbit apogee less than 2 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space station as described in *resolves* 1*a)*, shall not exceed a power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band, of −110 dB(W/(m² · 200 MHz)).

[End of Option 1]

Note: The pfd limits of unwanted emissions in Option 2 come from the studies done for AI 1.16.

[Option 2]

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space

[1] These provisions do not apply to non-GSO systems using orbits with an apogee less than 2 000 km that employ frequency reuse schemes of at least three colours.

station as described in *resolves* 1*a)*, shall not exceed the following power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band,

−123 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes greater than 2 000 km;

−117 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes between 1 000 km and 2 000 km;

−104 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes below 1 000 km.

[End of Option 2]

Alternative non-GSO FSS hard limits

ANNEX 4 TO DRAFT NEW RESOLUTION [A117-B](WRC-23)

Provisions for non-GSO space-to-space links in the frequency band 27.5-30.0 GHz to protect non-GSO space stations

The following conditions for non-GSO space stations transmitting in the frequency band 27.5-30.0 GHz to protect non-GSO space stations shall apply:

a) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a GSO FSS network shall not exceed the following on-axis e.i.r.p. spectral density limits:

– for non-GSO space station transmit on-axis antenna gains greater than 40.6 dBi: −15/−16.1/−17.5 dBW/Hz;

– for non-GSO space station transmit on-axis antenna gains less than 40.6 dBi: −15/−16.1/−17.5 − (40.6 – X) dBW/Hz;

where X is the on-axis gain of the non-GSO space station antenna in dBi.

Note: Further consideration of the reference bandwidth in the above provision a) *may be considered.*

b) To protect FSS feeder links to non-GSO mobile-satellite service systems the following conditions for non-GSO space stations and systems transmitting in the frequency band 29.1-29.5 GHz shall apply:

– emissions from any non-GSO space station communicating with a GSO network shall not exceed a maximum power spectral density of −70/−62 dBW/Hz at the input of the antenna of the non-GSO space station;

– any non-GSO space station communicating with a GSO network shall have a minimum antenna diameter of 0.3 m whose gain shall not exceed the gain envelope in the most recent version of Recommendation ITU-R S.580;

– non-GSO space stations communicating with a GSO network shall only operate in orbits with inclination between 80 and 100 degrees;

– non-GSO systems communicating with a GSO network shall not contain more than 100 satellites.

Option 1:

c) Non-GSO space stations transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz shall not operate at orbital altitudes greater than or equal to 900 km and less than 1 290 km.

c bis) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude higher than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of −20 dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

Transmitting non-GSO space station operational altitude (km)	Maximum total e.i.r.p. (dBW)
altitude < 450	63
450 ≤ altitude < 600	61
600 ≤ altitude < 750	58
750 ≤ altitude < 900	55
altitude ≥ 1 290	N/A

c ter) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of (−26/−28/−30) dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

Transmitting non-GSO space station operational altitude (km)	Maximum total e.i.r.p. (dBW)
altitude < 450	60
450 ≤ altitude < 600	58
600 ≤ altitude < 750	55
750 ≤ altitude < 900	53
altitude ≥ 1 290	N/A

End of Option 1

Option 2:

c) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude higher than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of −20 dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

Transmitting non-GSO space station operational altitude (km)	Maximum total e.i.r.p. (dBW)
altitude < 450	63
450 ≤ altitude < 600	61
600 ≤ altitude < 750	58
750 ≤ altitude < 900	55
900 ≤ altitude < 1 290	TBD
altitude ≥ 1 290	N/A

c bis) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of (−26/−28/−30) dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

Transmitting non-GSO space station operational altitude (km)	Maximum total e.i.r.p. (dBW)
altitude < 450	60
450 ≤ altitude < 600	58
600 ≤ altitude < 750	55
750 ≤ altitude < 900	53
900 ≤ altitude < 1 290	TBD
altitude ≥ 1 290	N/A

End of Option 2

d) For off-axis angles greater than 3.5 degrees, the off-axis e.i.r.p. emissions of a non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO ISS system with a minimum operational altitude higher than 2 000 km shall not exceed the envelope generated by the combination of an input power spectral density at the antenna flange of −62 dBW/Hz coupled with the off-axis gain derived from $29 - 25 \log(\varphi)$ dBi for angles between 3.5 degrees and 20 degrees.

End of Alternative non-GSO FSS hard limits

ANNEX 5 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Provisions for non-GSO space-to-space links in the frequency band 27.5-30.0 GHz to protect GSO space stations

1) In the frequency band 27.5-30 GHz, when a non-GSO system as identified in *resolves further* 1*b)* identifies an associated GSO network as described in *resolves further* 1*b)* to operate inter-satellite links, the BR shall perform the examination in Appendix 1 to this Annex.

2) The notifying administration of the GSO network identified in 1) above shall respect all coordination agreements that have already been recorded, noting the provisions from *resolves further* 1*d)*, 1*e)*, 2 and 3.

2*bis*) *Option A*: The notifying administration of the GSO network identified in 2) is urged to provide, upon any request from the notifying administration of a GSO network involved in the coordination agreements referred above, additional information on how the relevant coordination agreements will be respected. Efforts should be made to provide this information as soon as practicable.

Option B: The notifying administration of the GSO network identified in 2) above shall provide, upon any request from the notifying administration of a GSO network involved in the coordination agreements referred above, additional information on how the relevant coordination agreements will be respected with regard to protection from inter-satellite links. This information shall be provided within 90 days after the reception of the request.

3) In the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, when a non-GSO system as identified in *resolves further* 1*c)* identifies a non-GSO system as described in *resolves further* 1*c)* to operate space-to-space links, the BR shall perform the examination in Appendix 2 to this Annex.

4) The notifying administration of the receiving non-GSO network identified in 3) above shall respect all coordination agreements that have already been recorded, noting the provisions from *resolves further* 1*d)*, 1*e)*, 2 and 3.

5) In the frequency bands 27.5-28.6 GHz and 29.5-30 GHz, the pfd produced at any point in the geostationary-satellite orbit by a non-GSO space station as mentioned in *resolves further* 1*c)* shall not exceed a pfd of (−163/−165) dBW/m² in any 40 kHz band. A computation methodology is provided in Appendix 3 to this Annex.

APPENDIX 1

The aim of this Appendix is to provide a method to be used by the BR to assess whether the emissions from a non-GSO space station operating inter-satellite links with a GSO space station are within the envelope of the typical earth stations of the GSO network.

Step 1: For each group of the transmitting non-GSO notification.

Step 2: For each of the receiving GSO networks, as listed in *resolves further 1b)*.

Step 3: For each beam in the Earth-to-space direction of the receiving GSO network notification, compute the maximum e.i.r.p. produced in one hertz (EIRPSD).

Step 4: Compute the reduction in free space loss at the altitude of the user using:

$$\Delta FSL = 20\log_{10}\left(\frac{GSO_{alt}}{GSO_{alt} - NGSO_{alt}}\right)$$

where $NGSO_{alt}$ is the altitude of the transmitting non-GSO system space stations, and GSO_{alt} = 35 786 km. It should be noted that if several altitudes are included in the notification, each altitude shall be tested.

Step 5: Compute the reduced e.i.r.p. spectral density as $EIRPSD_{reduced} = EIRPSD - \Delta FSL$.

Step 6: For all beams in the non-GSO system notification with a class of station ES/XY, the e.i.r.p. spectral density mask is given in Appendix **4** data item A.25.c.2.

Step 7: For all emissions in the GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0 and 80°, with a step of 1°, and reduce it by ΔFSL. The e.i.r.p. spectral density mask computation should assume that the maximum gain is for an off-axis angle of 0°.

Step 8: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5 if, for all beams:

– the maximum value of the e.i.r.p. spectral density mask from step 6 does not exceed the $EIRPSD_{reduced}$ quantity, computed at the same altitude,

– the e.i.r.p. spectral density mask of the transmitting non-GSO space station from step 6 is less than the reduced e.i.r.p. spectral density mask, compared in one hertz, from step 7 for all angles for at least one emission in the GSO network notification.

Otherwise, the assignments shall receive an unfavourable finding.

APPENDIX 2

The aim of this Appendix is to provide a method to be used by the BR to assess whether the emissions from a non-GSO space station operating inter-satellite links with a non-GSO space station are within the envelope of the typical earth stations of the non-GSO system.

Step 1: For each group of the transmitting non-GSO notification.

Step 2: For each of the receiving non-GSO systems, as listed in *resolves further* 1*c)*.

Step 3: For each beam in the Earth-to-space direction of the receiving non-GSO system notification, compute the maximum e.i.r.p. produced in one hertz (EIRPSD).

Step 4: Compute the reduction in free space loss at the altitude of the user using:

$$\Delta FSL = 20\log_{10}\left(\frac{GSO_{alt}}{GSO_{alt} - NGSO_{alt}}\right)$$

where $NGSO_{alt}$ is the altitude of the transmitting non-GSO system space stations, and GSO_{alt} = 35 786 km. It should be noted that if several altitudes are included in the notification, each altitude shall be tested.

Step 5: Compute the reduced e.i.r.p. spectral density as $EIRPSD_{reduced} = EIRPSD - \Delta FSL$.

Step 6: For all beams in the non-GSO system notification with a class station ES/XY, the e.i.r.p. spectral density mask is given in Appendix **4** data item A.25.c.2.

Step 7: For all emissions in the receiving non-GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0 and 80°, with a step of 1°, and reduce it by ΔFSL. The e.i.r.p. spectral density mask computation should assume that the maximum gain is for an off-axis angle of 0°.

Step 8: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5 if, for all beams:

– the maximum value of the mask from step 6 does not exceed the $EIRPSD_{reduced}$ quantity, computed at the same altitude,

– the e.i.r.p. spectral density mask of the transmitting non-GSO space station from step 6 is less than the reduced e.i.r.p. spectral density mask from step 7 for all angles.

Otherwise, the assignments shall receive an unfavourable finding.

APPENDIX 3

To check the compliance of the non-GSO emissions with the pfd limit given in Annex 5, § 5), the following procedure shall be followed.

Step 1: Select the corresponding value to the GSO arc avoidance angle in the e.i.r.p. mask as given in Appendix **4** agenda item A.25.c.2, and denote it as $eirp_{\alpha}$. If the mask is non-monotonic, select the largest value in the e.i.r.p. mask considering all angles greater than or equal to the GSO arc avoidance angle as given in Appendix **4** agenda item A.25.c.1.

Step 2: Compute the PFD on the GSO arc using:

$$PFD = eirp_{\alpha} - 10\log\left(4\pi((35\,786 - alt) \times 1\,000)^2\right)$$

where *alt* is the altitude of the transmitting non-GSO space station, in kilometres.

Step 3: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5, § 5) if the pfd values calculated in step 3 are below the threshold given in Annex 5, § 5).

SUP

RESOLUTION 773 (WRC-19)

Study of technical and operational issues and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz

Agenda item 1.18

1.18 to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution ***248 (WRC-19)****;*

Resolution **248 (WRC-19)** – *Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems*

NOTE – Due to a divergence of views in several areas including methods, no consensus was reached and therefore, the entirety of the text below could not be agreed to by CPM23-2.

Moreover, Method B below does not invoke a new agenda item under agenda item 10 of WRC-23 since such item is outside the mandate of the CPM, taking into account that Resolution **804 (Rev.WRC-19)** provides course of actions under which new agenda items could be proposed to WRCs.

NOTE – The narrowband MSS parameters were not agreed to by the responsible group for the MSS under WRC-23 agenda item 1.18 partly due to ambiguities in Resolution **248 (WRC-19)**. As a result, appropriate sharing and compatibility studies between narrowband MSS and incumbent services could not be taken into account in this agenda item. Consequently, the compatibility of narrowband MSS systems and the protection of incumbent services, both in-band and adjacent band, could not be determined or ensured.

4/1.18/1 Executive summary

Resolution **248 (WRC-19)**, WRC-23 agenda item 1.18 invites ITU-R to conduct “studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems” while ensuring the protection of existing primary services in those frequency bands and adjacent frequency bands. Such studies are limited to MSS non-geostationary satellites operating low data-rate systems, taking into account *recognizing c)* of Resolution **248 (WRC-19)**.

There are three methods to satisfy WRC-23 agenda item 1.18:

– Method A: No change to the Radio Regulations and suppression of Resolution **248 (WRC-19)**;

– Method B: No change to any Articles of the Radio Regulations and the Appendices thereof, except revision of Resolution **248 (WRC-19)**.

– Method C: To allocate the frequency band 2 010-2 025 MHz to the mobile-satellite service (Earth-to-space) on a primary basis and suppression of Resolution **248 (WRC-19)**.
Alternative 1, Option 1: MSS narrowband use for all countries in Region 1;
Option 2: MSS narrowband use for a list of countries in Region 1.
Alternative 2, Option 1: MSS allocation for all countries in Region 1;
Option 2: MSS allocation for a list of countries in Region 1.

The reason for each of the methods are described in Section 4/1.18/4 of the CPM text.

4/1.18/2 Background

Non-geostationary orbit satellites narrowband MSS systems are designed with a view to providing means to transfer data collected from user terminals deployed over a geographic area (e.g. region or subregion). WRC-23 agenda item 1.18 invited ITU-R to conduct studies relating to spectrum needs and potential new allocations to the MSS for applications of low data rate systems for the collection of data from, and management of, terrestrial devices in the MSS; the aim was to consider possible new primary or secondary allocations, with the necessary technical limitations, taking into account the characteristics described in *recognizing c)* of Resolution **248 (WRC-19)**, to the MSS for non-geostationary orbit satellites, based on the findings of the sharing and compatibility studies, while ensuring the protection of existing primary services in these frequency bands and adjacent bands as well as not imposing undue restrictions on their further development.

Discussions in the responsible group on Resolution **248 (WRC-19)** have shown the language of the Resolution is ambiguous and unclear regarding the appropriate technical and operational characteristics of narrowband MSS that should be used in the sharing and compatibility studies and studies on spectrum needs. Given the ambiguity of Resolution **248 (WRC-19)** and subsequent lack of agreed technical and operational characteristics of narrowband MSS by the responsible group, sharing and compatibility studies with existing primary services and studies on the spectrum needs could not be concluded to determine the suitability of new allocations to the MSS for low data rate/narrowband applications. Accordingly, any potential new allocations to the MSS for future development of narrowband mobile-satellite systems is not possible under agenda item 1.18.

4/1.18/3 Summary and analysis of the results of ITU-R studies

The responsible group for WRC-23 agenda item 1.18 considered and discussed the technical and operational parameters as proposed by multiple input documents with the aim of providing the required parameters for narrowband mobile-satellite systems to conduct the mandatory sharing and compatibility studies with the current services in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz and its adjacent bands.

However, due to the difficulties and ambiguities of Resolution **248 (WRC-19)**, amongst other things, the responsible group was unable to achieve agreement on the interpretation of Resolution **248 (WRC-19)** and the technical parameters of narrowband MSS. Accordingly, the responsible group was unable to progress, finalize or fully discuss the sharing and compatibility studies with existing primary services to determine the suitability and spectrum needs of new allocations to the MSS for applications of low data rate systems under WRC-23 agenda item 1.18. Some preliminary sharing and compatibility studies were submitted during the study cycle[24], however none were fully discussed and/or liaised with the contributing working groups included in the ITU Radiocommunication Bureau Administrative Circular CA/251. Therefore, they do not reflect the views from affected services that would have been obtained during the usual course of a WRC study cycle.

4/1.18/4 Methods to satisfy the agenda item

4/1.18/4.1 Method A: No change to the Radio Regulations and suppression of Resolution 248 (WRC-19)

Reason: Given the lack of agreed technical and operational characteristics of narrowband MSS, sharing and compatibility studies with existing primary services and studies on the spectrum needs

[24] Such studies are referenced in section 3.1.1 of the Chairman's Report, Document 4C/388.

could not be concluded to determine the suitability of new allocations to the MSS for low data rate/narrowband applications. As a consequence, any potential new allocations to the MSS for future development of narrowband mobile-satellite systems is not possible under agenda item 1.18. Furthermore, discussions on Resolution **248 (WRC-19)** have shown it is ambiguous and unclear regarding the consideration of the appropriate technical and operational characteristics that should be used in the sharing and compatibility studies and studies on spectrum needs. Therefore, a no change (NOC) method to the Radio Regulations is proposed as Method A.

View 1: Some administrations were of the view that suppressing Resolution ***248 (WRC-19)*** *would not address the issue on shortage of unencumbered MSS spectrum. It was also the view of these administrations that the lack of agreed technical and operational characteristics was mainly, if not entirely, the result of the ambiguity in the Resolution that allowed different interpretation and understanding of the technical criteria of the narrowband MSS systems.*

4/1.18/4.2 Method B: No change to any Articles of the Radio Regulations and the Appendices thereof, except revision of Resolution 248 (WRC-19) in order to address the difficulties and inconsistencies of the Resolution

This method considers modification to Resolution **248 (WRC-19)** to address the difficulties, inconsistencies and shortcomings encountered during the WRC-23 study cycle.

View 1: This method shall in no way, whatsoever, be construed as an indirect or direct invocation of a consequential possible future WRC agenda item, as such action is totally outside the mandate of ITU-R, in particular of the CPM.

A proposed example draft Resolution is provided below. The example draft Resolution is for consideration towards possible improvements and facilitating discussion on the way forward for the work on this issue within the ITU-R. The example draft Resolution may facilitate possible worldwide allocations to the mobile-satellite service for the future development of narrowband mobile-satellite systems.

View 1: Some administrations were of the view that the example draft Resolution was not an invocation of a consequential future agenda item. The example draft Resolution could facilitate the WRC-23 for consideration of appropriate modifications that allow appropriate sharing and compatibility studies to be conducted and, based on the outcome of the studies, appropriate protection measures for existing radio services could be established.

View 2: Other administrations were of the view that the example draft Resolution submitted was a clear invocation of a consequential future agenda item and is not within the mandate of the draft CPM text for agenda item 1.18 and not within the remit of the responsible group. Additionally, the example WRC Resolution in Method B removes all the current frequency bands in Resolution ***248 (WRC-19)*** *and proposes an undetermined set of frequency bands that greatly expands the scope of Resolution* ***248 (WRC-19)*** *and consequently creates serious implications for the protection of numerous incumbent radio services under this frequency range. See Note before section 4/1.18/1.*

View 3: Some administrations are of the view that consideration of a draft Resolution ***248 (Rev.WRC-23)*** *submitted as an example Resolution* ***248 (WRC-19)*** *is out of the scope of WRC-23 agenda item 1.18.*

Furthermore, the proposed draft Resolution submitted as an example by the proponents of Method B was not discussed nor agreed to at the second session of the 2023 Conference Preparatory Meeting.

View 4: The continuing difficulties and disagreements associated with WRC-23 agenda item 1.18 and its Resolution ***248 (WRC-19)*** *can be attributed to the unjustified need to establish new MSS allocations that are solely exclusive to only one application/technology.*

Reason: The required studies under agenda item 1.18 could not be fully completed due to the lack of agreement on the interpretation and implementation of *recognizing c)* of Resolution **248 (WRC-19)** that resulted in difficulties with the development of technical and operational characteristics of NB-MSS. As a result, there is a need for addressing the shortcomings of the existing Resolution to support studies in determining the possibility for new primary allocations to the MSS under the existing, a modified or future Resolution, for the development of narrowband mobile-satellite systems, based on related input contributions to WRC-23.

4/1.18/4.3 Method C: Primary allocation to the mobile-satellite service in the frequency band 2 010-2 025 MHz (Earth-to-space) in Region 1

NOTE - This method was not drafted by Working Party 4C neither submitted by an input contribution to CPM23-2 but was proposed during CPM23-2 by some countries. This method was not discussed in detail.

View 1: Some administrations were of the view that any proposed potential allocation of the frequency bands under study should have the purpose to be included for its use by the radiocommunication service of interest based on the supporting studies within the relevant ITU-R SGs and shouldn't be limited to any particular application. Moreover, the text included in Method C was neither discussed nor agreed during either the study cycle or the CPM23-2.

View 2: Some administrations were of the view that the relevant assumptions towards the allocation addressed under Method C still need to be clarified. Further, there are questions regarding technical details of the possible implementation and the protection of the incumbent services in the band and in the adjacent bands. These open issues need to be clarified before or at WRC-23 before Method C may be taken into consideration by those administrations.

This method considers primary allocation to the mobile-satellite service (Earth-to-space) in the frequency band 2 010-2 025 MHz in Region 1 with two alternatives as follows:

- Alternative 1 with two options:
  - Option 1: MSS narrowband use for all countries in Region 1;
  - Option 2: MSS narrowband use for a list of countries in Region 1
- Alternative 2 with two options:
  - Option 1: MSS allocation for all countries in Region 1;
  - Option 2: MSS allocation for a list of countries in Region 1.

*View 1: The continuing difficulties and disagreements associated with WRC-23 agenda item 1.18 and its Resolution **248 (WRC-19)** can be attributed to the unjustified need to establish new MSS allocations that are solely exclusive to only one application/technology. There were also no ITU-R studies in accordance with Resolution **248 (WRC-19)** that were developed that would support the Method C proposal.*

4/1.18/5 Regulatory and procedural considerations

4/1.18/5.1 For Method A

NOC

ARTICLES

<u>NOC</u>

APPENDICES

SUP

RESOLUTION 248 (WRC-19)

Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems

4/1.18/5.2 For Method B

<u>NOC</u>

ARTICLES

<u>NOC</u>

APPENDICES

MOD

RESOLUTION 248 (WRC-19)

Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems

TBD

NOTE - The example draft Resolution was provided under Method B for information only and was not fully reviewed nor was it agreed in CPM23-2 by some administrations. This example does not limit Administrations from consideration of their own proposals related to this method or any other method for this agenda item.

EXAMPLE DRAFT REVISION OF RESOLUTION 248 (WRC-19)

Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands [TBD]~~1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz~~ for future development of narrowband mobile-satellite systems

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

considering

a) ~~that a preliminary assessment of the spectrum requirements would suggest that a pairing of no more than 5 MHz in the uplink and 5 MHz in the downlink may suffice for the applications of low data-rate systems~~that there is a lack of unincumbered spectrum globally for the implementation of narrowband, non-voice, low data-rate non-geostationary (non-GSO) satellite systems operating in low-Earth orbit for the collection of data from, and management of, terrestrial devices in the mobile-satellite service (MSS), excluding applications defined in No. **1.124** of the Radio Regulations;

~~*b)* that the frequency bands under consideration, namely 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz, are allocated on a primary or secondary basis to the mobile service, fixed service, mobile-satellite service (MSS), amateur service, radiolocation service and meteorological services, among others;~~

~~c~~b) that previous studies only addressed spectrum requirements for the satellite component of International Mobile Telecommunications (IMT) - IMT-2000 and systems beyond IMT-2000 (Report ITU-R M.2077), and spectrum requirements for new broadband MSS applications in the 4-16 GHz frequency range (Reports ITU-R M.2218 and ITU-R M.2221);

~~d~~c) that Report ITU-R M.2218 suggests that the operational characteristics of incumbent MSS systems may constrain and effectively hamper the sharing of existing MSS spectrum, resulting in a requirement for additional spectrum for new applications;

~~e~~d) that Report ITU-R SA.2312 suggests that MSS frequency bands already allocated above 5 GHz are not suited to the inherent size, weight and power restrictions of small satellites (usually having a mass of less than 100 kg)~~;~~,

~~*f)* that earth and space stations used for the applications of the systems referred to in *considering a)* may include a combination of low power and intermittent transmissions to facilitate spectrum sharing and spectrum requirements,~~

noting

~~*a)* the existing MSS allocation and current use of the frequency band 2 010-2 025 MHz, in particular in Region 2;~~

~~b~~a) that the number of mobile-satellite systems using small satellites for the systems described in *considering a)* is growing and the spectrum demand for suitable MSS allocations is increasing;

~~c~~b) the examples, technical characteristics and benefits of such satellites given in Report ITU-R SA.2312;

~~d~~c) the contribution of the applications described in *considering a)*, delivering actionable information, to the promotion of human welfare;

~~e~~*d*) the insufficient spectrum opportunities for new applications described in *considering a)* to operate in MSS frequency bands below 5 GHz~~;~~,

~~*f)* that Recommendation ITU-R SA.1158-3 summarized that narrowband short-duration types of data transmissions in the MSS (Earth-to-space) may feasibly share the frequency band 1 670-1 710 MHz with the meteorological-satellite service (space-to-Earth),~~

recognizing

a) that the existing primary allocated services in the frequency bands considered and adjacent frequency bands shall be protected;

b) the need for regulatory certainty regarding the available spectrum for both satellite and earth station design and planning purposes;

~~*c)* that the studies envisaged under *resolves to invite the ITU Radiocommunication Sector* in this Resolution are to be limited to those systems with space stations that have a maximum equivalent isotropically radiated power (e.i.r.p.) of 27 dBW or less, with a beamwidth of no more than 120 degrees, and earth stations that individually communicate no more than once every 15 minutes, for no more than 4 seconds at a time, with a maximum e.i.r.p. of 7 dBW;~~

~~*d)* that some of the frequency bands listed in *resolves to invite the ITU Radiocommunication Sector* 2 are identified for IMT in accordance with No. **5.429D**;~~

~~*e*~~*c)* that the introduction of the applications of the possible new MSS allocation should not impose constraints on other existing allocated primary services in the frequency bands under consideration and adjacent frequency bands operating in accordance with the Radio Regulations,

resolves to invite the ITU Radiocommunication Sector

1 to conduct studies on spectrum and operational requirements for new systems ~~as well as system characteristics of low data-rate systems for the collection of data from, and management of, terrestrial devices~~ in the MSS as described in *considering a)* ~~and limited to the basic characteristics in *recognizing c)*~~;

2 taking into account *resolves* 1, to conduct sharing and compatibility studies with existing in-band and adjacent primary services to determine the suitability of new allocations to the MSS, with a view to protecting the primary services, in the following frequency bands and adjacent frequency bands:

TBD;

~~• 1 695-1 710 MHz in Region 2,~~

~~• 2 010-2 025 MHz in Region 1,~~

~~• 3 300-3 315 MHz and 3 385-3 400 MHz in Region 2;~~

3 to ~~consider~~suggest possible new primary or secondary allocations, with the necessary technical limitations~~, taking into account the characteristics described in *recognizing c)*,~~ to the MSS for non-geostationary satellites ~~operating low data-rate systems for the collection of data from, and management of, terrestrial devices,~~ based on the results of sharing and compatibility studies in *resolves* 2, while ensuring the protection of existing primary services in those frequency bands and adjacent frequency bands, without causing undue constraints on their further development,

~~*invites the 2023 World Radiocommunication Conference*~~

~~to determine, on the basis of the studies conducted under *resolves to invite the ITU Radiocommunication Sector* above, appropriate regulatory actions,~~

invites administrations

to participate in the studies by submitting contributions to the ITU Radiocommunication Sector.

4/1.18/5.3 For Method C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

For Method C, Alternative 1, Option 1

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 010-2 025 FIXED MOBILE 5.388A 5.388B MOBILE-SATELLITE (Earth-to-space) ADD 5.A118	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	**2 010-2 025** FIXED MOBILE 5.388A 5.388B
5.388	5.388 5.389C 5.389E	5.388

ADD

5.A118 The use of the frequency band 2 010-2 025 MHz in Region 1 by the mobile-satellite service is subject to coordination under No. **9.11A**. The use of the mobile-satellite service shall not cause harmful interference to or constrain the development of the fixed and mobile services in all Regions and is limited for narrowband mobile-satellite systems. (WRC-23)

For Method C, Alternative 1, Option 2

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 010-2 025 FIXED MOBILE 5.388A 5.388B	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	**2 010-2 025** FIXED MOBILE 5.388A 5.388B

5.388 ADD 5.A118	5.388 5.389C 5.389E	5.388

ADD

5.A118 *Additional allocation*: in (list of countries of Region 1), the frequency band 2 010-2 025 MHz is also allocated to the mobile-satellite service (Earth-to-space) on a primary basis. Such use is subject to coordination under No. **9.11A**. The use of the mobile-satellite service shall not cause harmful interference to or constrain the development of the fixed and mobile services in all Regions and is limited for narrowband mobile-satellite systems. (WRC-23)

For Method C, Alternative 2, Option 1

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 010-2 025 FIXED MOBILE 5.388A 5.388B MOBILE-SATELLITE (Earth-to-space) ADD 5.A118	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	**2 010-2 025** FIXED MOBILE 5.388A 5.388B
5.388	5.388 5.389C 5.389E	5.388

ADD

5.A118 The use of the frequency band 2 010-2 025 MHz in Region 1 by the mobile-satellite service is subject to coordination under No. **9.11A**. The use of the mobile-satellite service shall not cause harmful interference to or constrain the development of the fixed and mobile services in all Regions. (WRC-23)

For Method C, Alternative 2, Option 2

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 010-2 025 FIXED MOBILE 5.388A 5.388B	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	**2 010-2 025** FIXED MOBILE 5.388A 5.388B
5.388 ADD 5.A118	5.388 5.389C 5.389E	5.388

ADD

5.A118 *Additional allocation*: in (list of countries of Region 1), the frequency band 2 010-2 025 MHz is also allocated to the mobile-satellite service (Earth-to-space) on a primary basis. Such use is subject to coordination under No. **9.11A**. The use of the mobile-satellite service shall not cause harmful interference to or constrain the development of the fixed and mobile services in all Regions. (WRC-23)

For Method C

SUP

RESOLUTION 248 (WRC-19)

Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems

Reasons: The frequency band 2 010-2 025 MHz is allocated and used in Region 2 for the mobile-satellite service (Earth-to-space), including narrowband applications in the mobile-satellite service. All technical and regulatory conditions for MSS (Earth-to-space) to ensure protection of other services (fixed and mobile) in this band are in the Radio Regulations. Allocations of other services (except MSS (Earth-to-space)) in the band 2 010-2 025 MHz in Region 1 and Region 2 are identical. This method provides allocation of the band 2 010-2 025 MHz to MSS (Earth-to-space) for development narrowband mobile satellite systems in Region 1 and ensure protection of all services by applying same technical and regulatory conditions as in Region 2 for Region 1.

Agenda item 1.19

1.19 to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with Resolution ***174 (WRC-19)****.*

Resolution **174 (WRC-19)** – *Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2*

4/1.19/1 Executive summary

WRC-23 agenda item 1.19 considers a new primary allocation to the fixed-satellite service (FSS) in the space-to-Earth direction pursuant to Resolution **174 (WRC-19)**.

Section 1/1.19/2 provides background for agenda item 1.19.

Section 1/1.19/3 summarizes and analyses the results of the studies:

– in the frequency band 17.3-17.7 GHz;

– in the adjacent frequency band 17.2-17.3 GHz;

– in the adjacent frequency band 17.7-17.8 GHz.

Section 1/1.19/4 includes four methods to satisfy the agenda item:

– Method A proposes no change to the RR and suppression of Resolution **174 (WRC-19)**;

– Method B proposes modifications to the RR in order to allocate the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction This method contains two alternatives for several items to provide a wide range of options. The selection of Alternative 1 for all the items extends provisions used in Region 1 to Region 2, as well as the addition of other provisions, while the selection of Alternative 2 for all items results in more conservative conditions with the objective to provide further protection of the BSS feeder link AP30A receiving space station and GSO FSS systems;

– Method C proposes modifications to the RR in order to allocate the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction, limiting the FSS operation to geostationary satellites; and

– Method D proposes modifications to the RR in order to allocate the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction, extending the regulatory provisions used in Region 1 to Region 2, as well as the addition of other provisions.

Section 1/1.19/5 includes the regulatory and procedural considerations.

The various studies were submitted, examined and agreed by consensus in ITU-R.

4/1.19/2 Background

In the 2019 World Radiocommunication Conference, Resolution **174 (WRC-19)** was established to consider a new primary allocation to the FSS in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, which is already allocated to the broadcasting-satellite service (BSS) on primary status.

An FSS (space-to-Earth) emission is similar to a BSS (space-to-Earth) emission. Both consist of a space station transmitting a signal towards the Earth that will be received by fixed earth station terminals. In principle, the interference scenario with respect to other services should not be different; however, with this new allocation, the flexibility in possible uses of the band would be increased.

In Region 1, the frequency band is already allocated to the FSS, a new allocation in Region 2 progresses the principle of Regional harmonization, which allows for synchronization of frequency bands across both Regions. The consideration of Recommendation ITU-R BO.1834 and Recommendation ITU-R BO.1835, which address compatibility and sharing between the BSS networks using the Region 2 BSS allocation in the frequency band 17.3-17.8 GHz and feeder links of BSS networks using the worldwide FSS (Earth-to-space) allocation in the frequency band 17.3-17.8 GHz, is well suited for addressing an approach to study the proposed FSS (space-to-Earth) allocation with existing feeder links of BSS networks using the frequency band 17.3-17.8 GHz.

For the coordination between new FSS GSO (space-to-Earth) frequency assignments with respect to BSS frequency assignments and between new FSS GSO (space-to-Earth) frequency assignments, no modification to Radio Regulations would be required, since RR No. 9.7 already covers the coordination process and RR Appendix 5, Table 5-1 already contemplates a coordination trigger (8° of orbital arc).

4/1.19/3 Summary and analysis of the results of ITU-R studies

Two orbital scenarios for FSS operations were considered in the studies conducted under agenda item 1.19. The studies consisted in analysing both FSS GSO and FSS non-GSO downlink operations with respect to sharing and compatibility with incumbent services in the frequency band 17.3-17.7 GHz and sharing and compatibility with primary services in the adjacent frequency bands 17.2-17.3 GHz and 17.7-17.8 GHz. Nominal parameters were identified to address all services within the frequency band 17.3-17.7 GHz and for the adjacent frequency bands, the contributing working parties liaised characteristics and protection criteria to be considered in the studies when applicable. FSS parameters varied depending on studies, i.e. non-GSO system parameters may differ from study to study based on representative systems under development. In some instances, no studies were performed even when an allocation may exist as no characteristics or protection criteria were liaised by the contributing working party.

4/1.19/3.1 Relevant ITU-R Recommendations and Reports

ITU-R Recommendations, relevant for the sharing and compatibility studies under WRC-23 agenda item 1.19 are Recommendations ITU-R F.699-8, F.758-7, F.1245-3, F.1336-5, F.1495-2, M.1730-1, M.1461-2, BO.1835-0, BO.1834-0, BO.1443-3, SM.1541-6, RS.577-7, RS.1166-4 and RS.2105-1.

ITU-R Reports, relevant for the sharing and compatibility studies under WRC-23 agenda item 1.19 are Report ITU-R RS.2310-1 and working document on WRC-23 agenda item 1.19 (see Annex 19 to Document 4A/856).

4/1.19/3.2 Sharing scenarios

In accordance with Resolution **174 (WRC-19)**, sharing and compatibility studies were conducted with existing services in the frequency band 17.3-17.7 GHz allocated to the FSS (Earth-to-space) and the BSS (space-to-Earth) and existing services in the adjacent frequency bands allocated to the Earth exploration-satellite service (EESS), the space research service (SRS), the radiolocation service (RLS), the fixed service (FS) and the mobile service (MS).

The following table indicates the different sharing scenarios in which compatibility of the FSS (space-to-Earth) in the frequency band 17.3-17.7 GHz has been studied.

Study #	Interferer Transmitting space or earth station	Victim Receiving space or earth station
1	GSO FSS – space station	BSS feeder link AP**30A** – space station
2	GSO FSS – space station	BSS – earth station
3	BSS feeder link AP**30A** – earth station	GSO FSS – earth station
4	BSS – space station	GSO FSS – earth station
5	BSS – space station	Non-GSO FSS – earth station
6	BSS feeder link AP**30A** – earth station	Non-GSO FSS – earth station
7	Non-GSO FSS – space station	GSO FSS – earth station
8	Non-GSO FSS – space station	BSS feeder link AP**30A** – space station
9	Non-GSO FSS – space station	BSS – earth station

With regard to adjacent frequency bands, it is important to mention that, according to RR No. **5.512**, the frequency band 15.7-17.3 GHz is also allocated to the FS and MS on a primary basis in some countries of Region 2, specifically El Salvador, Guatemala and Nicaragua. (WRC-15).

Additionally, the frequency band 17.7-17.8 GHz is allocated to both the FS and MS on a primary basis in Regions 1 and 3 whereas in Region 2 it is allocated to the FS on a primary basis and to the MS on a secondary basis. Regardless of the service area of the satellite, due to the low arrival angle and the potential for aggregate interference in general, the terrestrial services should be protected.

The following table indicates the different sharing scenarios in which compatibility of the FSS (space-to-Earth) in the frequency band 17.3-17.7 GHz with services in the adjacent frequency band 17.2-17.3 GHz has been studied.

Study #	Interferer Transmitting space station	Victim Receiving earth or terrestrial station
10	GSO FSS – space station	EESS (active)
11	GSO FSS – space station	RLS
12	GSO FSS – space station	SRS (active)
13	Non-GSO FSS – space station	EESS (active)
14	Non-GSO FSS – space station	RLS
15	Non-GSO FSS – space station	SRS (active)
16	GSO FSS – space station	FS
17	Non-GSO FSS – space station	FS
18	GSO FSS – space station	MS
19	Non-GSO FSS – space station	MS

The following table indicates the different sharing scenarios in which compatibility of the FSS (space-to-Earth) in the frequency band 17.3-17.7 GHz with services in the adjacent frequency band 17.7-17.8 GHz has been studied.

Study #	Interferer Transmitting space station	Victim Receiving space, earth or terrestrial station
20	GSO FSS – space station	FSS – earth station
21	Non-GSO FSS – space station	FSS – earth station
22	GSO FSS – space station	BSS feeder link AP**30A** – space station
23	Non-GSO FSS – space station	BSS feeder link AP**30A** – space station
24	GSO FSS – space station	BSS – earth station
25	Non-GSO FSS – space station	BSS – earth station
26	GSO FSS – space station	FS
27	Non-GSO FSS – space station	FS
28	GSO FSS – space station	MS
29	Non-GSO FSS – space station	MS

4/1.19/3.3 Analysis of the sharing and compatibility studies

4/1.19/3.3.1 Summary of the sharing and compatibility studies with the frequency band 17.3-17.7 GHz

4/1.19/3.3.1.1 Study 1: GSO FSS – transmitting space station versus BSS feeder link AP30A – receiving space station

There are two sharing scenarios to be considered between the FSS (space-to-Earth) and the BSS feeder link: 1) the adjacent-satellite case, when the transmitting and receiving satellites are very closely spaced, and 2) the equatorial-limb case, when the transmitting and receiving satellites are located in opposite parts of the geostationary orbital arc. In the case of the adjacent satellites, it was shown that with reasonable operating characteristics, transmitting and receiving satellites can be operated compatibly when spaced 0.015° to about 0.38° apart, not including station-keeping, assuming an interfering satellite peak e.i.r.p. density of −21 to −13 dBW/Hz respectively. For the equatorial-limb case, a transmitting space station with an orbital separation of 162.6° poses the scenario for which interference may occur to BSS space station service areas. In addition to this geometrical scenario, these specific circumstances would also need to apply:

– transmitting satellite beam covers Central America or equatorial South America;
– on-axis transmit power in the equatorial plane, i.e. low arrival angle of the transmit beam;
– receiving satellite beam covers equatorial or sub-tropical countries;
– on-axis receive gain in the equatorial plane, i.e. low arrival angle of the receive beam;
– orbital separation of 162.4 degrees appreciable receive gain in the equatorial plane, i.e. low arrival angle of the receive beam.

For this reason, the equatorial-limb case could avoid potential harmful interference with mitigation techniques, such as keeping arrival angles to service areas above 20°, and reducing the amount of spill over power transmitted towards the orbital arc. Additionally, one possible solution to address potential interference could be through coordination. With that, the result of the studies proposes the modifications of Article 7 of RR Appendix **30A.**

4/1.19/3.3.1.2 Study 2: GSO FSS – transmitting space station versus BSS – receiving earth station

The FSS (space-to-Earth) and BSS coexist in Region 2 in the immediate adjacent upper frequency band 17.7-17.8 GHz. Both services coordinate according to the provisions under RR No. **9.7** and the coordination threshold that triggers the coordination is defined in RR Appendix **5**, Table 5-1 (8° of orbital arc). Considering that both services are compatible and can coexist.

4/1.19/3.3.1.3 Study 3: BSS feeder link AP30A – transmitting earth station versus GSO FSS – receiving earth station

For BSS feeder link RR Appendix **30A** earth stations with respect to FSS receiving earth stations under WRC-23 agenda item 1.19, coordination under RR No. **9.17A** would be required. It is important to note that the ITU-R would have to develop an agreed methodology and protection criteria to be implemented under RR No. **9.17A**. A possible approach could be to take by extension similar parameters that are used in Table 9b of RR Appendix **7** for the adjacent frequency band 17.7-18.4 GHz and to use RR Appendix **7** methodology.

On the other hand, in Region 1, RR No. **5.516A** establishes that "in the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Region 1 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under RR Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link".

4/1.19/3.3.1.4 Study 4: BSS – transmitting space station versus GSO FSS – receiving earth station

The FSS (space-to-Earth) and BSS coexist in Region 2 in the immediate adjacent upper frequency band 17.7-17.8 GHz. Both services need to coordinate according to the provisions under RR No. **9.7** and the coordination threshold that triggers the coordination is defined in RR Appendix **5**, Table 5-1 (8° of orbital arc).

4/1.19/3.3.1.5 Study 5: BSS – transmitting space station versus non-GSO FSS – receiving earth station

RR No. **22.2** establishes that non-geostationary-satellite systems shall not cause unacceptable interference to and, unless otherwise specified in these Regulations, shall not claim protection from geostationary-satellite networks in the broadcasting-satellite service operating in accordance with these Regulations.

4/1.19/3.3.1.6 Study 6: BSS feeder link AP30A – transmitting earth station versus non-GSO FSS – receiving earth station

For BSS feeder link RR Appendix **30A** earth stations with respect to FSS receiving earth stations under WRC-23 agenda item 1.19, coordination under RR No. **9.17A** would be required. It is important to note that the ITU-R would have to develop an agreed methodology and protection criteria to be implemented under RR No. **9.17A**. A possible approach could be to take by extension similar parameters that are used in Table 9b of RR Appendix **7** for the adjacent frequency band 17.7-18.4 GHz and to use RR Appendix **7** methodology.

On the other hand, in Region 1, RR No. **5.516A** establishes that "in the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Region 1 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under RR Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link".

4/1.19/3.3.1.7 Study 7: non-GSO FSS – transmitting space station versus GSO FSS – receiving earth station

RR No. **22.2** applies and as such non-geostationary-satellite systems shall not cause unacceptable interference to and shall not claim protection from geostationary-satellite networks in the FSS and the BSS.

4/1.19/3.3.1.8 Study 8: non-GSO FSS – transmitting space station versus BSS feeder link AP30A – receiving space station

Under the provision RR No. **22.5F**, which ensures protection of GSO space station receivers from interference produced by non-geostationary space stations, the equivalent power flux-density limits of RR Table **22-3** in the frequency band 17.8-18.4 GHz for intersatellite operations, $epfd_{is}$, produced at any point in the geostationary-satellite orbit by emissions from all FSS space stations in a non-geostationary-satellite system could be extended to the frequency band 17.3-18.4 GHz in Region 2.

4/1.19/3.3.1.9 Study 9: non-GSO FSS – transmitting space station versus BSS – receiving earth station

The equivalent power flux-density, epfd↓ limits defined in RR No. **22.5C** will ensure protection of GSO receiving earth stations in the BSS from interference of non-GSO transmissions by extending the application of the epfd↓ limits defined in RR Table **22-1B** to the new FSS allocation in the frequency band 17.3-17.7 GHz.

4/1.19/3.3.2 Summary of the sharing and compatibility studies with the 17.2-17.3 GHz frequency band

4/1.19/3.3.2.1 Study 10: GSO FSS – transmitting space station versus EESS (active)

Based on studies, the GSO FSS satellite downlink operating in the frequency band 17.3-17.7 GHz would be compatible with the EESS (active) spaceborne sensor operating in the frequency band 17.2-17.3 GHz. For a SAR type EESS (active) application, given worst-case assumptions, dynamic simulation indicates that the maximum aggregate I/N never exceeds −45.35 dB (for 100% of the time), therefore the protection criteria of I/N of −6 dB for 99% of the time is always met.

4/1.19/3.3.2.2 Study 11: GSO FSS – transmitting space station versus RLS

According to the margin between the estimated I/N and the protection criteria value of −6 dB, the result of the studies concluded that compatibility between a new GSO FSS (space-to-Earth) allocation in Region 2 in the frequency band 17.3-17.7 GHz, with respect to a radiolocation system operating in the adjacent frequency band 15.4-17.3 GHz, is feasible.

4/1.19/3.3.2.3 Study 12: GSO FSS – transmitting space station versus SRS (active)

In the adjacent frequency band 17.2-17.3 GHz, no study was performed with a GSO FSS transmitter and an SRS (active) receiver, as no typical SRS characteristics were provided.

4/1.19/3.3.2.4 Study 13: non-GSO FSS – transmitting space station versus EESS (active)

Based on assumptions of FSS stations and deployment scenario parameters in this study, results indicate that the non-GSO FSS satellite downlink operating in the frequency band 17.3-17.7 GHz would be compatible with the EESS (active) spaceborne sensor operating in the frequency band 17.2-17.3 GHz. Based on the worst-case assumptions for a SAR type EESS (active) application, the dynamic simulation indicates that the maximum aggregate I/N never exceeds −19.35 dB (for 100% of the time) and therefore always meets the protection criteria of I/N of −6 dB for 99% of the time.

4/1.19/3.3.2.5 Study 14: non-GSO FSS – transmitting space station versus RLS

The results of the analysis indicate that for a typical LEO and MEO non-GSO FSS (space-to-Earth) system the protection criteria value of −6 dB with respect to a radiolocation system operating in the frequency band 15.4-17.3 GHz is always met for the six radiolocation systems studied.

4/1.19/3.3.2.6 Study 15: non-GSO FSS – transmitting space station versus SRS (active)

In the adjacent frequency band 17.2-17.3 GHz, no study was performed with a non-GSO FSS transmitter and an SRS (active) receiver, as no typical SRS characteristics were provided.

4/1.19/3.3.2.7 Study 16: GSO FSS – transmitting space station versus FS[25]

In the adjacent frequency band 17.2-17.3 GHz, no studies were performed with GSO FSS and terrestrial services, as no characteristics for the FS were provided.

4/1.19/3.3.2.8 Study 17: non-GSO FSS – transmitting space station versus FS[25]

In the adjacent frequency band 17.2-17.3 GHz, no studies were performed with non-GSO FSS and terrestrial services, as no characteristics for the fixed service were provided.

4/1.19/3.3.2.9 Study 18: GSO FSS – transmitting space station versus MS[25]

In the adjacent frequency band 17.2-17.3 GHz, no studies were performed with GSO FSS and terrestrial services, as no characteristics for the mobile service were provided.

4/1.19/3.3.2.10 Study 19: non-GSO FSS – transmitting space station versus MS[25]

In the adjacent frequency band 17.2-17.3 GHz, no studies were performed with non-GSO FSS and terrestrial services, as no characteristics for the mobile service were provided.

4/1.19/3.3.3 Summary of the sharing and compatibility studies with the 17.7-17.8 GHz frequency band

4/1.19/3.3.3.1 Study 20: GSO FSS – transmitting space station versus FSS – receiving earth station

In Region 2, there is a primary FSS allocation in the adjacent frequency band 17.7-20.2 GHz, used by a number of existing satellite operators. The potential for interference from FSS (space-to-Earth) operating in frequency band 17.3-17.7 GHz to FSS services in the frequency band 17.7-20.2 GHz, would be mitigated by the use of appropriate equipment design standards. For example, the FSS in the frequency band 17.7-20.2 GHz already uses these standards to protect the adjacent frequency band 17.3-17.7 GHz satellite services and the same mechanisms can be used for the reverse case of this new allocation in the frequency band 17.3-17.7 GHz. In addition, extending the allocation to the FSS (space-to-Earth) to the frequency band 17.3-20.2 GHz will allow coordination under RR Article **9** where frequency overlap occurs. For these reasons, no studies are presented for this section.

4/1.19/3.3.3.2 Study 21: non-GSO FSS – transmitting space station versus FSS – receiving earth station

In Region 2, there is a primary FSS allocation in the adjacent frequency band 17.7-20.2 GHz, used by a number of existing satellite operators. The potential for interference from the FSS (space-to-

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[25] The frequency band 15.7-17.3 GHz is allocated to the mobile and fixed services on a primary basis in some countries in accordance with RR No. **5.512**.

Earth) operating in the frequency band 17.3-17.7 GHz to the FSS services in the frequency band 17.7-20.2 GHz, would be mitigated by the use of appropriate equipment design standards. For example, the FSS in the frequency band 17.7-20.2 GHz already uses these standards to protect the adjacent frequency band 17.3-17.7 GHz satellite services and these same mechanisms can be used for the reverse case of this new allocation 17.3-17.7 GHz. In addition, extending the allocation to the FSS (space-to-Earth) to the frequency band 17.3-20.2 GHz will allow coordination under RR Article **9** where frequency overlap occurs. For these reasons, no studies are presented for this section.

4/1.19/3.3.3.3 Study 22: GSO FSS – transmitting space station versus BSS feeder link AP30A – receiving space station

In Region 2, there is a primary RR Appendix **30A** allocation in the adjacent frequency band 17.7-17.8 GHz, used by a number of existing satellite operators. The potential of interference from the FSS (space-to-Earth) operating in the frequency band 17.3-17.7 GHz to the RR Appendix **30A** services in the frequency band 17.7-17.8 GHz, would be mitigated by the use of appropriate equipment design standards. For example, the FSS in the frequency band 17.8-20.2 GHz already uses these standards to protect the adjacent frequency band 17.7-17.8 GHz RR Appendix **30A** satellite services and these same mechanisms can be used for the reverse case of this new allocation 17.3-17.7 GHz. In addition, extending the allocation to the FSS (space-to-Earth) to the frequency band 17.3-20.2 GHz will allow coordination under RR Article **9** where frequency overlap occurs. For these reasons, no studies are presented for this section.

4/1.19/3.3.3.4 Study 23: non-GSO FSS – transmitting space station versus BSS feeder link AP30A – receiving space station

In Region 2, there is a primary RR Appendix **30A** allocation in the adjacent frequency band 17.7-17.8 GHz, used by a number of existing satellite operators. The potential of interference from the FSS (space-to-Earth) operating in frequency band 17.3-17.7 GHz to the RR Appendix **30A** services in the frequency band 17.7-17.8 GHz, would be mitigated by the use of appropriate equipment design standards. For example, the FSS in the frequency band 17.8-20.2 GHz already uses these standards to protect the adjacent frequency band 17.7-17.8 GHz RR Appendix **30A** satellite services and these same mechanisms can be used for the reverse case of this new allocation 17.3-17.7 GHz. In addition, extending the allocation to the (space-to-Earth) to the frequency band 17.3-20.2 GHz will allow coordination under RR Article **9** where frequency overlap occurs. For these reasons, no studies are presented for this section.

4/1.19/3.3.3.5 Study 24: GSO FSS – transmitting space station versus BSS – receiving earth station

In Region 2, there is a primary BSS allocation in the adjacent frequency band 17.7-17.8 GHz, used by a number of existing satellite operators. The potential of interference from the FSS (space-to-Earth) operating in the frequency band 17.3-17.7 GHz to the BSS services in the frequency band 17.7-17.8 GHz, would be mitigated by the use of appropriate equipment design standards. For example, the FSS in the frequency band 17.8-20.2 GHz already uses these standards to protect the adjacent frequency band 17.7-17.8 GHz BSS satellite services and these same mechanisms can be used for the reverse case of this new allocation 17.3-17.7 GHz. In addition, extending the allocation to the FSS (space-to-Earth) to the frequency band 17.3-20.2 GHz will allow coordination under RR Article **9** where frequency overlap occurs. For these reasons, no studies are presented for this section.

4/1.19/3.3.3.6 Study 25: non-GSO FSS – transmitting space station versus BSS – receiving earth station

In Region 2, there is a primary BSS allocation in the adjacent frequency band 17.7-17.8 GHz, used by a number of existing satellite operators. The potential of interference from the FSS (space-to-Earth) operating in the frequency band 17.3-17.7 GHz to the BSS services in the frequency band 17.7-17.8 GHz, would be mitigated by the use of appropriate equipment design standards. For example, the FSS in the frequency band 17.8-20.2 GHz already uses these standards to protect the adjacent frequency band 17.7-17.8 GHz BSS satellite services and these same mechanisms can be used for the reverse case of this new allocation 17.3-17.7 GHz. In addition, extending the allocation to the FSS (space-to-Earth) to the frequency band 17.3-20.2 GHz will allow coordination under RR Article **9** where frequency overlap occurs. For these reasons, no studies are presented for this section.

4/1.19/3.3.3.7 Study 26: GSO FSS – transmitting space station versus FS

According to the estimated I/N and the protection criteria value of −20 dB for all cases and links and all the scenarios where worst-case assumptions have been adopted, it can be concluded that compatibility between a new GSO FSS (space-to-Earth) allocation in Region 2 in the frequency band 17.3-17.7 GHz with respect to FS systems operating in adjacent frequency bands, is feasible.

4/1.19/3.3.3.8 Study 27: non-GSO FSS – transmitting space station versus FS

In the first study based on a non-GSO constellation of 38 satellites in MEO orbit, with the various assumptions and parameters contained for the methodology used, including a maximum per satellite pfd of −119 dB(W/(m^2 · MHz)) for all satellites visible at the fixed station based on angles of arrival greater than 5 degrees, the dynamic simulation indicates margins of 12.1 dB and 17 dB for the long-term criteria for the FS antenna types of 31.5 dBi and 48 dBi gain, respectively. Similarly, margins of 21.8 to 24.2 dB for the 31.5 dBi FS type and 8.1 to 9.45 dB for the 48 dBi FS type were computed for the short-term criteria of +14 dB and 18 dB respectively.

In the second study based on a non-GSO constellation of 3 236 satellites in LEO orbit, with the various assumptions and parameters contained for the methodology used, including the maximum per satellite pfd of −114 dB(W/(m^2 · MHz)) for all satellites visible at the fixed station based on angles of arrival of greater than 25 degrees, the dynamic simulation indicates margins of 59.8 dB and 29.9 dB for the long-term criteria for the FS antenna types of 31.5 dBi and 48 dBi gain, respectively. Margins of 26.4 to 29.4 dB for the 31.5 dBi FS type and 16.1 to 18.3 dB for the 48 dBi FS type were computed for the short-term criteria of +14 dB and 18 dB respectively.

4/1.19/3.3.3.9 Study 28: GSO FSS – transmitting space station versus MS

In the adjacent frequency band 17.7-17.8 GHz, no studies were performed with GSO FSS and the MS, as no characteristics for the mobile service were provided.

4/1.19/3.3.3.10 Study 29: non-GSO FSS – transmitting space station versus MS

In the adjacent frequency band 17.7-17.8 GHz, no studies were performed with non-GSO FSS and the MS, as no characteristics for the mobile service were provided.

4/1.19/4 Methods to satisfy the agenda item

4/1.19/4.1 Method A

Under this method, no change is proposed to the RR and the suppression of Resolution **174 (WRC-19)**.

4/1.19/4.2 Method B

Modify footnotes in RR Article **5** that refer to the allocation of the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction and the suppression of Resolution **174 (WRC-19)**.

To address the new FSS allocation in the space-to-Earth direction, a modification to the Table of Frequency Allocations in Region 2, in the frequency band 17.3-17.7 GHz, is proposed.

To address the coordination between the FSS (space-to-Earth) in Region 2 and the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix **30A**, this method proposes modifications to Article 7 of RR Appendix **30A**, to RR Article **22** and extend the coordination procedure (RR No. **9.7**) that currently applies to similar services in Region 2 in the contiguous adjacent upper frequency band 17.7-17.8 GHz, by modifying RR Appendix **5**.

Furthermore, this method contains two alternatives for several items to provide a wide range of options. The selection of Alternative 1 for all the items extends provisions used in Region 1 to Region 2, as well as the addition of other provisions, while the selection of Alternative 2 for all items results in more conservative conditions with the objective to provide further protection of the BSS feeder link AP30A receiving space station and GSO FSS system.

In order to avoid potential unacceptable interference to the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix **30A**, this method proposes some conditions for the operation of FSS (space-to-Earth) in Region 2 if Alternative 2 is selected in relevant items. Based on that Region 2 FSS requires to comply with a pfd limit at the edge of Earth’s surface by modifying Annex 4 to RR Appendix **30A**.This limitation would result in producing a low pfd value over portions of the Earth's surface with a very low receiving elevation angle which is also consistent with the mitigation technique outlined for the equatorial-limb case in Study 1. According to another item when Alternative 2 is being selected, Region 2 FSS, requires obtaining the explicit agreement of the affected administrations which have indicated disagreement (RR No. **11.41** does not apply) as well as those who fail to reply or to give a decision within the regulatory deadline (RR Nos. **9.60** to **9.62** do not apply) by adding a new provision in Article 7 to RR Appendix **30A**.

In addition to the above-mentioned procedure it is proposed in Alternative 1 to modify RR No. **5.516A** by adding Region 2 in this footnote. In Alternative 2, in order to ensure the protection of space stations receivers operating under RR Appendix **30A**, it is proposed to also add to RR No. **5.516A** a text indicating that in Region 2, the use of the fixed-satellite service in the frequency band 17.3-17.7 GHz shall not cause unacceptable interference to the space station receivers of the BSS feeder link in Regions 1 and 3 operating and those to be operated in the future under RR Appendix **30A**; if such interference occurs the notifying administration of the FSS shall immediately eliminate this unacceptable interference.

To address the coordination between the FSS (space-to-Earth) and the BSS (space-to-Earth), no modifications to the RR are required, since the RR Article **9** coordination triggers are already contained in the RR Appendix **5**, Table 5-1.

4/1.19/4.3 Method C

Modify footnotes in RR Article **5** that refer to the allocation of the frequency band 17.3-17.7 GHz in Region 2 to the GSO FSS in the space-to-Earth direction and the suppression of Resolution **174 (WRC-19)**.

To address the new FSS allocation in the space-to-Earth direction, a modification to the Table of Frequency Allocations in Region 2, in the frequency band 17.3-17.7 GHz, is proposed.

To address the compatibility between earth stations of the FSS (space-to-Earth) in Region 2 and the BSS feeder-link earth stations operating under RR Appendix **30A**, this method proposes to modify RR No. **5.516A** by extending its application to Region 2. These modified footnotes including Region 2 also indicate that earth stations of the FSS (space-to-Earth) in Region 2 shall not claim protection from the BSS service feeder-link earth stations operating under RR Appendix **30A**, nor put any limitations or restrictions on the locations of the BSS feeder-link earth stations anywhere within the service area of the feeder link.

To address the coordination between the FSS (space-to-Earth) in Region 2 and the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix **30A**, this method proposes modifications to Article 7 of RR Appendix **30A**, to RR Article **22** and extend the coordination procedure (RR No. **9.7**) that currently applies to similar services in Region 2 in the contiguous adjacent upper frequency band 17.7-17.8 GHz, by modifying RR Appendix **5**.

In addition to the above-mentioned procedure it is proposed in Alternative 1 to modify RR No. **5.516A** by adding Region 2 in this footnote. In Alternative 2, in order to ensure the protection of space stations receivers operating under RR Appendix **30A**, it is proposed to also add to RR No. **5.516A** a text indicating that in Region 2, the use of the fixed-satellite service in the frequency band 17.3-17.7 GHz shall not cause unacceptable interference to the space station receivers of the BSS feeder link in Regions 1 and 3 operating and those to be operated in the future under RR Appendix **30A**; if such interference occurs the notifying administration of the FSS shall immediately eliminate this unacceptable interference.

To address the coordination between the FSS (space-to-Earth) and the BSS (space-to-Earth), no modifications to the RR are required, since the RR Article **9** coordination triggers are already contained in the RR Appendix **5**, Table 5-1.

4/1.19/4.4 Method D

Modify footnotes in RR Article **5** that refer to the allocation of the frequency band 17.3-17.7 GHz in Region 2 to the FSS in the space-to-Earth direction and the suppression of Resolution **174 (WRC-19)**.

To address the new FSS allocation in the space-to-Earth direction, a modification to the Table of Frequency Allocations in Region 2, in the frequency band 17.3-17.7 GHz, is proposed.

To address the compatibility between earth stations of the FSS (space-to-Earth) in Region 2 and the BSS feeder-link earth stations operating under RR Appendix **30A**, this method proposes to modify RR No. **5.516A** by extending its application to Region 2. These modified footnotes including Region 2 also indicate that earth stations of the FSS (space-to-Earth) in Region 2 shall not claim protection from the BSS service feeder-link earth stations operating under RR Appendix **30A**, nor put any limitations or restrictions on the locations of the BSS feeder-link earth stations anywhere within the service area of the feeder link.

To address the coordination between the FSS (space-to-Earth) in Region 2 and the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix **30A**, this method proposes modifications to Article 7 of RR Appendix **30A**, to RR Article **22** and extend the coordination procedure (RR No. **9.7**) that currently applies to similar services in Region 2 in the contiguous adjacent upper frequency band 17.7-17.8 GHz, by modifying RR Appendix **5**.

In addition to the above-mentioned procedure it is proposed in Method D to modify RR No. **5.516A** by adding Region 2 in this footnote and also proposed footnote RR No. **22.5F.Y**, for which "non-geostationary-satellite system operating in Region 2 shall meet the limits" to protect a receiving space station in the broadcasting-satellite feeder link of RR Appendix **30A**.

To address the coordination between the FSS (space-to-Earth) and the BSS (space-to-Earth), modifications to RR No. **5.517** extend the applicability to the frequency range 17.3-17.8 GHz.

Finally, the modification to include the frequency range 17.3-17.7 GHz for Region 2, with respect to footnote RR No. **5.484A** address the coordination of non-GSO FSS vis-à-vis other non-GSO and GSO FSS systems and networks. Additionally, the extension of the frequency range 17.3-17.7 GHz for Region 2, with respect to RR Article **22** limits found in RR Tables **22-1B** and **22-3** addresses and ensures the protection of BSS and AP**30A** feeder link services, respectively.

4/1.19/5 Regulatory and procedural considerations

4/1.19/5.1 For Method A

NOC

ARTICLES

NOC

APPENDICES

SUP

RESOLUTION 174 (WRC-19)

Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2

4/1.19/5.2 For Method B

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

15.4-18.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
17.3-17.7 FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) MOD 5.516A 5.516B Radiolocation 5.514	**17.3-17.7** FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) MOD 5.484A MOD 5.516A MOD 5.517 BROADCASTING-SATELLITE Radiolocation 5.514 5.515	**17.3-17.7** FIXED-SATELLITE (Earth-to-space) 5.516 Radiolocation 5.514

Reasons: Introduce the FSS (space-to-Earth) allocation in the frequency band 17.3-17.7 GHz in Region 2 and apply RR Nos. **5.516A** and **5.517** to this new allocation. Also, RR No. **5.484A** is modified to extend the use of the frequency band 17.3-17.7 GHz (space-to-Earth) in Region 2, for application of the provisions of RR No. **9.12** for non-GSO satellite systems and priority with relation with GSO FSS.

4/1.19/5.2.1 For Method B, Alternative 1 for the MOD RR No. 5.516A

MOD

5.516A In the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Region 1 and Region 2 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link. (WRC-~~03~~23)

Reasons: Extend the applicability of this footnote to Region 2.

4/1.19/5.2.2 For Method B, Alternative 2 for the MOD RR No. 5.516A

MOD

5.516A In the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Regions 1 and 2 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link. In Region 2, the use of the fixed-satellite service in the band 17.3-17.7 GHz shall not cause unacceptable interference to the space station receivers of the broadcasting-satellite service feeder link in Regions 1 and 3 operating and those to be operated in the future under

Appendix **30A**; upon receipt of a report of unacceptable interference, the notifying administration of the fixed-satellite service shall immediately eliminate or reduce interference to an acceptable level. In order to implement the commitment with regard to fixed-satellite service allocation in Region 2, the notifying administration of the fixed-satellite service at the time of notification under Article **11** of the Radio Regulations, submitting Appendix **4** information to ITU shall also provide a firm commitment that in the case of unacceptable interference undertake to immediately cease emission or reduce the interference to an acceptable level and that the fixed-satellite service system is capable to make this commitment immediately. (WRC-~~03~~23)

Reasons: Extend the applicability of this footnote to Region 2 and ensure the protection of receiving space stations operating under RR Appendix **30A** and to implement the commitment set out in RR No. **5.516A**.

4/1.19/5.2.3 For Method B, No. 5.484A, No. 5.517 and Article 22

MOD

5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.3-17.7 GHz (space-to-Earth) in Region 2, 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by a non-geostationary-satellite system in the fixed-satellite service is subject to application of the provisions of No. **9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and No. **5.43A** does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated. (WRC-~~2000~~23)

Reasons: Extend the applicability of this footnote to the frequency band 17.3-17.7 GHz in Region 2.

MOD

5.517 In Region 2, use of the fixed-satellite (space-to-Earth) service in the band ~~17.7~~17.3-17.8 GHz shall not cause harmful interference to nor claim protection from assignments in the broadcasting-satellite service operating in conformity with the Radio Regulations. (WRC-~~07~~23)

Reasons: Extend the applicability of the frequency ranges in this footnote to Region 2.

ARTICLE 22

Space services[1]

Section II − Control of interference to geostationary-satellite systems

4/1.19/5.2.4 For Method B, Alternative 1 for the MOD Table 22-1B

MOD

TABLE **22-1B** (WRC-~~03~~23)

Limits to the epfd↓ radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands[3, 6, 8, X]

Frequency band (GHz)	epfd↓ (dB(W/m^2))	Percentage of time during which epfd↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter and reference radiation pattern[7]
17.8-18.6	−175.4 −175.4 −172.5 −167 −164 −164	0 90 99 99.714 99.971 100	40	1 m Recommendation ITU-R S.1428-1
	−161.4 −161.4 −158.5 −153 −150 −150	0 90 99 99.714 99.971 100	1 000	
	−178.4 −178.4 −171.4 −170.5 −166 −164 −164	0 99.4 99.9 99.913 99.971 99.977 100	40	2 m Recommendation ITU-R S.1428-1
	−164.4 −164.4 −157.4 −156.5 −152 −150 −150	0 99.4 99.9 99.913 99.971 99.977 100	1 000	
	−185.4 −185.4 −180 −180 −172 −164 −164	0 99.8 99.8 99.943 99.943 99.998 100	40	5 m Recommendation ITU-R S.1428-1
	−171.4 −171.4 −166 −166 −158 −150 −150	0 99.8 99.8 99.943 99.943 99.998 100	1 000	

ADD

[X] **22.5C.X** In Region 2, a non-geostationary-satellite system in the fixed-satellite service shall meet the limits of this table for the 17.3-17.7 GHz band with respect to geostationary-satellite systems in the broadcasting-satellite service and shall utilize the reference patterns of Recommendation ITU-R BO.1443-3. (WRC-23)

Reasons: From a regulatory perspective, the use of the word "shall" is required. As well, the limits were derived using antenna reference patterns of a specific version of the Recommendation. For non-GSO systems operating in Region 2, extend the applicability of RR Table **22-1B** epfd limits to the frequency band 17.3-17.7 GHz to protect BSS services globally. The BSS earth station antenna pattern is already incorporated by reference in the Recommendation ITU-R S.1503 methodology and is correctly stated in this footnote.

4/1.19/5.2.5 For Method B, Alternative 2 for the MOD Table 22-1B

MOD

TABLE **22-1B** (WRC-~~03~~23)

Limits to the epfd↓ radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands[3, 6, 8, X]

Frequency band (GHz)	**epfd↓ (dB(W/m²))**	**Percentage of time during which epfd↓ may not be exceeded**	**Reference bandwidth (kHz)**	**Reference antenna diameter and reference radiation pattern**[7]
17.8-18.6; 17.3-17.7 in Region 2	−175.4 −175.4 −172.5 −167 −164 −164	0 90 99 99.714 99.971 100	40	1 m Recommendation ITU-R S.1428-1
	−161.4 −161.4 −158.5 −153 −150 −150	0 90 99 99.714 99.971 100	1 000	
	−178.4 −178.4 −171.4 −170.5 −166 −164 −164	0 99.4 99.9 99.913 99.971 99.977 100	40	2 m Recommendation ITU-R S.1428-1
	−164.4 −164.4 −157.4 −156.5 −152 −150 −150	0 99.4 99.9 99.913 99.971 99.977 100	1 000	
	−185.4 −185.4 −180	0 99.8 99.8	40	

Frequency band (GHz)	epfd↓ (dB(W/m²))	Percentage of time during which epfd↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter and reference radiation pattern[7]
	−180 −172 −164 −164	99.943 99.943 99.998 100		5 m Recommendation ITU-R S.1428-1
	−171.4 −171.4 −166 −166 −158 −150 −150	0 99.8 99.8 99.943 99.943 99.998 100	1 000	

Reasons: Extend the applicability of RR Table **22-1B** epfd limits to the frequency band 17.3-17.7 GHz for the protection of RR Appendix **30A** and other geostationary-satellite systems.

ADD

[X] **22.5C.X** In Region 2, a non-geostationary-satellite system in the fixed-satellite service shall meet the limits of this table for the 17.3-17.7 GHz band with respect to geostationary-satellite systems in the broadcasting-satellite service and shall utilize the reference patterns of Recommendation ITU-R BO.1443-3. (WRC-23)

Reasons: From a regulatory perspective, the use of the word "shall" is required. As well, the limits were derived using antenna reference patterns of a specific version of the Recommendation. For non-GSO systems operating in Region 2, extend the applicability of RR Table **22-1B** epfd limits to the frequency band 17.3-17.7 GHz to protect BSS services globally. The BSS earth station antenna pattern is already incorporated by reference in the Recommendation ITU-R S.1503 methodology and is correctly stated in this footnote.

4/1.19/5.2.6 For Method B, in addition to one of the Alternatives

MOD

TABLE **22-3** (WRC-~~2000~~23)

Limits to the $epfd_{is}$ radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands[19, Y]

Frequency band (GHz)	$epfd_{is}$ (dB(W/m²))	Percentage of time during which $epfd_{is}$ level may not be exceeded	Reference bandwidth (kHz)	Reference antenna beamwidth and reference radiation pattern[20]
10.7-11.7 (Region 1) 12.5-12.75 (Region 1) 12.7-12.75 (Region 2)	−160	100	40	4° Recommendation ITU-R S.672-4, *Ls* = −20

17.8-18.4	−160	100	40	4° Recommendation ITU-R S.672-4, $Ls = -20$

Reasons: Extend the applicability of RR Table **22-3** epfd limits to the frequency band 17.3-17.7 GHz for the protection of RR Appendix **30A**.

4/1.19/5.2.7 For Method B, Alternative 1 for the ADD RR No. 22.5F.Y

ADD

Y **22.5F.Y** In Region 2, a non-geostationary-satellite system in the fixed-satellite service shall meet the limits of this table for the frequency band 17.3-17.7 GHz with respect to a receiving space station in the fixed-satellite service of Appendix **30A**. (WRC-23)

Reasons: There is no need to specify all regions as they are already specified in RR Appendix **30A**. In addition, meeting the limits of this table will ensure protection for all feeder link stations.

4/1.19/5.2.8 For Method B, Alternative 2 for the ADD RR No. 22.5F.Y

ADD

Y **22.5F.Y** A non-geostationary-satellite system operating in Region 2, at any position in the orbit, shall meet the limits of this table for the 17.3-17.7 GHz band with respect to a receiving space station in the broadcasting-satellite feeder link of Appendix **30A**, in all three Regions. (WRC-23)

Reasons: There are two aspects regarding epfd, one is the areas where a non-geostationary satellite is located as the source of possible interference. This area is interpreted as all positions in non-GSO orbit. The other is the area that needs to be protected and is interpreted as the whole part of the GSO orbit. By this understanding, a non-geostationary-satellite system operating in Region 2 shall meet the epfd limits of this table for the 17.3-17.7 GHz band at any position in the orbit with respect to all receiving space station in the broadcasting-satellite feeder link of RR Appendix **30A**.

4/1.19/5.2.9 For Method B, Alternative 1 for the MOD Table 22-4B

For Alternative 1, no change is proposed to RR Table **22-4B**.

4/1.19/5.2.10 For Method B, Alternative 2 for the MOD Table 22-4B

MOD

TABLE **22-4B** (WRC-~~2000~~23)

Operational limits to the epfd↓ radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands[21, 25]

Frequency band (GHz)	epfd↓ (dB(W/m^2))	Percentage of time during which epfd↓ may not be exceeded	Reference bandwidth (kHz)	Geostationary-satellite system receive earth station antenna gain (dBi)	Orbital inclination of geostationary satellite (degrees)
19.7-20.2	−157 −157 −155	100 100 100	40 40 40	≥ 49 ≥ 43 [25] ≥ 49	≤ 2.5 ≤ 2.5 > 2.5 and ≤ 4.5
19.7-20.2	−143 −143 −141	100 100 100	1 000 1 000 1 000	≥ 49 ≥ 43 [25] ≥ 49	≤ 2.5 ≤ 2.5 > 2.5 and ≤ 4.5
17.8-18.6; 17.3-17.7 in Region 2	−164 −162	100 100	40 40	≥ 49 ≥ 49	≤ 2.5 > 2.5 and ≤ 4.5
17.8-18.6; 17.3-17.7 in Region 2	−150 −148	100 100	1 000 1 000	≥ 49 ≥ 49	≤ 2.5 > 2.5 and ≤ 4.5

Reasons: In order to fully protect geostationary satellites which have orbital inclination, extend the applicability of RR Table **22-4B** epfd limits to the frequency band 17.3-17.7 GHz.

4/1.19/5.2.11 For Method B, the MOD RR Appendix 30A and Appendix 5

APPENDIX 30A (REV.WRC-19)[*]

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Regions 1 and 2 in the frequency band 17.3-18.1 GHz and in Region~~s 2 and~~ 3 in the frequency band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in countries listed in Resolution 163 (WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution 164 (WRC-15) in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3 or in the frequency band 17.3-17.8 GHz in Region 2 are involved[28] (Rev.WRC-~~19~~23)

Section I – Coordination of transmitting space or earth stations in the fixed-satellite service or transmitting space stations in the broadcasting-satellite service with assignments to broadcasting-satellite service feeder links

MOD

7.1 The provisions of No. **9.7** and the associated provisions under Articles **9** and **11** are applicable to transmitting space stations in the fixed-satellite service in Regions 1 and 2 in the frequency band 17.3-18.1 GHz, to transmitting space stations in the fixed-satellite service in Region~~s 2 and~~ 3 in the frequency band 17.7-18.1 GHz, to transmitting earth stations in the fixed-satellite service in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to transmitting earth stations in the fixed-satellite service in countries listed in Resolution **163**

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29 (SUP – WRC-19)

(WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution **164 (WRC-15)** in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to transmitting space stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz. (WRC-~~19~~23)

4/1.19/5.2.12 For Method B, Alternative 1 for further MOD Article 7 to Appendix 30A and for MOD Annex 4 to Appendix 30A

In this alternative, the addition of a new provision RR No. **7.2.3** to Article 7 and changes in RR Appendix **30A**, Annex 4, are not required.

4/1.19/5.2.13 For Method B, Alternative 2 for further MOD Article 7 to Appendix 30A and for MOD Annex 4 to Appendix 30A

ADD

7.2.3 For the fixed-satellite service (space-to-Earth) in the bands 17.3-17.7 GHz (in Region 2), the course of action described in Nos. **9.60** to **9.62** and the provision No. **11.41** do not apply with respect to feeder links of an assignment in the Plan, List or proposed new or modified assignments in the List or an assignment intended to enter in the Regions 1 and 3 Plan. (WRC-23)

Reasons: In order to protect the feeder link of RR AP**30A**, it is proposed to establish obligation for obtaining the explicit agreement of the affected administrations (RR No. **11.41** does not apply) as well as those who fail to reply or to give a decision within the regulatory deadline (RR Nos. **9.60** to **9.62** do not apply).

ANNEX 4 (REV.WRC-19)

Criteria for sharing between services

MOD

1 Threshold values for determining when coordination is required between, on one hand, transmitting space stations in the fixed-satellite service or the broadcasting-satellite service and, on the other hand, a receiving space station in the feeder-link Plan or List or a proposed new or modified receiving space station in the List, in the frequency bands 17.3-18.1 GHz (Regions 1 and 3) and in the feeder-link Plan or a proposed modification to the Plan in the frequency band 17.3-17.8 GHz (Region 2) (WRC-~~03~~23)

In addition to the need to comply with the following coordination criteria, under assumed free-space propagation conditions, the power flux-density of an assignment in the fixed-satellite service (space to-Earth) in the frequency band 17.3-17.7 GHz in Region 2 shall not exceed the value of −147 dB(W/(m^2 · 27 MHz)) at the edge of Earth's surface. (WRC-23)

With respect to § 7.1, Article 7, coordination of a transmitting space station in the fixed-satellite service or in the broadcasting-satellite service with a receiving space station in a broadcasting-satellite service feeder link in the Regions 1 and 3 feeder-link Plan or List, or a proposed new or modified receiving space station in the List, or in the Region 2 feeder-link Plan or proposed modification to the Plan is required when the power flux-density arriving at the receiving space station of a broadcasting-satellite service feeder link of another administration would cause an increase in the noise temperature of the feeder-link space station which exceeds a threshold value of $\Delta T_s/T_s$ corresponding to 6%. $\Delta T_s/T_s$ is calculated in accordance with Case II of the method given in Appendix **8**. (WRC-03)

Reasons: The purpose is to limit the pfd at the edge of Earth's surface in order to avoid potential unacceptable interference to the receiving BSS feeder-link (Earth-to-space) operating under RR Appendix **30A**. This would result in producing a low pfd value over portions of the Earth's surface with a very low receiving elevation angle which is also consistent with the mitigation technique outlined for the equatorial-limb case in Study 1.

4/1.19/5.2.14 For Method B, in addition to one of the alternatives

MOD

APPENDIX 5 (REV.WRC-~~19~~23)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

MOD

TABLE 5-1 (Rev.WRC-~~19~~23)

Technical conditions for coordination
(see Article **9**)

…

Reference of Article 9	**Case**	**Frequency bands (and Region) of the service for which coordination is sought**	**Threshold/condition**	**Calculation method**	**Remarks**
No. **9.7** GSO/GSO (*cont.*)		2*bis*) 13.4-13.65 GHz (Region 1)	i) Bandwidth overlap, and ii) any network in the space research service (SRS) or any network in the FSS and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±6° of the nominal orbital position of a proposed network in the FSS or SRS		
		3) 17.7-19.7 GHz, (Region~~s 2 and~~ 3), 17.3-19.7 GHz (Regions 1 and 2) and 27.5-29.5 GHz	i) Bandwidth overlap, and ii) any network in the FSS and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±8° of the nominal orbital position of a proposed network in the FSS		
		3*bis*) 19.7-20.2 GHz and 29.5-30 GHz	i) Bandwidth overlap, and ii) any network in the FSS or in the mobile-satellite service (MSS) and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±8° of the nominal orbital position of a proposed network in the FSS or in the MSS.		

…

Reasons: Covers the coordination of two GSO networks of the FSS (except earth stations operating in opposite directions of transmission) under RR No. **9.7**.

SUP

RESOLUTION 174 (WRC-19)

Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2

4/1.19/5.3 For Method C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

15.4-18.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
17.3-17.7 FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) MOD 5.516A 5.516B Radiolocation 5.514	**17.3-17.7** FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) ADD 5.XXX MOD 5.516A MOD 5.517 BROADCASTING-SATELLITE Radiolocation 5.514 5.515	**17.3-17.7** FIXED-SATELLITE (Earth-to-space) 5.516 Radiolocation 5.514

Reasons: Introduce the FSS (space-to-Earth) allocation in the frequency band 17.3-17.7 GHz in Region 2 and apply RR Nos. **5.516A** and **5.517** to this new allocation. Also, new footnote RR No. **5.XXX** to address that the FSS (space-to-Earth) allocation in the frequency band 17.3-17.7 GHz in Region 2 is limited to geostationary satellites.

4/1.19/5.3.1 For Method C, ADD RR No. 5.XXX

ADD

5.XXX The use of the band 17.3-17.7 GHz in Region 2 by systems in the fixed-satellite service (space-to-Earth) is limited to geostationary satellites. (WRC-23)

Reasons: As the frequency band 17.3-17.7 GHz in Region 3 is not allocated to FSS (space-to-Earth), it shall limit the systems to geostationary satellites.

4/1.19/5.3.2 For Method C, Alternative 1 for the MOD RR No. 5.516A

MOD

5.516A In the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Regions 1 and 2 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link. (WRC-~~03~~23)

Reasons: Extend the applicability of this footnote to Region 2.

4/1.19/5.3.3 For Method C, Alternative 2 for the MOD RR No. 5.516A

MOD

5.516A In the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Regions 1 and 2 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link. In Region 2, the use of the fixed-satellite service in the band 17.3-17.7 GHz shall not cause unacceptable interference to the space station receivers of the broadcasting-satellite service feeder link in Regions 1 and 3 operating and those to be operated in the future under Appendix **30A**; upon receipt of a report of unacceptable interference, the notifying administration of the fixed-satellite service shall immediately eliminate or reduce interference to an acceptable level. (WRC-~~03~~23)

Reasons: Extend the applicability of this footnote to Region 2 and ensure the protection of receiving space stations operating under RR Appendix **30A**.

4/1.19/5.3.4 For Method C, MOD RR No. 5.517

MOD

5.517 In Region 2, use of the fixed-satellite (space-to-Earth) service in the band ~~17.7~~17.3-17.8 GHz shall not cause harmful interference to nor claim protection from assignments in the broadcasting-satellite service operating in conformity with the Radio Regulations. (WRC-~~07~~23)

Reasons: Extend the applicability of the frequency ranges in this footnote to Region 2.

4/1.19/5.3.5 For Method C, the MOD RR Appendix 30A and Appendix 5

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Regions 1 and 2 in the frequency band 17.3-18.1 GHz and in Region~~s 2 and~~ 3 in the frequency band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in countries listed in Resolution 163 (WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution 164 (WRC-15) in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3 or in the frequency band 17.3-17.8 GHz in Region 2 are involved[28] (Rev.WRC-~~19~~23)

* The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. (WRC-03)

[1] The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

[2] This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

Section I – Coordination of transmitting space or earth stations in the fixed-satellite service or transmitting space stations in the broadcasting-satellite service with assignments to broadcasting-satellite service feeder links

MOD

7.1 The provisions of No. **9.7** and the associated provisions under Articles **9** and **11** are applicable to transmitting space stations in the fixed-satellite service in Regions 1 and 2 in the frequency band 17.3-18.1 GHz, to transmitting space stations in the fixed-satellite service in Region~~s 2 and~~ 3 in the frequency band 17.7-18.1 GHz, to transmitting earth stations in the fixed-satellite service in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to transmitting earth stations in the fixed-satellite service in countries listed in Resolution **163 (WRC-15)** in the frequency band 14.5-14.75 GHz and in countries listed in Resolution **164 (WRC-15)** in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to transmitting space stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz. (WRC-~~19~~23)

MOD

APPENDIX 5 (REV.WRC-~~19~~23)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

29 (SUP – WRC-19)

MOD

TABLE 5-1 (Rev. WRC-~~19~~23)

Technical conditions for coordination
(see Article **9**)

…

Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. **9.7** GSO/GSO (*cont.*)		2*bis*) 13.4-13.65 GHz (Region 1)	i) Bandwidth overlap, and ii) any network in the space research service (SRS) or any network in the FSS and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±6° of the nominal orbital position of a proposed network in the FSS or SRS		
		3) 17.7-19.7 GHz, (Region~~s 2 and~~ 3), 17.3-19.7 GHz (Regions 1 and 2) and 27.5-29.5 GHz	i) Bandwidth overlap, and ii) any network in the FSS and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±8° of the nominal orbital position of a proposed network in the FSS		
		3*bis*) 19.7-20.2 GHz and 29.5-30 GHz	i) Bandwidth overlap, and ii) any network in the FSS or in the mobile-satellite service (MSS) and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±8° of the nominal orbital position of a proposed network in the FSS or in the MSS.		

…

Reasons: Covers the coordination of two GSO networks of the FSS (except earth stations operating in opposite directions of transmission) under RR No. **9.7**.

SUP

RESOLUTION 174 (WRC-19)

Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2

4/1.19/5.4 For Method D

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

15.4-18.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
17.3-17.7 FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) MOD 5.516A 5.516B Radiolocation 5.514	**17.3-17.7** FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) MOD 5.484A MOD 5.516A MOD 5.517 BROADCASTING-SATELLITE Radiolocation 5.514 5.515	**17.3-17.7** FIXED-SATELLITE (Earth-to-space) 5.516 Radiolocation 5.514

Reasons: Introduce the FSS (space-to-Earth) allocation in the frequency band 17.3-17.7 GHz in Region 2 and apply RR Nos. **5.516A** and **5.517** to this new allocation. Also, RR No. **5.484A** is modified to extend the use of the frequency band 17.3-17.7 GHz (space-to-Earth) in Region 2, for application of the provisions of No. **9.12** for non-GSO satellite systems and priority with relation with GSO FSS.

MOD

5.516A In the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Region 1 and Region 2 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix **30A**, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link. (WRC-~~03~~23)

Reasons: Extend the applicability of this footnote to Region 2.

MOD

5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.3-17.7 GHz (space-to-Earth) in Region 2, 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by a non-geostationary-satellite system in the fixed-satellite service is subject to application of the provisions of No. **9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and No. **5.43A** does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated. (WRC-~~2000~~23)

Reasons: Extend the applicability of this footnote to the frequency band 17.3-17.7 GHz in Region 2.

MOD

5.517 In Region 2, use of the fixed-satellite (space-to-Earth) service in the band ~~17.7~~17.3-17.8 GHz shall not cause harmful interference to nor claim protection from assignments in the broadcasting-satellite service operating in conformity with the Radio Regulations. (WRC-~~07~~23)

Reasons: Extend the applicability of the frequency ranges in this footnote to Region 2.

ARTICLE 22

Space services[1]

Section II − Control of interference to geostationary-satellite systems

MOD

TABLE **22-1B** (WRC-~~03~~23)

Limits to the epfd↓ radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands[3, 6, 8, X]

Frequency band (GHz)	epfd↓ ($dB(W/m^2)$)	Percentage of time during which epfd↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter and reference radiation pattern[7]
17.8-18.6	−175.4 −175.4 −172.5 −167 −164 −164	0 90 99 99.714 99.971 100	40	1 m Recommendation ITU-R S.1428-1
	−161.4 −161.4 −158.5 −153 −150 −150	0 90 99 99.714 99.971 100	1 000	
	−178.4 −178.4 −171.4 −170.5 −166 −164 −164	0 99.4 99.9 99.913 99.971 99.977 100	40	2 m Recommendation ITU-R S.1428-1
	−164.4 −164.4 −157.4 −156.5 −152 −150 −150	0 99.4 99.9 99.913 99.971 99.977 100	1 000	
	−185.4 −185.4 −180 −180 −172 −164 −164	0 99.8 99.8 99.943 99.943 99.998 100	40	5 m Recommendation ITU-R S.1428-1
	−171.4 −171.4 −166 −166 −158 −150 −150	0 99.8 99.8 99.943 99.943 99.998 100	1 000	

ADD

X **22.5C.X** In Region 2, a non-geostationary-satellite system in the fixed-satellite service shall meet the limits of this table for the 17.3-17.7 GHz band with respect to geostationary-satellite systems in the broadcasting-satellite service and shall utilize the reference patterns of Recommendation ITU-R BO.1443-3. (WRC-23)

Reasons: From a regulatory perspective, the use of the word "shall" is required. As well, the limits were derived using antenna reference patterns of a specific version of the Recommendation. For non-GSO systems operating in Region 2, extend the applicability of RR Table **22-1B** epfd limits to the frequency band 17.3-17.7 GHz to protect BSS services globally. The BSS earth station antenna pattern is already incorporated by reference in the Recommendation ITU-R S.1503 methodology and is correctly stated in this footnote.

MOD

TABLE **22-3** (WRC-~~2000~~23)

Limits to the epfd$_{is}$ radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands[19, Y]

Frequency band (GHz)	epfd$_{is}$ (dB(W/m^2))	Percentage of time during which epfd$_{is}$ level may not be exceeded	Reference bandwidth (kHz)	Reference antenna beamwidth and reference radiation pattern[20]
10.7-11.7 (Region 1) 12.5-12.75 (Region 1) 12.7-12.75 (Region 2)	−160	100	40	4° Recommendation ITU-R S.672-4, *Ls* = −20
17.8-18.4	−160	100	40	4° Recommendation ITU-R S.672-4, *Ls* = −20

Reasons: Extend the applicability of RR Table **22-3** epfd limits to the frequency band 17.3-17.7 GHz for the protection of RR Appendix **30A**.

ADD

Y **22.5F.Y** In Region 2, a non-geostationary-satellite system in the fixed-satellite service shall meet the limits of this table for the frequency band 17.3-17.7 GHz with respect to a receiving space station in the fixed-satellite service of Appendix **30A**. (WRC-23)

Reasons: There is no need to specify all regions as they are already specified in RR Appendix **30A**. In addition, meeting the limits of this table will ensure protection for all feeder link stations.

APPENDIX 30A (REV.WRC-19)[*]

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Regions 1 and 2 in the frequency band 17.3-18.1 GHz and in Regions~~ 2 and~~ 3 in the frequency band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in countries listed in Resolution 163 (WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution 164 (WRC-15) in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3 or in the frequency band 17.3-17.8 GHz in Region 2 are involved[28] (Rev.WRC-~~19~~23)

Section I – Coordination of transmitting space or earth stations in the fixed-satellite service or transmitting space stations in the broadcasting-satellite service with assignments to broadcasting-satellite service feeder links

MOD

7.1 The provisions of No. **9.7** and the associated provisions under Articles **9** and **11** are applicable to transmitting space stations in the fixed-satellite service in Regions 1 and 2 in the frequency band 17.3-18.1 GHz, to transmitting space stations in the fixed-satellite service in Regions~~ 2 and~~ 3 in the frequency band 17.7-18.1 GHz, to transmitting earth stations in the fixed-satellite service in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to transmitting earth stations in the fixed-satellite service in countries listed in Resolution **163 (WRC-15)** in the frequency band 14.5-14.75 GHz and in countries listed in Resolution **164 (WRC-15)** in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for

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the broadcasting-satellite service, and to transmitting space stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz. (WRC-~~19~~23)

MOD

APPENDIX 5 (REV.WRC-~~19~~23)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

MOD

TABLE 5-1 (Rev.WRC-~~19~~23)

Technical conditions for coordination
(see Article **9**)

...

Reference of Article 9	**Case**	**Frequency bands (and Region) of the service for which coordination is sought**	**Threshold/condition**	**Calculation method**	**Remarks**
No. **9.7** GSO/GSO (*cont.*)		2*bis*) 13.4-13.65 GHz (Region 1)	i) Bandwidth overlap, and ii) any network in the space research service (SRS) or any network in the FSS and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±6° of the nominal orbital position of a proposed network in the FSS or SRS		
		3) 17.7-19.7 GHz, (Region~~s 2 and~~ 3), 17.3-19.7 GHz (Regions 1 and 2) and 27.5-29.5 GHz	i) Bandwidth overlap, and ii) any network in the FSS and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±8° of the nominal orbital position of a proposed network in the FSS		
		3*bis*) 19.7-20.2 GHz and 29.5-30 GHz	i) Bandwidth overlap, and ii) any network in the FSS or in the mobile-satellite service (MSS) and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±8° of the nominal orbital position of a proposed network in the FSS or in the MSS.		

...

Reasons: Covers the coordination of two GSO networks of the FSS (except earth stations operating in opposite directions of transmission) under RR No. **9.7**.

SUP

RESOLUTION 174 (WRC-19)

Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2

Agenda item 7

7 to consider possible changes, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution ***86 (Rev.WRC-07)****, in order to facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;*

Resolution **86 (Rev.WRC-07)** – *Implementation of Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference*

CPM23-2 received an input contribution proposing the inclusion of a new Topic under WRC-23 agenda item 7 addressing "Modification to the Radio Regulations to protect broadcasting-satellite service (BSS) in Regions 1 and 3 from high power-flux density (pfd) values stemming from the operation of fixed-satellite service (FSS) in Region 2 in the frequency band 11.7-12.2 GHz". While there was some support for this new Topic, there were also some issues raised as to the timing and possible scope of this document. It was stated that there would not be sufficient time for Member States to conduct and complete studies in the ITU-R in time for WRC-23 agenda item 7. A question was also raised on the completeness of the contribution, noting that there could also be a reverse situation of Region 1 and 3 FSS interfering with Region 2 BSS for the same reasons provided in the contribution. Given this situation, CPM23-2 decided not to include this new Topic in its final CPM Report but as an easy reference for the membership it can be found here (https://www.itu.int/md/R19-CPM23.2-C-0197/en). There was support at CPM23-2 for future studies of the issues raised to be conducted in ITU-R as early as the June/July 2023 meeting of Working Party 4A.

4/7/1 Topic A – Tolerances for certain orbital characteristics of non-GSO space stations of the FSS, BSS or MSS

4/7/1.1 Executive summary

Topic A for WRC-23 agenda item 7 considers the adoption of possible tolerances for certain orbital characteristics of non-GSO space stations of the fixed-satellite, mobile-satellite or broadcasting-satellite services to account for potential differences between values recorded in the Master International Frequency Register (MIFR) for the specified orbital characteristics of non-GSO space stations operating on notified frequency assignments and those representative of the actual deployment of these non-GSO space stations. Any tolerances should provide the necessary flexibility to accommodate normal operations of non-GSO systems and allow operational coexistence between systems filed at same or close orbital positions. Optimization of initial orbital parameters of a system submitted at the coordination stage under RR Article **9** compared to the operational orbital parameters, is not addressed under this topic but under RR Article **11** through the notified orbital parameters recorded in the MIFR.

The results of ITU-R studies are included in this section, and four methods for resolving this Topic are presented:

- Method A1: No change to the Radio Regulations;
- Method A2: A draft new WRC-23 Resolution on the implementation of tolerances for certain orbital characteristics of satellites of non-GSO FSS, BSS or MSS systems to be referred to in RR Nos. 11.44C.1, 11.49.2 and 11.51;
  - Two options are proposed under this method for the Resolution:
  - ▪ Option A proposes to apply these tolerances, including temporary variation, for satellites of all non-GSO FSS, BSS or MSS systems (either with an eccentricity < 0.5/TBD or more broadly), or to non-GSO FSS, BSS or MSS systems subject to Resolution **35 (WRC-19)** (either with an eccentricity < 0.5/TBD or more broadly);
  - ▪ In Option B, the orbital elements are updated at the notification stage to reflect the final design. Therefore, Option B proposes to apply two sets of tolerances for satellites of certain non-GSO FSS, BSS or MSS systems with regard to changes between coordination and notification filings, as well tolerances, including temporary variation, between notification filings and deployed characteristics;
- Method A3: Modify RR Appendix 4 to add data items related to the planned tolerances for each of the four orbital characteristics for non-GSO systems subject to RR No. 11.44C and refer to these new data items in the relevant provisions of RR Article 11 and in Resolution 35 (WRC-19);
- Method A4: New footnotes in RR Article 11 pointing to a draft new WRC-23 Resolution, applicable to non-GSO FSS, BSS or MSS systems subject to Resolution 35 (WRC-19), other than certain highly-inclined satellites, calling for periodic reporting on the altitude and inclination of deployed satellites and providing provisions – including BR examination in some cases – for ensuring that deviations, excluding temporary deviations, do not increase interference or require additional protection.

4/7/1.2 Background

WRC-19 invited the ITU-R to study “as a matter of urgency, tolerances for certain orbital characteristics of non-GSO space stations of the fixed-satellite, mobile-satellite or broadcasting satellite services to account for potential differences between the notified and deployed orbital characteristics for the inclination of the orbital plane, the altitude of the apogee of the space station, the altitude of the perigee of the space station and the argument of the perigee of the orbital plane”[26].

The objective of these studies would be to determine the allowable differences between the values recorded in the Master International Frequency Register (MIFR) for the specified orbital characteristics of non-GSO space stations operating on notified frequency assignments and those representative of the actual deployment of these non-GSO space stations. Studies of tolerances arise from the obligations stipulated in the Radio Regulations (RR):

– to deploy at least one satellite on a notified orbital plane for a successful completion of the bringing into use (BIU) or bringing back into use (BBIU) of frequency assignments to a fixed-satellite service (FSS), broadcasting-satellite service (BSS) or mobile-satellite service (MSS) non-GSO satellite network or system irrespective of the frequency bands (see RR Nos. 11.44C and **11.49**.2);

– to deploy satellites on a notified orbital plane to satisfy the milestones stipulated in Resolution **35 (WRC-19)** for some services in some bands, and

– to operate frequency assignments in accordance with the notified required characteristics as specified in RR Appendix **4**.

When considering the requirements in these three areas, it seems clear that the first two areas correspond to one-time events, i.e. successful BIU/BBIU or successful completion of a milestone, whereas the third area addresses an ongoing operational requirement. This then leads to the question of whether “tolerance” for such one-time events should be treated differently from “tolerance” for continuing operation. It should be noted that WRC-19 also adopted RR No. **11.44C** and associated sub-footnotes, which indicate that the term “notified orbital plane” means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system’s frequency assignments, that corresponds to items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to RR Appendix **4** (i.e. inclination of the orbital plane, the altitude of the apogee of the space station, the altitude of the perigee of the space station and the argument of the perigee of the orbital plane). The same four orbital characteristics are also reflected in RR Nos. **11.49.2** through **11.49.5**, and a noting of Resolution **35 (WRC-19)** relating to the milestones for the deployment of non-GSO satellites in some frequency bands and for some services.

The concept of orbital tolerances for a space station on board a geostationary (GSO) satellite already exists with, in particular, item A.4.a.2 (Orbital tolerances) and its associated sub-items, A.4.a.2.a (the planned longitudinal tolerance easterly limit), A.4.a.2.b (the planned longitudinal tolerance westerly limit) and A.4.a.2.c (the planned inclination excursion). Effective limits on some of these tolerances are contained elsewhere in the RR (e.g. the constraint on E/W longitudinal tolerances for GSO satellites operating in unplanned bands in Section III of RR Article **22**). In addition, for the case of GSO FSS and non-Appendix **30** GSO BSS networks, the current practice of the Radiocommunication Bureau (BR) is to consider a GSO space station operating at a location within ±0.5° of the notified orbital location as fulfilling RR Nos. **11.44**, **11.44B** or **13.6** requirements, as appropriate, provided that the space station has the capability to maintain its position (i.e. station-keep) within ±0.1° of this location (see RR No. **22.7**), and that the space station does not cause more interference or claim more protection than would occur if the space station were operating within ±0.1° of the notified location (see RR No. **22.10**).

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[26] See WRC-19 Document CMR19/571 (10th Plenary Minutes), Section 10.5, paragraph 2.

So, in the GSO case, the one-time BIU orbital location requirement is less stringent than the long-term orbital location operational capability requirement. However, there are no equivalent limits for tolerances in RR Appendix **4** for a space station on board a non-GSO satellite. This difference was recognized during discussions at WRC-19 on the BIU of frequency assignments to non-GSO satellite systems and on the milestone-based approach for the implementation of frequency assignments to space stations in a non-GSO satellite system in specific frequency bands and services. This recognition led to the invitation for the study mentioned above.

4/7/1.3 Summary and analysis of the results of ITU-R studies

Deviations from the nominal parameters characterizing the notified plane (A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i), have an impact on the regulatory treatment by the Bureau of the confirmation of the BIU, the BBIU or the Resolution **35 (WRC-19)** submission. These deviations could also have a major impact on the interference environment of such a system and thereby could impact the efficient use of the non-GSO spectrum resource. For instance, significant altitude variation of non-GSO satellite systems, including but not limited to changing from a LEO altitude to a MEO altitude, or vice versa, could substantially alter the interference environment. Any deviation of such an obvious significant potential impact would require a modified or new filing that would be considered under the established RR Articles **9** and **11** processes.

It is important to recognize that the design considerations (including, the impact of atmospheric drag for systems at low-Earth orbit altitudes, e.g., lower than 700 km), the need to ensure safe flight operations between satellites in the same and/or other systems, *inter alia*, can lead to notifying administrations needing to operate some space stations in orbital parameters that are at variance from the notified orbital parameters or to employ orbital practices that do not increase interference or protection requirements. Furthermore, there are legitimate reasons for variations from notified orbital plane parameters (A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i), and it is important not to over-regulate deviations/tolerances in a way that limits administrations’ flexibility, and that does not inappropriately limit entry of additional systems. The degree of tolerances subject to this agenda item is an objective value that may be accepted in order to allow the proper deployment of the systems, and avoid over-regulation during the deployment of the systems.

Atmospheric drag is the atmospheric force acting opposite to the relative motion of an object. Atmospheric drag is important for space station as it hinders the space station exiting the atmosphere, and also pulls orbital satellites back towards Earth over time. As a consequence of this atmospheric drag, space stations will require additional propulsive manoeuvres to compensate for the effect.

In reality, the variety of non-GSO system designs and parameters may make it difficult to specify any specific tolerances that would both provide certainty and not unnecessarily constrain efficient use of the orbital/spectrum resource by non-GSO systems. However, it seems important to note that this topic has been identified in response to the requirements stipulated in the BIU/BBIU provisions and Resolution **35 (WRC-19)** to have satellites deployed on “notified orbital planes”.

A certain degree of flexibility regarding any deviation from the characteristics of a notified orbital plane, i.e. the altitude of the perigee, the altitude of the apogee, the inclination and the argument of the perigee (for HEO systems) needs to be provided under certain circumstances and conditions as informed by the notifying administration responsible for the system.

Although studies have been conducted below with a view to identifying allowable deviation/tolerance values for altitudes of apogee/perigee and inclination for a space station in a non-GSO notified orbit, there has been no definitive conclusion on an allowable limit for any of these parameters that would both provide certainty and not unnecessarily constrain efficient use of the orbital/spectrum resource by non-GSO systems.

The studies conducted under this topic have not considered the case of several non-GSO systems sharing the same altitude for all or some of their orbital planes as it could be already observed in the characteristics of some already notified non-GSO systems. This matter will need to be taken into account when developing deviation/tolerance values under this topic.

4/7/1.3.1 Studies on the derivation of allowable deviation/tolerance for altitude of apogee and perigee for a space station

Specifying a concept for allowable orbital altitude deviation/tolerance for a non-GSO system is important from the perspective of efficient use of the non-GSO orbital resource. Developing allowable orbital altitude deviation/tolerance limitations or similar constructs would provide additional information for later filed/deployed systems regarding the nominal operational altitude, and altitude variation, of earlier deployed systems and facilitate safe operations of multiple systems.

The question then becomes one of how to specify a range of orbital altitudes that vary from the notified altitudes of apogee and perigee but would still sufficiently correspond to the notified parameters to qualify as constituting part of a notified orbital plane.

4/7/1.3.1.1 Approaches for the derivation of tolerance for altitudes

Four different approaches have been identified in order to specify the tolerance for the altitude of the satellites defined as the allowable variation between the altitudes notified (altitude of the apogee and altitude of the perigee) and the actual altitudes of the space station deployed.

Approach 1: Tolerance based on allowable variation of the spreading loss

Under this approach, the tolerance could be determined based on the maximum acceptable decrease or increase of the spreading loss for a satellite at 90 degrees elevation angle (i.e. slant distance = altitude of the satellite).

Approach 1.1: Tolerance based on the maximum acceptable decrease of the spreading loss

In this case, the actual altitude of the satellite deployed is lower than the altitude notified:

$$\Delta d = \left(d_i(1 - 10^{-\frac{\varepsilon}{20}})\right)$$

Approach 1.2: Tolerance based on the maximum acceptable increase of the spreading loss

In this case, the actual altitude of the satellite deployed is greater than the altitude notified:

$$\Delta d = \left(d_i(10^{\frac{\varepsilon}{20}} - 1)\right)$$

where:

Δd: represents the allowable orbital altitude tolerance in kilometres

ε: represents the magnitude of the spreading loss variation

d_i: represents the altitude of the satellite as notified in kilometres.

Approach 2: Tolerance for the altitude based on an allowable variation of period associated with the orbit as notified

Under this approach, the tolerance on the altitude could be defined as a function of an allowable variation of the orbital period of the satellite. The idea here is to use Kepler's third law that stipulate that the square of the orbital period is proportional to the cube of the semi-major axis of its orbit. The allowable variation of the period could correspond to an increase or a decrease of that period.

$$\Delta a = a\left(\left(1+\frac{\Delta T}{T}\right)^{\frac{2}{3}} - 1\right)\ (m)$$

where:

a: represents the semi-major axis of the ellipse in metres. For a circular orbit, it represents the radius of the Earth + the altitude of the apogee/perigee;

Δa: represents the allowable tolerance of apogee/perigee in metres;

ΔT: the allowable variation of the period of the satellite in minutes, and T the notified period of the satellite in minutes.

Approach 3: General approach for the derivation of the tolerance for the altitude

Under this approach, the tolerances for the altitude of the apogee and the altitude of the perigee are defined as follows:

$$\text{Tolerance} = (|\Delta d| / d_i) \times 100$$

where:

d_i represents the altitude of the satellite as notified in kilometres

Δd: represents the variation between the altitude of the satellite as notified and the altitude of the satellite as deployed, in kilometres.

Under this approach, the allowable variation of altitude does not depend on whether there is an increase or decrease of the spreading loss or the period. However, a correlation could be established between Approach 3 and the other two.

Correspondence between Approach 1 and Approach 3

In order to illustrate the impact of Approach 1 and establish the correspondence with Approach 3, the maximum allowable variation in terms of altitude has been derived for ε = 0.3 and 0.5 dB for three different notified altitudes (500, 1 000, 10 000) for satellite on a circular orbit. These examples are shown in Table 4/7/1-1 below. Other values up to 3 dB for ε could be used to derive allowable tolerances as may be required for non-GSO systems.

TABLE 4/7/1-1

Examples of tolerances for the altitude of a satellite in a circular orbit derived based on assumed spreading loss variation

Notified altitude d_i (km)	Example allowable variation of the magnitude of the spreading loss (SL) (dB)	Associated maximum allowable altitude variation assuming an increase of SL (km)	Associated maximum allowable altitude variation assuming a decrease of SL (km)	Equivalent tolerance based on Approach 3 (assuming an increase of SL)	Equivalent tolerance based on Approach 3 (assuming a decrease of SL)
500	0.3	17.57	16.97	3.51%	3.39%
1 000		35.14	33.95		
10 000		351.42	339.49		
500	0.5	29.63	27.97	5.93%	5.59%
1 000		59.25	55.94		
10 000		592.54	559.39		

Approach 4: Maximum acceptable orbital tolerance

Determining the orbital altitude tolerance needs more complex equations than those proposed above, taking into account that several factors are considered such as the impact of atmospheric drag at altitudes lower than 700 km, the solar flux prediction, the impact of satellite design and any additional factors.

When these factors are taken into account, it is possible to identify a fixed value in kilometres as a maximum acceptable tolerance. Although studies are ongoing, one possible outcome could be a maximum acceptable tolerance of TBD km for altitudes lower than 700 km, and TBD km for altitudes greater than 700 km.

A maximum acceptable orbital tolerance would ease the regulatory procedures that the BR would use when determining compliance with BIU/BBIU and Resolution **35 (WRC-19)**, and could be applied to the non-GSO orbital characteristics for both the altitude and the inclination.

4/7/1.3.2 Studies on the derivation of allowable deviation/tolerance for the inclination

From the perspective of efficient use of the non-GSO orbit for the FSS, the BSS, and the MSS, it would seem that specifying an allowable range of orbit inclination variation would have little impact. On the other hand, operating at an orbital inclination different from that which was filed could certainly impact the interference environment. As such, it is important to consider how to specify an allowable range of orbit inclination around the filed nominal inclination. Unlike the case of orbital altitude, there is no compelling reason to consider specifying allowable variation of orbital inclination as a fraction of, or percentage of, the nominal orbital inclination. Indeed, for a non-GSO system with zero inclination, this would result in zero allowable variation. Instead, the only practicable way to specify an allowable variation in orbital inclination around the nominal filed inclination would be as an absolute value. The question then becomes how tightly does this value need to be controlled to ensure minimal variation in the interference environment created by a non-GSO system?

4/7/1.3.2.1 Approaches for the derivation of tolerance for the inclination

A single approach, other than considering an absolute value, has been identified for the derivation of the inclination. Under this approach, the tolerance for the inclination is defined as a function of the tolerance on the altitude and is given by the following formula:

$$\Delta i = arcsin\left(\frac{\alpha\Delta d}{\sqrt{{R_{Alt}}^2 + (\alpha\Delta d)^2}}\right)$$

where:

R_{Alt} = R_e (radius of the Earth) + d (altitude as notified) in km;

Δd: tolerance for the altitude in km established as per section 1.3.1 above;

α: factor equal to or greater than 1.

Examples of tolerances for the inclination of a satellite in a circular orbit derived based on assumed spreading loss variation are shown in Table 4/7/1-2 below.

TABLE 4/7/1-2

Examples of tolerances for the inclination of a satellite in a circular orbit derived based on assumed spreading loss variation

Notified altitude d_i (km)	**Example of allowable variation of the magnitude of the spreading loss (SL) (dB)**	**Associated maximum allowable altitude variation assuming an increase of SL (km) (Δd)**	**Associated maximum allowable altitude variation assuming a decrease of SL (km) (Δd)**	**Tolerance for the inclination assuming an increase of SL and α = 1 (°) (Δi)**	**Tolerance for the inclination assuming a decrease of SL and α = 2 (°) (Δi)**
500	0.3	17.57	16.97	0.15	0.14
1 000		35.14	33.95	0.27	0.26
10 000		351.42	339.49	1.23	1.19
500	0.5	29.63	27.97	0.25	0.23
1 000		59.25	55.94	0.46	0.43
10 000		592.54	559.39	2.07	1.96

Note: 6 378 km is the assumed value for the radius of the Earth.

4/7/1.3.3 Cases of non-GSO satellite notified with a circular orbit

The studies referred to in the previous sections focused on the mathematical expressions to be used to eventually ensure compliance with the adopted tolerances. However, these studies do not address the fundamental problem of the selection of the values associated with the various tolerances. (e.g. should it be ε = 0.3 dB, ε = 0.5 dB or any other value).

4/7/1.3.3.1 Study 1

In order to address this specific question, an analysis has been conducted based on a snapshot of the current deployment of some non-GSO satellite systems with a circular orbit to determine the type of variation observed between the notified altitudes and inclinations and those of the non-GSO satellites already deployed. It is important to note that due to the nature of the orbit, it does not seem important to address the tolerance for the argument of the perigee.

This analysis is based on information publicly available for a total of 2 400 satellites deployed that can be associated with non-GSO systems filed with a circular orbit.

Considering that the information for each satellite included the altitude of the apogee, the altitude of the perigee and the inclination, the following methodology was used in the analysis:

1 for each satellite, the maximum of the difference between the altitude of the apogee notified and the altitude of the apogee of the satellite deployed and the difference between the notified and deployed altitude of the perigee is calculated (i.e. $\max(|d_{iAp} - d_{fAp}|,| d_{iPe} - d_{fPe}|)$ and retained for the rest of the analysis;

2 based on the maximum variation identified above, the calculated tolerance $\Delta d/d$ as well as the associated spreading loss variation are calculated for each satellite considered under this analysis;

3 based on the maximum value obtained under 1 above, the associated tolerance for the inclination is calculated using the equation provided in section 1.3.2.1 assuming two values for α (α = 1 and α = 2) and a radius of the Earth of 6 371 km;

Results of the analysis with respect to the tolerance on altitude are provided in Figures 4/7/1-1 and 4/7/1-2 below.

FIGURE 4/7/1-1

Statistical distribution of the calculated spreading loss variation

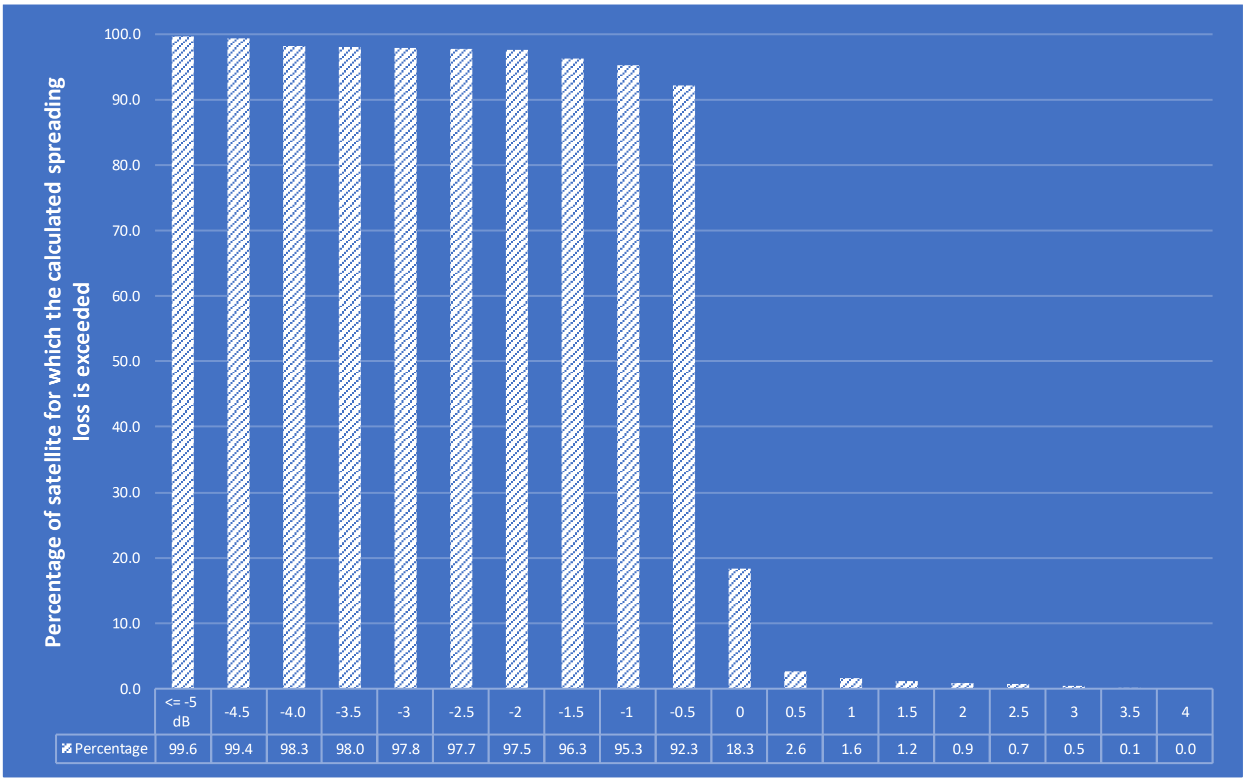
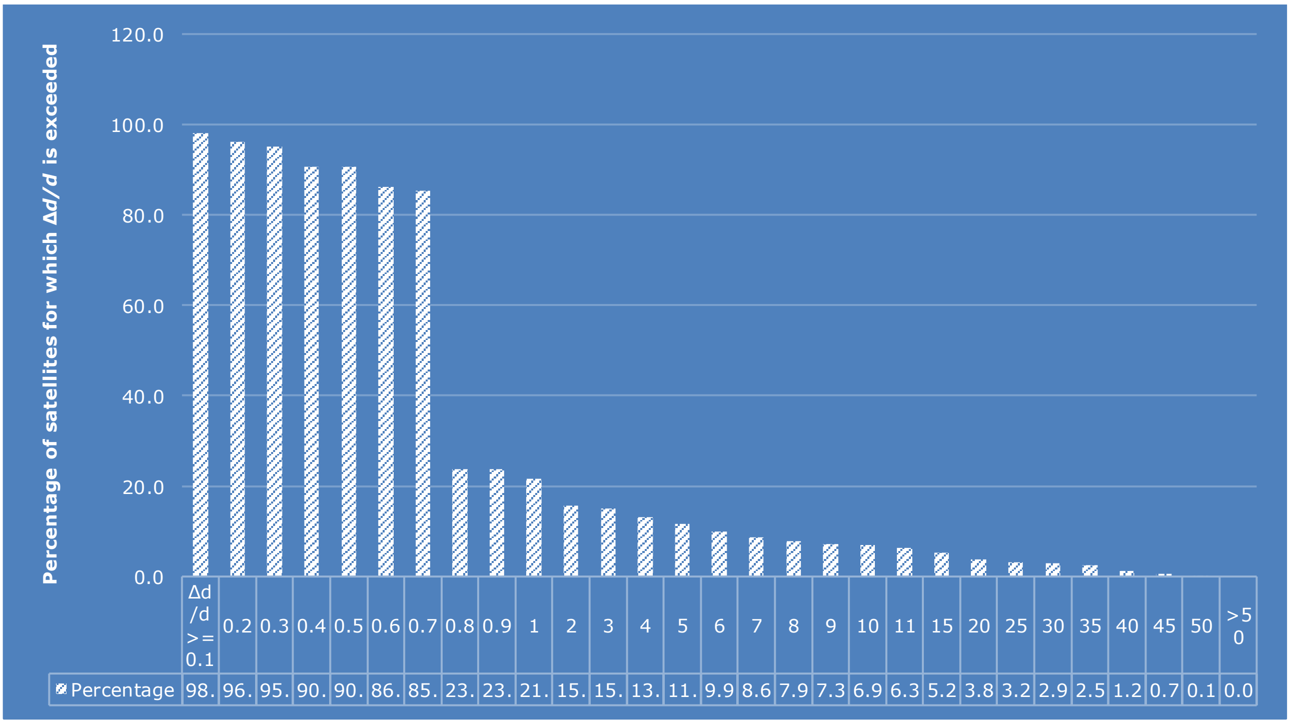


FIGURE 4/7/1-2

Statistical distribution of the calculated Δ*d/d*



From Figure 4/7/1-2 above, it appears that a tolerance $\Delta d/d$ ranging from 10% to 15% covers the tolerance observed for 93.1% to 94.8% of the 2 400 satellites deployed and considered in this analysis. These statistics may improve based on access to more detailed operational information as well as the association between the deployed satellite considered and the proper ITU notices. These statistics may also improve if temporary variations, such as re-phasing period (i.e. the operational period used to reorganize satellites within an orbit after a launch of new satellites in this orbit), are excluded. These operational temporary periods are required to manage the constellation and therefore should not be considered in developing acceptable tolerance. Another key element of the analysis provided consisted in determining an appropriate value for the parameter α to derive the tolerance on the inclination using the equation in section 4/7/1.3.2.1. In particular, statistics are provided in Table 4/7/1-3 below for a comparison between the variation of the inclination observed and the one calculated for different values of $\Delta d/d$. In other words, Table 4/7/1-3 provides a means of determining the potential impact of adopting a specific value for $\Delta d/d$ on the allowable variation of the inclination.

TABLE 4/7/1-3

Comparison of $\Delta i_{observed}$ and $\Delta i_{calculated}$ for different values of $\Delta d/d$ assumed

$\Delta d/d_{\text{assumed}}$ (%)	α = 1	
	Number of satellites for which $\Delta i_{observed} > \Delta i_{calculated}$	**Percentage of satellites for which $\Delta i_{observed} > \Delta i_{calculated}$**
0.1	2 214	92.25
0.2	2 017	84.04
0.3	1 904	79.33
0.4	1 886	78.58
0.5	1 708	71.17
0.6	1 707	71.13
0.7	1 701	70.88
0.8	1 699	70.79
0.9	1 686	70.25
1	1 686	70.25
2	60	2.5
3	60	2.5
4	30	1.25
5	14	0.58
6	5	0.21
7	4	0.17
8	3	0.13
9	3	0.13
10	3	0.13
11	3	0.13
15	0	0
20	0	0
25	0	0
30	0	0
35	0	0
40	0	0

$\Delta d/d_{assumed}$ (%)	α = 1	
	Number of satellites for which $\Delta i_{observed} > \Delta i_{calculated}$	Percentage of satellites for which $\Delta i_{observed} > \Delta i_{calculated}$
45	0	0
50	0	0

Based on the information provided in Table 4/7/1-3, and considering all cases without excluding periods of temporary operational variances such as rephasing period as it is a snapshot, for a tolerance, $\Delta d/d$ of 10%, the tolerance $\Delta i_{observed}$ is greater than the tolerance $\Delta i_{calculated}$ only for 0.13% of the total number of satellites considered in this analysis (i.e. 3 satellites among the 2 400 considered). For a tolerance, $\Delta d/d$ of 15%, the tolerance $\Delta i_{observed}$ is never greater than the tolerance $\Delta i_{calculated}$.

4/7/1.3.3.1.1 Summary of Study 1

As a result of this analysis, one possibility consists of defining the tolerance on the altitude in terms of $\Delta d/d$ with a value ranging from 10 to 15% and using the equation provided in section 4/7/1.3.2.1 with α = 1 to derive the allowable variation for the inclination.

Any methodology to derive the tolerance that is based on percentages would lead to greater tolerance values at higher altitudes.

4/7/1.3.3.2 Study 2

This study analysed the orbital parameters of 2 546 satellites from the date of their launch until March 2022 as measured by the NORAD. This study considered 3 different constellations in Ku/Ka frequency bands (i.e. 20 satellites from an MEO constellation at 8 062 km, 428 satellites from an LEO constellation at 1 200 km and 2 098 satellites from an LEO constellation at 550-570 km). The first measures started in June 2013 and 2 770 154 measures were considered in this study.

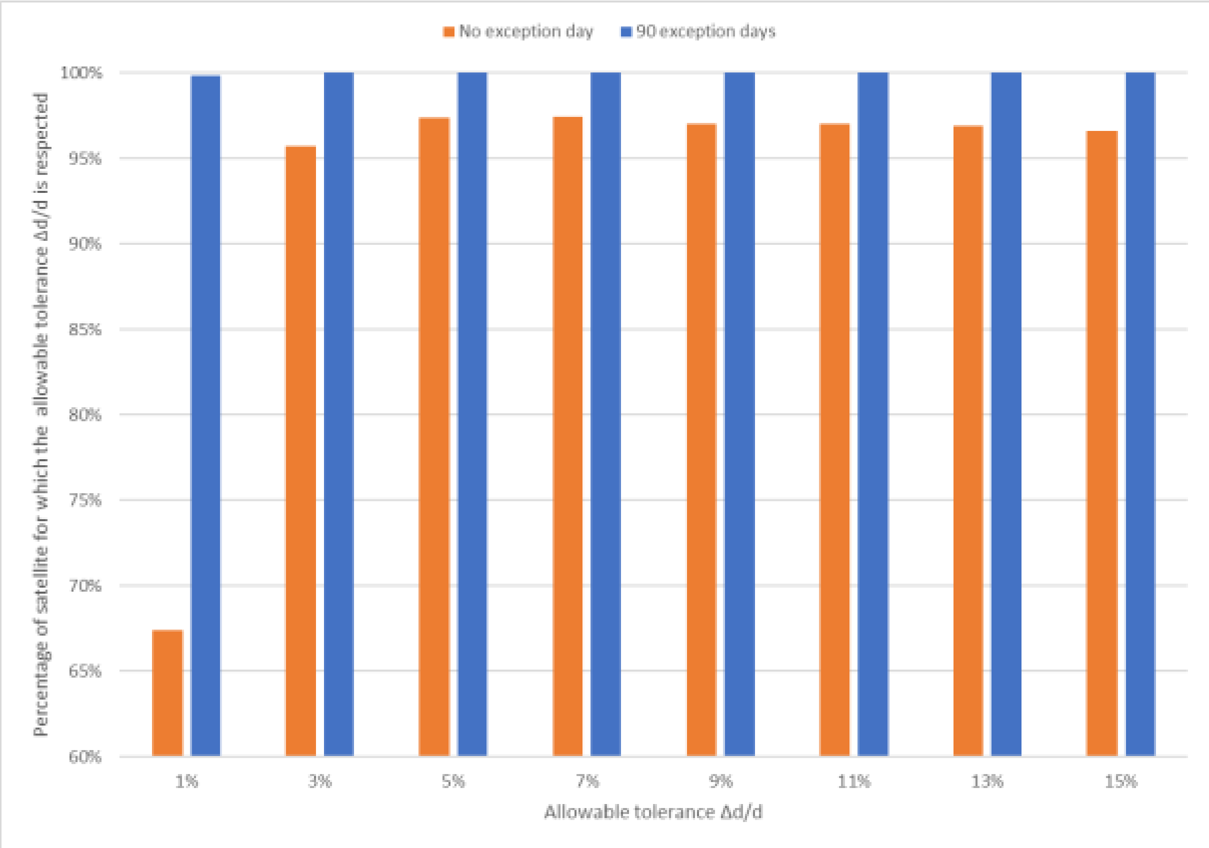
Methodology

– Analysis was performed considering different allowable tolerance $\Delta d/d$ values (i.e. from 1% to 15%) and associated allowable tolerance Δi considering two α values (i.e. α = 1 and α = 2)
– Allowable tolerance Δi is derived from the allowable tolerance $\Delta d/d$ (see section 4/7/1.3.2.1)
– Orbit raising period was not considered in the analysis (i.e. period required to reach an altitude within the allowable tolerance $\Delta d/d$ considered)
– Percentage of time within the allowable tolerance $\Delta d/d$ is computed
– Number of consecutive hours/days when the satellite is outside the allowable tolerance $\Delta d/d$ is computed.

To address the rephasing period (i.e. the period used to reorganize satellites within an orbit after a launch of new satellites in this orbit), it was considered a possible exception period of 90 days. If the satellite exceeds the allowable tolerance $\Delta d/d$ for a consecutive period lower than 90 days, the satellite is considered as respecting the allowable tolerance $\Delta d/d$ considered.

FIGURE 4/7/1-3

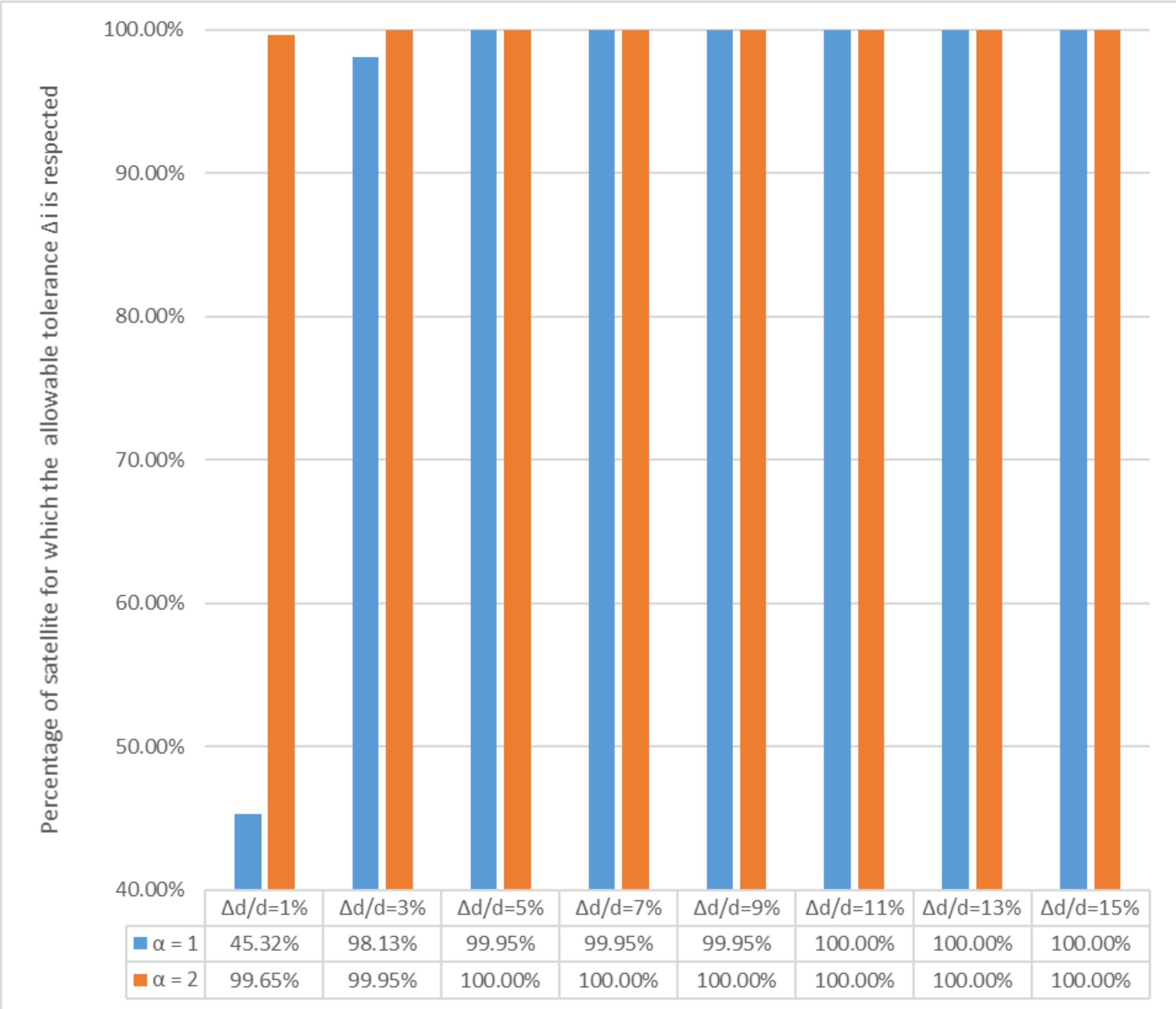
Statistical distribution of the calculated Δ*d/d*



From Figure 4/7/1-3 above, it appears that an allowable tolerance Δ*d/d* of 3% covers 100% of the tolerance observed of the considered satellites in this analysis with an exception period of 90 days and 95.73% without an exception period.

FIGURE 4/7/1-4

Statistical distribution of the calculated Δ*i*



From Figure 4/7/1-4 above, it appears that an allowable tolerance Δ*i* derived from an allowable tolerance Δ*d/d* of 3% covers close to 100% of the tolerance observed of the considered satellites in this analysis with an α equal to 2 and 98.13% with an α equal to 1. Results obtained shows no real difference with an α equal to 1 or 2 for a minimum allowable tolerance Δ*d/d* of 5%.

4/7/1.3.4 Cases of non-GSO satellite using a non-circular orbit (HEO)

Satellites on highly elliptical orbits have significant orbital precession rates. Consequently, ultra-precise orbital keeping and correction of orbit parameters may lead to a reduction of HEO satellites' lifetime and to frequent replacement. In addition, an ITU-R study has shown that the number of notified HEO non-GSO systems makes up only a very small fraction of the total number of notified non-GSO systems. As such, some proposed regulatory Methods concluded that the current practice with regard to HEO non-GSO systems should be retained without any changes.

With regard to argument of perigee, even though this orbital element was specifically called out by WRC-19, if reasonable control of the altitude of apogee/perigee and the inclination angle of orbital planes is maintained it may not be necessary to specify allowable deviations from the filed parameter for circular or near circular orbits (non-GSO systems in the FSS, BSS or MSS). As such, there is no need to specify control on the argument of perigee for such non-GSO systems.

4/7/1.4 Methods to satisfy Topic A

4/7/1.4.1 Method A1: NOC to the Radio Regulations

Under this method, no change is proposed to the Radio Regulations to address variations in non-GSO orbital parameters at this WRC due, in part, to the limited number of studies and lack of overall results and operational data and experience with the deployment of non-GSO FSS, BSS or MSS satellite systems.

4/7/1.4.2 Method A2: A draft new WRC-23 Resolution on the implementation of tolerances for certain orbital characteristics of satellites of non-GSO FSS/BSS or MSS systems to be referred to in RR Nos. 11.44C.1, 11.49.2 and 11.51

Under this method, it is proposed to have a new WRC Resolution with specific regulatory measures to allow for variation from the notified or recorded orbital plane characteristics, including temporary variation for operational purposes, e.g. reorganization of satellites in an orbit-plane after a launch of new non-GSO space stations. It is also proposed to consider space stations which do not respect the tolerances, including those specified for temporary variation, as not in compliance with notified and/or recorded orbital parameters of the associated non-GSO system and as such, should not be considered as compliant with RR Nos. **11.44C**, **11.49.2** and **11.51**, as applicable accordingly.

Two options are proposed under this method for the Resolution:

– Option A proposes to apply these tolerances, including temporary variation, for satellites of all non-GSO FSS, BSS or MSS systems (either with an eccentricity < 0.5/TBD or more broadly), or to non-GSO FSS, BSS or MSS systems subject to Resolution **35 (WRC-19)** (either with an eccentricity < 0.5/TBD or more broadly);

– In Option B, the orbital elements are updated at the notification stage to reflect the final design. Therefore, Option B proposes to apply two sets of tolerances for satellites of certain non-GSO FSS, BSS or MSS systems with regard to changes between coordination and notification filings, as well tolerances, including temporary variation, between notification filings and deployed characteristics.

This Resolution will be referred to in relevant provisions of RR Article **11**.

4/7/1.4.3 Method A3: Modify RR Appendix 4 data items related to the planned tolerances for each of the four orbital characteristics for non-GSO systems subject to RR No. 11.44C and refer to them in the relevant provisions of RR Article 11 and in Resolution 35 (WRC-19)

Under this method, it is proposed to require the notifying administration to provide their tolerances for the four characteristics referred to in RR Nos. **11.44C.1**, **11.49.2** or in No. **11.51** (through the reference to Resolution **35 (WRC-19)**) as part of the RR Appendix **4** data items provided for satellites that are part of a non-GSO FSS, BSS or MSS system. As a result, the Radiocommunication Bureau and administrations would have an indication of how much variation could be expected between the values provided for the four notified characteristics and the actual values for the satellites actually deployed and used to confirm BIU/BBIU or in application of Resolution **35 (WRC-19)**.

These new RR Appendix **4** data items should also become an integral part of the relevant existing provisions in RR Article **11**, i.e. RR Nos. **11.44C.1**, **11.49.5** as well as one of the *noting* in

Resolution **35 (WRC-19)** that are meant to characterize a “notified orbital plane” for non-GSO systems in the FSS, BSS and MSS.

There may also be a need to identify a mechanism by which these tolerances could be provided for systems already recorded or having initiated the milestone period as per Resolution **35 (WRC-19)**.

4/7/1.4.4 Method A4: New footnotes in RR Article 11 pointing to a draft new WRC-23 Resolution, applicable to the Resolution 35 (WRC-19) frequency bands, calling for periodic reporting on the altitude and inclination of deployed satellites and providing provisions for ensuring that deviations, excluding temporary deviations, do not increase interference or require additional protection

The fourth method is designed to recognize that there may be deviations in altitude and inclination, but these deviations should not result in an increase in interference to or an increase in required protection from other users of the orbital/spectrum resource.

Part of this method calls for periodic reporting of conformity with the notified orbital characteristics in order to provide all administrations with information on where a system’s non-GSO satellites are physically located. Modified Part I-S submissions subject to BR examination are required if variations in altitude or inclination exceed specific thresholds.

Significant changes in the character of the orbital planes (e.g. going from LEO to MEO or vice versa) would not be allowed under this fourth approach, even if there is no increased interference or protection requirements; a new filing would be needed.

In addition, the method specifically reinforces that there is nothing in the method or the implementing Resolution that would limit or otherwise constrain the Bureau from initiating or following the procedure set forth in RR No. **13.6** at any time with respect to the bringing into use, bringing back into use, or continuation in use of the frequency assignments to non-GSO space stations in accordance with the notified required characteristics of a notified orbital plane as specified in RR Appendix **4**.

This method focuses on the non-GSO systems that operate in the frequency bands and services now included in Resolution **35 (WRC-19)**. The systems in these bands and services are the most critical in terms of the use of notified orbital characteristics. For other bands and services with non-GSO satellites, the current procedures remain available for use by the Bureau to deal with significant deviations on a case-by-case basis.

4/7/1.5 Regulatory and procedural considerations

4/7/1.5.1 For Method A1

NOC

ARTICLES

NOC

APPENDICES

NOC

RESOLUTIONS

4/7/1.5.2 For Method A2

4/7/1.5.2.1 Method A2, Radio Regulation Provisions

An example of regulatory text is provided below.

ARTICLE 11

Notification and recording of frequency assignments[1, 2, 3, 4, 5, 6, 7] (WRC-19)

Section II − Examination of notices and recording of frequency assignments in the Master Register

MOD

11.44C A frequency assignment to a space station in a non-geostationary-satellite orbit network or system in the fixed-satellite service, the mobile-satellite service or the broadcasting-satellite service shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment has been deployed and maintained on one of the notified orbital plane(s)MOD [27] of the non-geostationary satellite network or system for a continuous period of 90 days, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system. The notifying administration shall so inform the Bureau within 30 days from the end of the 90-day period[25, 28, 29]. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC subsequently. (WRC-~~19~~23)

MOD

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[27] **11.44C.1** and **11.44D.1** For the purposes of No. **11.44C** or No. **11.44D**, the term "notified orbital plane" means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system's frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.5.c (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. For the purposes of No. **11.44C**, Resolution **[A7(A)-NGSO-FSS-BSS-MSS-Tolerance] (WRC-23)** also applies for space stations of a non-GSO FSS, BSS or MSS system. (WRC-~~19~~23)

MOD

11.49 Wherever the use of a recorded frequency assignment to a space station of a satellite network or to all space stations of a non-geostationary-satellite system is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When the recorded assignment is brought back into use, the notifying administration shall, subject to the provisions of Nos. **11.49.1**, **11.49.2**, **11.49.3** or **11.49.4**, as applicable, so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available as soon as possible on the ITU website and shall publish it in the BR IFIC. The date on which the recorded assignment is brought back into use[32, 33, 34, 35,] MOD [36] shall be not later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled. Ninety days before the end of the period of suspension, the Bureau shall send a reminder to the notifying administration. If the Bureau does not receive the declaration of the commencement of the bringing back into use period within thirty days following the limit date of the period of suspension established in accordance with this provision, it shall cancel the entry in the Master Register. The Bureau shall, however, inform the administration concerned before taking such action. (WRC-~~19~~23)

MOD

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[36] **11.49.5** For the purposes of Nos. **11.49.2** and **11.49.3**, the term “notified orbital plane” means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system’s frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.5.c (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. For the purposes of No. **11.49.2**, Resolution **[A7(A)-NGSO-FSS-BSS-MSS-Tolerance] (WRC-23)** also applies for space stations of a non-GSO FSS, BSS or MSS system. (WRC-~~19~~23)

Section III – Maintenance of the recording of frequency assignments to non-geostationary-satellite systems in the Master Register (WRC-19)

MOD

11.51 For frequency assignments to some non-geostationary-satellite systems in specific frequency bands and services, Resolution **35 (WRC-19)** and Resolution **[A7(A)-NGSO-FSS-BSS-MSS-Tolerance] (WRC-23)** for space stations of a non-GSO FSS, BSS or MSS system shall apply. (WRC-~~19~~23)

4/7/1.5.2.2 Method A2, draft new Resolution

4/7/1.5.2.2.1 Method A2, Option A for the draft new Resolution

ADD

DRAFT NEW RESOLUTION [A7(A)-NGSO-FSS-BSS-MSS-TOLERANCE-OPTION A] (WRC-23)

Tolerances for certain orbital characteristics of space stations deployed as part of non-GSO FSS, BSS or MSS systems

The World Radiocommunication Conference (Dubai, 2023),

considering

that WRC-19 invited ITU-R to study, as a matter of urgency, tolerances for certain orbital characteristics of the non-geostationary-satellite orbit (non-GSO) space stations of the fixed-satellite service (FSS), the broadcasting-satellite service (BSS) and the mobile-satellite service (MSS) to account for the potential differences between the notified and deployed orbital characteristics for the inclination of the orbital plane, the altitude of the apogee of the space station, the altitude of the perigee of the space station and the argument of the perigee of the orbital plane,

noting

that, for the purposes of this Resolution, tolerances refer to the maximum variations allowed between the value notified and/or recorded for the orbital characteristics referred to in the *considering* above and those associated with the actual deployment of satellites of the non-GSO FSS, BSS or MSS under consideration,

recognizing

a) that the use of frequency assignments to non-GSO FSS, BSS and MSS are subject to the regulatory and operational limits stipulated in the Radio Regulations;

b) that Nos. **11.44C**, **11.49.2** and **11.51** require the deployment of satellites on notified orbital planes;

c) that orbital tolerances for a non-GSO system should take into account design considerations including the atmospheric drag characteristics of the altitude chosen and solar cycle predictions, which could have an impact on the lifetime of the satellites;

d) that there are legitimate reasons for a satellite operating at a variance from its notified orbital characteristics, such as maintaining separation between satellites in the same system or with satellites in another satellite system, in order to minimize the risk of collision;

e) that satellites on highly elliptical orbits and high inclined orbits have significant orbital precession rates and, consequently, restrictive orbital-keeping requirements and correction of orbit parameters may lead to a reduction of such satellites lifetime and to a frequent replacement;

f) that this Resolution defines the maximum acceptable variation of certain orbital characteristics of a non-GSO system to be considered as operating within its notified orbital plane and does not preclude other coordination requests or notification filings under Articles **9** and **11** of the Radio Regulations for other non-GSO systems at the same altitude and tolerance;

g) that administrations and their operators may establish separate operational arrangements regarding coexistence of the physical orbits of satellite systems and networks, including satellites in geostationary-satellite orbits and non-GSO, and that such arrangements are not addressed by the ITU Radio Regulations which deal with avoidance of harmful interference due to radio frequency usage,

resolves

1 ***Option A2A1***: that, as of [*16 December 2023 or the entry into force of the Final Acts of WRC-23]* for space stations notified as part of a non-GSO FSS, BSS or MSS system with an apogee altitude less than 15 000 km:

Option A2A2: that, as of [*16 December 2023 or the entry into force of the Final Acts of WRC-23]* for space stations with an orbital eccentricity[1] less than 0.5/TBD notified as part of a non-GSO FSS, BSS or MSS system with an apogee altitude less than 15 000 km:

Option A2A3: that, as of [*16 December 2023 or the entry into force of the Final Acts of WRC-23]* for space stations notified as part of a non-GSO FSS, BSS or MSS system subject to Resolution **35 (WRC-19)** with an apogee altitude less than 15 000 km:

Option A2A4: that, as of [*16 December 2023 or the entry into force of the Final Acts of WRC-23]* for space stations with an orbital eccentricity[1] less than 0.5/TBD notified as part of a non-GSO FSS, BSS or MSS system subject to Resolution **35 (WRC-19)** with an apogee altitude less than 15 000 km:

a) the observed variation for the altitude ($\Delta alt_{Observed}$) of both perigee and apogee, shall not exceed allowed variation for the altitude ($\Delta alt_{Allowed}$) (see the Annex);

b) the observed variation for the inclination ($\Delta i_{Observed}$) shall not exceed allowed variation ($\Delta i_{Allowed}$) for the inclination (see the Annex);

2 that, as of [*16 December 2023 or the entry into force of the Final Acts of WRC-23]* and except for the application of Nos. **11.44C** or **11.49.2**, the BR shall allow a possible exceedance of the tolerances referred to in *resolves* 1 for a maximum of (90/180) consecutive days, when conducting its investigations under No. **13.6;**

3 that any space station deployed as part of a non-GSO FSS, BSS or MSS system at an altitude and with an inclination other than the notified altitude or the notified inclination, shall not cause more interference nor require more protection than if the space station was deployed at the notified altitude and the notified inclination,

instructs the Radiocommunication Bureau

1 to take the necessary actions to implement this Resolution, including providing assistance to administrations when requested, to address the difficulties they may encounter in the implementation of this Resolution without any regulatory impact on the administrations; and

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution.

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[1] The eccentricity "*e*" is equal to: $e=\left(R_a-R_p\right)/\left(R_a+R_p\right)$,

where:

R_a: distance between the centre of the Earth and the space station at apogee

R_p: distance between the centre of the Earth and the space station at perigee.

ANNEX TO DRAFT NEW RESOLUTION [A7(A)-NGSO-FSS-BSS-MSS-TOLERANCE-OPTION A] (WRC-23)

Variation for the altitude and the inclination

1 The observed variation for the altitude ($\Delta alt_{Observed}$) of a non-GSO satellite is equal to:

$$\Delta alt_{Observed} = \left| alt_d - alt_n \right| \quad \text{in kilometres}$$

where:

alt_d: is the observed altitude in kilometres of the deployed satellite at the perigee or apogee

alt_n: is the altitude of the perigee or apogee in kilometres of the associated notified orbital plane of the non-GSO system.

2 The allowed variation for the altitude ($\Delta alt_{Allowed}$) of a non-GSO satellite is equal to:

Option 1

$$\Delta alt_{Allowed} = \mathrm{X} \quad \text{in kilometres}$$

Where X is a fixed value equal to TBD

End of Option 1

Option 2

$$\Delta alt_{Allowed} = Y \times alt_n \quad \text{in kilometres}$$

Where Y is *a fixed percentage value* equal to TBD

End of Option 2

3 The observed variation for the inclination ($\Delta i_{Observed}$) of a non-GSO satellite is equal to:

$$\Delta i_{Observed} = \left| i_d - i_n \right| \quad \text{in degrees}$$

where:

i_d is the observed inclination in degrees of the deployed satellite

i_n is the inclination in degree of the associated notified orbital plane of the non-GSO system.

4 The allowed variation for the inclination ($\Delta i_{Allowed}$) of a non-GSO satellite is equal to:

Option 1

$$\Delta \mathrm{i}_{Allowed} = \mathrm{Z} \quad \text{in degrees}$$

Where Z is a fixed value equal to TBD

End of Option 1

Option 2

$$\Delta i_{Allowed} = \arcsin\left(\frac{\Delta alt_{Allowed}}{\sqrt{R_{Alt}{}^2 + \Delta alt_{Allowed}{}^2}}\right) \text{ in degrees} \qquad (1)$$

with:

$$R_{Alt} = R_e + alt_n$$

where:

R_e: is the radius of the Earth (i.e. 6 378 km).

End of Option 2

4/7/1.5.2.2.2 Method A2, Option B for the draft new Resolution

ADD

DRAFT NEW RESOLUTION [A7(A)-NGSO-FSS-BSS-MSS TOLERANCE-OPTION B] (WRC-23)

Tolerances for certain orbital characteristics of space stations deployed as part of non-GSO FSS, BSS or MSS systems

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that WRC-19 invited ITU-R to study, as a matter of urgency, tolerances for certain orbital characteristics of the non-geostationary-satellite orbit (non-GSO) space stations of the fixed-satellite service (FSS), the broadcasting-satellite service (BSS) and the mobile-satellite service (MSS) to account for the potential differences between the notified and deployed orbital characteristics for the inclination of the orbital plane, the altitude of the apogee of the space station, the altitude of the perigee of the space station and the argument of the perigee of the orbital plane;

b) that a potential variation between the orbital characteristics submitted under No. **9.30** and the notified orbital characteristics is needed to provide administrations with flexibility for design and coordination considerations,

noting

that, for the purposes of this Resolution, tolerances refer to the maximum variations allowed between the value notified and/or recorded for the orbital characteristics referred to in the *considering* above and those associated with the actual deployment of satellites of the non-GSO FSS, BSS or MSS under consideration,

recognizing

a) that the use of frequency assignments to non-GSO FSS, BSS and MSS are subject to the regulatory and operational limits stipulated in the Radio Regulations;

b) that Nos. **11.44C**, **11.49.1** and **11.51** require the deployment of satellites on notified orbital planes;

c) that notified orbital characteristics shall reflect the deployed orbital characteristics, *resolves*

Note 1: It is proposed to have one tolerance between the submitted under No. ***9.30*** *and the notified orbital characteristics, and a second tolerance between the notified and deployed orbital characteristics.*

Note 2: Special measures need to be developed for non-GSO systems already notified with orbital characteristics exceeding tolerances referred to in resolves *2c) and 2d), maintaining the benefits of the original submitted information under No.* ***9.30****.*

Note 3: Tolerances defined in resolves *2c) are lower than the tolerances defined in* resolves *2a).*

1 that assignments of non-GSO systems notified before [*16 December 2023 or the entry into force of the Final Acts of WRC-23]* maintain their protection date and benefit from special measures to adapt their notified parameters taking into consideration their original submitted information under No. **9.30**;

2 Option **A2B1:** that for space stations deployed as part of a non-GSO FSS, BSS, or MSS system:

Option **A2B2:** that for space stations deployed as part of a non-GSO FSS, BSS, or MSS system with an eccentricity[1] less than 0.5/TBD:

a) the maximum variation Δalt_s allowed for the altitude with regard to the altitude submitted under No. **9.30**, shall not exceed [Δalt_{smax} km] (see the Annex);

b) the maximum variation Δi_1 allowed for the inclination shall not exceed with regard to the inclination submitted under No. **9.30** [Option 1: [TBD] degrees (see the Annex)][Option 2: the value derive Δi_{Max} using equation (1) in the Annex];

c) the maximum variation Δalt_n allowed for the altitude with regard to the altitude notified, shall not exceed [Δalt_{smax} km] (see the Annex);

d) the maximum variation Δi_2 allowed for the inclination shall not exceed with regard to the inclination notified, [Option 1: [TBD] degrees (see the Annex)][Option 2: the value derive Δi_{Max} using equation (1) in the Annex];

3 that, as of [*16 December 2023 or the entry into force of the Final Acts of WRC-23]*, if all the space stations referred to in a submission to the Bureau under No. **11.15** for a non-GSO FSS, BSS or MSS satellite system exceed the tolerances referred to in *resolves* 2a) and 2b), this submission shall be returned by the Bureau to the notifying administration with an unfavourable finding according to this Resolution;

4 that, as of 16 December 2023, if all the space stations referred to in a submission to the Bureau under Nos. **11.44C** or **11.49.2** for a non-GSO FSS, BSS or MSS satellite system exceed the tolerances referred to in *resolves* 2c) and 2d), this submission shall not be considered as compliant with Nos. **11.44C** or **11.49.2** accordingly;

5 that, as of 16 December 2023, if any of the space stations referred to in a submission to the Bureau under No. **11.51** for satellite non-GSO FSS, BSS or MSS systems exceed the tolerances

---

[1] The eccentricity "*e*" is equal to: $e = (R_a - R_p)/(R_a + R_p)$,

where:

R_a: distance between the centre of the Earth and the space station at apogee

R_p: distance between the centre of the Earth and the space station at perigee.

referred to in *resolves* 2c) and 2d) for any period of more than 180 consecutive days, that space station shall not be considered in the count of the satellites deployed provided under No. **11.51**, except if the notifying administration has previously applied No. **11.49** to the notified frequency assignments specifically associated to the satellite network of this space station;

6 that any space station deployed as part of a non-GSO FSS, BSS or MSS system at altitude and with an inclination other than the notified altitude or the notified inclination, shall not cause more interference nor require more protection nor impose any additional operational impact to other systems than if the space station was deployed at the notified altitude and the notified inclination,

instructs the Radiocommunication Bureau

to take the necessary actions to implement this Resolution, including providing assistance to administrations when requested, to address the difficulties they may encounter in the implementation of this Resolution without any regulatory impact on the administrations.

ANNEX 1 TO DRAFT NEW RESOLUTION [A7(A)-NGSO-FSS-BSS-MSS TOLERANCE-OPTION B] (WRC-23)

Determination of the variation for the altitude and the inclination

1 The variations Δalt_s and Δalt_n observed for the altitude of a non-GSO satellite is equal to:

$$\Delta alt_s = |alt_s - alt_n| \quad \text{in km}$$

$$\Delta alt_n = |alt_d - alt_n| \quad \text{in km}$$

where:

alt_d: is the observed altitude in kilometres of the deployed satellite at the perigee or apogee

alt_n: is the altitude of the perigee or apogee in kilometres of the associated notified non-GSO system

alt_s: is the altitude of the perigee or apogee in kilometres of the submitted under No. **9.30** non-GSO system.

2 The variation Δi_1 and Δi_2 observed for the inclination of a non-GSO satellite is equal to:

$$\Delta i_1 = |i_n - i_s| \quad \text{in degrees}$$

$$\Delta i_2 = |i_d - i_n| \quad \text{in degrees}$$

where:

i_d is the observed inclination in degrees of the deployed satellite

i_n is the inclination in degree of the associated notified non-GSO system

i_s is the inclination in degree of the submitted under No. **9.30** non-GSO system.

Note: The section below to be added if Option 2 is retained:

3 The variation Δi_{Max} for the inclination of a non-GSO satellite is equal to:

$$\Delta i_{Max} = \arcsin\left(\frac{\Delta d}{\sqrt{R_{Alt}{}^2 + (\Delta d)^2}}\right) \tag{1}$$

with:

$$R_{Alt} = R_e + alt_n$$

where:

R_e: is the radius of the Earth (i.e. 6 378 km)

Δd: is the value Δalt_{smax} to assess Δi_{Max} from *resolves* 2b) or the value Δalt_{nmax} to assess Δi_{Max} from *resolves* 2d).

4/7/1.5.3 For Method A3

An example of regulatory text is provided below.

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

Footnotes to Tables A, B, C and D

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b	**For space station(s) onboard non-geostationary satellite(s):**										A.4.b	
…	**…**											
A.4.b.4	**For each orbital plane, where the Earth is the reference body:**										A.4.b.4	
A.4.b.4.a	the angle of inclination (i_j) of the orbital plane with respect to the Earth's equatorial plane ($0° \leq i_j < 180°$)			**X**		**X**					A.4.b.4.a	
A.4.b.4.a.1	the planned inclination tolerance [excursion] in degrees Required only for space stations operating in a frequency band subject to No. **11.44C** or Resolution **35 (Rev.WRC-23)**			+		+					A.4.b.4.a.1	
A.4.b.4.b	the number of satellites in the orbital plane			**X**		**X**					A.4.b.4.b	
A.4.b.4.c	the period			**X**		**X**					A.4.b.4.c	
A.4.b.4.d	the altitude, in kilometres, of the apogee of the space station			**X**		**X**					A.4.b.4.d	
A.4.b.4.d.1	the planned tolerance for the altitude of the apogee of the space station in kilometres Required only for space stations operating in a frequency band subject to No. **11.44C** or Resolution **35 (Rev.WRC-23)**			+		+					A.4.b.4.d.1	
A.4.b.4.e	the altitude, in kilometres, of the perigee of the space station			**X**		**X**					A.4.b.4.e	
A.4.b.4.e.1	the planned tolerance for the altitude of the perigee of the space station in kilometres Required only for space stations operating in a frequency band subject to No. **11.44C** or Resolution **35 (Rev.WRC-23)**			+		+					A.4.b.4.e.1	

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	**Advance publication of a geostationary-satellite network**	**Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9**	**Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9**	**Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)**	**Notification or coordination of a non-geostationary-satellite network or system**	**Notification or coordination of an earth station (including notification under Appendices 30A or 30B)**	**Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)**	**Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)**	**Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)**	**Items in Appendix**	**Radio astronomy**
A.4.b.4.f	the minimum altitude of the space station above the surface of the Earth at which any satellite transmits			X		X					A.4.b.4.f	
A.4.b.4.g	the right ascension of the ascending node (Ω_j) for the *j*-th orbital plane, measured counter-clockwise in the equatorial plane from the direction of the vernal equinox to the point where the satellite makes its South-to-North crossing of the equatorial plane ($0° \leq \Omega_j < 360°$), determined at the reference time indicated in A.4.b.4.k and A.4.b.4.l Required only for space stations operating in a frequency band subject to the provisions of Nos. **9.12** or **9.12A** *Note* – All satellites in all orbital planes must use the same reference time. If no reference time is provided in A.4.b.4.k and A.4.b.4.l, it is assumed to be $t = 0$					+					A.4.b.4.g	
A.4.b.4.h	the initial phase angle (ω_i) of the *i*-th satellite in its orbital plane at reference time $t = 0$, measured from the point of the ascending node ($0° \leq \omega_i < 360°$) Required only in the case of a non-geostationary-satellite system representing a "constellation" (A.4.b.1.a), and to be specified in: 1) the advance publication information, for any frequency assignment not subject to the provisions of Section II of Article **9** 2) the coordination request, for any frequency assignment subject to the provisions of Nos. **9.12**, **9.12A**, **22.5C**, **22.5D**, **22.5F** or **22.5L** 3) the notification, in all cases *Note* – The initial phase angle is the argument of perigee plus the true anomaly			+		+					A.4.b.4.h	
A.4.b.4.i	the argument of perigee (ω_p), measured in the orbital plane, in the direction of motion, from the ascending node to the perigee ($0° \leq \omega_p < 360°$) Required only for orbits of a "constellation" (A.4.b.1.a) where the altitudes of apogee and perigee (A.4.b.4.d and A.4.b.4.e) are different, and to be specified in: 1) the advanced publication information, for any frequency assignment not subject to the provisions of Section II of Article **9** 2) the coordination request, for any frequency assignment subject to the provisions of Nos. **9.12**, **9.12A**, **22.5C**, **22.5D**, **22.5F** or **22.5L** 3) the notification, in all cases			+		+					A.4.b.4.i	

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b.4.i.1	the planned tolerance [excursion] for the argument of the perigee in degrees Required only for space stations operating in a frequency band subject to No. **11.44C** or Resolution **35 (Rev.WRC-23)**			+		+					A.4.b.4.i.1	
A.4.b.4.j	the longitude of the ascending node (θ_j) for the *j*-th orbital plane, measured counter-clockwise in the equatorial plane from the Greenwich meridian to the point where the satellite orbit makes its South-to-North crossing of the equatorial plane ($0° \leq \theta_j < 360°$) Required only for orbits of a “constellation” (A.4.b.1.a), and to be specified in: 1) the advance publication information, for any frequency assignment not subject to the provisions of Section II of Article **9** 2) the coordination request, for any frequency assignment subject to the provisions of Nos. **9.12**, **9.12A**, **22.5C**, **22.5D**, **22.5F** or **22.5L** 3) the notification, in all cases *Note* – All satellites in all orbital planes must use the same reference time. If no reference time is provided in A.4.b.4.k and A.4.b.4.l, it is assumed to be *t* = 0			+		+					A.4.b.4.j	

ARTICLE 11

Notification and recording of frequency assignments[1, 2, 3, 4, 5, 6, 7] (WRC-19)

Section II − Examination of notices and recording of frequency assignments in the Master Register

MOD

11.44C A frequency assignment to a space station in a non-geostationary-satellite orbit network or system in the fixed-satellite service, the mobile-satellite service or the broadcasting-satellite service shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment has been deployed and maintained on one of the notified orbital plane(s)[MOD 27] of the non-geostationary satellite network or system for a continuous period of 90 days, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system. The notifying administration shall so inform the Bureau within 30 days from the end of the 90-day period[25, 28, 29]. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC subsequently. (WRC-~~19~~23)

MOD

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[27] **11.44C.1**~~ and **11.44D.1**~~ For the purpose~~s~~ of No. **11.44C**~~ or No. **11.44D**~~, the term "notified orbital plane" means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system's frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.a.1, A.4.b.4.d, A.4.b.4.d.1, A.4.b.4.e, A.4.b.4.e.1, ~~and~~ ~~A.4.b.5.c~~ A.4.b.4.i and A.4.b.4.i.1 (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. (WRC-~~19~~23)

MOD

11.44D A frequency assignment to a space station in a non-geostationary satellite orbit network or system with "Earth" as the reference body, other than a frequency assignment to which No. **11.44C** applies, shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment has been deployed on one of the notified orbital plane(s)[~~27~~ADD 30] of the non-geostationary satellite network or system, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system. The notifying administration shall so inform the Bureau as soon as possible, but not later than 30 days after the end of the period referred to in No. **11.44**.[25, 29] On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC subsequently. (WRC-~~19~~23)

ADD

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[30] **11.44D.1** For the purpose of No. **11.44D**, the term “notified orbital plane” means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system’s frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. (WRC-23)'

MOD

11.49 Wherever the use of a recorded frequency assignment to a space station of a satellite network or to all space stations of a non-geostationary-satellite system is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When the recorded assignment is brought back into use, the notifying administration shall, subject to the provisions of Nos. **11.49.1**, **11.49.2**, **11.49.3** or **11.49.4**, as applicable, so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available as soon as possible on the ITU website and shall publish it in the BR IFIC. The date on which the recorded assignment is brought back into use[32, 33, 34, 35, MOD 36, ADD 37] shall be not later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled. Ninety days before the end of the period of suspension, the Bureau shall send a reminder to the notifying administration. If the Bureau does not receive the declaration of the commencement of the bringing back into use period within thirty days following the limit date of the period of suspension established in accordance with this provision, it shall cancel the entry in the Master Register. The Bureau shall, however, inform the administration concerned before taking such action. (WRC-~~19~~23)

MOD

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[36] **11.49.5** For the purpose~~s~~ of No. **11.49.2**~~ and **11.49.3**~~, the term “notified orbital plane” means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system’s frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.a.1, A.4.b.4.d, A.4.b.4.d.1, A.4.b.4.e, A.4.b.4.e.1, ~~and A.4.b.5.c~~A.4.b.4.i and A.4.b.4.i.1 (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. (WRC-~~19~~23)

ADD

[37] **11.49.6** For the purpose of No. **11.49.3**, the term "notified orbital plane" means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system's frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. (WRC-23)

MOD

RESOLUTION 35 (REV.WRC-~~19~~23)

A milestone-based approach for the implementation of frequency assignments to space stations in a non-geostationary-satellite system in specific frequency bands and services

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

considering

…

recognizing

…

recognizing further

…

noting

that for the purpose of this Resolution:

– the term "frequency assignments" is understood to refer to frequency assignments to a space station of a non-GSO system;

– the term "notified orbital plane" means an orbital plane of the non-GSO system, as provided to the Radiocommunication Bureau (BR) in the most recent notification information for the system's frequency assignments, that possesses the general characteristics of items:

  – A.4.b.4.a, the inclination of the orbital plane of the space station;
  – A.4.b.4.a.1, the planned tolerance for the inclination of the orbital plane of the space station;
  – A.4.b.4.d, the altitude of the apogee of the space station;
  – A.4.b.4.d.1, the planned tolerance for the altitude of the apogee of the space station;
  – A.4.b.4.e, the altitude of the perigee of the space station; ~~and~~
  – A.4.b.4.e.1, the planned tolerance for the altitude of the perigee of the space station;

– ~~A.4.b.5.c~~A.4.b.4.i, the argument of the perigee of the orbit of the space station (only for orbits whose altitudes of the apogee and perigee are different); and

– A.4.b.4.i.1, the planned tolerance for the argument of the perigee of the orbit of the space station (only for orbits whose altitudes of the apogee and perigee are different

in Table A of Annex 2 to Appendix **4**;

– the term "total number of satellites" is understood to mean the sum of the various values of Appendix **4** data item A.4.b.4.b associated with the notified orbital planes in the most recent notification information submitted to BR,

resolves

…

4/7/1.5.4 For Method A4

This method calls for changes to RR Article **11** and a new associated WRC Resolution to address orbital tolerances for non-GSO systems subject to Resolution **35 (WRC-19)**. This method calls for periodic reporting for awareness, and for provision of assurances that any deviations in altitude and inclination in circular-orbit non-GSO systems would not result in an increase in interference to or an increase in required protection from other users of the orbital/spectrum resource. This method requires an explanatory statement of the reason for the change to the notified parameters, as well as a new filing or modification if the interference environment is changed with respect to any other satellite system.

The regulatory provisions for Method A4 consist of modifications to RR Nos. **11.44C.1/11.44D.1** and **11.49.5** to make the reporting requirement and procedure mandatory for the systems subject to the obligations. A new Resolution implementing the tolerance provisions and associated changes to Appendix **4** are also included.

4/7/1.5.4.1 For Method A4, RR Article 11 Changes

Modify footnotes 27 and 36 in RR Article **11** to read as follows:

ARTICLE 11

Notification and recording of frequency assignments[1, 2, 3, 4, 5, 6, 7] (WRC-19)

Section II − Examination of notices and recording of frequency assignments in the Master Register

MOD

11.44C A frequency assignment to a space station in a non-geostationary-satellite orbit network or system in the fixed-satellite service, the mobile-satellite service or the broadcasting-satellite service shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment has been deployed and maintained on one of the notified orbital plane(s)MOD [27] of the non-geostationary satellite network or system for a continuous period of 90 days, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system. The notifying administration shall so inform the Bureau within 30 days from the end of the 90-day period[25, 28, 29]. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC subsequently. (WRC-~~19~~23)

MOD

11.44D A frequency assignment to a space station in a non-geostationary satellite orbit network or system with "Earth" as the reference body, other than a frequency assignment to which No. **11.44C** applies, shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment has been deployed on one of the notified orbital plane(s)MOD [27] of the non-geostationary satellite network or system, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system. The notifying administration shall so inform the Bureau as soon as possible, but not later than 30 days after the end of the period referred to in No. **11.44**.[25, 29] On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC subsequently. (WRC-~~19~~23)

MOD

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[27] **11.44C.1** and **11.44D.1** For the purposes of No. **11.44C** or No. **11.44D**, the term "notified orbital plane" means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system's frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and ~~A.4.b.5.c~~A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. For frequency assignments to some non-geostationary-satellite systems in specific frequency bands and services, Resolution **[B7(A)] (WRC-23)** shall apply. (WRC-~~19~~23)

MOD

11.49 Wherever the use of a recorded frequency assignment to a space station of a satellite network or to all space stations of a non-geostationary-satellite system is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When the recorded assignment is brought back into use, the notifying administration shall, subject to the provisions of Nos. **11.49.1**, **11.49.2**, **11.49.3** or **11.49.4**, as applicable, so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available as soon as possible on the ITU website and shall publish it in the BR IFIC. The date on which the recorded assignment is brought back into use[32, 33, 34, 35,] MOD [36] shall be not later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled. Ninety days before the end of the period of suspension, the Bureau shall send a reminder to the notifying administration. If the Bureau does not receive the declaration of the commencement of the bringing back into use period within thirty days following the limit date of the period of suspension established in accordance with this provision, it shall cancel the entry in the Master Register. The Bureau shall, however, inform the administration concerned before taking such action. (WRC-~~19~~23)

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36 **11.49.5** For the purposes of Nos. **11.49.2** and **11.49.3**, the term "notified orbital plane" means an orbital plane of the non-geostationary-satellite system, as provided to the Bureau in the most recent notification information for the system's frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and ~~A.4.b.5.c~~A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**. For frequency assignments to some non-geostationary-satellite systems in specific frequency bands and services, Resolution **[B7(A)] (WRC-23)** shall apply. (WRC-~~19~~23)

4/7/1.5.4.2 For Method A4, draft new Resolution for Orbital Tolerance Reporting/Interference Impact

Add new Resolution **[B7(A)] (WRC-23)** to read as follows:

ADD

DRAFT NEW RESOLUTION [B7(A)] (WRC-23)

An approach to orbital tolerances for the implementation and use of frequency assignments to space stations in a non-geostationary-satellite system in specific bands and services

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that filings for frequency assignments to circular-orbit non-geostationary-satellite (non-GSO) systems composed of hundreds to thousands of non-GSO satellites have been received by ITU since 2011, in particular in frequency bands allocated to the fixed-satellite service (FSS) or the mobile-satellite service (MSS);

b) that non-GSO systems using highly-inclined orbits having an apogee altitude greater than 18 000 km and an orbital inclination between 35° and 145° are typically composed of only a few satellites and the number of such systems notified represents only a small fraction of the number of notified non-GSO systems;

c) that under Nos. **11.44C.1**, **11.44D.1**, **11.49.2** and **11.49.3**, the term "notified orbital plane" means an orbital plane of the non-geostationary-satellite system, as provided to the Radiocommunication Bureau (Bureau) in the most recent notification information for the system's frequency assignments, that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**;

d) that design considerations, availability of launch vehicles to support multiple satellite launches, the need to ensure safe flight operations between satellites in the same and other systems, and other factors can lead to notifying administrations needing to operate some space stations in orbital planes with some nominal variance from the notified orbital planes for the non-GSO systems referred to in *considering a)*;

e) that significant discrepancies between the operational orbital plane(s) of a non-GSO system and the notified orbital plane(s) for those systems as recorded in the Master International Frequency Register (Master Register) could negatively impact the efficient use of the orbit/spectrum resource in any frequency band used by non-GSO systems, including non-GSO systems not subject to this Resolution;

f) that minor discrepancies between the operational orbital plane(s) of a non-GSO system and the notified orbital plane(s) for those systems as recorded in the Master Register may not negatively impact the efficient use of the orbit/spectrum resource in any frequency band used by non-GSO systems, including non-GSO systems not subject to this Resolution;

g) that the determination whether an orbital plane of a non-GSO system has characteristics that corresponds to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4** as provided to the Bureau in the most recent notification information for the system's frequency assignments is not always straightforward, and can depend on factors that are specific to the non-GSO system in question;

h) that it is important, for consideration of instances where a non-GSO satellite system operates with orbital planes that are at variance with the system's notified orbital planes, that there is a mechanism developed for determining that such at-variance operation does not now and will not in the future result in the space stations of the non-GSO system causing more interference or claiming a higher need for protection than would have been the case if the operational orbital planes matched perfectly with the notified orbital planes for the system;

i) that for purposes of maximizing the efficient use of the orbit/spectrum resource for all non-GSO systems, whether or not they are in the same frequency band or service, it is important for there to be a listing maintained by the Radiocommunication Bureau (Bureau), and periodically updated by filing administrations, of all satellites in a subject non-GSO system that are operating in orbital planes that are at variance with Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4** of any of the system's notified orbital planes, as provided to the Bureau in the most recent notification information for the system's frequency assignments;

j) that, notwithstanding *considering g), h)* and *i)* above, there will be instances where the Bureau can determine without a methodology that an orbital plane of a non-geostationary-satellite system has characteristics that do not correspond to Items A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4** as provided to the Bureau in the most recent notification information for the system's frequency assignments;

k) that, in addressing the subject of orbital tolerances, there is a need to seek a balance between the prevention of spectrum/orbit warehousing, providing accurate information regarding the operational orbital planes used by non-GSO systems to assist the proper functioning of coordination mechanisms, and the operational requirements related to the safe deployment and operation of a non-GSO system;

l) that satellites using highly-inclined orbits having an apogee altitude greater than 18 000 km and an orbital inclination between 35° and 145° have significant orbital precession rates and, consequently, restrictive orbital keeping requirements, and correction of orbit parameters may lead to a reduction of such satellites' lifetime and to frequent replacement;

m) that adherence to a transparent approach to the question of orbital tolerances is desirable, as this reduces uncertainty with respect to the deployment of non-GSO systems,

recognizing

a) that the bringing into use of frequency assignments to non-GSO systems is addressed in Article **11**;

b) that any regulatory mechanism for management of frequency assignments to non-GSO systems in the Master Register should not impose an unnecessary burden;

c) that the core characteristics of notified orbital planes in a non-GSO system are among the notified required characteristics as specified in Appendix **4** (specifically provisions A.4.b.4.a, A.4.b.4.d, A.4.b.4.e and A.4.b.4.i);

d) that Resolution **35 (WRC-19)** addresses variances between the actual number of satellites in notified orbital planes and the number of satellites notified for each orbital plane, and this Resolution is addressing the subject of orbital tolerances for different notified orbital characteristics;

e) that No. **13.6** is applicable to non-GSO systems with frequency assignments in the frequency bands and services to which this Resolution applies;

f) that No. **11.49** addresses the suspension of recorded frequency assignments to a space station of a satellite network or to space stations of a non-GSO system,

recognizing further

that this Resolution relates to those aspects of non-GSO systems to which *resolves* 1 applies with regard to the notified required characteristics as specified in Appendix **4**, and the conformity of the notified required characteristics of the non-GSO systems, other than those referred to in *recognizing c)* above and Nos. **11.44C.1**, **11.44D.1**, **11.49.2** and **11.49.3** is outside the scope of this Resolution,

noting

that for the purpose of this Resolution:

– the term “frequency assignments” is understood to refer to frequency assignments to a space station of a non-GSO system;

– the term “notified orbital plane” means an orbital plane of the non-GSO system, as provided to the Radiocommunication Bureau (Bureau or BR) in the most recent notification information for the system’s frequency assignments, that possesses the general characteristics of items:

  - A.4.b.4.a, the angle of inclination of the orbital plane of the space station;
  - A.4.b.4.d, the altitude of the apogee of the space station;
  - A.4.b.4.e, the altitude of the perigee of the space station; and
  - A.4.b.4.i, the argument of the perigee of the orbit of the space station (only for orbits whose altitudes of the apogee and perigee are different) in Table A of Annex 2 to Appendix **4**,

*Note 2: Added “angle” to A.4.b.4.a and renumbered the arg of the perigee. Any mods to Resolution **35 (WRC-19)** should pick these points up.*

resolves

1 that this Resolution applies to frequency assignments to non-GSO systems, other than non-GSO systems using the orbits described in *considering b)* above, in the frequency bands and for the services listed in the Table below:

TABLE

Frequency bands and services for application of the orbital tolerance approach

Frequency bands (GHz)	Space radiocommunication services		
	Region 1	**Region 2**	**Region 3**
10.70-11.70	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (space-to-Earth)	
11.70-12.50	FIXED-SATELLITE (space-to-Earth)		
12.50-12.70	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (space-to-Earth)	BROADCASTING-SATELLITE FIXED-SATELLITE (space-to-Earth)
12.70-12.75	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (Earth-to-space)	BROADCASTING-SATELLITE FIXED-SATELLITE (space-to-Earth)
12.75-13.25	FIXED-SATELLITE (Earth-to-space)		
13.75-14.50	FIXED-SATELLITE (Earth-to-space)		
17.30-17.70	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	None	FIXED-SATELLITE (Earth-to-space)
17.70-17.80	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (space-to-Earth)	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)
17.80-18.10	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)		
18.10-19.30	FIXED-SATELLITE (space-to-Earth)		
19.30-19.60	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)		
19.60-19.70	FIXED-SATELLITE (space-to-Earth) (Earth-to-space)		
19.70-20.10	FIXED-SATELLITE (space-to-Earth)	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)	FIXED-SATELLITE (space-to-Earth)
20.10-20.20	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)		
27.00-27.50		FIXED-SATELLITE (Earth-to-space)	
27.50-29.50	FIXED-SATELLITE (Earth-to-space)		

Frequency bands (GHz)	Space radiocommunication services		
	Region 1	Region 2	Region 3
29.50-29.90	FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space)	FIXED-SATELLITE (Earth-to-space)
29.90-30.00	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space)		
37.50-38.00	FIXED-SATELLITE (space-to-Earth)		
38.00-39.50	FIXED-SATELLITE (space-to-Earth)		
39.50-40.50	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)		
40.50-42.50	FIXED-SATELLITE (space-to-Earth) BROADCASTING-SATELLITE		
47.20-50.20	FIXED-SATELLITE (Earth-to-space)		
50.40-51.40	FIXED-SATELLITE (Earth-to-space)		

2 that, for frequency assignments to which *resolves* 1 applies, and for which information concerning the bringing into use or bringing back into use of the frequency assignments is provided to the Bureau on or after 1 January 2025, the notifying administration shall communicate to the BR the required information regarding the system's deployed space stations in accordance with Annex 1 to this Resolution no later than 30 days after the end of the regulatory period specified in No. **11.44** or No. **11.49**, as applicable, or 30 days after the end of the bringing/bringing back into use period in No. **11.44C** or No. **11.49.2**, as applicable, whichever comes later;

3 that, for frequency assignments to which *resolves* 1 applies and that were brought into use or brought back into use prior to 1 January 2025, the notifying administration shall communicate to BR the required information regarding the system's deployed space stations in accordance with Annex 1 to this Resolution no later than 1 April 2025;

4 that, for frequency assignments to which *resolves* 1 applies, and that retain the remark to the Master Register entry that was added under *resolves* 5*b)* of Resolution **35 (WRC-19)**, the notifying administration shall communicate to the BR the required information regarding the system's deployed space stations in accordance with Annex 1 to this Resolution at the same time the notifying administration communicates to the BR the required information under *resolves* 7 or 8, as applicable, from Resolution **35 (WRC-19)**;

5 that, for frequency assignments to which *resolves* 1 applies, the notifying administration shall communicate to the BR the required information regarding the system's deployed space stations in accordance with Annex 1 to this Resolution three years after the date of submission in accordance with *resolves* 2 or 3 above, or if applicable, three years after the date of submission of the information required under *resolves* 7*c)* or 8*c)* from Resolution **35 (WRC-19)** as required under *resolves* 4 of this Resolution, and continue doing so on the anniversary date of submission every three years thereafter;

6 that, upon receipt of the required deployment information submitted in accordance with *resolves* 2, 3, 4 or 5 above, BR shall promptly make this information available "as received" on the ITU website;

7 that, if the information provided in any Annex 1 submission under *resolves* 2, 3, 4 or 5 above shows a change in the altitude of the apogee or perigee of the space station of more than [TBD] or a change of more than [TBD] degree in the angle of inclination of the orbital plane of the space station from the notified orbital plane(s) provided in the latest notification information

published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments, the notifying administration shall also submit to the BR, no later than 90 days after the deadline for the Annex 1 submission under *resolves* 2, 3, 4 or 5 above, modifications to the characteristics of the notified or recorded frequency assignments reflecting the revised parameters;

8 that, upon receipt of the modifications to the characteristics of the notified or recorded frequency assignments as referred to in *resolves* 7:

a) the BR shall promptly make this information available "as received" on the ITU website;

b) the BR, for the purpose of No. **11.43B**, shall retain the original dates of entry of the frequency assignments in the Master Register if:

i) BR reaches a favourable finding under No. **11.31**; and

ii) the modifications are limited to changes in the altitude of the apogee of the space station (Appendix **4** data item A.4.b.4.d), the altitude of the perigee of the space station (Appendix **4** data item A.4.b.4.e), and the angle of inclination of the orbital plane of the space station (Appendix **4** data item A.4.b.4.a), along with changes associated with not causing more interference or requiring more protection than the characteristics provided in the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available); and

iii) the notifying administration provides a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments (see Appendix **4** data item A.25.a);

c) the BR shall publish the information provided and its findings in the BR IFIC;

9 that BR shall, no later than 45 days before any deadline for submission by a notifying administration under *resolves* 2, 3, 4, 5 or 6, send a reminder to the notifying administration to provide the information required;

10 that, if a notifying administration fails to communicate the information required under *resolves* 2, 3, 4, 5 or 6, as appropriate, the BR shall promptly send to the notifying administration a reminder asking the administration to provide the required information within 30 days from the date of this reminder from the BR;

11 that, if a notifying administration fails to provide information after the reminder sent under *resolves* 10, the BR shall send to the notifying administration a second reminder asking it to provide the required information within 15 days from the date of the second reminder;

12 that, if a notifying administration fails to provide the required information under *resolves* 2, 3, 4, 5 or 6, as appropriate, following the reminders under *resolves* 10 and 11, the Bureau shall:

a) inform the Radio Regulations Board (RRB), at the RRB's next scheduled meeting, that the Bureau intends to discontinue taking the entry in the Master Register into account when conducting its examinations;

b) in the absence of a determination by the RRB to reject or postpone the course of action outlined in *resolves* 12*a)* at the first RRB meeting after the Bureau provides the information in *resolves* 12*a)*, no longer consider the frequency assignments under subsequent examinations under Nos. **9.36**, **11.32** or **11.32A**, and inform administrations having frequency assignments subject to Sub-Section IA of Article **9** that those assignments shall not cause harmful interference to, nor claim protection from, other frequency assignments recorded in the Master Register with a favourable finding under No. **11.31**;

13 that the suspension of the use of frequency assignments in accordance with No. **11.49** at any point prior to a reporting deadline as specified in *resolves* 2, 3, 4 or 5 of this Resolution, as applicable, shall not alter or reduce the requirements associated with any reporting obligations as stated in this Resolution;

14 that, if information provided by a notifying administration under *resolves* 4 of this Resolution results in frequency assignments not retaining their original dates of entry in the Master Register after application of *resolves* 8 of this Resolution, those space stations with altitude or inclination variances that caused this result shall not be included in the total number of space stations deployed as part of the system during any relevant milestone period;

15 that nothing in this Resolution, including *resolves* 6 above, shall be considered to limit or constrain the Bureau from implementing or following the procedure set forth in No. **13.6** of the Radio Regulations upon receipt of any Annex 1 submission under *resolves* 2, 3, 4 or 5 above, or at any other time, with respect to the bringing into use, bringing back into use, or continuation in use of frequency assignments to non-GSO space stations in accordance with the notified required characteristics of a notified orbital plane as specified in Appendix **4**,

instructs the Radiocommunication Bureau

1 to take the necessary actions to implement this Resolution, including providing assistance to administrations when requested, to address the difficulties they may encounter in the implementation of this Resolution without any regulatory impact on the administrations;

2 to report any difficulties it encounters in the implementation of this Resolution to WRC-27,

invites ITU-R

to continue studies with a view to identifying a methodology or methodologies for determining whether specific changes to a notified orbital plane will cause more interference or require more protection than the characteristics provided in the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments.

ANNEX 1 TO DRAFT NEW RESOLUTION [B7(A)] (WRC-23)

Information to be submitted about the deployed space stations

A Satellite system information

1) Name of the satellite system

2) Name of the notifying administration

3) Country symbol

4) Reference to the advance publication information or the request for coordination, or the notification information, if available

5) Total number of space stations deployed into each notified orbital plane of the satellite system with the capability of transmitting or receiving the frequency assignments

6) Orbital plane number indicated in the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments into which each space station is deployed.

B Space station characteristics for each space station deployed

1) Name of the space station.

2) Orbital plane number with which the space station is associated.

3) Altitude of the apogee of the space station and angle of inclination of the orbital plane of the space station. If there is no variance from the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) in either altitude of the apogee or angle of inclination of the orbital plane in all space stations covered by the submission, the notifying administration may indicate "No Variance" in its response here, and skip the remaining steps below.

4) For each space station operating in an orbital plane with an altitude of the apogee/perigee or angle of inclination at variance from the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) by an amount less than or equal to a threshold level in *resolves* 7 of this Resolution, a detailed explanation of why there is a change in the orbital characteristics of the space station.

5) For each space station operating in an orbital plane with an altitude of the apogee/perigee or angle of inclination at variance from the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) by an amount greater than a threshold level in *resolves* 7 of this Resolution, a detailed explanation of why there is a change in the orbital characteristics of the space station and a technical showing to support a determination that the variance does not result in any increased interference or protection requirements as compared to those requirements for operation without the variance.

C Commitment of non-interference/non-protection

By providing a submission under Annex 1 to this Resolution, the notifying administration commits that the operation of its notified frequency assignments using the orbital characteristics of the submission that are at variance with the notified orbital plane(s) will not cause more interference or require more protection than the characteristics provided in the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments to the non-geostationary-satellite system.

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

Footnotes to Tables A, B, C and D

[2] The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
…												
A.23	**COMPLIANCE WITH RESOLUTION 35 (WRC-19)**										**A.23**	
A.23.a	a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments to the non-geostationary-satellite system					**O**					A.23.a	
…												
A.25	**COMPLIANCE WITH RESOLUTION [B7(A)] (WRC-23)**										**A.25**	
A.25.a	a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments to the non-geostationary-satellite system					**O**					A.25.a	

4/7/2 Topic B – Non-GSO bringing into use post-milestone procedure

4/7/2.1 Executive summary

Topic B for WRC-23 agenda item 7 considers the possible adoption of a procedure to apply in cases where a non-GSO system subject to the milestone procedure in Resolution **35 (WRC-19)** has completed the milestone procedure, but subsequently experiences a sustained reduction in the number of space stations deployed and capable of transmitting/receiving the assigned frequencies. When developing a post-milestone procedure, some degree of operational flexibility, including temporary operations, which is necessary for the maintenance of the non-GSO system in the FSS, BSS and MSS, needs to be duly considered. The results of ITU-R studies are included in section 4/7/2.3, and in response to this Topic, two methods as outlined in sections 4/7/2.4 and 4/7/2.5 have been developed.

- Method B1 is to make no further changes to the Radio Regulations.
- Method B2 is to permit some operational flexibility in the maintenance of the non-GSO system while keeping reasonable alignment over time between the number of capable non-GSO system satellites deployed for a system, and the number notified in the MIFR through a Resolution referred to in the provision of RR Article **11**. Method B2 contains two options regarding the required threshold for decreases in the number of deployed satellites capable of transmitting/receiving the recorded frequency assignments to apply such a Resolution.

4/7/2.2 Background

WRC-19 discussed at length and ultimately agreed on Resolution **35 (WRC-19)**, "A milestone-based approach for the implementation of frequency assignments to space stations in a non-geostationary-satellite system in specific frequency bands and services." This Resolution contains a detailed procedure to be followed by administrations and the Radiocommunication Bureau (BR) when recording and maintaining in the Master International Frequency Register (MIFR) frequency assignments for non-geostationary satellite (non-GSO) systems to which the Resolution applies. One aspect raised but not addressed in a regulatory sense in the Resolution relates to the case where a non-GSO system has completed the milestone process and subsequently experiences an intermediate- or long-term reduction of the number of satellites deployed. To generate data not then available to the BR, WRC-19 included *resolves* 19 in Resolution **35 (WRC-19)**, which requires administrations to inform the BR, for information purposes only, of the date when the number of satellites capable of transmitting or receiving the recorded frequency assignments deployed falls below a specified threshold. Further, if appropriate and applicable, the same *resolves* states that the notifying administration should also inform the BR of the date on which the deployment of the total number of satellites was resumed. The BR is to publish all information received under *resolves* 19 on its website.

It is important to note that Resolution **35 (WRC-19)** *resolves* 19 requires the notifying administration to inform the BR "for information purposes only" of the date the threshold (95%, rounded down to the lower integer, minus one) was first "crossed". (Reporting is not required until the number remains below the threshold for six months.) Importantly, the number of satellites capable of transmitting or receiving the recorded frequency assignments deployed is not required to be reported under Resolution **35 (WRC-19)** *resolves* 19, and suspension of the frequency assignments under RR No. **11.49** is not required unless the number of satellites capable of transmitting or receiving the recorded frequency assignments deployed drops to zero.

Based on the above, in the minutes of a WRC-19 Plenary session, WRC-19 invited ITU-R to study, as a matter of urgency, possible development of a post-milestone procedure taking into account the reporting defined in *resolves* 19 of the Resolution **35 (WRC-19)** (WRC-19 Documents 500 and 571).

4/7/2.3 Summary and analysis of the results of ITU-R studies

4/7/2.3.1 Studies on the need for a post-milestone procedure and its potential applicability

One of the main motivations for developing Resolution **35 (WRC-19)** was to find a way to ensure that the content of the MIFR for non-GSO systems closely aligns with what is actually deployed in space, particularly for very large constellations of non-GSO systems. As such, there is a check at each milestone in the process to assess whether the non-GSO system deployment is compliant with the milestone requirements, and if not, an adjustment is made to the notified parameters for the non-GSO system. After the last milestone is reached and all required adjustments to the MIFR regarding the number of satellites in the system have been made, the requirement remains to have the number of satellites deployed and capable of transmitting or receiving the recorded frequency assignments correspond to the number of satellites in the recorded frequency assignments – unless further modified – for the entire duration of their recording in the MIFR.

It is anticipated that, following completion of the milestone procedure, there may be instances where the number of space stations in a non-GSO system capable of transmitting or receiving the frequency assignments decreases below the number of space stations recorded in the MIFR. This may result from:

– in-orbit failures of satellites making the space stations incapable of transmitting or receiving on some or all of the recorded frequency assignments, or

– natural orbital decay or voluntary relocation of satellites resulting in operations on different orbital planes than those recorded in the MIFR. In this context, irrespective of the fact that those satellites may still be capable of operating in accordance with all the recorded characteristics other than those associated with orbital planes, there would be a reduction of the total number of satellites deployed.

In the context of GSO satellite networks, and for non-GSO satellite systems with no satellite capable of using frequency assignments in accordance with the recorded characteristics, both situations are addressed through the following regulatory mechanism/provisions:

– RR No. **11.49** by which a notifying administration informs the ITU of the situation and indicates the intention to address it within a period prescribed in the Regulations, or

– RR No. **13.6** by which the Bureau performs the maintenance of the entry in the MIFR by ensuring that the recorded frequency assignments are, among other things, used in accordance with the recorded characteristics.

Indeed, in both situations (loss of the transmitting and receiving capabilities or the relocation of the GSO satellite), a notifying administration has six months to request the suspension of the use of the recorded frequency assignments and three years from the onset of the suspension event to bring back into use the frequency assignments.

However, RR No. **11.49** does not address a situation where frequency assignments to a non-GSO system continue to be used, but the number of satellites capable of using those assignments is greater than zero but smaller than the number recorded in the MIFR following completion of the milestone process of Resolution **35 (WRC-19)**. This situation cannot be addressed through the suspension of the use of recorded frequency assignments as long as they remain in use in accordance with the notified characteristics on at least one satellite in the non-GSO satellite system.

Therefore, it may be deemed appropriate to consider a more adapted regulatory mechanism than RR No. **11.49** to address this situation.

It is important to note that, as of 1 February 2023, the Bureau had not received, and therefore not published, any information specific to Resolution **35 (WRC-19)** *resolves* 19. The Director's Report to the 92nd RRB meeting (Document RRB23-1/6), Section 7, lists the twenty-six non-GSO systems to which Resolution **35 (WRC-19)** applies. Of those, only four systems are fully-deployed (Milestone "M3" completed) – and thus Resolution **35 (WRC-19)** *resolves* 19 applies, with BIU dates of 1994, 1997, 2010 and 2018. Given this small sample size, it is understandable that there is no Resolution **35 (WRC-19)** *resolves* 19 reports. This indicates neither success nor failure of the Resolution **35 (WRC-19)** milestone procedure. It indicates that Resolution **35 (WRC-19)** has not been in force long enough to generate a sufficient quantity and quality of data to the Bureau from which to draw conclusions.

Furthermore, RR No. **13.6**, with a post-milestone procedures in place, the Bureau will be relieved from the burden to conduct an investigation under RR No. **13.6**, whenever it appears from reliable information available that the use of a recorded assignment is not in accordance with the notified characteristics in the MIFR. A post-milestone procedure could give administrations more flexibility and certainty to operate non-GSO satellite systems that are subject to Resolution **35 (WRC-19)** and have completed the milestone procedure, and then suffer a decrease in the number of deployed satellites. If there is no decision taken at WRC-23 on this post-milestone procedure, the only regulatory provision available will be RR No. **13.6**. Under such circumstances, the notifying administration could be immediately asked by the BR to reduce the number of satellites in the MIFR in order to reflect the current number of satellites deployed. This could lead to undesirable consequences, such as the immediate reduction of the number of satellites of the non-GSO satellite network or system, even if there is only a marginal discrepancy between the number of satellites deployed and the number of satellites recorded in the MIFR. The notifying administration could appeal the decision of the BR to the Radio Regulations Board (RRB), explaining the reason of such discrepancy between the number of satellites deployed compared to the number of satellites recorded in the MIFR, the absence of any other regulatory mechanism to address the situation would place unnecessary burden on administrations, BR and RRB and may lead the RRB to endorse the decision from the Bureau based on the existing Radio Regulations so developing defined provisions for non-GSO systems in the context of post-milestone procedures provides flexibility and certainty compared with the uncertain outcome of the Bureau investigation process under RR No. **13.6**.

It was noted that the same situations referred to above (i.e. in-orbit failure or orbit decay/voluntary relocation of satellites in part of the system) could occur for frequency assignments to non-GSO systems in bands and services not subject to Resolution **35 (WRC-19)**, and could subject them to a potential application of RR No. **13.6** at any time. Although systems outside of Resolution **35 (WRC-19)** were not studied under this Topic, it would be arbitrary for the Bureau to impose more stringent requirements on non-GSO systems not included in Resolution **35 (WRC-19)** than the requirements that are imposed on the most congested bands and systems by Resolution **35 (WRC-19)** itself.

As a conclusion, the proposed regulatory mechanism may cover the following points:

1) Specify the conditions to be met in order for the requirement to report the reduction in the number of satellites to apply; the idea here is that a certain level of reduction may be allowed.

2) Specify the timelines for:

   a) reporting the reduction to the BR, and

b) reporting confirmation that the reduction has been successfully restored.

3) The consequences for a post-milestone system that has not been suspended under RR No. **11.49** but that fails to restore the number of space stations capable of using the frequency assignments within an agreed period, should not be cancellation of the entry in the MIFR. There are operational spacecraft to consider. Instead, the most suitable option would be to have the notifying administration modify the characteristics of the recorded frequency assignments to reduce the number of space stations per orbital plane (in the manner described in *resolves* 14 of Resolution **35 (WRC-19)**.

4) The consequences for a non-GSO network/system subject to Resolution **35 (WRC-19)** that does not comply with the new regulatory mechanism which means that a reduction in the number of space stations capable of using the frequency assignments below the threshold and the notifying administration neither report to the BR nor respond to the reminders sent from the BR.

4/7/2.3.2 Studies on the potential methodology for a post-milestone procedure

The threshold for diminution in the number of deployed satellites in a post-milestone environment could differ between systems with hundreds or thousands of satellites and for smaller systems, where the loss of even one satellite could drop the number of deployed satellites below a [95%] threshold. The same threshold(s) could be used for reporting "no longer significantly reduced", but this would not be the same, as the request in Resolution **35 (WRC-19)**, *resolves* 19, to report when the number of capable satellites is equal to the number recorded in the MIFR.

A view was expressed that, "the percentage number rounded down to the lower integer, minus one" mechanism could address non-GSO systems with a small number of satellites. To exemplify, a post-milestone threshold of 95% applied to a non-GSO system with 5, 10 and 1 000 satellites implies to start the post-milestone procedure if and only if, the number of satellites deployed is less than or equal to 40%, 70% and 94.8%, respectively, of the constellation.

Accordingly, the result of the studies shows that thresholds X of the number of satellites capable of transmitting or receiving the frequency assignments deployed in the non-GSO system will depend on the number of satellites indicated in the Master Register:

Alternative 1

For $3 \leq N < 50$ $X = N * 70\% - 1$ satellite

For $N \geq 50$ $X = N * 95\% - 1$ satellite,

Alternative 2

For $N < 550$ $X = N * 90\% - 1$ satellite

For $550 \leq N < 5\,000$ $X = N * 93\% - 1$ satellite

For $N \geq 5\,000$ $X = N * 95\% - 1$ satellite,

Alternative 3

For $N < 100$ $X = N * 50\% - 1$ satellite

For $100 \leq N < 1\,000$ $X = N * 65\% - 1$ satellite

For $1\,000 \leq N < 5\,000$ $X = N * 85\% - 1$ satellite

For $N \geq 5\,000$ $X = N * 95\% - 1$ satellite,

Alternative 4

For $2 \leq N < 50$ $X = N * 50\%$

For $50 \leq N < 100$ $X = N * 65\%$

For $100 \leq N < 550$ $X = N * 80\%$

For $550 \leq N < 5\,000$ $X = N * 93\%$

For $N \geq 5\,000$ $X = N * 95\%$

where:

N the number of satellites in the non-GSO system

X the thresholds of the number of satellites capable of transmitting or receiving the frequency assignments deployed in the non-GSO system.

The result of calculations X should be rounded **down** to the **lower** integer.

As for RR No. **13.6**, it appears to provide a proper regulatory mechanism for the Bureau to inquire a notifying administration that may not have reported a reduction of the number of satellites capable of using the frequency assignments.

Finally, consideration would have to be given to whether modifications of the number of satellites indicated as deployed and capable of using recorded frequency assignments to non-GSO satellite systems resulting from not satisfying the requirement of the proposed new regulatory mechanism, or as a result of the application of RR No. **13.6**, should be addressed under the existing provisions of the RR (i.e. RR Nos. **11.43A**/**11.43B**) or some new provision(s).

4/7/2.4 Methods to satisfy Topic B

To satisfy Topic B, there are two methods identified. Method B1 is to make no further changes to the Radio Regulations once the milestone process is completed and to rely on existing regulatory mechanisms (including RR Nos. **11.49** and **13.6**) to assure reasonable correspondence between the number of space stations in a non-GSO system and the number recorded in the MIFR following completion of the process established in Resolution **35 (WRC-19)**. Information could continue to be gathered in accordance with *resolves* 19 of Resolution **35 (WRC-19)** and reported by the Bureau to WRC-27.

Method B2 was developed to enhance the existing suspension provision (i.e. RR No. **11.49**) for frequency assignments to non-GSO systems (i.e. constellations) and permit some operational flexibility in the maintenance of the non-GSO system while keeping reasonable alignment over time between the number of capable non-GSO system satellites deployed for a system, and the number notified in the MIFR. The proposed changes include modification of RR Article **11** and adoption of new WRC Resolution **[A7(B)] (WRC-23)** that contains details of a regulatory mechanism by which the obligation to operate in accordance with the notified characteristics of frequency assignments to non-GSO system, could be waived for a limited period of time, after the end of the milestone period in an approach similar to the suspension provision under RR No. **11.49**.

The new draft Resolution contains two options regarding the required threshold for decreases in the number of deployed satellites capable of transmitting/receiving the recorded frequency assignments to apply such Resolution. One option (Option B2a) involves a single percentage of the system's satellites, without regard to the number of satellites in the non-GSO system. The second option (Option B2b) proposes a different number depending on the number of satellites in the non-GSO system.

4/7/2.5 Regulatory and procedural considerations

The regulatory and procedural considerations to satisfy this topic are considered below for each of the proposed methods defined in section 4/7/2.4.

4/7/2.5.1 For Method B1

NOC

ARTICLES

NOC

APPENDICES

NOC

RESOLUTIONS

4/7/2.5.2 For Method B2

Method B2 involves changes to Resolution **35 (WRC-19)** to remove *resolves* 19 and adoption of changes to RR Article **11** and a new resolution to capture the post-milestone procedure for systems subject to Resolution **35 (WRC-19)**. Examples of the regulatory changes needed to implement Method B2 are provided below as two options (B2a and B2b), where the difference between these sub-methods is based on differences in constellation size.

MOD

RESOLUTION 35 (REV.WRC-~~19~~23)

A milestone-based approach for the implementation of frequency assignments to space stations in a non-geostationary-satellite system in specific frequency bands and services[1]

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

18 that the suspension of the use of frequency assignments in accordance with No. **11.49** at any point prior to the end of a milestone period as specified in *resolves* 7*a)*, *b)* or *c)* or 8*a)*, *b)* or *c)* of this Resolution, as applicable, shall not alter or reduce the requirements associated with any of the remaining milestones as derived from *resolves* 7*a)*, *b)* or *c)* or 8*a)*, *b)* or *c)*, as appropriate.~~;~~

~~19 that, for a non-GSO system that has completed the milestone process described in this Resolution, including application of *resolves* 10*c)* by BR, and for systems to which *resolves* 6 applies, if the number of satellites capable of transmitting or receiving the frequency assignments deployed in that system subsequently falls below 95% (rounded down to the lower integer) of the~~

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[1] See also Resolution **[A7(B)] (WRC-23)**.

~~total number of satellites indicated in the Master Register entry minus one satellite for six continuous months, the notifying administration shall inform BR of the date when this event began, for information purposes only, as soon as possible thereafter; if appropriate and applicable, the notifying administration should also inform BR, as soon as possible thereafter, of the date on which the deployment of the total number of satellites was resumed; BR shall make the information received under this *resolves* available on its website,~~

ARTICLE 11

Notification and recording of frequency assignments[1, 2, 3, 4, 5, 6, 7] (WRC-19)

Section III – Maintenance of the recording of frequency assignments to non-geostationary-satellite systems in the Master Register (WRC-19)

MOD

11.51 For frequency assignments to some non-geostationary-satellite systems in specific frequency bands and services, Resolution **35 (Rev.WRC-~~19~~23)** and Resolution **[A7(B)] (WRC-23)** shall apply. (WRC-~~19~~23)

ADD

DRAFT NEW RESOLUTION [A7(B)] (WRC-23)

Enhanced suspension procedure for frequency assignments to space stations in a non-geostationary-satellite system in the fixed-satellite, mobile-satellite and broadcasting-satellite services subject to Resolution 35 (Rev.WRC-23)

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that one of the main motivations for developing Resolution **35 (WRC-19)** was to find a way to ensure that the content of the Master International Frequency Register (MIFR) for non-geostationary orbit (non-GSO) systems closely aligns with what is actually deployed in space;

b) that any regulatory mechanism for the post-milestone procedure to non-GSO systems should not impose an unnecessary burden on the administrations and the Radiocommunication Bureau,

recognizing

a) that Resolution **35 (Rev.WRC-23)** applies to frequency assignments to non-GSO systems brought into use in accordance with Nos. **11.44** and **11.44C**, in the frequency bands and for the services listed in its *resolves* 1;

b) that the magnitude of the typical variation of the number of satellites deployed and capable of transmitting or receiving the recorded frequency assignments needs to be carefully considered to avoid a requirement to report variations that have inconsiderable consequence, as is the case for very small constellations,

resolves

1 that this Resolution applies to non-GSO satellite systems with space stations with an apogee altitude lower than 15 000 km having completed the milestone period for those subject to Resolution **35 (Rev.WRC-23)** with at least one satellite deployed on a notified orbital plane and capable of transmitting or receiving according to the recorded frequency assignments;

2 that the notifying administration shall inform the Radiocommunication Bureau of the date of commencement of any continuous period exceeding 6 months during which the number of satellites deployed on notified orbital planes (as that term is used in Resolution **35 (Rev.WRC-23)**) and capable of transmitting or receiving the recorded frequency assignments is below [*Option B2a:* 95/P% or *Option B2b:* X] (rounded down to the lower integer) of the total number of satellites indicated in the Master Register entry minus one satellite;

Alternative 1

For	$3 \leq N < 50$	$X = N * 70\% - 1$ satellite
For	$N \geq 50$	$X = N * 95\% - 1$ satellite,

Alternative 2

For	$N < 550$	$X = N * 90\% - 1$ satellite
For	$550 \leq N < 5\,000$	$X = \mathrm{N} * 93\% - 1$ satellite
For	$N \geq 5\,000$	$X = \mathrm{N} * 95\% - 1$ satellite,

Alternative 3

For	$N < 100$	$X = N * 50\% - 1$ satellite
For	$100 \leq N < 1\,000$	$X = N * 65\% - 1$ satellite
For	$1\,000 \leq N < 5\,000$	$X = N * 85\% - 1$ satellite
For	$N \geq 5\,000$	$X = N * 95\% - 1$ satellite,

Alternative 4

For	$2 \leq N < 50$	$X = N * 50\%$
For	$50 \leq N < 100$	$X = N * 65\%$
For	$100 \leq N < 550$	$X = N * 80\%$
For	$550 \leq N < 5\,000$	$X = N * 93\%$
For	$N \geq 5\,000$	$X = N * 95\%$,

3 that, upon receipt of the information submitted under *resolves* 2, the Bureau shall promptly make it available on the ITU website;

4 that the notifying administrations shall inform the Bureau as soon as possible when the number of satellites deployed on notified orbital planes and capable of transmitting or receiving the recorded assignments has reached again [*Option B2a:* 95/P% or *Option B2b:* X] (rounded down to the lower integer) of the total number of satellites indicated in the Master Register minus one satellite;

5 that, in any case, the date at which the number of satellites deployed on notified orbital planes and capable of transmitting or receiving the recorded assignments reaches again

[*Option B2a:* 95/P% or *Option B2b:* X] (rounded down to the lower integer) of the total number of satellites indicated in the Master Register minus one satellite shall not be later than three years from the date of commencement of the continuous period referred to in *resolves* 2 provided that the notifying administration informs the Bureau pursuant to *resolves* 2 within 6 months of the start of that continuous period;

6 that, if the notifying administration informs the Bureau under *resolves* 2 more than 6 months after the date of commencement of the continuous period referred to in *resolves* 2, the number of years referred to in *resolves* 5 shall be reduced by the amount of time that has elapsed between the end of the 6-month period and the date at which the Bureau is informed under *resolves* 2;

7 that, if the notifying administration informs the Bureau more than 21 months after the date of commencement of the continuous period referred to in *resolves* 2, the notifying administration shall submit to BR, within 90 days:

a) the number of satellites capable of transmitting or receiving the frequency assignments actually deployed in that system, and

b) the modifications to the characteristics of the notified or recorded frequency assignments to reduce the total number of satellites indicated in the Master Register to a number of satellites not exceeding (1 + (1 – [*Option B2a:* 95/P% or *Option B2b:* X])) times the number of satellites indicated in *resolves* 7*a)* (rounded down to the lower integer);

8 that, ninety days before the end of the period referred to in *resolves* 5 or 6, as appropriate, the Bureau shall send a reminder to the notifying administration;

9 that the notifying administration shall submit to BR, no later than 30 days after the end of the period referred to in *resolves* 5 or 6, as appropriate, the number of satellites capable of transmitting or receiving the frequency assignments actually deployed in that system;

10 that, if the number of satellites indicated in *resolves* 9 still falls below [*Option B2a:* 95/P% or *Option B2b:* X] (rounded down to the lower integer) of the total number of satellites indicated in the Master Register entry minus one satellite, the notifying administration shall submit to BR, no later than 90 days after the end of the period referred to in *resolves* 5 or 6, as appropriate, the modifications to the characteristics of the notified or recorded frequency assignments to reduce the total number of satellites indicated in the Master Register to a number of satellites not exceeding [1 + (1 – [*Option B2a:* 95/P% or *Option B2b:* X])] times the number of satellites indicated in *resolves* 9 (rounded down to the lower integer);

11 that, upon receipt of the modifications to the characteristics of the notified or recorded frequency assignments as referred to in *resolves* 7 or 9, as appropriate:

a) BR shall promptly make this information available "as received" on the ITU website;

b) BR shall conduct an examination for compliance with Nos. **11.43A/11.43B**, as appropriate;

c) BR, for the purpose of No. **11.43B**, shall retain the original dates of entry of the frequency assignments in the Master Register if:

i) BR reaches a favourable finding under No**. 11.31**; and

ii) the modifications are limited to a reduction of the number of orbital planes (Appendix **4** data item A.4.b.1) and modifications to the right ascension of the ascending node of each plane (Appendix **4** data item A.4.b.5.a/A.4.b.4.g), the longitude of the ascending node (Appendix **4** data item A.4.b.6.g) and its date and time (Appendix **4** data items A.4.b.6.h and A.4.b.6.i.a) associated with the remaining orbital planes, or reduction of the number of space stations per plane (Appendix **4** data item A.4.b.4.b) and modifications of the initial phase angle of the space stations (Appendix **4** data item A.4.b.5.b/h) within planes; and

iii) the notifying administration provides a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments (see Appendix **4** data item A.23.a);

d) BR shall publish the information provided and its findings in the BR IFIC;

12 that, if a notifying administration fails to communicate the information required under *resolves* 7 or 9, as appropriate, the BR shall promptly send to the notifying administration a reminder asking the administration to provide the required information within 30 days from the date of this reminder from BR;

13 that, if a notifying administration fails to provide information after the reminder sent under *resolves* 12, the BR shall send to the notifying administration a second reminder asking it to provide the required information within 15 days from the date of the second reminder;

14 that, if a notifying administration fails to provide the required information under *resolves* 7 or 9, as appropriate, following the reminders under *resolves* 12 and 13, the BR shall no longer consider the frequency assignments under subsequent examinations under Nos. **9.36**, **11.32** or **11.32A**, and inform administrations having frequency assignments subject to Sub-Section IA of Article **9** that those assignments shall not cause harmful interference to, nor claim protection from, other frequency assignments recorded in the Master Register with a favourable finding under No. **11.31**,

instructs the Radiocommunication Bureau

1 to take the necessary actions to implement this Resolution;

2 to report any difficulties encountered in the implementation of this Resolution to WRC-27;

3 to publish the list of non-GSO satellite systems whose assignments shall not cause harmful interference to, nor claim protection from, other frequency assignments recorded in the Master Register with a favourable finding under No. **11.31** in accordance with *resolves* 14 above.

4/7/3 Topic C – Protection of geostationary-satellite networks in the mobile-satellite service operating in the 7/8 GHz and 20/30 GHz bands from emissions of non-geostationary-satellite systems operating in the same frequency bands and identical directions

4/7/3.1 Executive summary

Topic C under WRC-23 agenda item (AI) 7 was established to verify the effectiveness of the regulatory protection of the geostationary-satellite orbit (GSO) mobile-satellite service (MSS) from interference caused by non-GSO systems, and to identify possible inconsistencies in the provisions of the Radio Regulations (RR) applicable to the frequency bands:

– 7 250-7 750 MHz (space-to-Earth);
– 7 900-8 025 MHz (Earth-to-space);
– 20.2-21.2 GHz (space-to-Earth); and
– 30-31 GHz (Earth-to-space).

In response to this Topic, three methods are outlined in sections 4/7/3.4 and 4/7/3.5.

These methods consist of:

- Method C1 for no change to the Radio Regulations.
- Method C2 for a new provision in RR Article **22** extending the application of the concept of provisions of RR No. **22.2** for the protection of GSO satellite networks operating in the mobile-satellite service in the frequency bands under consideration in this topic.
- Method C3 for the modification of RR No. **5.461** and the additions of two new footnotes in RR Article **5** extending the application of the concept of provisions of RR No. **22.2** for the protection of GSO satellite networks operating in the mobile-satellite service in the frequency bands under consideration in this topic.

4/7/3.2 Background

Non-GSO systems operating in the frequency bands 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space) currently do not require coordination with GSO MSS networks under RR No. **9.11A** (RR Nos. **9.12A** or **9.13**). However, RR No. **9.21** applies to both non-GSO MSS systems and GSO MSS networks in the bands covered by RR No. **5.461**.

If an administration is of the view that unacceptable interference may be caused by a non-GSO system in the frequency bands 20.2-21.2 GHz and 30-31 GHz or by non-GSO FSS in the bands 7 250-7 750 MHz and 7 900-8 025 MHz to its existing or planned GSO MSS networks, e.g. by having conducted investigations providing results leading to this view, its comments may be communicated to the notifying administration responsible for the non-GSO system according to RR No. **9.3**. However, sometimes requests for the resolution of difficulties under RR No. **9.3** simply remain unanswered. This could be explained by the absence of clear criteria to be used during technical discussions. Furthermore, considering that resolving difficulties with respect to assignments of non-GSO systems subject to RR No. **9.3** does not have any regulatory implication with respect to the recording of assignments, it appears that the protection of GSO MSS networks is based on a best effort only. It should be noted that this is not the case for assignments to non-GSO MSS systems in the bands covered by RR No. **5.461**. In fact, the unsuccessful application of RR No. **9.21** (i.e. the absence of an agreement) leads to a recording in the Master International Frequency Register (MIFR) with favourable finding but the recorded assignment is subject to not causing harmful interference nor claiming protection from the assignments of the objecting administration, i.e. the administration having stated its disagreement (see also RR No. **11.31.1**).

Under RR No. **22.2**, non-GSO systems shall not cause unacceptable interference to GSO networks in the fixed-satellite service (FSS) and broadcasting-satellite service (BSS). However, GSO MSS networks are not covered under RR No. **22.2**.

Because of this apparent deficiency in the regulatory framework, the protection of GSO MSS networks from non-GSO systems in these bands is not ensured.

Furthermore, it is common to change mandatory RR Appendix **4** parameters of non-GSO satellite systems for filings not subject to coordination under Section II of RR Article **9** for the notification process without the need to provide a comparative analysis between the originally filed parameters and the modified parameters, and irrespective of any previous agreements.

4/7/3.3 Summary and analysis of the results of ITU-R studies

The scope of this WRC-23 AI 7 topic is limited to the frequency ranges 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space) with MSS or maritime mobile-satellite service (MMSS) allocations.

For each of the frequency bands covered under this Topic, Table 4/7/3.3-1 below provides the relevant provisions of RR Article **9** to communicate comments or express disagreement following the publication of a special section (CR/C or API/A) for a non-GSO satellite system, as appropriate, with a GSO network operating in the MSS. The applicable provisions of RR Article **9** depend on whether the GSO MSS satellite network is the “incoming” network or the “existing” network. The identification of the RR Article **9** provisions under which comments could be provided is particularly important to identify the applicable coordination procedure[27], if any, and the rights for protection resulting from the application of the relevant provisions of RR Articles **9** and **11**.

TABLE 4/7/3.3-1

Frequency bands and applicable RR Article 9 provisions

Line #	Bands	Incoming network/system	Existing network/system	Provisions in RR Art. 9
1	7 250-7 375 MHz	Non-GSO MSS (Special Section CR/C)	GSO MSS	No. **9.21** Nos. **9.50 / 9.52**
2		GSO MSS	Non-GSO MSS (Special Section CR/C)	No. **9.21** Nos. **9.50 / 9.52**
3		GSO MSS	Non-GSO FSS (Special Section API/A)	No. **9.52.1**
4		Non-GSO FSS (Special Section API/A)	GSO MSS	No. **9.3**
5	7 375-7 750 MHz	Non-GSO FSS (Special Section API/A)	GSO MMSS	No. **9.3**
6		GSO MMSS	Non-GSO FSS (Special Section API/A)	No. **9.52.1**
7	7 900-8 025 MHz	Non-GSO MSS	GSO MSS	No. **9.21**

[27] Coordination under Sub-Section IA of RR Article **9**, also known as “resolution of difficulties” versus “formal” coordination under Section II of RR Article **9**.

Line #	Bands	Incoming network/system	Existing network/system	Provisions in RR Art. 9
		(Special Section CR/C)		Nos. **9.50 / 9.52**
8		GSO MSS	Non-GSO MSS (Special Section CR/C)	No. **9.21** Nos. **9.50 / 9.52**
9		Non-GSO FSS (Special Section API/A)	GSO MSS	No. **9.3**
10		GSO MSS	Non-GSO FSS (Special Section API/A)	No. **9.52.1**
11	20.2-21.2 GHz	Non-GSO FSS/MSS (Special Section API/A)	GSO MSS	No. **9.3**
12		GSO MSS	Non-GSO FSS/MSS (Special Section API/A)	No. **9.52.1**
14	30-31 GHz	Non-GSO FSS/MSS (Special Section API/A)	GSO MSS	No. **9.3**
16		GSO MSS	Non-GSO FSS/MSS (Special Section API/A)	No. **9.52.1**

4/7/3.3.1 Application of RR Nos. 9.3/9.4 and 9.52.1

As shown in Table 4/7/3.3-1 above, these procedures apply with respect to:

– Non-GSO FSS with respect to GSO MSS in the frequency bands covered by RR No. **5.461** and in 7 375-7 750 MHz and,

– Non-GSO FSS and MSS with respect to GSO MSS in the frequency bands 20.2-21.2 GHz and 30-31 GHz.

For both the RR Nos. **9.3/9.4** and **9.52.1** procedures, the administrations concerned (notifying administration and affected administrations) shall make every possible effort to resolve the difficulties by means of mutually acceptable adjustments to their satellite networks. However, the absence of an agreement between the parties involved in the process of resolution of difficulties under RR Nos. **9.3/9.4** or No. **9.52.1** does not prevent the recording in the MIFR of the frequency assignments to non-GSO satellite systems not subject to Section II of RR Article **9**. For the frequency assignments that are subject to Section II of RR Article **9**, their status in the MIFR with respect to those with an earlier "date of protection" is dependent on the outcome of the coordination procedure (see RR No. **11.41**).

4/7/3.3.2 Application of RR No. 9.21

As shown in Table 4/7/3.3-1 above, these procedures apply only for non-GSO MSS and GSO MSS in the bands covered by RR No. **5.461.** For these two frequency bands, the agreement of other administrations needs to be sought through the application of the coordination procedure as described in Section II of RR Article **9** and more specifically the submission of a request for coordination. It is important to note that, the successful completion of the process initiated under RR No. **9.21** is examined by the BR with respect to RR No. **11.31** as opposed to RR No. **11.32** for any other coordination provisions under Sub-Section II of RR Article **9**. However, in accordance with RR No. **11.31.1**, "the recording of the assignment with respect to those objecting administration(s) whose agreement(s) have not been obtained will be with a favourable finding, subject to the condition that the assignment in question shall not cause harmful interference to nor claim protection from the service(s) of the objecting administration(s)".

4/7/3.3.3 Summary of regulatory studies

The focus of the studies had to be given to the regulatory provisions and solutions.

After a careful investigation of the existing regulatory provisions, a number of shortcomings and other issues with respect to the protection of GSO MSS networks from non-GSO systems can be summarized as follows:

– The provisions and principles in Sub-Section IA of RR Article **9** were not necessarily meant for satellite systems with constellations of large number of space stations and requiring 24/7 transmissions from and to their associated earth stations and service areas. The probability of interference is significantly higher from large constellations than in cases typically addressed under Sub-Section IA of RR Article **9**, and the prevention of interference requires complex technical and operational solutions that may not be suitably addressed through the regulatory process;

– Rules for protecting GSO networks operating in the MSS are incomplete or even missing compared to FSS, BSS (see RR No. **22.2**), resulting in difficulties to protect e.g. maritime or aeronautical applications during the coordination process;

– The protection of GSO MSS networks in the frequency bands 7/8 GHz and 20/30 GHz depends on the applicable provisions in the respective GSO MSS allocations. For the frequency ranges 7 250-7 375 MHz and 7 900-8 025 MHz, the MSS allocation would be subject to the same regulatory constraint as a secondary allocation in case the agreement of the affected administration is not obtained (RR No. **9.21**). In contrast, no distinction between the MSS and FSS is made in the frequency range 7 375-7 750 MHz and in the frequency ranges 20.2-21.2 GHz and 30-31 GHz (RR No. **9.3**). Hence, it is apparent that the protection of GSO MSS networks differs throughout the identified frequency bands, compared to the protection of GSO FSS networks; and

– The unsuccessful application of the RR No. **9.21** procedures for assignments to GSO MSS in frequency bands covered by RR No. **5.461** would, according to RR No. **11.31.1**, make them subject to the condition that it "*shall not cause harmful interference to nor claim protection from*" assignments including those associated with any non-GSO of an administration not having provided its agreement under RR No. **9.21**. In that context, the condition associated with the recording of the assignment to the GSO MSS as per RR No. **11.31.1** will be incompatible with the application of a new operational provision similar to RR No. **22.2** stipulating that *"... non-GSO shall not cause unacceptable interference and shall not claim protection from GSO MSS".*

These shortcomings should be addressed in any regulatory solution considered under Topic C.

4/7/3.4 Methods to satisfy Topic C

4/7/3.4.1 Method C1

No change to the Radio Regulations.

4/7/3.4.2 Method C2

Under this method, it is proposed to add a new provision, RR No. **22.2*bis***, to extend the concept of RR No. **22.2** for the protection of GSO MSS networks in the frequency bands 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space).

Furthermore, it is proposed to modify RR No. **5.461** to indicate the specific conditions of application of RR No. **9.21**.

Two alternatives are proposed for the modifications to RR No. **5.461**.

The first alternative specifies the conditions of the application of RR No. **9.21** for GSO MSS networks for which the complete coordination information is received by the Bureau from 16 December 2023 or the date of entry into force of the Final Acts of WRC-23, with respect to non-GSO systems for which complete coordination or notification information, as appropriate, is received by the Bureau from 16 December 2023 or the date of entry into force of Final Acts of WRC-23, and for non-GSO MSS systems for which complete coordination information is received by the Bureau from 16 December 2023 or the date of entry into force of the Final Acts of WRC-23, with respect to GSO MSS.

The second alternative only specifies the conditions of the application of RR No. **9.21** for GSO MSS networks for which the complete coordination information is received by the Bureau from 16 December 2023 or the date of entry into force of the Final Acts of WRC-23, with respect to non-GSO systems for which complete coordination or notification information, as appropriate, is received by the Bureau from 16 December 2023 or the date of entry into force of the Final Acts of WRC-23.

Finally, it is also proposed to add new RR Appendix **4** data items for assignments to non-GSO FSS systems in the frequency bands 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space) subject to Section IA of RR Article **9** to allow notifying administrations for GSO MSS operators to conduct reliable interference assessment into their networks using information directly from the BR International Frequency Information Circular (BR IFIC) publication without having to contact the notifying administration.

4/7/3.4.3 Method C3

Under this method, it is proposed to extend the concept of RR No. **22.2** to GSO MSS with respect to non-GSO systems in the frequency bands 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space) in the relevant provisions of RR Article **5**. Therefore, it is proposed to modify RR No. **5.461** to indicate the specific conditions of application of RR No. **9.21** and extend the concept of RR No. **22.2** for the protection of GSO MSS networks in the frequency bands 7 250-7 375 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space). Furthermore, it is proposed to add two new footnotes RR No. **5.A7C3** and RR No. **5.B7C3** to extend the concept of RR No. **22.2** for the protection of GSO MSS networks in the frequency bands 7 375-7 750 MHz (space-to-Earth) and for the bands 20.2-21.2 GHz and 30-31 GHz, respectively.

4/7/3.5 Regulatory and procedural considerations

4/7/3.5.1 For Method C1

NOC

ARTICLES

NOC

APPENDICES

4/7/3.5.2 For Method C2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

7 250-8 500 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
7 250-7 300	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOD 5.461	
7 300-7 375	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MOD 5.461	
...		
7 900-8 025	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOD 5.461	

NOTE: In order to protect the geostationary-satellite network in the mobile-satellite service from the non-geostationary-satellite system, the concept of RR No. **22.2** could be applied. However, this approach would create an inconsistency for GSO satellite networks in the mobile-satellite service which are obliged to apply RR No. **9.21**; this could be resolved by WRC-23 for which an example of the possible solution is described below.

Possible examples to address the above-mentioned inconsistency arising from the modification of RR No. **5.461**, as of the date 16 December 2023, assignments to GSO MSS satellite networks are not required to apply RR No. **9.21** with respect to non-GSO systems received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]* are shown below.

For Method C2, Alternative 1:

MOD

5.461 *Additional allocation:* the frequency bands 7 250-7 375 MHz (space-to-Earth) and 7 900-8 025 MHz (Earth-to-space) are also allocated to the mobile-satellite service on a primary basis, subject to agreement obtained under No. **9.21**~~.~~, with the exception that No. **9.21** shall not apply to the geostationary-satellite networks in the mobile-satellite service with respect to non-geostationary-satellite systems for which complete coordination or notification information, as appropriate, is received by the Bureau from *[16 December 2023 or the date of entry into force of* *the Final Acts of WRC-23]*, and to non-geostationary-satellite systems in the mobile-satellite service for which complete coordination information is received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]* with respect to geostationary-satellite networks in the mobile-satellite service. (WRC-23)

For Method C2, Alternative 2:

MOD

5.461 *Additional allocation:* the frequency bands 7 250-7 375 MHz (space-to-Earth) and 7 900-8 025 MHz (Earth-to-space) are also allocated to the mobile-satellite service on a primary basis, subject to agreement obtained under No. **9.21**. However, No. **9.21** is not applicable to the geostationary-satellite networks in the mobile-satellite service with respect to non-geostationary-satellite systems for which complete coordination or notification information, as appropriate, is received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]*. (WRC-23)

For Method C2:

ARTICLE 22

Space services[1]

Section II − Control of interference to geostationary-satellite systems

ADD

22.2*bis* In the frequency bands 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space), non-geostationary-satellite systems for which complete coordination or notification information, as appropriate, is received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]* shall not cause unacceptable interference to and shall not claim protection from geostationary-satellite networks in the mobile-satellite service which are operating in accordance with these Regulations. No. **5.43A** does not apply in this case. (WRC-23)

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

Footnotes to Tables A, B, C and D

[2] The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

Items in Appendix	*A – GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
…	…	…	…	…	…	…	…	…	…	…	…	…
A.25	**CHARACTERISTICS OF NON-GSO SYSTEMS IN THE FREQUENCY BANDS 7 250-7 750 MHz (SPACE-TO-EARTH), 7 900-8 025 MHz (EARTH-TO-SPACE), 20.2-21.2 GHz (SPACE-TO-EARTH) AND 30-31 GHz (EARTH-TO-SPACE) FOR ADVANCE PUBLICATION OF A NON-GEOSTATIONARY-SATELLITE NETWORK OR SYSTEM NOT SUBJECT TO COORDINATION UNDER SECTION II OF ARTICLE 9 AND/OR NOTIFICATION OF THOSE SATELLITE NETWORKS OR SYSTEMS**										A.25	
A.25.a	*Option 1:* Maximum aggregate e.i.r.p. of associated non-GSO earth stations of a single non-GSO constellation/configuration towards any point within the geostationary arc	-	-	X		+	-	-	-	-	A.25.a	
A.25.b	*Option 1:* Maximum aggregate pfd caused by all non-GSO space stations in a filing/configuration at any point of the Earth's surface within the visibility area of the GSO *Option 2:* Maximum pfd caused by a non-GSO space station of a single non-GSO constellation at any point of the Earth's surface within the visibility area of the GSO	-	-	X		+	-	-	-	-	A.25.b	
A.25.c	For the exclusion zone about the geostationary-satellite orbit, the type of zone (based on topocentric angle or satellite-based angle for establishing the exclusion zone)	-	-	X		+					A.25.c	
A.25.d	For the exclusion zone about the geostationary-satellite orbit, if the zone is based on a topocentric angle or a satellite-based angle, the width of the zone, in degrees	-	-	X		+					A.25.d	

NOTE: A.25 is applicable only to the frequency bands 7 250-7 750 MHz (space-to-Earth), 7 900-8 025 MHz (Earth-to-space), 20.2-21.2 GHz (space-to-Earth) and 30-31 GHz (Earth-to-space) and only for the advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article **9** and/or notification of those satellite networks or systems. The proposed parameters are intended to support the bilateral efforts of administrations to resolve difficulties. They are not used for any examination by the Bureau. It will allow for GSO MSS operators to conduct reliable interference assessment into their networks using information directly from the BR IFIC publication without having to contact the notifying administration of the non-geostationary satellite network or system.

*View: A different view was expressed expressing opposition to adding new AP**4** data items in relation to this AI 7 topic.*

4/7/3.5.3 For Method C3

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. **2.1**)

MOD

7 250-8 500 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
7 250-7 300	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOD 5.461	
7 300-7 375	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MOD 5.461	
…		
7 900-8 025	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOD 5.461	

NOTE: In order to protect the geostationary-satellite network in the mobile-satellite service from the non-geostationary-satellite system, the concept of RR No. **22.2** could be applied. However, this approach would create an inconsistency for GSO satellite networks in the mobile-satellite service which are obliged to apply RR No. **9.21**; this could be resolved by WRC-23 for which an example of the possible solution is described below.

Possible examples to address the above-mentioned inconsistency arising from the modification of RR No. **5.461**, as of the date 16 December 2023, assignments to GSO MSS satellite networks are not required to apply RR No. **9.21** with respect to non-GSO systems received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]* are shown below.

MOD

5.461 *Additional allocation:* the frequency bands 7 250-7 375 MHz (space-to-Earth) and 7 900-8 025 MHz (Earth-to-space) are also allocated to the mobile-satellite service on a primary basis, subject to agreement obtained under No. **9.21**. However, No. **9.21** is not applicable to the geostationary-satellite networks in the mobile-satellite service with respect to non-geostationary-satellite systems for which complete coordination or notification information, as appropriate, is received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]*. Non-geostationary-satellite systems for which complete coordination or notification information, as appropriate, is received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23]*, shall not cause unacceptable interference to and shall not claim protection from geostationary-satellite networks in the mobile-satellite service operating in accordance with these Regulations. No. **5.43A** does not apply. (WRC-23)

MOD

7 250-8 500 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
7 375-7 450	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB ADD 5.A7(C)3	
7 450-7 550	FIXED FIXED-SATELLITE (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB 5.461A ADD 5.A7(C)3	
7 550-7 750	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB ADD 5.A7(C)3	

ADD

5.A7(C)3 In the frequency band 7 375-7 750 MHz, non-geostationary-satellite systems operating in the fixed-satellite service for which complete notification information is received by the Bureau *from [16 December 2023 or the date of entry into force of the Final Acts of WRC-23]*, shall not cause unacceptable interference to and shall not claim protection from geostationary-satellite networks in the maritime mobile-satellite service operating in accordance with these Regulations. No. **5.43A** does not apply. (WRC-23)

MOD

18.4-22 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
20.2-21.2	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) 5.524 ADD 5.B7(C)3	

MOD

29.9-34.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
30-31	FIXED-SATELLITE (Earth-to-space) 5.338A MOBILE-SATELLITE (Earth-to-space) Standard frequency and time signal-satellite (space-to-Earth) 5.542 ADD 5.B7(C)3	

ADD

5.B7(C)3 In the frequency bands 20.2-21.2 GHz and 30-31 GHz, non-geostationary-satellite systems for which complete notification information is received by the Bureau from *[16 December 2023 or the date of entry into force of the Final Acts of WRC-23],* shall not cause unacceptable interference to and shall not claim protection from geostationary-satellite networks in the mobile-satellite service operating in accordance with these Regulations. No. **5.43A** does not apply. (WRC-23)

4/7/4 Topic D – Topics for which consensus was achieved in ITU-R

4/7/4.1 Executive summary

Topic D is a collection of three different topics that are viewed as being straightforward and for which consensus was achieved within ITU-R when presented. The topics address matters such as resolving inconsistencies in regulatory provisions or formalizing certain existing practices. The topics are separately numbered in the following sections. Given the straightforward nature of the topics, and the fact that consensus was achieved, only a single method has been developed to address each topic. However, for Topic D2 the final RR Appendix **4** elements will need to be aligned with the agreed revision of Recommendation ITU-R S.1503-3.

4/7/4.2 Background

4/7/4.2.1 Background for Topic D1 - Modifications to Appendix 1 to Annex 4 of RR Appendix 30B

In §§ 1.1 and 1.2 of Annex 4 of Appendix **30B** of Radio Regulations (RR) 2016**,** an allotment or an assignment was considered as being affected by a proposed new allotment or assignment if the orbital spacing between its orbital position and the orbital position of the proposed new allotment or assignment was equal to or less than:

a) 10° in the frequency bands 4 500-4 800 MHz (space-to-Earth) and 6 725-7 025 MHz (Earth-to-space);

b) 9° in the frequency bands 10.70-10.95 GHz (space-to-Earth), 11.20-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space).

The World Radiocommunication Conference 2019 (WRC-19) adopted modifications to Annex 4 of RR Appendix **30B** replacing the orbital separation from 10° and 9° to 7° and 6°, respectively. However, in § 2 of Appendix 1 to Annex 4 of RR Appendix **30B**, the calculation of the aggregate C/I ratio at a given downlink test point still considers 10° and 9°.

WRC-23 agenda item 7, Topic D1, considers this discrepancy and a method as outlined in sections 4/7/4.4 and 4/7/4.5 has been developed, which is to modify section 2 of Appendix 1 to Annex 4 of RR Appendix **30B** to align the values of orbital separation with those in sections 1.1 and 1.2 of the Annex adopted by WRC-19.

4/7/4.2.2 Background for Topic D2 – New RR Appendix 4 parameters for Recommendation ITU-R S.1503 updates

WRC-23 agenda item 7 Topic D2 addresses modification of RR Appendix **4** data items to support implementation of agreed revisions to Recommendation ITU-R S.1503-3.

ITU-R has been working on changes to Recommendation ITU-R S.1503-3 titled "Functional description to be used in developing software tools for determining conformity of non-geostationary-satellite orbit fixed-satellite service systems or networks with limits contained in Article **22** of the Radio Regulations". Some of the agreed changes require additional or modified RR Appendix **4** data items in order to be implemented in practice. Therefore, it was proposed to develop draft CPM text to cover these changes, assuming a revision to Recommendation ITU-R S.1503-3 is adopted by Study Group 4.

4/7/4.2.3 Background for Topic D3 – BR Reminders for BIU and BBIU

WRC-23 agenda item 7 Topic D3 addresses the establishment of reminders for confirming the bringing into use (or bringing back into use) of a satellite network or system under RR Nos. **11.44B**,

11.44C, **11.49** (**11.49.1** and **11.49.2**), RR Appendices **30/30A** § 5.2.10 (20*bis* and 24*bis*) and RR Appendix **30B** § 8.17 (14*ter*).

To assist administrations in managing their ITU satellite system filings under the Radio Regulations, WRCs, RRB and the Radiocommunication Bureau (BR) have, over time, included in the RR or Rules of Procedures reminders for most of the provisions with strict time-limits for submission of mandatory information. Indeed, an unfortunate oversight in the application of the RR, e.g. missing a deadline for providing information, may jeopardize a satellite system project.

These reminders exist for most key provisions of the RR, under Nos. **9.47** or **9.62** (acknowledgement of receipt of a request for coordination or absence of reply or decisions on a coordination request), or Nos. **11.44** and **11.49** (bringing into use or bringing back into use of frequency assignments) or No. **11.47** (provisionally recorded assignments), but also under No. **13.6**, all footnotes referring to the payments under Decision 482, and under many similar other occurrences in the Appendices **30**/**30A** and **30B**, and numerous resolutions, as e.g. Resolution **35 (WRC-19)**.

One critical time-limit however does not yet include a formal BR reminder. This is the confirmation of bringing into use or bringing back into use of frequency assignments under RR Nos. **11.44B**, **11.44C**, **11.49** (**11.49.1** and **11.49.2**), RR Appendices **30/30A** § 5.2.10 (20*bis* and 24*bis*) and RR Appendix **30B** § 8.17 (14*ter*) where the notifying administration shall inform the Bureau within 30 days of the end of the 90-day period after the bringing into use or bringing back into use that a space station in the geostationary-satellite or non-geostationary-orbit having the capability to transmit or receive on that assigned frequency, has been deployed and maintained at the notified orbital position or one of the notified orbital planes, as appropriate, for a continuous period of 90 days.

4/7/4.3 Summary and analysis of the results of ITU-R studies

4/7/4.3.1 Summary and analysis of the results of ITU-R studies for Topic D1

In section 2 of Appendix 1 to Annex 4 of RR Appendix **30B**, it is indicated that the aggregate *C*/*I* ratio at any given downlink test point is calculated by including the interference contribution from allotments or assignments for which the orbital separation is less than or equal to 10 degrees for the 6/4 GHz bands and less to 9 degrees for the 13/10-11 GHz band. This implies that contributions from allotments or assignments beyond the minimum orbital separation stipulated in sections 1.1 and 1.2 of Annex 4 of RR Appendix **30B** would be included in such calculation, taking into consideration allotments or the assignments not considered as affecting allotments or assignments of the desired satellite.

The discrepancy between sections 1.1 and 1.2 of Annex 4 and section 2 of Appendix 1 to Annex 4 of RR Appendix **30B** has also been identified in Annex 5 to Circular Letter CCRR/66. A rule of procedure has been adopted to address this discrepancy by aligning the values of the minimum orbital separation with those adopted by WRC-19 until such time as a competent WRC could consider the matter.

4/7/4.3.2 Summary and analysis of the results of ITU-R studies for Topic D2

The various agreed changes to Recommendation ITU-R S.1503-3 where a change to RR Appendix **4** is required are shown in the table below:

Item in revisions to Rec. ITU-R S.1503-3	New or existing App. 4 parameter
Minimum angle in degrees at the surface of the Earth between the lines to any two active non-GSO satellites	New
Maximum number of co-frequency non-GSO ES that can be tracked by a non-GSO satellite	New
Minimum angle in degrees at the non-GSO satellite between the lines to any two active non-GSO earth stations	New
Definition of an equivalent isotropically radiated power (e.i.r.p.) mask to be used for the epfd(up) case	Existing
Removal of X angle PFD mask format	Existing

4/7/4.3.3 Summary and analysis of the results of ITU-R studies for Topic D3

The BR, as an internal practice, has been sending a message recalling the 90-day obligation under RR Nos. **11.44B** or **11.44C** to administrations informing them of their satellite system bringing into use, that reads:

> "The Radiocommunication Bureau acknowledges receipt of your communication in reference above, in which your Administration indicated that the frequency assignments to the [xxx] satellite network were brought into use on [date of BIU] and notes that the continuous period of 90 days established under [No. **11.44B**][No. **11.44C**] of the Radio Regulations will soon be reached.
>
> Your Administration is requested, under [No. **11.44B**][No. **11.44C**], to confirm the bringing into use of the frequency assignments to the [xxx] satellite network and to inform the Bureau that a space station with the capability of transmitting or receiving the frequency assignments has been deployed and maintained at the notified orbital position for a continuous period of 90 days, starting from the notified date of bringing into use. In this respect, kindly note that the date of bringing into use shall be in conformity with [No. **11.44B**][No. **11.44C**], …
>
> In the absence of the confirmation of the bringing into use of the frequency assignments to the [xxx] satellite network within 120 days from the end of the period provided under No. **11.44**, in accordance with the Rules of Procedure relating to [No. **11.44B**] [No. **11.44C**], these provisionally recorded frequency assignments will be considered as not having been brought into use before the end of the period provided under No. **11.44** and will be cancelled from the Master Register, in accordance with No. **11.48**."

For the BR practice to be fully suitable, the message should be sent sufficiently early to the notifying administration to ensure a proper response within the regulatory time-frame, e.g. as soon as the date of receipt of the bringing or bringing back into use information. The dispatch of this message, depending on the resources of the BR, for some cases, has occurred almost at the end of the 120-day period which provides little flexibility to the notifying administration to respond to the BR message on time.

4/7/4.4 Methods to satisfy Topic D

4/7/4.4.1 Method to satisfy Topic D1

The method is to modify Section 2 of Appendix 1 to Annex 4 of RR Appendix **30B** to reflect the values of the minimum orbital separation as adopted by WRC-19 in sections 1.1 and 1.2 of Annex 4 of RR Appendix **30B**.

4/7/4.4.2 Method to satisfy Topic D2

Modification of RR Appendix **4** to support the implementation of agreed revisions to Recommendation ITU-R S.1503-3, including new data elements and modified data items.

4/7/4.4.3 Method to satisfy Topic D3

Addition of footnotes to RR Nos. **11.44B**, **11.44C**, **11.49**, RR Appendices **30/30A** § 5.2.10, and RR Appendix **30B** § 8.17 providing a formal reminder of the deadline for informing the Bureau of completion of BIU/BBIU in cases not subject to RR No. **11.47** or RR Appendices **30/30A** § 5.2.7 or RR Appendix **30B** § 8.16, as applicable, and for bringing into use or bringing back into use initiated to be sent by the Bureau to the notifying administration.

4/7/4.5 Regulatory and procedural considerations

4/7/4.5.1 Regulatory and procedural considerations for Topic D1

An example of possible implementation of Method D1 is given below.

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ANNEX 4 (REV.WRC-19)

Criteria for determining whether an allotment or an assignment is considered to be affected[15bis]

MOD

APPENDIX 1 TO ANNEX 4 (REV.WRC-~~07~~23)

Method for determination of the overall single-entry and aggregate carrier-to-interference value averaged over the necessary bandwidth of the modulated carrier

NOC

1 Single-entry *C*/*I*

MOD

2 Aggregate *C*/*I*

The aggregate $(C/I)_{agg}$ at a given downlink test point is given by:

$$(C/I)_{agg} = -10\log_{10}\left(\sum_{j}^{n} 10^{-\frac{(C/I)_{t_j}}{10}}\right) \qquad \text{dB}$$

$$j = 1, 2, 3 \ldots n,$$

where:

$(C/I)_{tj}$: overall carrier-to-interference ratio due to interference from the j^{th} ~~th~~ allotment or assignment calculated using the method for overall single-entry $(C/I)_t$ as provided in § 1 of Appendix **1** to this Annex; and

---

15bis For frequency assignments recorded in the List and brought into use before 23 November 2019, the criteria of § 2.2 of this Annex are not applicable. (WRC-19) *n*: total number of interfering allotments or assignments for which the orbital separation with the desired satellite is less than or equal to 7~~10~~° in the case of the 6/4 GHz band and less than or equal to 6~~9~~° in the case of the 13/10-11 GHz band.

4/7/4.5.2 Regulatory and procedural considerations for Topic D2

Example changes to RR Appendix **4**:

APPENDIX 4 (REV.WRC-19)

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations or radio astronomy stations[2] (Rev.WRC-12)

Footnotes to Tables A, B, C and D

[2] The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

MOD

TABLE A

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-~~19~~23)

*Note: These proposed changes are included for information purposes only as ITU-R discussions on revisions to Recommendation ITU-R S.1503-3 will continue at the June/July 2023 meeting of ITU-R Working Party 4A. There have been no agreements on which elements will be submitted to SG 4 as part of updates to Recommendation ITU-R S.1503-3. These discussions could lead to additions or deletion to the Appendix **4** data items included in example regulatory text below. Upon approval of revision to Recommendation ITU-R S.1503-3 additional explanations may be added to these items to clarify their applicability (uplink or downlink etc.), if needed.*

Items in Appendix	*A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION*	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
…	…	…	…	…	…	…	…	…	…	…	…	…
A.14	**FOR STATIONS OPERATING IN A FREQUENCY BAND SUBJECT TO Nos. 22.5C, 22.5D, 22.5F OR 22.5L: SPECTRUM MASKS**										**A.14**	
…	…	…	…	…	…	…	…	…	…	…	…	…
A.14.b.6	the mask pattern defined in terms of the power in the reference bandwidth as a function of latitude and the off-axis angle between the non-geostationary earth station boresight line and the line from the non-geostationary earth station to a point on the GSO arc or as a function of latitude, the non-geostationary earth station pointing angles (azimuth, elevation) and the difference in longitude between the non-geostationary earth station and a point on the geostationary arc					X					A.14.b.6	
…	…	…	…	…	…	…	…	…	…	…	…	…
A.14.c.4	the type of mask, among one of the following types: (Earth-based exclusion zone angle, difference in longitude, latitude)~~, (satellite-based exclusion zone angle, difference in longitude, latitude)~~ or (satellite azimuth, satellite elevation, latitude)					X					A.14.c.4	
…	…	…	…	…	…	…	…	…	…	…	…	…
A.14.d	**For each set of non-geostationary-satellite system operating parameters** to be provided, if A.4.b.6*bis* indicates the use of an extended set of operating parameters *Note* – There could be different sets of parameters at different frequency bands, but only one set of operating parameters for any frequency band used by the non-geostationary-satellite system										A.14.d	
…	…	…	…	…	…	…	…	…	…	…	…	…
A.14.d.x1	the minimum angle in degrees at the surface of the Earth between the lines to any two active non-GSO satellites. Assumed to be zero if not provided					O					A.14.d.x1	
A.14.d.x2	the minimum angle in degrees at the non-GSO satellite between the lines to any two active non-GSO earth stations. Assumed to be zero if not provided					O					A.14.d.x2	
A.14.d.x3	the maximum number of non-geostationary earth stations tracked co-frequency by a non-geostationary satellite. If a value is not provided, it is assumed that the maximum number of earth stations tracked co-frequency by a non-geostationary satellite is equal to the number of earth stations created for the epfd↑ run					O					A.14.d.x3	
A.14.d.x4	the likelihood of a non-geostationary satellite having an alpha angle in degrees that is less than or equal to a set of given values defined for a range of latitudes, where the alpha angle is the minimum topocentric angle between the line to a non-GSO satellite and the line to any point on the visible geostationary arc. Note: Can only be specified if the minimum track duration in A.14.d.8 is set to zero					O					A.14.d.x4	
…	…	…	…	…	…	…	…	…	…	…	…	…

4/7/4.5.3 Regulatory and procedural considerations for Topic D3

The following is example regulatory text of how to implement the method to satisfy Topic D3 in the Radio Regulations:

ARTICLE 11

Notification and recording of frequency assignments[1, 2, 3, 4, 5, 6, 7] (WRC-19)

Section II − Examination of notices and recording of frequency assignments in the Master Register

MOD

11.44B A frequency assignment to a space station in the geostationary-satellite orbit shall be considered as having been brought into use when a space station in the geostationary-satellite orbit with the capability of transmitting or receiving that frequency assignment has been deployed and maintained at the notified orbital position for a continuous period of 90 days. The notifying administration shall so inform the Bureau within 30 days from the end of the 90-day period[25, 26, ADD 26*bis*]. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. Resolution **40 (Rev.WRC-19)** shall apply. (WRC-~~19~~23)

ADD

[26*bis*] **11.44B.3** and **11.44C.5** If the notifying administration has informed the Bureau of the date of commencement of the 90-day bringing into use period, but, as of 15 days after the end of the 90-day bringing into use period has not yet informed the Bureau of the completion of the bringing into use period as per Nos. **11.44B** or **11.44C**, the Bureau shall promptly send the notifying administration a reminder of the obligation to inform the Bureau of the completion of the bringing into use period under Nos. **11.44B** or **11.44C**. (WRC-23)

MOD

11.44C A frequency assignment to a space station in a non-geostationary-satellite orbit network or system in the fixed-satellite service, the mobile-satellite service or the broadcasting-satellite service shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment has been deployed and maintained on one of the notified orbital plane(s)[27] of the non-geostationary satellite network or system for a continuous period of 90 days, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system. The notifying administration shall so inform the Bureau within 30 days from the end of the 90-day period[25, ADD 26*bis*, 28, 29]. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC subsequently. (WRC-~~19~~23)

MOD

11.49 Wherever the use of a recorded frequency assignment to a space station of a satellite network or to all space stations of a non-geostationary-satellite system is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When the recorded assignment is brought back into use, the notifying administration shall, subject to the provisions of Nos. **11.49.1**, **11.49.2**, **11.49.3** or **11.49.4**, as applicable, so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available as soon as possible on the ITU website and shall publish it in the BR IFIC. The date on which the recorded assignment is brought back into use[32, ADD 32*bis*, 33, 34, 35, 36] shall be not later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled. Ninety days before the end of the period of suspension, the Bureau shall send a reminder to the notifying administration. If the Bureau does not receive the declaration of the commencement of the bringing back into use period within thirty days following the limit date of the period of suspension established in accordance with this provision, it shall cancel the entry in the Master Register. The Bureau shall, however, inform the administration concerned before taking such action. (WRC-~~19~~23)

ADD

[32*bis*] **11.49.1*bis*** and **11.49.2*bis*** If the notifying administration has informed the Bureau of the date of commencement of the 90-day bringing back into use period, but, as of 15 days after the end of the 90-day bringing back into use period has not yet informed the Bureau of the completion of the bringing back into use period as per Nos. **11.49.1** or **11.49.2**, the Bureau shall promptly send the notifying administration a reminder of the obligation to inform the Bureau of the completion of the bringing back into use period under Nos. **11.49.1** or **11.49.2**, as applicable. (WRC-23)

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

ARTICLE 5 (REV.WRC-19)

Notification, examination and recording in the Master International Frequency Register of frequency assignments to space stations in the broadcasting-satellite service[18] (WRC-07)

5.2 Examination and recording

MOD

5.2.10 Wherever the use of a frequency assignment to a space station recorded in the Master Register and emanating from the Regions 1 and 3 List is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When the recorded assignment is brought back into use, the notifying administration shall so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. The date on which the recorded assignment is brought back into

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* The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. See also Annex 7 for the orbital limitations. (WRC-2000)

1 The Regions 1 and 3 List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

18 If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.6 and the corresponding entries in the Master Register under § 5.2.2, 5.2.2.1, 5.2.2.2 or 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. See also Resolution **905 (WRC-07)***. (WRC-07)

* *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

use[20*bis*, 20*ter*] shall be no later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled. (WRC-~~19~~23)

[20*bis*] The date of bringing back into use of a frequency assignment to a space station in the geostationary-satellite orbit shall be the commencement of the 90-day period defined below. A frequency assignment to a space station in the geostationary-satellite orbit shall be considered as having been brought back into use when a space station in the geostationary-satellite orbit with the capability of transmitting or receiving that frequency assignment has been deployed and maintained at the notified orbital position for a continuous period of 90 days. The notifying administration shall inform the Bureau within 30 days from the end of the 90-day period. Resolution **40 (Rev.WRC-19)** shall apply. (WRC-19)

[20*ter*] If the notifying administration has informed the Bureau of the date of commencement of the 90-day bringing back into use period, but, as of 15 days after the end of the 90-day bringing back into use period has not yet informed the Bureau of the completion of the bringing back into use period as per footnote 20*bis*, the Bureau shall promptly send the notifying administration a reminder of the obligation to inform the Bureau of the completion of the bringing back into use period under footnote 20*bis*. (WRC-23)

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

ARTICLE 5 (REV.WRC-19)

Coordination, notification, examination and recording in the Master International Frequency Register of frequency assignments to feeder-link transmitting earth stations and receiving space stations in the fixed-satellite service[21, 22] (WRC-19)

5.2 Examination and recording

MOD

5.2.10 Wherever the use of a frequency assignment to a space station recorded in the Master Register and emanating from the Regions 1 and 3 List is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was

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* The expression “frequency assignment to a space station”, wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. (WRC-03)

[1] The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

[2] This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

[21] Notification of assignments to transmitting feeder-link earth stations included in the Region 2 feeder-link Plan after 2 June 2000, or included in the feeder-link List, following successful application of Article 4, shall be effected applying the provisions of Article **11** following completion of the procedure of Article **9**. (WRC-03)

[22] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.10 and the corresponding entries in the Master Register under § 5.2.2, § 5.2.2.1, § 5.2.2.2 or § 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. (WRC-19)

suspended. When the recorded assignment is brought back into use, the notifying administration shall so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. The date on which the recorded assignment is brought back into use[24*bis*, 24*ter*] shall be no later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled. (WRC-~~15~~23)

24*bis* The date of bringing back into use of a frequency assignment to a space station in the geostationary-satellite orbit shall be the commencement of the 90-day period defined below. A frequency assignment to a space station in the geostationary-satellite orbit shall be considered as having been brought back into use when a space station in the geostationary-satellite orbit with the capability of transmitting or receiving that frequency assignment has been deployed and maintained at the notified orbital position for a continuous period of 90 days. The notifying administration shall inform the Bureau within 30 days from the end of the 90-day period. Resolution **40 (Rev.WRC-19)** shall apply. (WRC-19)

24*ter* If the notifying administration has informed the Bureau of the date of commencement of the 90-day bringing back into use period, but, as of 15 days after the end of the 90-day bringing back into use period has not yet informed the Bureau of the completion of the bringing back into use period as per footnote 24*bis*, the Bureau shall promptly send the notifying administration a reminder of the obligation to inform the Bureau of the completion of the bringing back into use period under footnote 24*bis*. (WRC-23)

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ARTICLE 8 (WRC-15)

Procedure for notification and recording in the Master Register of assignments in the planned bands for the fixed-satellite service[11, 12] (WRC-19)

MOD

8.17 Wherever the use of a recorded frequency assignment to a space station is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When the recorded assignment is brought back into use, the notifying administration shall so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. The date on which the assignment is brought back into use[14*ter*, 14*quater*] shall be no later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the

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[11] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in §§ 8.5 and 8.12 and the corresponding entries in the Master Register under § 8.11 or § 8.16*bis*, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action and that any resubmitted notice shall be considered to be a new notice. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. (WRC-19)

[12] Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

[14*ter*] The date of bringing back into use of a frequency assignment to a space station in the geostationary-satellite orbit shall be the date of the commencement of the 90-day period defined below. A frequency assignment to a space station in the geostationary-satellite orbit shall be considered as having been brought back into use when a space station in the geostationary-satellite orbit with the capability of transmitting or receiving that frequency assignment has been deployed and maintained at the notified orbital position for a continuous period of 90 days. The notifying administration shall inform the Bureau within 30 days from the end of the 90-day period. Resolution **40 (Rev.WRC-19)** shall apply. (WRC-19)

[14*quater*] If the notifying administration has informed the Bureau of the date of commencement of the 90-day bringing back into use period, but, as of 15 days after the end of the 90-day bringing back into use period has not yet informed the Bureau of the completion of the bringing back into use period as per footnote 14*ter*, the Bureau shall promptly send the notifying administration a reminder of the obligation to inform the Bureau of the completion of the bringing back into use period under footnote 14*ter*. (WRC-23) notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled from the Master Register and the Bureau shall apply the provisions of § 6.33. (WRC-~~19~~23)

4/7/5 Topic E – RR Appendix 30B improved procedures for new Member States

4/7/5.1 Executive summary

Article 7 of RR Appendix **30B** contains a procedure for the addition of a new allotment to the Plan for a new Member State of the Union. However, administrations have found difficulties adding their new allotment to the Plan without the need to conduct coordination. This is due to the fact that there have been a lot of submissions for additional systems with global/regional coverage after WRC-07.

§ 1.1 of Article 1 of RR Appendix **30B** (Rev.WRC-19) stipulates that "The objective of the procedures prescribed in this Appendix is to guarantee in practice, for all countries, equitable access to the geostationary-satellite orbit in the frequency bands of the fixed-satellite service covered by this Appendix".

WRC-19 introduced Resolution **170 (WRC-19)** which offers preferential conditions for administrations having no network in the RR Appendix **30B** List and which want to convert their allotment in the Plan into an assignment with modifications outside the envelope of the initial allotment while restricted to providing service to their national territory. However, after WRC-19 administrations found difficulty adding their new allotment to the Plan with the current procedures of Articles 6 and 7 of RR Appendix **30B** and also those included in Resolution **170 (WRC-19)**, which offers certain preferential conditions for administrations having no network in the RR Appendix **30B** List and which want to convert their allotment in the Plan into an assignment with modifications outside the envelope of the initial allotment while restricted to providing service to their national territory.

Under this Topic, it is considered to improve the Article 7 procedure of RR Appendix **30B** (Rev.WRC-19) for new ITU Member States to obtain a national allotment like other ITU Member States that already have a national allotment in the fixed-satellite service (FSS) Plan.

Three methods have been developed to address this topic. The first is NOC to the Radio Regulations. The second method involves possible amendments to RR Appendix **30B**, including the use in Article 7 of the coordination triggers found in Appendices 1 and 2 to Attachment 1 of Resolution **170 (WRC-19)**, i.e. the preferential criteria. The third method proposes to modify the Article 7 procedure of RR Appendix **30B** (Rev.WRC-19) by affording special consideration to the coordination requirements for such request for a new national allotment during the examination process of the request.

4/7/5.2 Background

The RR Appendix **30B** FSS Plan was created and approved by WARC-88, in which each administration being an ITU Member State at that time was given an allotment in the FSS Plan. In order to account for an administration which has joined the Union as a new Member State at a later stage, Article 7 of RR Appendix **30B** (Rev.WRC-19) contains a procedure for the addition of a new allotment to the Plan for a new Member State of the Union. This procedure prescribes that submissions received under Article 7 shall be processed ahead of all submissions waiting to be processed under Article 6, e.g. submissions for conversion of allotments into assignments or submissions for additional use. Yet, administrations in applying Article 7 have encountered difficulties to obtain allotments in the Plan without having to conduct bilateral coordination with other administrations.

WRC-19 adopted Resolution **170 (WRC-19)** in which administrations that do not have any assignments in the RR Appendix **30B** List, or under coordination, have a one-off chance to file for assignments in the List and have this filing processed ahead of regular filings waiting to be processed. Moreover, in determining coordination requirements for the filings under Resolution **170 (WRC-19)**, criteria more preferential to the filing administration are used.

WRC-07 revised Article 7 of RR Appendix **30B** (Rev.WRC-19), which provides provisions for new ITU Member States to obtain allotments in the Plan. Like those of Resolution **170 (WRC-19)**, these procedures prescribe that the filings under Article 7 (Rev.WRC-07) will be processed ahead of regular filings waiting to be processed. However, unlike Resolution **170 (WRC-19)**, Article 7 (Rev.WRC-07) identifies coordination requirements using the regular criteria as contained in Annex 4 to RR Appendix **30B** (Rev.WRC-19). This would give rise to a larger number of coordination requirements being identified than if the criteria in Resolution **170 (WRC-19)** had been used. This difficulty has been observed after WRC-19, where new ITU Member States have applied the Article 7 procedure in order to obtain national allotments in the FSS Plan. These administrations could not obtain national allotments directly under the Article 7 procedure even though these requests received preferential treatment by the Bureau (i.e. the request under Article 7 (Rev.WRC-19) was processed ahead of regular filings waiting to be processed). One of the factors influencing this, is the large number of networks in the List and the large number of additional systems with global coverage and service area that had already been processed by the Bureau as seen from statistics submitted by the BR Director. The average orbital spacing calculated in the arc corresponding to 20 degrees elevation angle and considering Plan allotments, assignments in the List and pending networks (BR IFIC 2936 / 22.12.2020) is between 0.55 and 0.62 degrees.

Over and above this difficulty, despite the procedure in Resolution **170 (WRC-19)** being available to new ITU Member States also, the relaxed criteria in Resolution **170 (WRC-19)** have not yet been applied to Article 7 requests.

Under this Topic, improved procedures for new ITU-R Member States to obtain national allotments in the RR Appendix **30B** Plan are sought.

4/7/5.3 Summary and analysis of the results of ITU-R studies

WRC-07 revised the regulatory provisions for RR Appendix **30B** (Rev.WRC-19), facilitating coordination of networks with characteristics different from those in the Plan by providing identified coordination requirements to conduct this coordination.

WRC-07 also reduced the antenna size for allotments in the Plan to the minimum technically possible while retaining the required protection between allotments in the Plan. This, together with the resulting large number of networks filed for additional use has led to difficulties for new ITU Member States to obtain their national allotment with the application of Article 7. Before WRC-07 there were only a few networks in the List in addition to the allotments in the Plan of other administrations, therefore the Administrations of Uzbekistan, Kazakhstan, Belarus, Azerbaijan and Lithuania could obtain allotments with direct application of Article 7 of RR Appendix **30B** in absence of potentially affected administrations. Nevertheless, it needs to be mentioned that some administrations have agreed with some restrictions (minimum elevation angle less than 20 degrees for some test points and degradation in single-entry (SE) and aggregate (AGG) reference situation values) of their allotments.

Tables 4/7/5.3-1 through 4/7/5.3-3 provide an overview of submissions, and details of submissions and suppressions under RR Appendix **30B** by administrations from 2009 up till March 2023.

TABLE 4/7/5.3-1

Overview of submissions under RR Appendix 30B made by administrations from 2009 up till March 2023

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (supra national service area and global coverage*)	Suppression
2009 Q1 + Q2	0	0	0	1	3	11	0
2009 Q3 + Q4	0	0	0	0	0	6	15
2010 Q1 + Q2	1	0	0	0	1	14	2
2010 Q3 + Q4	0	0	0	0	1	19	1
2011 Q1 + Q2	1	0	0	0	2	18	1
2011 Q3 + Q4	1	0	0	0	2	20	23
2012 Q1 + Q2	0	0	0	0	3	20	1
2012 Q3 + Q4	1	0	2	0	2	23	4
2013 Q1 + Q2	1	0	0	0	4	27	7
2013 Q3 + Q4	1	0	0	0	0	17	12
2014 Q1 + Q2	1	0	0	0	2	30	42
2014 Q3 + Q4	0	0	0	0	7	20	0
2015 Q1 + Q2	0	0	1	0	1	30	11
2015 Q3 + Q4	0	0	0	0	0	26	7
2016 Q1 + Q2	0	1	0	0	0	23	8
2016 Q3 + Q4	0	0	0	0	1	24	4
2017 Q1 + Q2	0	0	0	0	4	34	1
2017 Q3 + Q4	0	1	0	0	0	25	7
2018 Q1 + Q2	0	0	0	0	6	20	9
2018 Q3 + Q4	0	0	0	0	0	10	15
2019 Q1 + Q2	1	1	0	0	0	4	17
2019 Q3 + Q4	0	0	0	0	1	19	17
2020 Q1 + Q2	7**)	1	0	0	2	14	16
2020 Q3 + Q4	0	1	0	0	1	13	9
2021 Q1 + Q2	0	0	0	0	0	21	27
2021 Q3 + Q4	0	0	0	1	2	14	22
2022 Q1 + Q2	0	0	0	0	0	8	25
2022 Q3 + Q4	1	0	0	0	4	10	14
2023 Q1	0	0	0	0	0	8	7

* Notices for additional use with service area and coverage beyond the national territory of notifying administration.

** Notices under Article 7 of RR Appendix **30B** (request from a new Member State for a new allotment in the Plan).

TABLE 4/7/5.3-2

Number of RR Appendix 30B submissions that have been received (2009 – 2023/Q1)

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (with supra national service area and global coverage)	Total
ALG						2	2
ARM						1	1
ARS/ARB						10	10
AUS						2	2
B			2		2	4	8
BGD	1					3	4
BIH	1						1
BLR	1					4	5
BOL		1					1
BUL	1					1	2
CAN			1			3	4
CBG						1	1
CHN					8	22	30
CYP						6	6
D						14	14
E						35	35
ETH						1	1
F						135	135
G						23	23
GEO	1						1
GRC						1	1
HNG						2	2
HOL						36	36
HRV	1						1
I				1			1
IND					17	15	32
INS					3	3	6
IRN		1				5	6
IRQ						1	1
ISR						19	19
J						9	9
KAZ						3	3
KOR		1			3		4
LAO						2	2
LUX						13	13
MCO						4	4

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (with supra national service area and global coverage)	Total
MDA	1						1
MEX	1				3		4
MKD	1						1
MLA					1	5	6
MNE	1						1
MNG	2						2
NCG						2	2
NOR						1	1
NPL		1			1		2
PAK		1				2	3
PNG						30	30
QAT						18	18
ROU	1						1
RUS					9	7	16
RUS/IK						29	29
S						18	18
SDN	1						1
SRB	1						1
SSD	1						1
TUR						4	4
UAE						21	21
USA				1		9	10
VEN					1	1	2
VTN					1	1	2
Total:	**16**	**5**	**3**	**2**	**49**	**528**	**603**

TABLE 4/7/5.3-3

Number of RR Appendix 30B networks that have been suppressed (2009 – 2023/Q1)

	2009-2023*	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023*
ALG	1													1		
ARM	1												1			
ARS/ARB	14						3	1	1	1	2	3	1	1	1	
B	4												1	3		
BGD	3												1	2		
BLR	3										1		1	1		
BUL	1					1										

	2009-2023*	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023*
CAN	2						1	1								
CHN	23						15					1	4	1	2	
E	11											5		1	5	
D	1														1	
F	31						2	1			6	5	1	9	7	
F/EUT	38	15	3	16	2	1			1							
G	14				1			6		1		1		2	1	2
HOL	20								3			3	1	7	5	1
IND	10			1				6	1					2		
IRN	1												1			
IRQ	1													1		
ISR	8										2	4	1	1		
J	4														2	2
KAZ	1															1
KOR	10					10										
LAO	1													1		
LBY	1			1												
LUX	27			1		4	13		2	5	1		1			
MCO	1					1										
MEX	2												2			
MLA	2								1					1		
MNG	1													1		
NCG	1													1		
NOR	2						1	1								
PNG	21			3						1	1	1	3	3	9	
QAT	3												1	2		
QAT/ARB	1												1			
RUS	19			2	1	1	5	1	2			1	1		5	
RUS/IK	15										6	6	1	2		
S	9						2		1		1		2	2		1
SDN	1											1				
TUR	2										2					
UAE	6										1	3		2		
USA	4					1		1						1	1	
VTN	3				1						1			1		
Total	**324**	**15**	**3**	**24**	**5**	**19**	**42**	**18**	**12**	**8**	**24**	**34**	**25**	**49**	**39**	**7**

* In 2023, the statistics stop at 31 March.

A request under Article 7 (Rev.WRC-19) will be processed ahead of regular filings waiting to be processed. However, due to the large number of submissions having been already processed by the Bureau, little benefit is obtained from the procedure provided under Article 7. This is the main reason why a new ITU Member State has difficulties obtaining a national allotment directly from the application of Article 7, contrary to the requests received before WRC-07.

WRC-19 adopted changes to the procedures of RR Appendix **30B** to improve and further facilitate access to enter assignments into the RR Appendix **30B** List for those Member States which do not have any assignments in the RR Appendix **30B** List, or under coordination. A study shows that while providing improvement and reducing the coordination requirements, the use of the preferential criteria in Resolution **170 (WRC-19)** does not eliminate the need for coordination for submissions under Article 7. A study showed that the use of criteria contained in Resolution **170 (WRC-19)** for the examination of Article 7 requests only brings 3 dB improvement.

Studies conducted have revealed that submissions under Article 7, accepted by the Bureau, processed and published, include assignments with characteristics beyond what is granted to other ITU-R administrations in the Plan. Most notably, e.i.r.p. levels much higher than those required to obtain the *C*/*N* prescribed for administrations in Annex 1 of RR Appendix **30B** (Rev.WRC-19).

In considering preferential treatment of submissions under Article 7, consideration should be given as to what can be contained in such filings while enjoying such preferential treatment. This would include consideration of boundaries on technical parameters of assignments contained in submissions and if administrations under Article 7 should be entitled to alter the characteristics developed by the Bureau under No. **7.3** of RR Appendix **30B** (Rev.WRC-19).

As a result of the above-mentioned studies, Topic E proposes to modify the Article 7 procedure of RR Appendix **30B** (Rev.WRC-19) to better facilitate any new ITU Member State to obtain a national allotment by reconsidering the priority between the Article 7 requests and the application of Article 6 for additional systems.

4/7/5.4 Methods to satisfy Topic E

Three methods to satisfy Topic E have been identified.

4/7/5.4.1 Method E1

No changes to the Radio Regulations.

4/7/5.4.2 Method E2

Under this method, to grant new ITU Member States the same privileges as those granted by WRC-19 to administrations having no assignments in the RR Appendix **30B** List or under coordination, some possible amendments to RR Appendix **30B** are suggested as shown below.

1 Use the same coordination triggers in RR Appendix 30B Article 7 as those of Resolution 170 (WRC-19)

Under this option, the coordination triggers used for filings under Article 7 of RR Appendix **30B** would be those found in Appendices 1 and 2 to Attachment 1 of Resolution **170 (WRC-19)**, i.e. the preferential criteria. This could be done e.g. by copying these into Annex 4 of RR Appendix **30B** and specifying for what filings and in respect of what assignments they would apply. Furthermore, the current Article 7 already prescribes processing of filings ahead of regular filings waiting to be processed so this element of Resolution **170 (WRC-19)** is already contained in Article 7.

2 Provide a pointer in RR Appendix 30B Article 7 to Resolution 170 (WRC-19)

Under this option, in Article 7, following the support by the Bureau prescribed in §§ 7.3 and 7.4, new ITU Member States could be pointed to Resolution **170 (WRC-19)**:

a) either as a one-off option to be decided by the new ITU Member State or;

b) automatic for the first submission under Article 7 of a new ITU Member State or;

c) automatic for all submissions under Article 7 of a new ITU Member State.

4/7/5.4.3 Method E3

Under this method, it is proposed to develop a special procedure through a new Resolution to better facilitate any new ITU Member State to obtain a national allotment by providing additional guidance to the Bureau and the new ITU Member State and re-considering some priority between the Article 7 requests and the application of Article 6 for additional systems.

Special consideration shall be given to the request for a new national allotment under Article 7 of RR Appendix **30B** in order to fulfil the objectives of the FSS Plan. As it could be difficult to apply additional guidance for Article 7 requests already received by the Bureau from 12 March 2020, this Resolution proposes generic solutions for future Article 7 requests received after WRC-23 and specific solutions for Article 7 requests already received which are still at the coordination phase.

For Article 7 requests, it is proposed that:

– When examining a request under Article 7.3:
    - The Bureau shall take into account only:
        – Allotments in the Plan;
        – Existing systems (those listed in Resolution **148 (WRC-07)**);
        – Assignments appearing in the List on or before the date of receipt of the request under Article 7;
        – Pending Article 7 transferred to Article 6;
        – Pending conversion of allotment into assignments without modification;
        – Pending conversion of allotment into assignments with modification but within the envelope of the allotment;
        – and submissions received in accordance with Resolution **170 (WRC-19)**.
    - The Bureau shall apply the criteria contained in Resolution **170 (WRC-19)** to identify potentially affected administrations.
    - The Bureau shall not take into account all pending satellite networks except for the above-mentioned cases.
    - The Bureau shall verify if the final characteristics of the new allotment or assignment in the List, as appropriate, are in compliance with Annex 1 of RR Appendix **30B** with due regard to the overall aggregate carrier-to-interference value under free-space conditions.

– All satellite networks identified as affected under § 6.5 *b)* of Appendix **30B** and all pending satellite networks except for the above-mentioned case identified as affected under § 6.5 *c)* of Appendix **30B** will be informed by the BR of the specific nature of such a Special Section which is intended to allow a national allotment to a new Member State of the Union with a request to consider this request with the greatest possible goodwill.

– BR shall inform regularly the RRB of the coordination status of these Article 7 requests.

– In case of continuing disagreement without valid argument, the RRB could instruct the BR to consider that a special agreement has been concluded imposing the administration of the additional system to fully protect the new Allotment when it will be BIU and to not consider mutual interference in updating the reference situation.

– In case an assignment in the List or an existing system is identified as potentially affected by a new Allotment, the responsible administration of that assignment is urged to take all necessary measures to accommodate the new Allotment.

– In case an existing Allotment is identified as potentially affected by a new Allotment, if the requesting administration insists, a remark should be inserted indicating that an agreement shall be reached before the new Allotment is brought into use under Article 8 of RR Appendix **30B**. In such case, the reference situation of existing Allotments would not take into account the interference from the new Allotment.

In section 4/7/5.5.3, an example regulatory text for Method E3 above is provided.

4/7/5.5 Regulatory and procedural considerations

Examples of regulatory text relating to the Methods to satisfy Topic E.

4/7/5.5.1 For Method E1

NOC

ARTICLES

NOC

APPENDICES

4/7/5.5.2 For Method E2

Example regulatory text in response to Method E2.

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

MOD

ARTICLE 6 (REV.WRC-~~19~~23)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*, 2*ter*] (WRC-~~19~~23)

2*ter* In respect of proposed allotments by new Member States of the Union under Article 7 of this Appendix, special provisions as outlined in that Article apply. (WRC-23)

ARTICLE 7 (REV.WRC-15)

Procedure for the addition of a new allotment to the Plan for a new Member State of the Union

NOC

7.1 The administration of a country** which has joined the Union as a Member State and does not have a national allotment in the Plan or an assignment stemming from the conversion of an allotment shall obtain a national allotment by the following procedure. (WRC-15)

NOC

7.2 The administration shall submit its request for an allotment to the Bureau, with the following information:

a) the geographical coordinates of not more than 20 test points for determining the minimal ellipse to cover its national territory;

b) the height above sea level of each of its test points;

c) any special requirement which is to be taken into account to the extent practicable.

NOC

7.3 Upon receipt of the complete information (mentioned in § 7.2 above), the Bureau shall expeditiously and ahead of submissions for which the examination under § 6.5 has not yet started, identify appropriate technical characteristics and associated orbital locations for a prospective national allotment. The Bureau shall send this information to the requesting administration.

NOC

7.4 Upon receipt of the Bureau's response under § 7.3, the requesting administration shall, within thirty days, indicate which of the proposed orbital locations with the associated technical parameters as identified by the Bureau it has selected. During this period, the requesting administration may at any time seek the assistance of the Bureau.

MOD

7.4*bis* If a selection for an allotment under § 7.4 has not been received by the Bureau within the specified time-limit referred to in § 7.4 above, the Bureau ~~will~~shall resume examination of submissions under § 6.5, or subsequent submission under Article 7, as appropriate, and inform the requesting administration that its request will be processed under § 7.5 when the Bureau is informed about the selected orbit location.

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9 (SUP - WRC-15)

MOD

7.5 Upon receipt of a request under § 7.4, the Bureau shall process the request ahead of submissions for which the examination under § 6.5 has not yet started and, using ~~Annexes 3 and 4~~Appendices 1 and 2 of Attachment 1 to Resolution **170 (WRC-19)**, examine it with respect to its conformity with:

a) the Table of Frequency Allocations and the other provisions[10] of the Radio Regulations, except those provisions relating to conformity with the fixed-satellite service Plan which are the subject of the following subparagraph;

b) allotments in the Plan;

c) assignments which appear in the List;

d) assignments for which the Bureau has previously received complete information and which have been examined, or are at the stage of examination under § 6.5.

NOC

7.6 When the examination under § 7.5 leads to a favorable finding, the Bureau shall enter the national allotment of the new Member State of the Union in the Plan and publish the characteristics of the allotment concerned and the result of its examination in a Special Section of the BR IFIC with the updated reference situation.

MOD

7.7 In the event that the Bureau's findings under § 7.5 are unfavourable, the proposed allotment of the Member State shall be treated as a submission under § 6.1 and shall be treated by the Bureau ahead of any other submissions received under Article 6, except for submissions which were already under examination under § 6.5 by the Bureau at the time of completion of the examination of the request of the new Member State under § 7.5. During the Article 6 procedure for the proposed allotment of the new Member State of the Union, the additional provisions contained in §§ 8 and 9 of Attachment 1 to Resolution **170 (WRC-19)** shall apply and the associated technical criteria specified in Appendices 1 and 2 to that Attachment shall be used during technical examinations at the various stages of Article 6.

MOD

RESOLUTION 170 (REV.WRC-~~19~~23)

Additional measures for satellite networks in the fixed-satellite service in frequency bands subject to Appendix 30B for the enhancement of equitable access to these frequency bands

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

ATTACHMENT 1 TO RESOLUTION 170 (REV.WRC-~~19~~23)

…

APPENDIX 2 TO ATTACHMENT 1 TO RESOLUTION 170 (REV.WRC-~~19~~23)

Protection criteria for a new incoming network

Incoming network	Allotments or assignments to be protected	Protection criteria
Assignment applying the special procedure or allotment proposed under Article 7 of Appendix **30B**	Allotment in the Plan	Annex 4 of Appendix **30B**
	Assignment converted from allotment without modification	Annex 4 of Appendix **30B**
	Assignment converted from allotment with modification within the envelope of the allotment	Annex 4 of Appendix **30B**
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure applied	Annex 4 of Appendix **30B**
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure NOT applied	New criteria specified in this Resolution
	Former existing system	Annex 4 of Appendix **30B**
	Additional system for which the special procedure applied	Annex 4 of Appendix **30B**
	Additional system with frequency assignments recorded in the List until 22 November 2019 with service area limited to national territories for which the special procedure NOT applied	Annex 4 of Appendix **30B**
	Additional system with frequency assignments submitted under item 6.1 of Appendix **30B** with service area limited to national territories for which the special procedure NOT applied	New criteria specified in this Resolution
	Additional system with frequency assignments with service area beyond national territories for which the special procedure NOT applied	New criteria specified in this Resolution
	Request under Article 7 but transferred to Article 6	Annex 4 of Appendix **30B**
	New allotment through the application of § 6.35	Annex 4 of Appendix **30B**
Conversion of allotment or new additional system for which the special procedure NOT applied	All	Annex 4 of Appendix **30B**

…

4/7/5.5.3 For Method E3

An example of possible implementation of Method E3 for RR Appendix **30B** is given below.

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

MOD

ARTICLE 6 (REV.WRC-~~19~~23)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*, 2*ter*] (WRC-~~19~~23)

ADD

6.4*bis* When the examination of each assignment in a notice received under § 6.1, to convert an allotment into an assignment, with respect to § 6.3 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice. This telefax shall inform these administrations of the reception under § 6.1 of this notice. (WRC-23)

ADD

6.15*quat* When an agreement is concluded under this provision between an allotment in the Plan or proposed allotment which was treated as a submission under § 6.1 in accordance with § 7.5 and assignments which appear in the List or the Bureau has previously examined under § 6.5 after receiving complete information in accordance with § 6.1, the administration responsible of the assignments which appear in the List or the Bureau has previously examined under § 6.5 after receiving complete information in accordance with § 6.1 shall commit to respect the power flux-density limits shown in Section 2.2 of Annex 4 of Appendix **30B** (Rev.WRC-19**)** at any point within the territory, situated inside the −3 dB contour of the associated beam area, of the administration of the allotment/proposed allotment concerned at the date on which the frequency assignment, stemming from the conversion of the allotment concerned, is to be brought into use as communicated under § 8.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 8.10*bis*, whichever comes later. (WRC-23)

2*ter* In respect of proposed allotments by new Member States of the Union received by the Bureau under Article 7 of this Appendix, the procedure as outlined in Resolution **[NEW-MEMBER-STATE-AP30B] (WRC-23)** applies. (WRC-23)

ADD

6.15*quin* Upon receipt of agreements under § 6.15*quat*, when entering the assignment in the List, the Bureau shall indicate those administrations whose allotments were the basis of the agreement. (WRC-23)

NOC

6.25 After a notice is returned under § 6.24, should the notifying administration resubmit the notice and insist upon its reconsideration, the Bureau, on the condition of a favourable finding under § 6.21 and 6.22 with respect to allotments in the Plan, shall enter the assignment provisionally in the List, with an indication of those administrations whose assignments were the basis of the unfavourable finding. The entry in the List shall be changed from provisional to definitive only if the Bureau is informed that all required agreements have been obtained.

ADD

6.27*bis* When an assignment is entered in the List referred to in § 6.15*quin*, that assignment shall not be taken into account in updating the reference situation of those allotments which were the basis for the agreement under § 6.15*quat*. (WRC-23)

ADD

6.29*bis* Should the commitment under § 6.15*quat* not be respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment requesting an immediate respect of conditions specified in § 6.15*quat*. (WRC-23)

ADD

6.29*ter* If, in spite of the application of § 6.29*bis*, the conditions specified in § 6.15*quat* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

MOD

ARTICLE 7 (REV.WRC-~~15~~23)

Procedure for the addition of a new allotment to the Plan for a new Member State of the Union[XX2] (WRC-23)

XX2 See also Resolution **[NEW-MEMBER-STATE-AP30B] (WRC-23)**. (WRC-23)

NOC

7.1 The administration of a country** which has joined the Union as a Member State and does not have a national allotment in the Plan or an assignment stemming from the conversion of an allotment shall obtain a national allotment by the following procedure. (WRC-15)

NOC

7.2 The administration shall submit its request for an allotment to the Bureau, with the following information:

a) the geographical coordinates of not more than 20 test points for determining the minimal ellipse to cover its national territory;

b) the height above sea level of each of its test points;

c) any special requirement which is to be taken into account to the extent practicable.

NOC

7.3 Upon receipt of the complete information (mentioned in § 7.2 above), the Bureau shall expeditiously and ahead of submissions for which the examination under § 6.5 has not yet started, identify appropriate technical characteristics and associated orbital locations for a prospective national allotment. The Bureau shall send this information to the requesting administration.

NOC

7.4 Upon receipt of the Bureau's response under § 7.3, the requesting administration shall, within thirty days, indicate which of the proposed orbital locations with the associated technical parameters as identified by the Bureau it has selected. During this period, the requesting administration may at any time seek the assistance of the Bureau.

MOD

7.4*bis* If a selection for an allotment under § 7.4 has not been received by the Bureau within the specified time-limit referred to in § 7.4 above, the Bureau ~~will~~shall resume examination of submissions under § 6.5, or subsequent submission under Article 7, as appropriate, and inform the requesting administration that its request will be processed under § 7.5 when the Bureau is informed about the selected orbit location.

MOD

7.5 Upon receipt of a request under § 7.4, the Bureau shall process the request ahead of submissions for which the examination under § 6.5 has not yet started and, using ~~Annexes 3~~

9 (SUP - WRC-15)

~~and 4~~Appendices 1 and 2 of Attachment 1 to Resolution **170 (WRC-19)**, examine it with respect to its conformity with:

a) the Table of Frequency Allocations and the other provisions[10] of the Radio Regulations, except those provisions relating to conformity with the fixed-satellite service Plan which are the subject of the following subparagraph;

b) allotments in the Plan;

c) assignments which appear in the List;

d) assignments for which the Bureau has previously received complete information and which have been examined, or are at the stage of examination under § 6.5.

NOC

7.6 When the examination under § 7.5 leads to a favorable finding, the Bureau shall enter the national allotment of the new Member State of the Union in the Plan and publish the characteristics of the allotment concerned and the result of its examination in a Special Section of the BR IFIC with the updated reference situation.

MOD

7.7 In the event that the Bureau's findings under § 7.5 are unfavourable, the proposed allotment of the Member State shall be treated as a submission under § 6.1 and shall be treated by the Bureau ahead of any other submissions received under Article 6, except for submissions which were already under examination under § 6.5 by the Bureau at the time of completion of the examination of the request of the new Member State under § 7.5. During the Article 6 procedure for the proposed allotment of the new Member State of the Union, the additional provisions contained in §§ 8 and 9 of Attachment 1 to Resolution **170 (WRC-19)** shall apply and the associated technical criteria specified in Appendices 1 and 2 to that Attachment shall be used during technical examinations at the various stages of Article 6.

ARTICLE 8 (WRC-15)

Procedure for notification and recording in the Master Register of assignments in the planned bands for the fixed-satellite service[11, 12] (WRC-19)

ADD

8.10*bis* When the examination with respect to § 8.9 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice, if any. This telefax shall inform these administrations of the notification under § 8.1 of this notice and the date on which the frequency assignment is to be brought into use. (WRC-23)

MOD

RESOLUTION 170 (REV.WRC-~~19~~23)

Additional measures for satellite networks in the fixed-satellite service in frequency bands subject to Appendix 30B for the enhancement of equitable access to these frequency bands

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

ATTACHMENT 1 TO
RESOLUTION 170 (REV.WRC-~~19~~23)

…

APPENDIX 2 TO ATTACHMENT 1 TO RESOLUTION 170 (REV.WRC-~~19~~23)

Protection criteria for a new incoming network

Incoming network	Allotments or assignments to be protected	Protection criteria
Assignment applying the special procedure or allotment proposed under Article 7 of Appendix **30B**	Allotment in the Plan	Annex 4 of Appendix **30B**
	Assignment converted from allotment without modification	Annex 4 of Appendix **30B**
	Assignment converted from allotment with modification within the envelope of the allotment	Annex 4 of Appendix **30B**
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure applied	Annex 4 of Appendix **30B**
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure NOT applied	New criteria specified in this Resolution
	Former existing system	Annex 4 of Appendix **30B**
	Additional system for which the special procedure applied	Annex 4 of Appendix **30B**
	Additional system with frequency assignments recorded in the List until 22 November 2019 with service area limited to national territories for which the special procedure NOT applied	Annex 4 of Appendix **30B**
	Additional system with frequency assignments submitted under item 6.1 of Appendix **30B** with service area limited to national territories for which the special procedure NOT applied	New criteria specified in this Resolution
	Additional system with frequency assignments with service area beyond national territories for which the special procedure NOT applied	New criteria specified in this Resolution
	Request under Article 7 but transferred to Article 6	Annex 4 of Appendix **30B**
	New allotment through the application of § 6.35	Annex 4 of Appendix **30B**
Conversion of allotment or new additional system for which the special procedure NOT applied	All	Annex 4 of Appendix **30B**

ADD

DRAFT NEW RESOLUTION [NEW-MEMBER-STATE-AP30B] (WRC-23)

Additional measures for addition of a new allotment to the Appendix 30B Plan for a new Member State of the Union

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that WARC Orb-88 created an allotment Plan for the use of the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz;

b) that WRC-07 revised the regulatory regime governing the use of the frequency bands mentioned in *considering a)* above;

c) that WRC-07 developed a specific procedure under Article 7 of Appendix **30B** for the addition of a new allotment to the Plan for a new Member State of the Union,

recognizing

a) that Article 44 of the ITU Constitution lays down the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite and other satellite orbits, taking into account the needs of developing countries;

b) the possible difficulty for a new Member State of the Union in coordination negotiations for various reasons such as a lack of resources and expertise,

resolves

1 that the additional measures described in Attachment 1 to this Resolution shall be applied for the processing of submissions received on or after 16 December 2023 by the Radiocommunication Bureau (BR) under Article 7 of Appendix **30B** for addition of a new allotment for a new Member State of the Union;

2 that the additional measures described in Attachment 1 to this Resolution shall be applied for the processing of submissions received before 16 December 2023 by BR under Article 7 of Appendix **30B** for addition of a new allotment for a new Member State of the Union and for which the selection for an allotment under § 7.4 of Appendix **30B** has not been received as of 16 December 2023;

3 that the additional measures described in Attachment 2 to this Resolution shall be applied for the processing of submissions received before 16 December 2023 by BR under Article 7 of Appendix **30B** for addition of a new allotment for a new Member State of the Union and for which the selection for an allotment under § 7.4 of Appendix **30B** has already been received as of 16 December 2023,

further resolves

that, when coordinating networks submitted under these additional measures, administrations exercise the utmost goodwill, and endeavour to overcome any difficulties encountered by the incoming network, in order to accommodate the incoming submission.

ATTACHMENT 1 TO
DRAFT NEW RESOLUTION [NEW-MEMBER-STATE-AP30B] (WRC-23)

Additional measures for addition of a new allotment to the Appendix 30B Plan for a new Member State of the Union subject to *resolves* 1 and 2

1 The special procedure described in this Attachment can only be applied once by an administration having no allotment in the Appendix **30B** Plan.

2 Administrations seeking to apply this special procedure shall submit their request to BR, with the information specified in § 7.2 or § 7.4 of Appendix **30B** with an explicit request to use this special procedure in the cover letter to BR.

3 If the information submitted under § 2 above is found to be incomplete, BR shall immediately seek from the administration concerned any clarification required and information not provided.

4 Following the complete submission of information under § 2 above, BR shall apply the following procedures specified in Article 7 of Appendix **30B**.

5 In the event that the proposed allotment of the Member State shall be treated as a submission under § 6.1 of Appendix **30B** due to BR's unfavourable finding under § 7.5 of Appendix **30B**, the special procedure described in this Attachment can only be applied:

– if the orbital position with the associated technical parameters selected by the Member State are those initially identified and recommended by BR under § 7.3 of Appendix **30B**;

– if the pfd limits specified in § 2.2 of Annex 4 of Appendix **30B** are exceeded by no more than 3 dB for allotments in the Plan and assignments which appear in the List.

6 If the proposed allotment of the Member State can benefit from this special procedure described in this attachment according to § 5 above, BR shall inform affected administrations identified under §§ 6.5 *b)* and 6.5 *c)* of Appendix **30B** of the specific nature of such a Special Section which is intended to allow a national allotment to a new Member State of the Union, and shall highlight the possibility to conclude an agreement under § 6.15*quat*[1] of Appendix **30B**.

7 If the proposed allotment of the Member State can benefit from this special procedure described in this attachment according to § 5 above, BR shall inform affected administrations identified under § 6.5 *a)* of Appendix **30B** that a remark should be inserted indicating that an agreement shall be reached before the proposed allotment of the Member State is brought into use under Article 8 of Appendix **30B** and that proposed allotment shall not be taken into account in updating the reference situation of those identified under § 6.5 *a)* of Appendix **30B**.

8 Administrations informed under § 6 above are required to apply all practical measures to overcome coordination difficulties encountered by the incoming network, in accordance with *further resolves* above.

9 If there is still continuing disagreement with administrations informed under § 6 above, the notifying administration may seek the assistance of BR.

10 BR shall regularly inform the Radio Regulations Board (RRB) of the coordination status of the proposed allotment of the Member State benefitting from this special procedure with

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[1] Note: New type of agreement under discussion in Topic I.

affected administrations identified under §§ 6.5 *b)* and 6.5 *c)* of Appendix **30B**.

11 If there is still continuing disagreement, the RRB may instruct the BR to consider that an agreement under § 6.15*quat*[1] of Appendix **30B** has been concluded between the assignment of affected administrations identified under §§ 6.5 *b)* and 6.5 *c)* of Appendix **30B** and the proposed allotment of the new Member State benefitting from this special procedure.

ATTACHMENT 2 TO DRAFT NEW RESOLUTION [NEW-MEMBER-STATE-AP30B] (WRC-23)

Additional measures for addition of a new allotment to the Appendix 30B Plan for a new Member State of the Union subject to *resolves* 3

1 The special procedure described in this Attachment can only be applied once by an administration having no allotment in the Appendix **30B** Plan and for which the Article 7 of Appendix **30B** procedure and the selection for an allotment under § 7.4 of Appendix **30B** has already been received by BR as of 16 December 2023.

2 Administrations seeking to apply this special procedure for a notice treated as a submission under § 6.1 of Appendix **30B** in accordance with § 7.7 of Appendix **30B** shall submit their request to BR no later than 1 February 2024 with the satellite network name of such notice.

3 In the event that the new Member State submitted several maximum power density per hertz values (i.e. items C.8.b.2 and C.8.h) in their notice referred under § 2 above, only the minimum value required to fulfil carrier-to-noise ratio under § 1.2 of Annex 1 of Appendix **30B** and interference criteria under § 1.4 of Annex 1 of Appendix **30B** shall be retained under this special procedure.

4 BR shall then inform affected administrations identified under §§ 6.5 *b)* and 6.5 *c)* of Appendix **30B**, considering § 3 above, of the specific nature of such a Special Section which is intended to allow a national allotment to a new Member State of the Union, and shall highlight the possibility to conclude an agreement under § 6.15*quat*[1] of Appendix **30B**.

5 BR shall inform affected administrations identified under § 6.5 *a)* of Appendix **30B** that a remark should be inserted indicating that an agreement shall be reached before the proposed allotment of the Member State is brought into use under Article 8 of Appendix **30B** and that proposed allotment shall not be taken into account in updating the reference situation of those identified under § 6.5 *a)* of Appendix **30B**.

6 Administrations informed under § 4 above are required to apply all practical measures to overcome coordination difficulties encountered by the incoming network, in accordance with *further resolves* above.

7 If there is still continuing disagreement with administrations informed under § 4 above, the notifying administration may seek the assistance of BR.

8 BR shall regularly inform the RRB of the coordination status of the proposed allotment of the Member State benefitting from this special procedure with affected administrations identified under §§ 6.5 *b)* and 6.5 *c)* of Appendix **30B** considering § 5 above.

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[1] Note: New type of agreement under discussion in Topic I.

9 If there is still continuing disagreement, the RRB may instruct the BR to consider that an agreement under § 6.15*quat*[1] of Appendix **30B** has been concluded between the assignment of affected administrations identified under §§ 6.5 *b)* and 6.5 *c)* of Appendix **30B**, considering § 4 above, and the proposed allotment of the new Member State benefitting from this special procedure.

[1] Note: New type of agreement under discussion in Topic I.

4/7/6 Topic F – Excluding uplink service area in RR Appendix 30A for Regions 1 and 3 and RR Appendix 30B

4/7/6.1 Executive summary

Resolution **2 (Rev.WRC-03)** resolves that "the registration with the Radiocommunication Bureau of frequency assignments for space radiocommunication services and their use **do not provide any permanent priority for any individual country or groups of countries and do not create an obstacle to the establishment of space systems by other countries**".

For the space-to-Earth direction, provisions such as RR No. **23.13** and § 6.16 of Article 6 of RR Appendix **30B** facilitate an administration to coordinate the downlink and contribute to preventing one administration from creating an obstacle to the establishment of space systems by other countries.

However, it has not been the case for the feeder link in the RR Appendix **30A** or uplink in the RR Appendix **30B** even though the exclusion of a territory from RR Appendix **30B** uplink service area is allowed in the Radio Regulations. This fact has been acknowledged by WRC-19 in *taking into account* of Resolution **170 (WRC-19)**.

Topic F was therefore created in order to establish adequate mechanisms to prevent one administration from creating an obstacle to the establishment of space systems by other countries in the feeder-link/uplink. Possible solutions to address the Topic are provided in four methods outlined in this Report.

Method F1 consists of NOC to the Radio Regulations. Methods F2, F3 and F4 proposes to add a new provision to Article 4 of RR Appendix **30A** to allow an administration to request at any time the exclusion of its territory from the feeder-link service area of a satellite network of other administrations. These three methods also include measures to avoid networks with uplink coverage area extending beyond the service area to seek protection because of this enlarged coverage area. Methods F2 and F3 include such measures for both RR Appendices **30A** and **30B** while Method F4 include such measures only for RR Appendix **30A**.

4/7/6.2 Background

The planned space services are based on the principle of equitable access to the satellite orbit/frequency spectrum in accordance with Article 44 of the ITU Constitution. To this end, relevant provisions of RR Appendix **30/30A** and RR Appendix **30B** specifically aim at ensuring this principle.

In accordance with the Table of Frequency Allocations contained in RR Article **5**, there are many frequency bands that are allocated to space services. Nevertheless, there are only a few frequency bands that are used for the BSS and FSS Plans as contained in RR Appendices **30**, **30A** and **30B**.

Provision 3.4 of Article 3 of RR Appendix **30A** stipulates that: "The Regions 1 and 3 feeder-link Plan is based on national coverage from the geostationary-satellite orbit. The associated procedures contained in this Appendix are intended to promote long-term flexibility of the Plan and to avoid monopolization of the planned bands and orbit by a country or a group of countries".

Provision 2.6*bis* of RR Appendix **30B** stipulates that: "When submitting additional system(s), administrations shall fully comply with the requirements stipulated in Article 44 of the ITU Constitution. In particular, these administrations shall limit the number of orbital positions and associated spectrum so that:

a) the orbital/spectrum natural resources are used rationally, efficiently and economically, and *b)* the use of multiple orbital locations to cover the same service area is avoided."

Resolution **2 (Rev.WRC-03)** resolves that "the registration with the Radiocommunication Bureau of frequency assignments for space radiocommunication services and their use do not provide any permanent priority for any individual country or groups of countries and do not create an obstacle to the establishment of space systems by other countries".

In spite of the purpose of the planned space services together with their current associated procedures, submissions of global uplink coverage area or submissions in which the coverage area extends well beyond the service area create obstacles for an administration or a group of named administrations to deploy its new national system or their subregional systems, as appropriate for close orbital separations.

4/7/6.3 Summary and analysis of the results of ITU-R studies*

In case an administration or a group of named administrations (newcomer) wishes to implement a satellite network with a service area limited to its or their territories, as appropriate, RR No. **23.13** and § 6.16 of Article 6 of RR Appendix **30B** provide these administrations with an effective measure to coordinate in the downlink because its territory or their national territories are excluded from the service area of the interfered-with network (existing). With regard to the downlink service area of the interfered-with network situated outside the excluded territories of notifying administration(s), shaped beam technology could be applied to meet the protection criteria with respect to the interfered-with network (existing). The shaped beam is to be applicable to the satellite network of those notifying administrations and is thus independent of the administration of the interfered-with satellite network (existing). Paragraph 2 of the Rule of Procedure on § 6.16 of Article 6 of RR Appendix **30B** has been adopted by the Radio Regulations Board to this effect.

With regard to the feeder-link/uplink, the interference is normally calculated at the output of receiving satellite antenna of an interfered-with satellite network. It is therefore dependent on the satellite receiving antenna coverage of the interfered-with satellite and the location of interfering earth stations of the other satellite network. More specifically, the roll-off of the satellite receiving antenna of the interfered-with satellite is a determining factor because interfering earth stations cannot be placed outside the corresponding uplink service area, which is limited to the national territories of an administration or a group of named administrations.

Below are two case studies that cover different scenarios of the issue of feeder-link and uplink global coverage.

Case study 1

In this case study, the following incoming subregional RR Appendix **30B** network is introduced into the RR Appendix **30B** master database in order to identify its impact on RR Appendix **30B** allotments/assignments of other administrations.

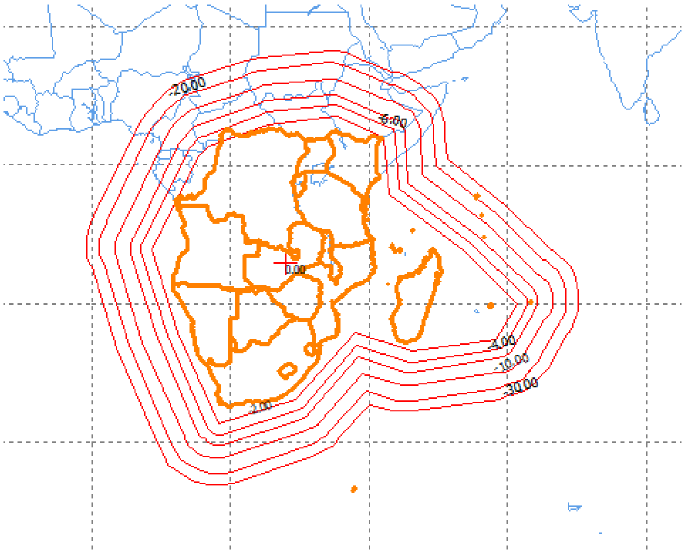
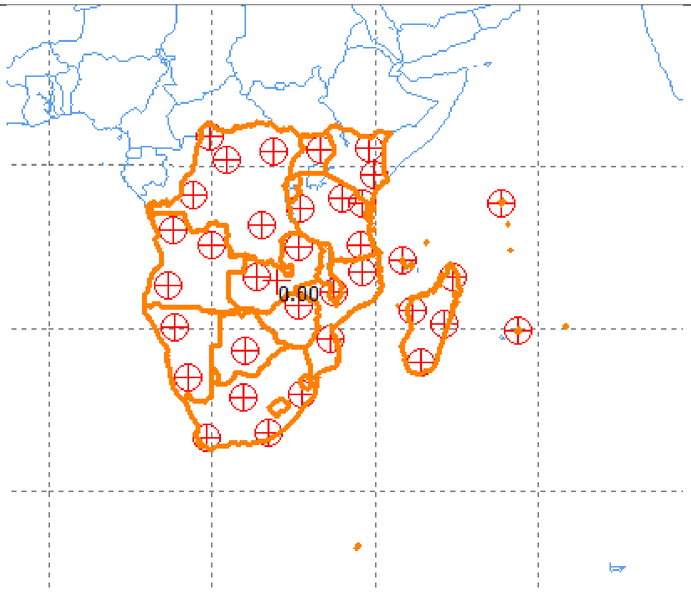
– *Type of network:* Uplink-only network. Therefore, all interference created to satellite networks of other administrations would be due to uplink interference from that subregional RR Appendix **30B** network.
– *The coverage and service area:* in compliance with Resolution **170 (WRC-19)**; i.e. the service area is composed of the territories of administrations participating in that

* The designations employed and the presentation of material on maps/infographics do not imply the expression of any opinion whatsoever on the part of ITU and of the Secretariat of the ITU concerning the legal status of the country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

subregional RR Appendix **30B** network and the coverage area is the minimum one encompassing the service area. It should be noted that the receiving coverage area of this incoming subregional RR Appendix **30B** network would not cause any interference to satellite networks of other administrations and therefore would not trigger coordination.

– *Criteria to identify if an allotment/assignment of other administrations is affected or not*: in accordance with Resolution **170 (WRC-19)**.

The coverage and the technical parameters of the incoming subregional RR Appendix **30B** network are assumed as below:

Orbital position	57° E
Coverage and service area	
Uplink test-points	
Receiving satellite antenna gain	34 dBi
Receiving noise temperature	550 K
Frequency band	12.75-13.25 GHz
Earth station diameter/input power density	1.2 m / −43 dBW/Hz 1.8 m / −42 dBW/Hz 2.7 m / −45.5 dBW/Hz
Earth station antenna pattern	AP**30B**

The RR Appendix **30B** master database contained in BR IFIC 2967 of 22.03.2022 is used to assess the impact of the above-mentioned subregional RR Appendix **30B** network into allotments/assignments of other administrations.

The table below shows the RR Appendix **30B** allotments/assignments located within a coordination arc of ±6 degrees as well as those that are affected by the subregional RR Appendix **30B** network.

Within the coordination arc						Affected in uplink	Level of UP_SE degradation (dB)
prov	**adm**	**ntc_id**	**sat_name**	**long_nom**	**OrbSep**		
A30B#6.17	HOL	107559030	NSS-FSS 57E	57	0	Y	33.456
A30B#6.1A	HOL	121559007	NSS-FSS-G3 57E	57	0	Y	11.739
	CHN	90558098	HKG00000	57.5	0.5	N	
	G	90558063	CYPSBA00	57.5	0.5	Y	1.216
	G	90558085	GIB00000	57.5	0.5	N	
	PAK	90558161	PAK00000	56.5	0.5	N	
A30B#6.1C	PAK	120559015	PAK00000	56.5	0.5	N	
A30B#6.17	BUL	114559031	BALKANSAT AP30B	56.02	0.98	N	
	ETH	90558075	ETH00000	58.3	1.3	N	
A30B#6.1A	ETH	116559011	ETHIOSAT-1	58.3	1.3	N	
7.2	KAZ	104558002	KAZ00000	58.5	1.5	N	
A30B#6.1A	KAZ	115559003	KAZSAT-30B-58.5E-2	58.5	1.5	N	
A30B#6.25	KAZ	110559035	KAZSAT-30B-58.5E	58.5	1.5	N	
	CVA	90558061	CVA00000	59	2	N	
A30B#6.1A	G	114559057	UKMMSAT-4E	55	2	N	
A30B#6.1A	IND	115559009	INSAT-KUP-FSS(55E)	55	2	N	
A30B#6.25	RUS	108559006	YAMAL-PK2	55	2	N	
A30B#6.25	RUS	111559020	YAMAL-FSS-55E	55	2	N	
	BTN	90558040	BTN00000	59.1	2.1	N	
	BEL	90558028	BEL00000	54.55	2.45	N	
A30B#6.1A	CYP	114559063	CYP-30B-59.7E-3	59.7	2.7	N	
A30B#6.25	CYP	109559005	CYP-30B-59.7E	59.7	2.7	Y	9.738
A30B#6.25	CYP	110559005	CYP-30B-59.7E-2	59.7	2.7	Y	9.76
A30B#6.1A	UAE	115559054	YAHSAT-FSS2-60E	60	3	N	
	RUS	105559055	RUS00001	61	4	N	
A30B#6.17	RUS	109559002	EXPRESS-5P	53	4	N	
A30B#6.1A	F	117559010	F-SAT-30B-53E	53	4	N	
A30B#6.1A	UAE	113559051	YAHSAT-FSS2-52.5E	52.5	4.5	N	
A30B#6.1A	UAE	115559055	YAHSAT-FSS3-52.5E	52.5	4.5	N	
A30B#6.1A	UAE	118559028	YAHSAT-FSS4-52.5E	52.5	4.5	N	
A30B#6.25	UAE	110559006	YAHSAT-FSS-52.5E	52.5	4.5	N	
A30B#6.1A	MCO	114559010	MCO-FSS-52EA TTC	52	5	N	
A30B#6.1A	MCO	118559007	MCO-FSS-52EB	52	5	N	
A30B#6.1A	PNG	112559040	NEW DAWN FSS-3	62	5	N	

Within the coordination arc						Affected in uplink	Level of UP_SE degradation (dB)
prov	**adm**	**ntc_id**	**sat_name**	**long_nom**	**OrbSep**		
A30B#6.1A	PNG	115559028	NEW DAWN FSS-3	62	5	N	
A30B#6.25	MCO	105559004	MCO-FSS-52E	52	5	N	
A30B#6.25	MCO	110559034	MCO-FSS-52EA	52	5	N	
A30B#6.25	MCO	112559032	MCO-FSS-52EAP	52	5	N	
	ARS	90558012	ARS00000	51.9	5.1	N	
A30B#6.1A	BLR	114559059	BLR-FSS2-51.5E	51.5	5.5	N	
A30B#6.1A	RUS	116559028	IK-62.5E-F	62.5	5.5	N	
A30B#6.25	BLR	110559032	BLR-FSS-51.5E	51.5	5.5	N	
A30B#6.1A	IND	118559036	INSAT-KUP-FSS(62.8E)	62.8	5.8	N	
A30B#6.1A	IND	114559036	INSAT-PKU63E	63	6	N	
A30B#6.1A	IND	116559005	INSAT-KUP-FSS(63E)	63	6	N	
A30B#6.1A	UAE	115559052	YAHSAT-FSS-63E	63	6	N	
A30B#6.1T	HRV	120559040	HRV00000	63	6	N	

In this case study, there are 47 allotments/assignments of other administrations situated within the coordination arc of ±6 degrees in 12.75-13.25 GHz.

Based on GIBC/Appendix **30B** simulation with protection criteria of Resolution **170 (WRC-19)**, there are five allotments/assignments that are identified as affected.

Among the 42 allotments/assignments that are not identified as affected, a detailed investigation reveals that it is due to one or combination of the following factors:

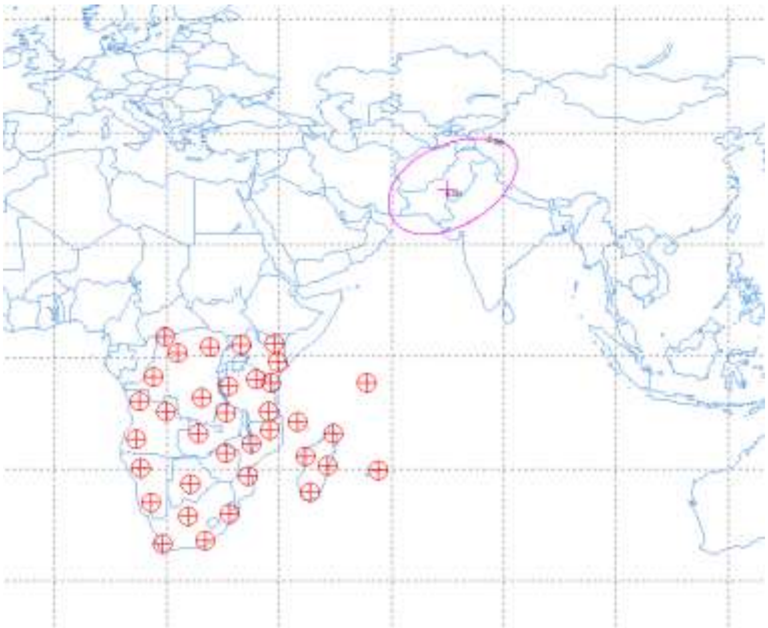
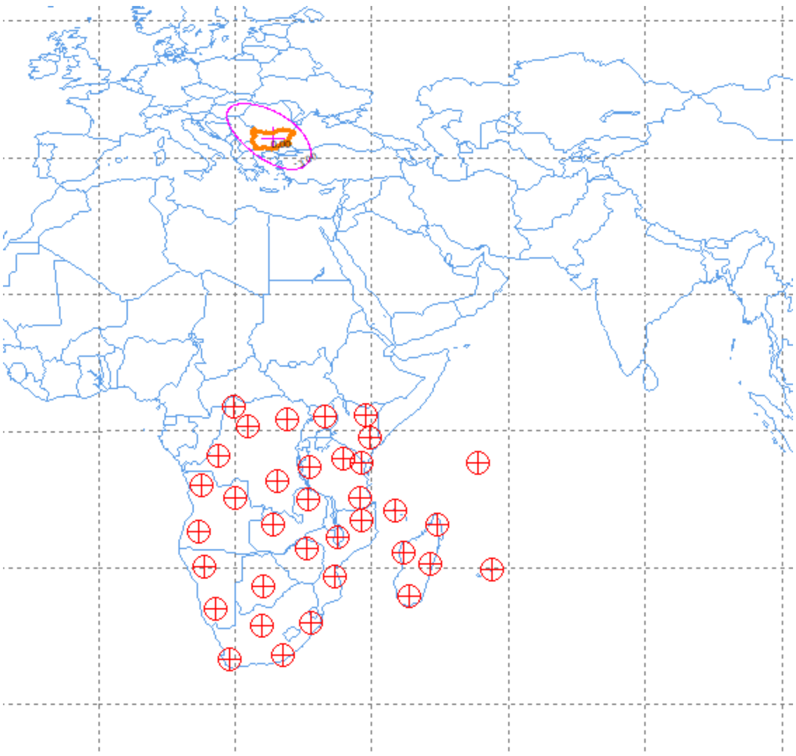
– large uplink geographical isolation;

– very low reference situation;

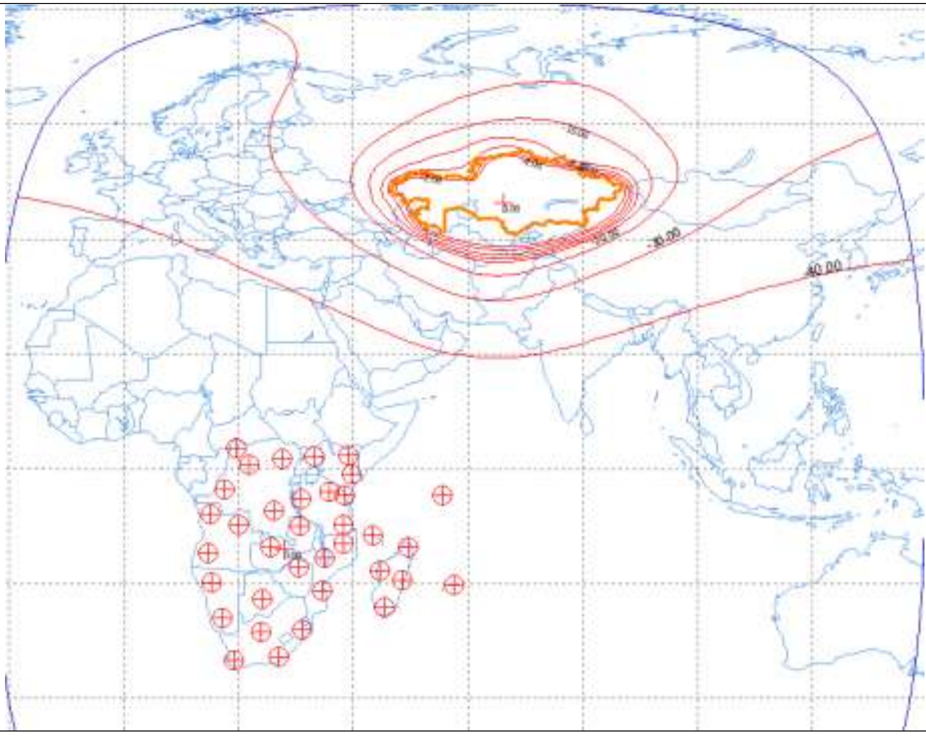
– very high uplink e.i.r.p. density;

– wide enough orbital separation.

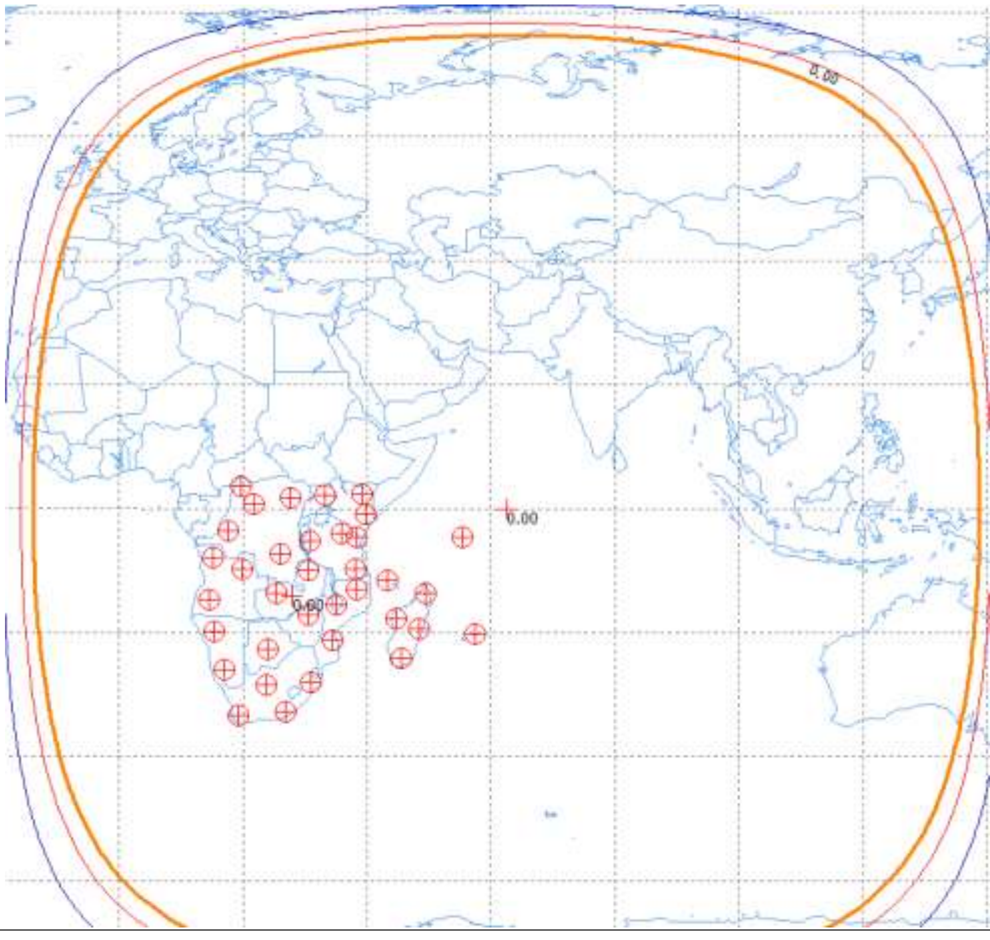
Some of the cases not being affected are illustrated below.

The PAK00000 allotment is NOT affected **<u>thanks to the sufficient geographical isolation</u>** between the transmitting earth stations of the RR Appendix **30B** subregional network and the receiving satellite antenna of the PAK00000 allotment even though there is only 0.5-degree separation (0.3 degree if we take station keeping into account).

The BALKANSAT AP**30B** assignment is NOT affected **<u>thanks to the sufficient geographical isolation</u>** between the transmitting earth stations of the RR Appendix **30B** subregional network and the receiving satellite antenna of the BALKANSAT AP**30B** assignments even though there is only 0.98-degree separation (0.78 degrees if we take station keeping into account).


The KAZSAT-30B-58.5E assignment is NOT affected **thanks to the sufficient geographical isolation** between the transmitting earth stations of the RR Appendix **30B** subregional network and the receiving satellite antenna of the KAZSAT-30B-58.5E assignments even though there is only 1.5-degree separation (1.3 degree if we take station keeping into account).

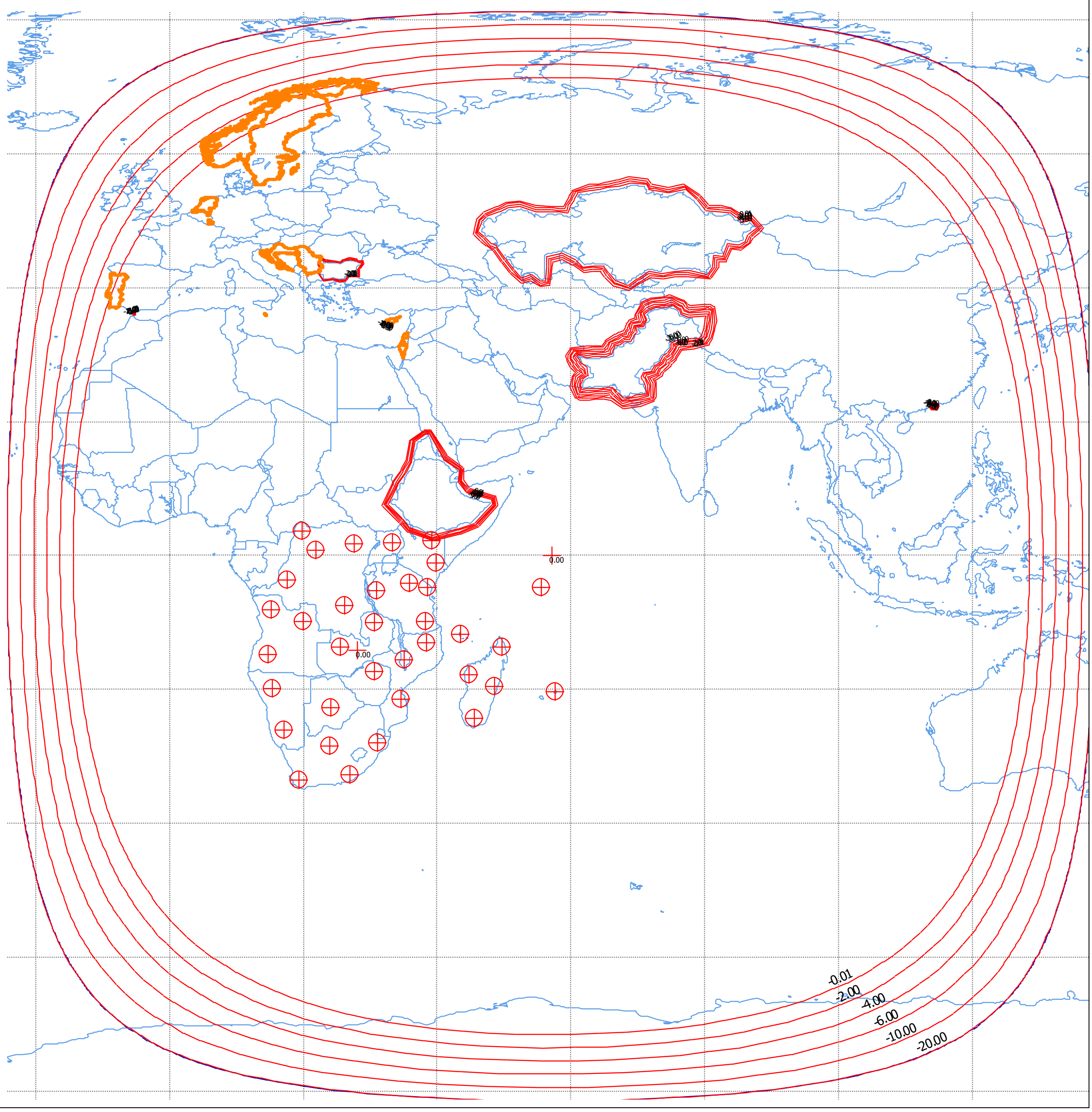


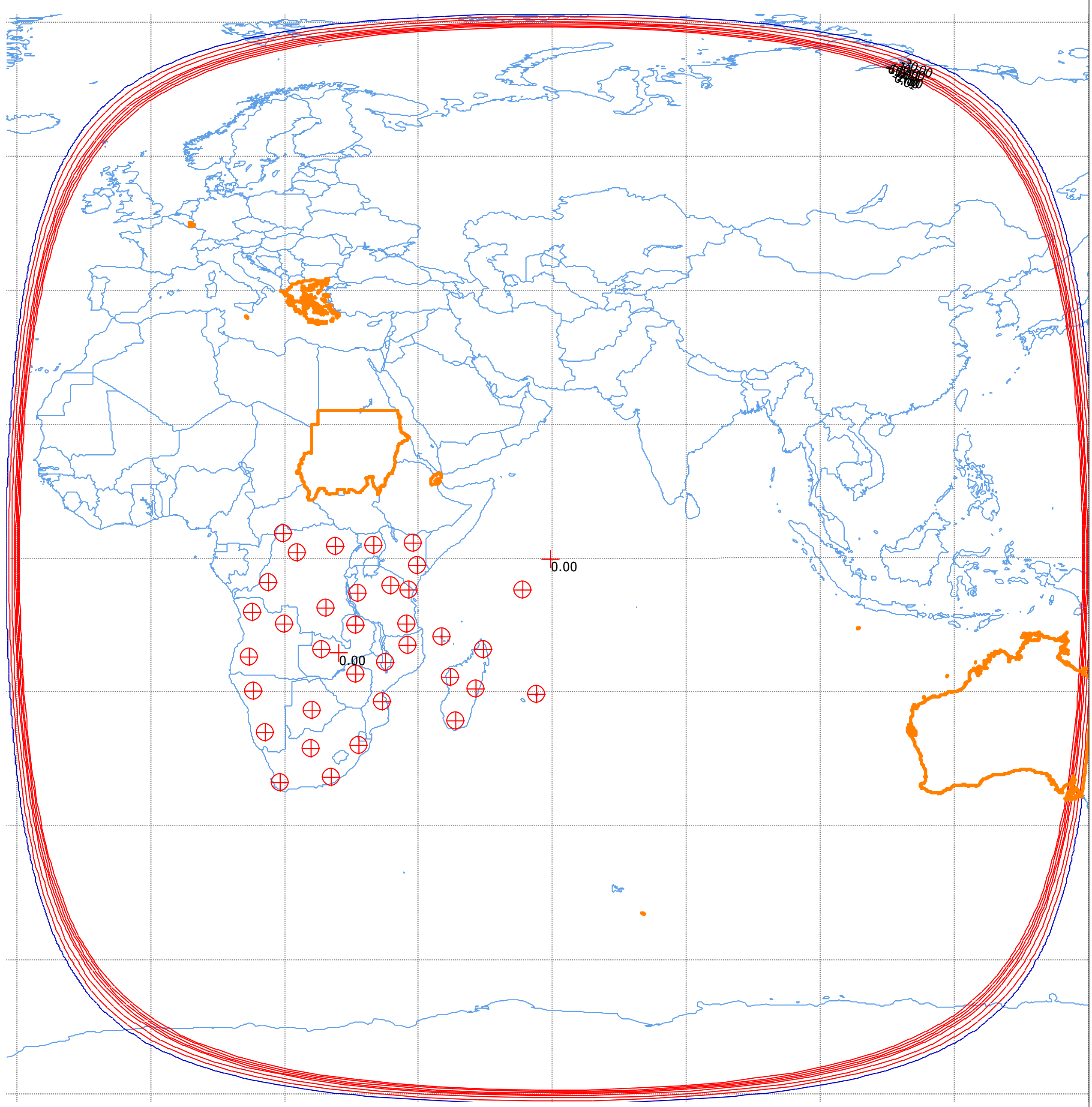
The IK-62.5E-F assignment is not affected **thanks to the wide enough orbital separation of 5.5 degrees**.



With respect to the assignments in the List that are affected by the proposed RR Appendix **30B** subregional network, the following show the relationship between the coordinated service area and the coverage area of the affected network together with the location of interfering transmitting earth stations.

The NSS-FSS 57E assignments are affected **because of the high receiving sensitivity over the interfering transmitting earth stations together with small orbital separation**.



The CYP-30B-59.7E assignments are affected **because of the high receiving sensitivity over the interfering transmitting earth stations together with small orbital separation**. It should be noted that in accordance with § 6.16 of RR Appendix **30B**, Sudan and Djibouti can request the exclusion of their territories from the service area at any time.


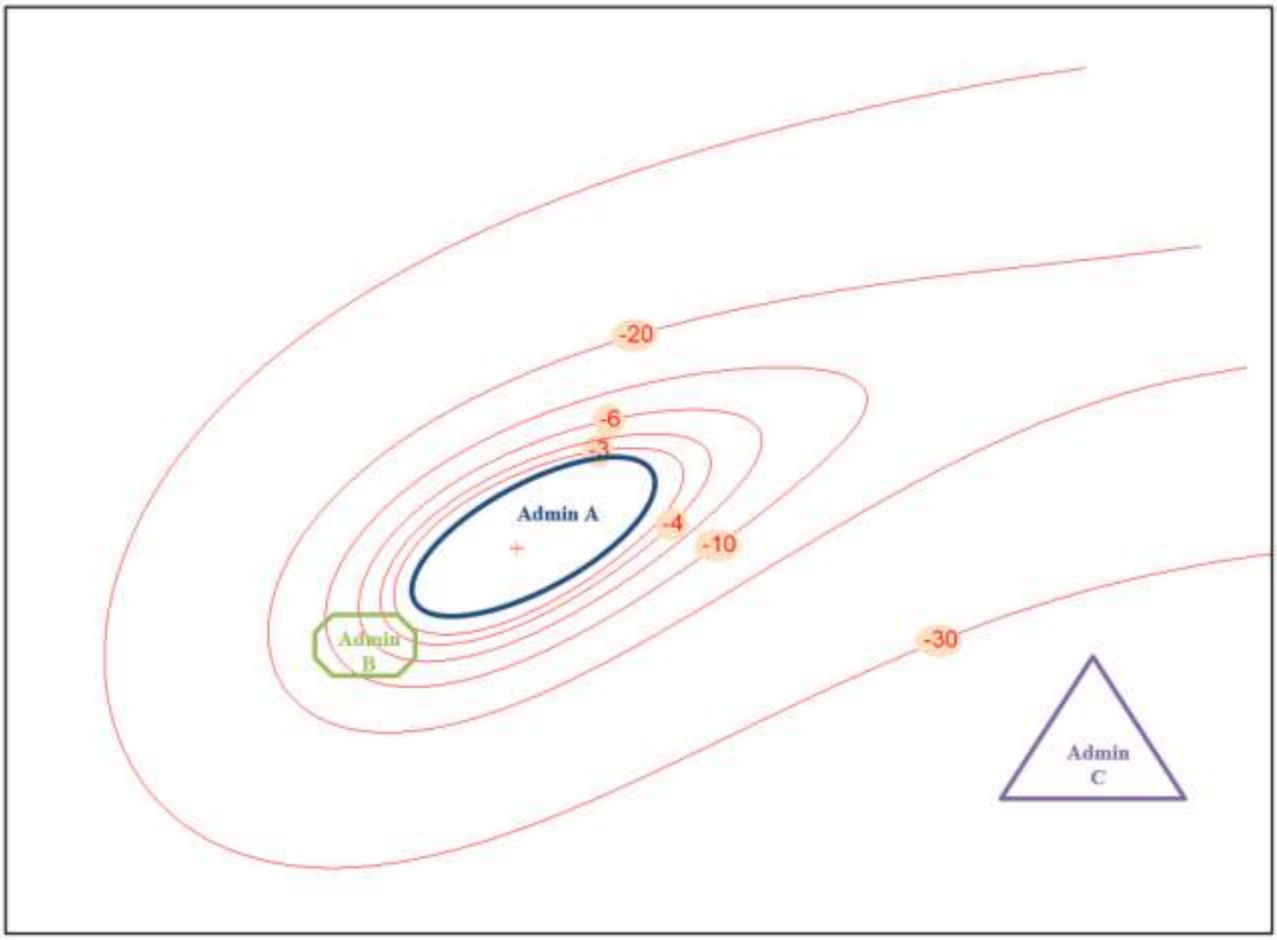
This case study shows the types of coordination difficulties that can occur in case of application of Resolution **170 (WRC-19)** by uplink assignments in the List that have limited service area with high receiving sensitivity expanded well beyond that limited service area.

Case study 2

Figure 4/7/6-1 provides an example where administration A has an assignment or allotment in the RR Appendix **30A** or **30B** Plan or List with a space station receiving antenna coverage as shown. This coverage could constitute the minimum ellipse to cover the national territory of administration A. Due to the roll-off of the space station A receiving antenna over the territory of administrations B and C, and considering closed orbital positions of space stations of administrations A, B and C (see figure below and results of simulation), any operation towards space station B from an earth station deployed on the territory of administration B will severely impact space station A while operation towards space station C from an earth station deployed on the territory of administration C will not impact space station A. It is also important to note that reciprocity will exist between space stations B and A, any operation towards space station A from an earth station deployed on the territory of administration A will severely impact space station B.

FIGURE 4/7/6-1

Localization of administrations A, B and C with regard to the receiving antenna of space station A



To estimate the potential impact of earth stations operating within the territory of administrations B and C towards space station A, it is proposed to calculate the carrier-to-interference level.

The carrier-to-interference potentially generated on space station A by an earth station deployed on the territory of administration X and operating towards space station X is:

$$\frac{C}{I} = \frac{PD_{ES_A} \times G_{ES_A}(Sat_A) \times G_{Sat_A}(ES_A)}{PD_{ES_X} \times G_{ES_X}(Sat_A) \times G_{Sat_A}(ES_X)}$$

with:

PD_{ES_A} the transmit power density of earth station of admin A

PD_{ES_X} the transmit power density of earth station of admin X

$G_{ES_A}(Sat_A)$ the transmit gain of the earth station of admin A towards the space station of admin A

$G_{ES_X}(Sat_A)$ the transmit gain of the earth station of admin X towards the space station of admin A

$G_{Sat_A}(ES_A)$ the receive gain of the space station of admin A towards the earth station of admin A

$G_{Sat_A}(ES_X)$ the receive gain of the space station of admin A towards the earth station of admin X.

The following example illustrates the impact of geographic separation between the territories of administrations on the uplink interference:

– space station A located at 0.3° from space stations B and C,

– earth stations of 2.7 m antenna in 13/10-11 GHz band,

– same transmit power density (PD).

An earth station of admin B located within the −3 dB contour of the receiving antenna of space station A, will generate a carrier-to-interference of 6.8 dB.

$$\frac{C}{I} = 49.8 - 46.0 + 3 = 6.8 \text{ (dB)}$$

With the same assumptions, an earth station of admin C located within the −30 dB contour of the receiving antenna of space station A, will generate a carrier-to-interference of 33.8 dB.

$$\frac{C}{I} = 49.8 - 46.0 + 30 = 33.8 \text{ (dB)}$$

This simulation demonstrates that the distance between two territories is one important element to address this Topic and shall be taken into account when seeking a regulatory solution.

Statistics submitted by the Bureau indicate that almost all submissions under Article 6 of RR Appendix **30B** for additional uses have global coverage or coverage extended well beyond the service area, which poses a real obstacle for an administration or a group of named administrations to deploy its national system or their subregional systems, as appropriate. While this problem has been recognized, to date, there has been no provision in the Radio Regulations to solve that problem.

There is a definition for the BSS downlink coverage area in § 1.2 of Annex 5 of RR Appendix **30**. A similar provision may be implemented in RR Appendix **30A**, in order to introduce the necessity of alignment of coverage area and service area for satellite networks in the coordination process of RR Appendix **30A**. It has been recognized that shaped beam technology is widely applicable. Nevertheless, it is applicable only to solve the difficulty of notifying administrations and not the others.

4/7/6.4 Methods to satisfy Topic F

Four methods to satisfy agenda item 7, Topic F, have been identified.

4/7/6.4.1 Method F1

No changes to the Radio Regulations.

4/7/6.4.2 Method F2

The proposed method is to add:

– a new provision under Article 4 of RR Appendix **30A** to allow an administration to request at any time the exclusion of its territory from the feeder-link service area of a satellite network of other administrations;

– a requirement for the notifying administration to align the coverage area to the associated up-to-date service area when submitting a Part A and/or Part B of an AP**30A**/AP**30B** notice to the Bureau. When it is not possible to do so as it relates to an operational satellite or a satellite soon to be launched, the notifying administration shall request the Bureau to update the coverage area in the List and Master Register when that satellite has been replaced by a new one without the need to restart the Article 4 / Article 6 procedures, as appropriate;

– footnotes to the new provision of RR Appendix **30A** and § 6.16 of Article 6 of RR Appendix **30B** to request a notifying administration of a satellite network having high receiving sensitivity (relative satellite antenna gain of at least −20 dB) over territory of other administrations to accept feeder-link or uplink interference emanating from the territory of other administrations if so requested;

– amend Article 9 of RR Appendix **30B** to remove the right to claim protection from harmful interference from additional systems which have not indicated their agreement to inclusion in the given service area;

– amend Article 10 of RR Appendix **30A** to remove the right to claim protection from harmful interference from additional systems which have not indicated their agreement to inclusion in the given service area.

4/7/6.4.3 Method F3

The proposed method is to add:

– A new provision under Article 4 of RR Appendix **30A** to allow an administration to request at any time the exclusion of its territory from the feeder-link service area of a satellite network of other administrations.

– A new footnote under Article 4 of RR Appendix **30A** and a revised footnote of Article 6 of RR Appendix **30B** to allow relocation of test points from the excluded territory to a new location within the remaining part of its service area if such relocation does not cause more interference.

– New provisions under Article 4 of RR Appendix **30A** and Article 6 of RR Appendix **30B** to request a notifying administration of a satellite network having relative satellite antenna gain derived from the minimum ellipse required to cover the service area of equal to or less than −20 dB over the territory of other administrations to accept uplink interference emanating from the territory of those other administrations if so requested. The minimum ellipse is determined by the set of test points contained in the RR Appendices **30** and **30A** or RR Appendix **30B** satellite network using the relevant BR software application. For service areas with test points associated with small geographic areas, including service areas associated with just one single test point, it is noted that §§ 3.7.2 and 4.6.2 of Annex 3 to Appendix **30A** and § 1.7.4 of Annex 1 to Appendix **30B** specifies the minimum beamwidth for beams covering such service areas. This is also implemented in the Bureau's software to generate minimum ellipses to cover service areas.

4/7/6.4.4 Method F4

This method consists of two elements.

In respect of RR Appendix **30A**:

– a new provision under Article 4 of RR Appendix **30A** to allow an administration to request at any time the exclusion of its territory from the feeder-link service area of a satellite network of other administrations;

– amend Annex 3 of RR Appendix **30A** to include a definition of the feeder link coverage area.

4/7/6.5 Regulatory and procedural considerations

The following sections provide example regulatory text in respect of Methods F1 to F4 as described in section 4/7/6.4.

4/7/6.5.1 For Method F1

NOC

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

NOC

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

4/7/6.5.2 For Method F2

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

ARTICLE 4 (REV.WRC-19)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

MOD

4.1.1 An administration proposing to include a new or modified assignment in the feeder-link List shall seek the agreement of those administrations whose current or future services are considered to be affected, i.e. administrations[4, 5]:

…

d) having a feeder-link frequency assignment in the frequency bands 14.5-14.8 GHz or 17.8-18.1 GHz in Region 2 in the fixed-satellite service (Earth-to-space) to a space station in the broadcasting-satellite service, or a frequency assignment in the frequency band 14.5-14.75 GHz in countries listed in Resolution **163 (WRC-15)** and in the frequency band 14.5-14.8 GHz in countries listed in Resolution **164 (WRC-15)**, in the fixed-satellite service (Earth-to-space) not subject to a Plan, which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **9.7**, or under § 7.1 of Article 7, with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment~~.~~; *or*

e) the territory of which is partially or wholly covered by an antenna relative gain contour of −20 dB or greater. (WRC-~~19~~23)

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4 Agreement with administrations having a frequency assignment in the band 14.5-14.8 GHz or 17.7-18.1 GHz to a terrestrial station, or having a frequency assignment in the band 17.7-18.1 GHz to an earth station in the fixed-satellite service (space-to-Earth), or having a frequency assignment in the band 17.3-17.8 GHz in the broadcasting-satellite service shall be sought under No. **9.17**, No. **9.17A** or No. **9.19**, respectively.

5 Coordination under Nos. **9.17** or **9.17A** is not required for an earth station of an administration on the territory of which this earth station is located and for which the procedures of former § 4.2.1.2 and 4.2.1.3 of Appendix **30A (WRC-97)** have been successfully applied by that administration before 3 June 2000 in respect of terrestrial stations or earth stations operating in the opposite direction of transmission. (WRC-03)

ADD

4.1.10e[XX] An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-23)

ARTICLE 10

Interference

ADD

10.2 An administration shall not claim protection from harmful interference to a new or modified assignment included in the feeder-link List, where such interference results from the territory of an administration that has not provided its agreement under § 4.1.1. (WRC-23)

ANNEX 3

Technical data used in establishing the provisions and associated Plans and Regions 1 and 3 feeder-link List, which should be used for their application[36] (Rev.WRC-03)

1 Definitions

ADD

1.2*bis* Feeder-link coverage area

The area on the surface of the Earth delineated by a contour of a constant given value of relative receiving space station antenna gain which would permit the wanted quality of reception in the absence of interference.

NOTE – The coverage area must be the smallest area which encompasses the service area. The notifying administration shall respect this requirement when submitting an Appendix **30A** notice to the Bureau. Should the associated satellite be already in operation at the time of the submission of Appendix **30A** notice or be launched within [1] year from the date of submission of Appendix **30A**

XX When an administration or a group of named administrations plans to implement a satellite network with a service area limited to its territory or their territories, as appropriate, any other notifying administration of a satellite network having high receiving sensitivity (relative satellite antenna gain of −20 dB or greater) over the territory/territories of the former administration(s) and being identified as affected by the Bureau shall, under no circumstances whatsoever, claim protection from the assignments transmitting from the territory/territories of the former administration(s). (WRC-23) notice, the notifying administration shall submit to the Bureau an updated coverage area diagram(s). The Bureau shall update the coverage area in the List and Master Register when that satellite is replaced by a new one and there is no need to restart the Article 4 procedure. In this connection, the coverage area at the time of the submission or the updated one after replacement of the satellite shall be aligned with the most up-to-date service area.

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ARTICLE 6 (REV.WRC-19)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*] (WRC-19)

MOD

6.16[YY] An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points[6*bis*] that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-~~19~~23)

ARTICLE 9 (REV.WRC-07)

General provisions

MOD

9.2 ~~(SUP - WRC-07)~~An administration that implements an additional system with a service area beyond its national territory shall not claim protection from harmful interference from the Earth-to-

YY When an administration or a group of named administrations plans to implement a satellite network with a service area limited to its territory or their territories, as appropriate, any other notifying administration of a satellite network having high receiving sensitivity (relative satellite antenna gain of −20 dB or greater) over the territory/territories of the former administration(s) and being identified as affected by the Bureau shall, under no circumstances whatsoever, claim protection from the assignments transmitting from the territory/territories of the former administration(s). (WRC-23) space emissions from the territory/territories of an administration(s) that has informed the Bureau of its objection to being included in the service area of such assignments under § 6.16. (WRC-23)

ANNEX 1 (WRC-03)

Parameters used in characterizing the fixed-satellite service allotment Plan (WRC-07)

Section A (SUP - WRC-07)

1 Basic technical characteristics

ADD

1.9 Coverage area and service area

The coverage area must be the smallest area which encompasses the service area. The notifying administration shall respect this requirement when submitting an Appendix **30B** notice to the Bureau. Should the associated satellite be already in operation at the time of the submission of Appendix **30B** notice or be launched within [1] year from the date of submission of Appendix **30B** notice, the notifying administration shall submit to the Bureau updated coverage area diagram(s). The Bureau shall update the coverage area in the List and Master Register when that satellite is replaced by a new one and there is no need to restart the Article 6 procedure. In this connection, the coverage area at the time of the submission or the updated one after replacement of the satellite shall be aligned with the most up-to-date service area. (WRC-23)

4/7/6.5.3 For Method F3

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

ARTICLE 4 (REV.WRC-19)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

ADD

4.1.10e An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points[WW] that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-23)

ADD

4.1.20*bis* When an administration or a group of named administrations plans to implement a satellite network with a service area limited to its territory or their territories, as appropriate, and with characteristics in compliance with §§ 3.2, 3.4 and 3.5 of Annex 3 of this Appendix, including the co- and cross-polar off-axis e.i.r.p. characteristics specified by curves A′ and B′ of Figure A respectively, any other notifying administration of a satellite network having relative satellite antenna gain derived from the minimum ellipse[ZZ] required to cover the service area of equal to or less than −20 dB over the territory/territories of the former administration(s) and being identified as affected by the Bureau shall not claim protection from uplink interference emanating from the territory of the former administration(s). § 4.1.20 does not apply. (WRC-23)

[WW] The administration responsible for the assignment may request to relocate the uplink test points from the excluded territory to a new location within the remaining part of its service area provided that the relocation shall not cause more interference. (WRC-23)

[ZZ] The minimum ellipse is determined by the set of test points contained in the satellite network, including the associated relevant Regions 1 and 3 List of additional uses, using the relevant BR software application. (WRC-23)

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ARTICLE 6 (REV.WRC-19)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*] (WRC-19)

MOD

6.16 An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points[MOD 6*bis*] that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-~~19~~23)

ADD

6.29*bis* When an administration or a group of named administrations plans to implement a satellite network with a service area limited to its territory or their territories, as appropriate, and with uplink characteristics in compliance with §§ 1.2, 1.3 and 1.6 of Annex 1 of this Appendix, including those of Table 1 of § 1.6.4, any other notifying administration of a satellite network having relative satellite antenna gain derived from the minimum ellipse[ZZ] required to cover the service area of equal to or less than −20 dB over the territory/territories of the former administration(s) and being identified as affected by the Bureau shall not claim protection from uplink interference emanating from the territory of the former administration(s). § 6.29 does not apply. (WRC-23)

6*bis* The administration responsible for the assignment may request to relocate the ~~downlink~~ test points from the excluded territory to a new location within the remaining part of its service area. Uplink test points relocation shall not cause more interference. (WRC-~~19~~23)

ZZ The minimum ellipse is determined by the set of both uplink and downlink test points contained in the satellite network using the relevant BR software application. (WRC-23)

4/7/6.5.4 For Method F4

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

ARTICLE 4 (REV.WRC-19)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

ADD

4.1.10e An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-23)

ANNEX 1 (REV.WRC-19)

Limits for determining whether a service of an administration is considered to be affected by a proposed modification to the Region 2 feeder-link Plan or by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List or when it is necessary under this Appendix to seek the agreement of any other administration (Rev.WRC-03)

MOD

4 Limits to the interference into frequency assignments in conformity with the Regions 1 and 3 feeder-link Plan or with the Regions 1 and 3 feeder-link List or proposed new or modified assignments in the Regions 1 and 3 feeder-link List (WRC-03)

Under assumed free-space propagation conditions, the power flux-density of a proposed new or modified assignment in the feeder-link List shall not exceed the value of −76 dB(W/(m^2 · 27 MHz)) at any point in the geostationary-satellite orbit, and the relative off-axis e.i.r.p. of the associated feeder-link antenna shall be in compliance with Fig. A (WRC-97 curves) of Annex 3. (WRC-03)

With respect to § 4.1.1 *a)* or *b)* of Article 4, an administration in Region 1 or 3 is considered by the Bureau as being affected if the minimum orbital spacing between the wanted and interfering space stations, under worst-case station-keeping conditions, is less than 9°. (WRC-03)

However, an administration is not considered as being affected if, under assumed free-space propagation conditions, the effect of the proposed new or modified assignments in the feeder-link List is that the feeder-link equivalent protection margin[35] corresponding to a test point of its assignment in the feeder-link Plan or the feeder-link List or for which the procedure of Article 4 has been initiated, including the cumulative effect of any previous modification to the feeder-link List or any previous agreement, does not fall more than 0.45 dB below 0 dB, or, if already negative, more than 0.45 dB below the value resulting from:

–i) the Regions 1 and 3 feeder-link Plan and List as established by WRC-2000; *or*

–ii) a proposed new or modified assignment to the feeder-link List in accordance with this Appendix; *or*

–iii) a new entry in the Regions 1 and 3 feeder-link List as a result of the successful application of Article 4 procedures. (WRC-03)

For a proposed new or modified assignment to the feeder-link List, in the interference analysis, for each test point, the antenna characteristics described in § 3.5 of Annex 3 shall apply. (WRC-03)

For examination of a proposed new or modified assignment to the feeder-link List, in the interference analyses, the Bureau will generate coverage diagrams for assignments of ii) and iii) above based on the minimum ellipse determined by the set of test points of the satellite network[36, 37] and the reference antenna patterns used for replanning at WRC-97 of § 3.7.3 of Annex 3 to this Appendix, using the relevant BR software applications. (WRC-23)

ANNEX 3

Technical data used in establishing the provisions and associated Plans and Regions 1 and 3 feeder-link List, which should be used for their application[36] (Rev.WRC-03)

1 Definitions

ADD

1.2*bis* **Feeder-link coverage area**

The area on the surface of the Earth delineated by a contour of a constant given value of relative receiving space station antenna gain which would permit the wanted quality of reception in the absence of interference.

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[35] For the definition of the equivalent protection margin, see § 1.7 of Annex 3.

[36] For assignments where Resolution **49** information has been received by the Bureau, the Bureau will use the set of test points as of the time of receipt of the Resolution **49** information.

[37] For assignments entered into the Regions 1 and 3 feeder-link List before [16 December 2023], the Bureau will use the coverage diagram as contained in the List.

NOTE 1 – The coverage area must be the smallest area which encompasses the service area. See also § 4.1.10e to this Appendix.

NOTE 2 – The coverage area, which will normally encompass the entire service area, will result from the intersection of the antenna beam (elliptical, circular, or shaped) with the surface of the Earth, and will be defined by a given value of relative receiving space station antenna gain. For example, it would be the area delineated by the contour corresponding to −3 dB of the relative receiving space station antenna gain. There will usually be an area outside the service area but within the coverage area in which the relative receiving space station antenna gain will be at least equivalent to the minimum specified value. Protection from uplink interference will be given to satisfy the required criterion depending on the receiving space station antenna contour, earth station transmitting power, the orbital separation angle, etc. (see also NOTE 1).

4/7/7 Topic G – Revisions to Resolution 770 (WRC-19) to allow its implementation

4/7/7.1 Executive summary

Resolution **770 (WRC-19)** provides a methodology to determine conformity of non-GSO satellite systems with single-entry interference thresholds in RR Article **22** to ensure the protection of the GSO fixed-satellite service (FSS) and broadcasting-satellite service (BSS) in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz. The objective of this topic is to propose corrections to Resolution **770 (WRC-19)**. In addition to Method G1 proposing no change to Resolution **770 (WRC-19)**, editorial and regulatory modifications are proposed in Methods G2 and G3. Both methods contain the same elements. While Method G2 proposes that the modifications are included in a revision of Resolution **770 (WRC-19)**, Method G3 proposes to remove Annex 2 from Resolution **770 (WRC-19)** and move it to a new ITU-R Recommendation which would be incorporated by reference in a revision of Resolution **770 (WRC-19)** and in the RR provisions referring to this Resolution.

4/7/7.2 Background

ITU-R noted that the outcome of several WRC-19 agenda items requires follow-on studies to determine methods on how to implement and apply criteria and conditions decided by WRC-19. This includes Resolution **770 (WRC-19)** (related to single-entry interference from non-GSO systems to GSO networks in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space)).

In addressing the *invites* of Resolution **770 (WRC-19)** to provide a functional description to implement the methodology contained in that Resolution, it has been determined that additional information is required to allow for a proper implementation. That is, corrections or clarifications need to be made to Resolution **770 (WRC-19)** before it can be consistently applied, some of which are regulatory in nature. Because of this, it was agreed that a new topic under WRC-23 agenda item 7 would be appropriate to provide for the above-mentioned regulatory corrections and clarifications related to the implementation of the methodology contained in Resolution **770 (WRC-19)**.

4/7/7.3 Summary and analysis of the results of ITU-R studies

ITU-R has studied Resolution **770 (WRC-19)** and specifically has identified difficulties in the application of this Resolution, along with possible solutions. The preliminary draft new Recommendation ITU-R S.[RES 770] includes the compilation of relevant studies and results. Based on this work, it has been recognized that some modifications to Resolution **770 (WRC-19)** are required to allow for its implementation. ITU-R studies concluded that the following amendments to Resolution **770 (WRC-19)** are required:

– As there are not enough parameters in Resolution **770 (WRC-19)** to compute the maximum probability p_{max} (probability of rain attenuation greater than 0 dB), it is suggested to use a fixed value of 10%, and this value could be added in Tables 1 and 2 of Resolution **770 (WRC-19)**.

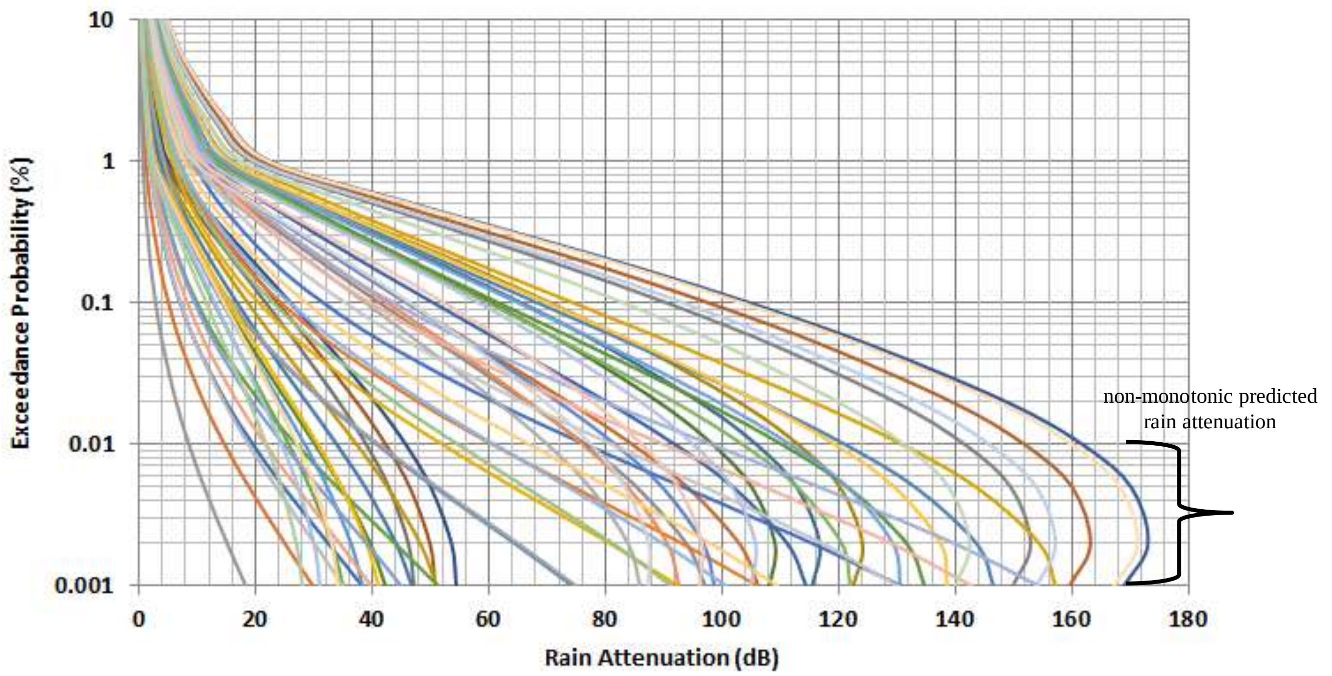
– Recommendation ITU-R S.2131-0 has been updated to ITU-R S.2131-1. ITU-R studies showed that the text in Resolution **770 (WRC-19)** should be updated to refer to a limit for the spectral efficiency of the victim GSO link of 5.944 bps/Hz for C/N > 25 dB.

– The rain attenuation model in Recommendation ITU-R P.618-13 contains the following inconsistencies that make implementation of Resolution **770 (WRC-19)** difficult:

1) the non-monotonic predicted rain attenuation for exceedance probabilities[28] between 0.01% and 0.001%, and

FIGURE 4/7/7.3-1

Exceedance probability (%) vs rain attenuation (dB) for all the rain conditions in Resolution 770 (WRC-19)

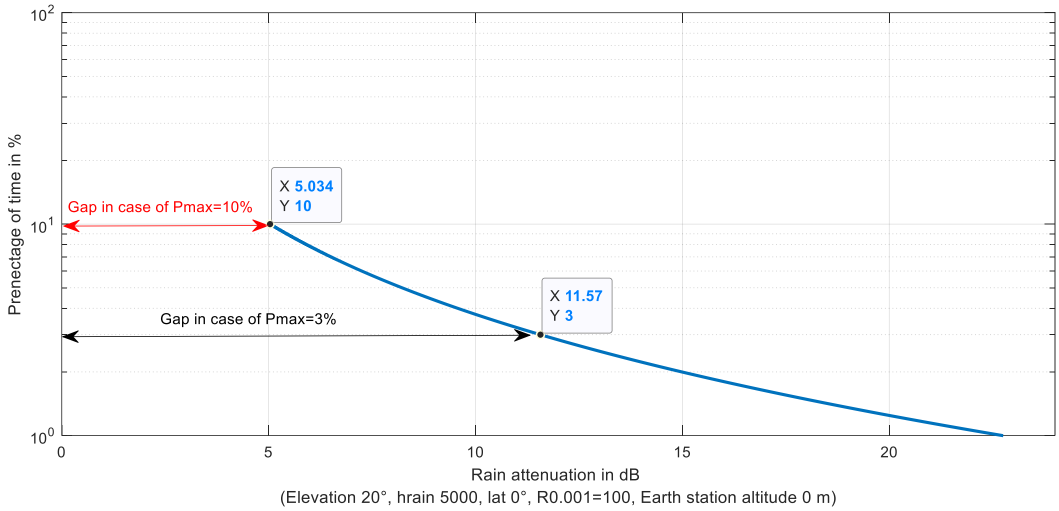


2) the non-zero predicted rain attenuation for exceedance probabilities greater than the slant path probability of rain.

[28] The terms exceedance probability, time percentage of exceedance, and complementary cumulative distribution function (CCDF) are synonymous.

FIGURE 4/7/7.3-2

Zoom on one curve of Figure 4/7/7.3-1 at a percentage around the probability of rain



The ITU-R expert group on propagation models provided guidance on how to solve these inconsistencies in the context of Resolution **770 (WRC-19)**. ITU-R studies showed the need to implement such guidance in this Resolution.

– Include the value of speed of light: 2.99792458 × 10^5 km/s

– Modify the lower value for p_{rain} (unavailability of the link without interference) in (Steps 0-10) as 0.01% instead of 0.001%

– Determine procedural and regulatory provisions to ensure that administrations having submitted coordination requests and/or notification information before 15 December 2023 are given the opportunity to rectify the data already submitted (e.g. pfd and e.i.r.p. masks used to compute epfd statistics at the victim GSO receiver by applying the methodology contained in Recommendation ITU-R S.1503) based upon which the methodology in Resolution **770 (WRC-19)** is applied.

4/7/7.4 Methods to satisfy Topic G

4/7/7.4.1 Method G1

No changes to Resolution **770 (WRC-19)**.

4/7/7.4.2 Method G2

Modify Resolution **770 (WRC-19)** to allow for its implementation.

4/7/7.4.3 Method G3

Remove Annex 2 from Resolution **770 (WRC-19)** and move it to a new ITU-R Recommendation which would be incorporated by reference in Resolution **770 (WRC-19)**.

4/7/7.5 Regulatory and procedural considerations

4/7/7.5.1 For Method G1

NOC

RESOLUTION 770 (WRC-19)

Application of Article 22 of the Radio Regulations to the protection of geostationary fixed-satellite service and broadcasting-satellite service networks from non-geostationary fixed-satellite service systems in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz

4/7/7.5.2 For Method G2

MOD

RESOLUTION 770 (REV.WRC-~~19~~23)

Application of Article 22 of the Radio Regulations to the protection of geostationary fixed-satellite service and broadcasting-satellite service networks from non-geostationary fixed-satellite service systems in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz

The World Radiocommunication Conference (~~Sharm el-Sheikh, 2019~~Dubai, 2023),

…

resolves

…

6 that *resolves* 3, 4 and 5 shall no longer be applied after BR has communicated to all administrations via a circular letter that validation software is available and BR is able to verify compliance with the limits in No. **22.5L**~~.~~;

7 that administrations responsible for those non-GSO systems having submitted coordination requests and/or notification information under the applicable provisions of Article **9** or Article **11** of the Radio Regulations, as appropriate, prior to 15 December 2023, shall be given the possibility to resubmit the information used to derive the probability density function of the epfd computed as per Annex 2 to this Resolution,

…

instructs the Director of the Radiocommunication Bureau

1 to review, once the validation software as described in *resolves* 3 is available, BR's findings made in accordance with Nos. **9.35** and **11.31**~~.~~;

2 to take all necessary measures to facilitate the implementation of this Resolution, in particular its *resolves* 7.

ANNEX 1 TO RESOLUTION 770 (REV.WRC-~~19~~23)

Generic GSO reference links for evaluation of compliance with single-entry requirements for non-GSO systems

…

TABLE 1

Parameters of generic GSO reference links to be used in examination of the downlink (space-to-Earth) impact from any one non-GSO system

1	**Generic GSO reference link parameters - service**					**Parameters**
	Link type	User #1	User #2	User #3	Gateway	
1.1	E.i.r.p. density (dBW/MHz)	44	44	40	36	*eirp*
1.2	Equivalent antenna diameter (m)	0.45	0.6	2	9	D_m
1.3	Bandwidth (MHz)	1	1	1	1	B_{MHz}
1.4	ES antenna gain pattern	S.1428	S.1428	S.1428	S.1428	
1.5	Additional link losses (dB) This field includes non-precipitation impairments	3	3	3	3	L_o
1.6	Additional noise contribution including margin for inter-system interference (dB)	2	2	2	2	M_{0inter}
1.7	Additional noise contribution including margin for intra-system interference (dB) and non-time varying sources	1	1	1	1	M_{0intra}

2	**Generic GSO reference link parameters - parametric analysis**	**Parametric cases for evaluation**						
2.1	E.i.r.p. density variation	−3, 0, +3 dB from value in 1.1						$\Delta eirp$
2.2	Elevation angle (deg)	20			55		90	ε
2.3	Rain height (m) for specified latitude in item 2.4	5 000	3 950	1 650	5 000	3 950	5 000	h_{rain}
2.4	Latitude* (deg. *N*)	0	± 30	± 61.8	0	± 30	0	Lat
2.5	ES noise temperature (K)	340						T
2.6	0.01% rain rate (mm/hr)	10, 50, 100						$R_{0.01}$
2.7	Height of ES above mean sea level (m)	0, 500, 1 000						h_{ES}
2.8	Threshold C/N (dB)	−2.5, 2.5, 5, 10						$\left(\frac{C}{N}\right)_{Thr,i}$
2.9	Probability of non-zero rain attenuation	10						p_{max} (%)

NOTE – For items 2.2, 2.3 and 2.4, these three groups of data are be considered as unique sets of data to be used in the larger, overall set of total possible permutations. For example, 20 degrees of elevation angle will consider three different latitudes of 0, 30 and 61.8 degrees while 90 degrees of elevation will only consider a latitude of 0 degrees and one possible rain height 5 km. The above parameters are chosen as representative propagation parameters for purposes of calculations of precipitation fade statistics. These precipitation fades are representative of other geographic locations.

*	Latitude is evaluated as a single value representing the absolute value of the latitude

TABLE 2

Parameters of generic GSO reference links to be used in examination of the uplink (Earth-to-space) impact from any one non-GSO system

1	**Generic GSO reference link parameters - service**					
	Link type	Link #1	Link #2	Link #3	Gateway	
1.1	ES e.i.r.p. density (dBW/MHz)	49	49	49	60	*eirp*
1.2	Bandwidth (MHz)	1	1	1	1	B_{MHz}
1.3	Half-power beamwidth (deg)	0.2	0.3	1.5	0.3	
1.4	ITU-R S.672 sidelobe level (dB)	−25	−25	−25	−25	
1.5	Satellite antenna peak gain (dBi)	58.5	54.9	38.5	54.9	G_{max}
1.6	Additional link losses (dB) This field includes non-precipitation impairments	4.5	4.5	4.5	4.5	L_o
1.7	Additional noise contribution including margin for inter-system interference (dB)	2	2	2	2	M_{0inter}
1.8	Additional noise contribution including margin for intra-system interference (dB) and non-time varying sources	1	1	1	1	M_{0intra}

2	**Generic GSO reference link parameters - parametric analysis**	**Parametric cases for evaluation**						
2.1	E.i.r.p. density variation	−6, 0, +6 dB from value in 1.1						$\Delta eirp$
2.2	Elevation angle (deg)	20			55		90	ε
2.3	Rain height (m) for specified latitude in item 2.4	5 000	3 950	1 650	5 000	3 950	5 000	h_{rain}
2.4	Latitude* (deg. *N*)	0	± 30	± 61.8	0	± 30	0	Lat
2.5	0.01% rain rate (mm/hr)	10, 50, 100						$R_{0.01}$
2.6	Height of ES above mean sea level (m)	0, 500, 1 000						h_{ES}
2.7	Satellite noise temperature (K)	500, 1 600						T
2.8	Threshold *C*/*N* (dB)	−2.5, 2.5, 5, 10						$\left(\frac{C}{N}\right)_{Thr,i}$
2.9	Probability of non-zero rain attenuation	10						p_{max} (%)

NOTE – For items 2.2, 2.3 and 2.4, these three groups of data are be considered as unique sets of data to be used in the larger, overall set of total possible permutations. For example, 20 degrees of elevation angle will consider three different latitudes of 0, 30 and 61.8 degrees while 90 degrees of elevation will only consider a latitude of 0 degrees and one possible rain height 5 km. The above parameters are chosen as representative propagation parameters for purposes of calculations of precipitation fade statistics. These precipitation fades are representative of other geographic locations.

*	Latitude is evaluated as a single value representing the absolute value of the latitude

ANNEX 2 TO RESOLUTION 770 (REV.WRC-~~19~~23)

Description of parameters and procedures for the evaluation of interference from any one non-GSO system into a global set of generic GSO reference links

…

APPENDIX 1 TO ANNEX 2 TO RESOLUTION 770 (REV.WRC-~~19~~23)

Algorithm steps to be applied in the space-to-Earth direction to determine compliance with No. 22.5L

…

Step 0: Verification of the generic GSO reference link and selection of *C*/*N* threshold

The following steps should be used to determine if the generic GSO reference link is valid and if so, which of the thresholds $\left(\frac{C}{N}\right)_{Thr,i}$ should be used. It is assumed that R_s = 6 378.137 km, R_{geo} = 42 164 km, ~~and~~ k_{dB} = −228.6 dB(J/K) and c = 2.99792458 × 10^5 km/s. Note that the term “cumulative distribution function” is meant to include the concept of the complementary cumulative distribution function depending upon context.

…

9) Using the precipitation model in ~~Recommendation ITU-R P.618~~ Annex 3 together with the selected rain rate, ES height, rain height, ES latitude, elevation angle, frequency, calculated rain fade margin and an assumed polarization of vertical, calculate the associated percentage of time, $p_{rain,i}$.

10) If for each threshold $(C/N)_{Thr,i}$ the associated percentage of time is not within the range:

$$\cancel{0.001\% \le p_{rain,i} \le 10\%}\ 0.01\% \le p_{rain,i} \le 10\%$$

…

Step 1: Generation of precipitation fade PDF

The precipitation fade PDF should be generated using ~~Recommendation ITU-R P.618~~Annex 3 to this Resolution from the selected rain rate, ES height, ES latitude, rain height, elevation angle, frequency (summarized in Table 2 of Annex 3) and an assumed polarization of vertical as follows:

1) Calculate the maximum fade depth ~~A_{max}~~ $A_{rain}(p)$ using p = p_{min}~~0.001%~~, noting that p_{min} is provided in Annex 3

2) Create a set of N bins of 0.1 dB width~~bins~~ of precipitation fade A_{rain} between 0 dB and round to 1 digit to the right of the decimal point of (A_{rain}~~max~~(p_{min})) + 0.1 dB

3) For each of the bins, determine the associate probability p to create a cumulative distribution function (CDF) of A_{rain}:

$$CDF_n = \text{Probability that } A_{rain} \ge \left((n-1)*0.1\right) \text{ dB} \quad \text{for } n < N$$

$$CDF_n = 0\% \quad \text{for } n = N$$

with n = 1, 2, 3, …N.

4) For each of the bins, convert this CDF into a PDF of A_{rain}:

$$PDF_n = CDF_n - CDF_{n+1} \qquad \text{for } n < N$$

$$PDF_n = 0\% \qquad \text{for } n = N$$

with: $\sum_{n=1}^{N} PDF_n = 100\%$

~~When using Recommendation ITU-R P.618, the precipitation attenuation should be 0 dB for time percentages above p_{max} where p_{max} is the minimum value of a) 10% and b) the probability of rain attenuation on a slant path calculated from § 2.2.1.2. of Recommendation ITU-R P.618-13.~~

A bin size of 0.1 dB should be used to ensure consistency with the output from Recommendation ITU-R S.1503. Each bin of the CDF contains the probability that the precipitation fade is at least A_{rain} dB. Each bin of the PDF contains the probability that the precipitation fade is between A_{rain} and A_{rain} + 0.1 dB. ~~During implementation, the array of bins can be capped at the minimum of A_{max} and the fade for which the resulting C/N would lead to the link being unavailable or have zero through-put.~~

…

Step 4: Use of C/N and $C/(N+I)$ distributions with the criteria in No. 22.5L

…

Step 4B: Check on the time-weighted average spectral efficiency decrease

Determine the long-term time-weighted average spectral efficiency, SE_R, assuming precipitation only by:

Set $SE_R = 0$

For all bins in the C/N PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-~~0~~1 should be used to convert the C/N to a spectral efficiency

Increment SE_R by the spectral efficiency multiplied by the probability associated with this C/N

}

Determine the long-term time-weighted average spectral efficiency, SE_{RI}, assuming precipitation and interference by:

Set $SE_{RI} = 0$

For all bins in the C/(N+I) PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-~~0~~1 should be used to convert the C/(N+I) to a spectral efficiency

Increment SE_{RI} by the spectral efficiency multiplied by the probability associated with this C/(N+I)

}

Then the condition to be verified for compliance is:

$$SE_{RI} >= SE_R*(1 – 0.03)$$

APPENDIX 2 TO ANNEX 2 TO RESOLUTION 770 (REV.WRC-~~19~~23)

Algorithm steps to be applied in the Earth-to-space direction to determine compliance with No. 22.5L

…

Step 0: Verification of the generic GSO reference link and selection of *C*/*N* threshold

The following steps should be used to determine if the generic GSO reference link is valid and if so, which of the thresholds $\left(\frac{C}{N}\right)_{Thr,i}$ should be used. It is assumed that R_s = 6 378.137 km, R_{geo} = 42 164 km, ~~and~~ k_{dB} = −228.6 dB(J/K) and c = 2.99792458 × 10^5 km/s. Note that the term cumulative distribution function is meant to include the concept of the complementary cumulative distribution function depending upon context.

…

8) Using the precipitation model in ~~Recommendation ITU-R P.618~~ Annex 3 to this Resolution together with the selected rain rate, ES height, rain height, ES latitude, elevation angle, frequency, calculated precipitation fade margin and an assumed polarization of vertical, calculate the associated percentage of time, $p_{rain,i}$.

9) If for each threshold $(C/N)_{Thr,i}$ the associated percentage of time is not within the range:

$$\cancel{0.001\% \le p_{rain,i} \le 10\%}\ 0.01\% \le p_{rain,i} \le 10\%$$

then this generic GSO reference link is not valid.

…

Step 1: Generation of precipitation fade PDF

The precipitation fade PDF should be generated using ~~Recommendation ITU-R P.618~~Annex 3 to this Resolution from the selected rain rate, ES height, ES latitude, rain height, elevation angle, frequency and an assumed polarization of vertical as follows:

1) Calculate the maximum fade depth ~~A_{max}~~ $A_{rain}(p)$ using p = p_{min} ~~0.001%~~, noting that p_{min} is provided in Annex 3

2) Create a set of N bins of 0.1 dB ~~bins~~width of precipitation fade A_{rain} between 0 dB and round to 1 digit to the right of the decimal point of (A~~$_{max}$~~$_{rain}(p_{min})$) + 0.1 dB

3) For each of the bins, determine the associate probability p to create a cumulative distribution function (CDF) of A_{rain}:

$$CDF_n = \text{Probability that } A_{rain} \ge ((n-1)*0.1) \text{ dB} \quad \text{for } n < N$$

$$CDF_n = 0\% \quad \text{for } n = N$$

with n = 1, 2, 3, …N

4) For each of the bins, convert this CDF into a PDF of A_{rain}:

$$PDF_n = CDF_n - CDF_{n+1} \quad \text{for } n < N$$

$PDF_n = 0\%$ for $n = N$

with: $\sum_{n=1}^{N} PDF_n = 100\%$

~~When using Recommendation ITU-R P.618, the precipitation attenuation should be 0 dB for time percentages above p_{max} where p_{max} is the minimum value of a) 10% and b) the probability of rain attenuation on a slant path calculated from § 2.2.1.2. of Recommendation ITU-R P.618-13.~~

A bin size of 0.1 dB should be used to ensure consistency with the output from Recommendation ITU-R S.1503. Each bin of the CDF contains the probability that the precipitation fade is at least A_{rain} dB. Each bin of the PDF contains the probability that the precipitation fade is between A_{rain} and A_{rain} + 0.1 dB. ~~During implementation, the array of bins can be capped at the minimum of A_{max} and the fade for which the resulting *C/N* would lead to the link being unavailable or have zero through-put.~~

…

Step 4: Use of *C*/*N* and *C*/(*N*+*I*) distributions with the criteria in No. 22.5L

…

Step 4B: Check on the time-weighted average spectral efficiency decrease

Determine the long-term time-weighted average spectral efficiency, SE_R, assuming precipitation only by:

Set $SE_R = 0$

For all bins in the C/N PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-~~0~~1 should be used to convert the C/N to a spectral efficiency

Increment SE_R *by the spectral efficiency multiplied by the probability associated with this C/N*

}

Determine the long-term time-weighted average spectral efficiency, SE_{RI}, assuming precipitation and interference by:

Set $SE_{RI} = 0$

For all bins in the C/(N+I) PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-~~0~~1 should be used to convert the C/(N+I) to a spectral efficiency

Increment SE_{RI} *by the spectral efficiency multiplied by the probability associated with this C/(N+I)*

}

Then the conditions to be verified for compliance are:

$$SE_{RI} \geq SE_R{*}(1 - 0.03)$$

ANNEX 3 TO RESOLUTION 770 (REV.WRC-23)

Calculation of precipitation fade statistics

The long-term statistics of the precipitation fade to be used are provided by the following equations:

$$\begin{array}{lll} A_{rain}\,(p_{min}) & \text{for} & 0\% \leq p \leq p_{min} \\ A_{rain}\,(p) & \text{for} & p_{min} < p \leq p_1 \\ A_{rain}\,(p_1)(\log_{10}(p)-1)/(\log_{10}(p_1)-1) & & p_1 < p \leq p_{max} \\ 0\ \text{dB} & & p_{max} < p \leq 100\% \end{array}$$

where:

p_{max} is the probability of rain fade higher than 0 dB (see 2.9 in Tables 1 and 2 in Annex 1 of Resolution **770 (Rev.WRC-23)**)

$A_{rain}(p)$ is generated using § 2.2.1.1. of Recommendation ITU-R P.618-13

p_1 and p_{min} are provided in Table 1 for the GSO space-to-Earth direction (F = 42 GHz), in Table 2 for the GSO Earth-to-space direction (F = 48 GHz) and the rain index and the associated rain conditions for both space-to-Earth and Earth-to-space directions are in Table 3 below.

TABLE 1

p_1 and p_{min} to be used for the space-to-Earth direction (downlink)

Index	**p_1 (%)**	**p_{min} (%)**	**Index**	**p_1 (%)**	**p_{min} (%)**	**Index**	**p_1 (%)**	**p_{min} (%)**	**Index**	**p_1 (%)**	**p_{min} (%)**
1	2.3581	0.0026	15	2.22303	0.0017	29	2.47911	0.0012	43	2.156191	0.0010
2	2.37715	0.0025	16	2.077825	0.0025	30	2.50404	0.0011	44	2.17964	0.0010
3	2.39856	0.0024	17	2.09965	0.0023	31	2.20629	0.0024	45	2.20728	0.0010
4	2.11823	0.0049	18	2.125081	0.0022	32	2.22521	0.0023	46	2.491	0.0018
5	2.136121	0.0047	19	2.5703	0.0010	33	2.24656	0.0021	47	2.51571	0.0017
6	2.156221	0.0044	20	2.63781	0.0010	34	2.10366	0.0031	48	2.54323	0.0016
7	2.01934	0.0062	21	2.765	0.0010	35	2.121864	0.0029	49	2.16559	0.0043
8	2.0368	0.0060	22	2.32372	0.0010	36	2.14242	0.0028	50	2.191301	0.0041
9	2.056404	0.0057	23	2.38707	0.0010	37	2.51255	0.0010	51	2.21998	0.0038
10	2.41044	0.0010	24	2.49144	0.0010	38	2.54424	0.0010	52	2.022331	0.0062
11	2.4347	0.0010	25	2.22289	0.0010	39	2.5807	0.0010	53	2.04828	0.0058
12	2.46293	0.0010	26	2.28419	0.0010	40	2.2583	0.0010	54	2.07725	0.0054
13	2.17425	0.0019	27	2.3852	0.0010	41	2.28273	0.0010			
14	2.19677	0.0018	28	2.45877	0.0012	42	2.31152	0.0010			

TABLE 2

p_1 and p_{min} to be used for the Earth-to-space direction (uplink)

Index	p_1 (%)	p_{min} (%)	Index	p_1 (%)	p_{min} (%)	Index	p_1 (%)	p_{min} (%)	Index	p_1 (%)	p_{min} (%)
1	2.3176	0.0029	15	2.1883	0.0018	29	2.4364	0.0013	43	2.1196	0.0010
2	2.3369	0.0028	16	2.0439	0.0027	30	2.4605	0.0012	44	2.1437	0.0010
3	2.3586	0.0026	17	2.0663	0.0025	31	2.1688	0.0026	45	2.1722	0.0010
4	2.0845	0.0053	18	2.0923	0.0024	32	2.1881	0.0025	46	2.4455	0.0021
5	2.1027	0.0051	19	2.5308	0.0010	33	2.2100	0.0023	47	2.4707	0.0020
6	2.1231	0.0048	20	2.5992	0.0010	34	2.0677	0.0034	48	2.4987	0.0018
7	1.9881	0.0069	21	2.7270	0.0010	35	2.0865	0.0032	49	2.1259	0.0048
8	2.0059	0.0065	22	2.2907	0.0010	36	2.1076	0.0030	50	2.1523	0.0045
9	2.0258	0.0062	23	2.3552	0.0010	37	2.4682	0.0010	51	2.1817	0.0042
10	2.3689	0.0011	24	2.4614	0.0010	38	2.5005	0.0010	52	1.9844	0.0071
11	2.3935	0.0011	25	2.1920	0.0010	39	2.5377	0.0010	53	2.0112	0.0064
12	2.4222	0.0010	26	2.2546	0.0010	40	2.2203	0.0010	54	2.0410	0.0059
13	2.1385	0.0021	27	2.3577	0.0010	41	2.2453	0.0010			
14	2.1615	0.0020	28	2.4158	0.0013	42	2.2749	0.0010			

TABLE 3

Rain index and corresponding rain conditions

Rain index	E	h_{rain}	Lat	R0.01	h_{ES}	Rain index	ε	h_{rain}	Lat	R0.01	h_{ES}
1	20	5 000	0	10	0	28	55	5 000	0	10	0
2	20	5 000	0	10	500	29	55	5 000	0	10	500
3	20	5 000	0	10	1 000	30	55	5 000	0	10	1 000
4	20	5 000	0	50	0	31	55	5 000	0	50	0
5	20	5 000	0	50	500	32	55	5 000	0	50	500
6	20	5 000	0	50	1 000	33	55	5 000	0	50	1 000
7	20	5 000	0	100	0	34	55	5 000	0	100	0
8	20	5 000	0	100	500	35	55	5 000	0	100	500
9	20	5 000	0	100	1 000	36	55	5 000	0	100	1 000
10	20	3 950	30	10	0	37	55	3 950	30	10	0
11	20	3 950	30	10	500	38	55	3 950	30	10	500
12	20	3 950	30	10	1 000	39	55	3 950	30	10	1 000
13	20	3 950	30	50	0	40	55	3 950	30	50	0
14	20	3 950	30	50	500	41	55	3 950	30	50	500
15	20	3 950	30	50	1 000	42	55	3 950	30	50	1 000
16	20	3 950	30	100	0	43	55	3 950	30	100	0
17	20	3 950	30	100	500	44	55	3 950	30	100	500
18	20	3 950	30	100	1 000	45	55	3 950	30	100	1 000
19	20	1 650	61.8	10	0	46	90	5 000	0	10	0
20	20	1 650	61.8	10	500	47	90	5 000	0	10	500

Rain index	E	h_{rain}	Lat	R0.01	h_{ES}	Rain index	ε	h_{rain}	Lat	R0.01	h_{ES}
21	20	1 650	61.8	10	1 000	48	90	5 000	0	10	1 000
22	20	1 650	61.8	50	0	49	90	5 000	0	50	0
23	20	1 650	61.8	50	500	50	90	5 000	0	50	500
24	20	1 650	61.8	50	1 000	51	90	5 000	0	50	1 000
25	20	1 650	61.8	100	0	52	90	5 000	0	100	0
26	20	1 650	61.8	100	500	53	90	5 000	0	100	500
27	20	1 650	61.8	100	1 000	54	90	5 000	0	100	1 000

4/7/7.5.3 For Method G3

MOD

RESOLUTION 770 (REV.WRC-~~19~~23)

Application of Article 22 of the Radio Regulations to the protection of geostationary fixed-satellite service and broadcasting-satellite service networks from non-geostationary fixed-satellite service systems in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz

…

resolves

1 that during the examination under Nos. **9.35** and **11.31**, as applicable, of a non-GSO FSS satellite system with frequency assignments in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), the compliance with No. **22.5L** shall be established using the technical characteristics of generic GSO reference links contained in Annex 1 to this Resolution ~~shall be used in conjunction with the methodology in Annex 2 to this Resolution to determine compliance with No. **22.5L**~~and Recommendation ITU-R S.[QV-METH-REF-LINKS];

…

6 that *resolves* 3, 4 and 5 shall no longer be applied after BR has communicated to all administrations via a circular letter that validation software is available and BR is able to verify compliance with the limits in No. **22.5L**~~.~~;

7 that administrations responsible for those non-GSO systems having submitted coordination requests and/or notification information under the applicable provisions of Article **9** or Article **11** of the Radio Regulations, as appropriate, prior to 15 December 2023, shall be given the possibility to resubmit the information used to derive the probability density function of the epfd computed as per Recommendation ITU-R S.[QV-METH-REF-LINKS],

…

instructs the Director of the Radiocommunication Bureau

1 to review, once the validation software as described in *resolves* 3 is available, BR's findings made in accordance with Nos. **9.35** and **11.31**~~.~~;

2 to take all necessary measures to facilitate the implementation of this Resolution, in particular its *resolves* 7.

ANNEX 1 TO RESOLUTION 770 (REV.WRC-~~19~~23)

Generic GSO reference links for evaluation of compliance with single-entry requirements for non-GSO systems

…

TABLE 1

Parameters of generic GSO reference links to be used in examination of the downlink (space-to-Earth) impact from any one non-GSO system

1	**Generic GSO reference link parameters - service**					**Parameters**
	Link type	User #1	User #2	User #3	Gateway	
1.1	E.i.r.p. density (dBW/MHz)	44	44	40	36	*eirp*
1.2	Equivalent antenna diameter (m)	0.45	0.6	2	9	D_m
1.3	Bandwidth (MHz)	1	1	1	1	B_{MHz}
1.4	ES antenna gain pattern	S.1428	S.1428	S.1428	S.1428	
1.5	Additional link losses (dB) This field includes non-precipitation impairments	3	3	3	3	L_o
1.6	Additional noise contribution including margin for inter-system interference (dB)	2	2	2	2	M_{0inter}
1.7	Additional noise contribution including margin for intra-system interference (dB) and non-time varying sources	1	1	1	1	M_{0intra}

2	**Generic GSO reference link parameters - parametric analysis**	**Parametric cases for evaluation**						
2.1	E.i.r.p. density variation	−3, 0, +3 dB from value in 1.1						Δ*eirp*
2.2	Elevation angle (deg)	20			55		90	ε
2.3	Rain height (m) for specified latitude in item 2.4	5 000	3 950	1 650	5 000	3 950	5 000	h_{rain}
2.4	Latitude* (deg. *N*)	0	± 30	± 61.8	0	± 30	0	Lat
2.5	ES noise temperature (K)	340						*T*
2.6	0.01% rain rate (mm/hr)	10, 50, 100						$R_{0.01}$
2.7	Height of ES above mean sea level (m)	0, 500, 1 000						h_{ES}
2.8	Threshold *C*/*N* (dB)	−2.5, 2.5, 5, 10						$\left(\frac{C}{N}\right)_{Thr,i}$
2.9	Probability of non-zero rain attenuation	10						p_{max} (%)

NOTE – For items 2.2, 2.3 and 2.4, these three groups of data are be considered as unique sets of data to be used in the larger, overall set of total possible permutations. For example, 20 degrees of elevation angle will consider three different latitudes of 0, 30 and 61.8 degrees while 90 degrees of elevation will only consider a latitude of 0 degrees and one possible rain height 5 km. The above parameters are chosen as representative propagation parameters for purposes of calculations of precipitation fade statistics. These precipitation fades are representative of other geographic locations.

* Latitude is evaluated as a single value representing the absolute value of the latitude

TABLE 2

Parameters of generic GSO reference links to be used in examination of the uplink (Earth-to-space) impact from any one non-GSO system

1	**Generic GSO reference link parameters - service**					
	Link type	Link #1	Link #2	Link #3	Gateway	
1.1	ES e.i.r.p. density (dBW/MHz)	49	49	49	60	*eirp*
1.2	Bandwidth (MHz)	1	1	1	1	B_{MHz}
1.3	Half-power beamwidth (deg)	0.2	0.3	1.5	0.3	
1.4	ITU-R S.672 sidelobe level (dB)	−25	−25	−25	−25	
1.5	Satellite antenna peak gain (dBi)	58.5	54.9	38.5	54.9	G_{max}
1.6	Additional link losses (dB) This field includes non-precipitation impairments	4.5	4.5	4.5	4.5	L_o
1.7	Additional noise contribution including margin for inter-system interference (dB)	2	2	2	2	M_{0inter}
1.8	Additional noise contribution including margin for intra-system interference (dB) and non-time varying sources	1	1	1	1	M_{0intra}

2	**Generic GSO reference link parameters - parametric analysis**	**Parametric cases for evaluation**						
2.1	E.i.r.p. density variation	−6, 0, +6 dB from value in 1.1						$\Delta eirp$
2.2	Elevation angle (deg)	20			55		90	ε
2.3	Rain height (m) for specified latitude in item 2.4	5 000	3 950	1 650	5 000	3 950	5 000	h_{rain}
2.4	Latitude* (deg. *N*)	0	± 30	± 61.8	0	± 30	0	Lat
2.5	0.01% rain rate (mm/hr)	10, 50, 100						$R_{0.01}$
2.6	Height of ES above mean sea level (m)	0, 500, 1 000						h_{ES}
2.7	Satellite noise temperature (K)	500, 1 600						T
2.8	Threshold *C*/*N* (dB)	−2.5, 2.5, 5, 10						$\left(\frac{C}{N}\right)_{Thr,i}$
2.9	Probability of non-zero rain attenuation	10						p_{max} (%)

NOTE – For items 2.2, 2.3 and 2.4, these three groups of data are be considered as unique sets of data to be used in the larger, overall set of total possible permutations. For example, 20 degrees of elevation angle will consider three different latitudes of 0, 30 and 61.8 degrees while 90 degrees of elevation will only consider a latitude of 0 degrees and one possible rain height 5 km. The above parameters are chosen as representative propagation parameters for purposes of calculations of precipitation fade statistics. These precipitation fades are representative of other geographic locations.

* Latitude is evaluated as a single value representing the absolute value of the latitude

~~ANNEX 2 TO RESOLUTION 770 (WRC-19)~~

~~**Description of parameters and procedures for the evaluation of interference from any one non-GSO system into a global set of generic GSO reference links**~~

~~This Annex provides an overview of the process to validate compliance with the single-entry permissible interference of a non-GSO system into GSO networks using the generic GSO reference link parameters in Annex 1 and the interference impact using the latest version of Recommendation ITU-R S.1503. The procedure to determine compliance with the single-entry permissible interference relies on the following principles.~~

~~*Principle 1*: The two time-varying sources of link performance degradation considered in the verification are link fading (from rain) using the characteristics of the generic GSO reference link and interference from a non-GSO system. The total *C*/*N* in the reference bandwidth for a given carrier is:~~

$$\cancel{C/N = C/(N_T + I)} \qquad \cancel{(1)}$$

~~where:~~

~~*C*: wanted signal power (W) in the reference bandwidth, which varies as a function of fades and also as a function of transmission configuration~~

~~N_T: total system noise power (W) in the reference bandwidth~~

~~*I*: time-varying interference power (W) in the reference bandwidth generated by other networks.~~

~~*Principle 2*: The calculation of spectral efficiency is focused on satellite systems utilizing adaptive coding and modulation (ACM) by calculating the throughput degradation as a function of *C*/*N*,~~

~~which varies depending on the propagation and interference impacts on the satellite link over the long term.~~

~~*Principle 3:* During a fading event in the downlink direction the interfering carrier is attenuated by the same amount as the wanted carrier. This principle results in slight underestimation of the impact of the downlink interference.~~

~~**Implementation of verification algorithm**~~

~~The generic GSO reference link parameters described in Annex 1 should be used as described in the following algorithm to determine if a non-GSO FSS network is compliant with No. **22.5L**.~~

~~Within the parametric analysis there are a range of values for each of the following parameters in Section 2 of Tables 1 and 2:~~

~~– e.i.r.p. density variation~~

~~– elevation angle (degree)~~

~~– rain height (m)~~

~~– latitude (degree)~~

~~– 0.01% rain rate (mm/hr)~~

~~– height of ES (m)~~

~~– ES noise temperature (K) or satellite noise temperature (K), as appropriate.~~

~~A set of generic GSO reference links should be created using one per service case identified in Section 1 of Tables 1 and 2 and one value from each of the parametric analysis parameters in Section 2 of Tables 1 and 2. Then, with this set of generic GSO reference links, the following process should be undertaken:~~

~~*Determine the frequency that should be used in the analysis, f_{GHz}, by applying the methodology in Recommendation ITU-R S.1503 to the non-GSO system filed frequencies and the frequency bands for which No.* ***22.5L*** *applies*~~

~~*For each of the generic GSO reference links*~~

~~*{*~~

~~*Step 0: Determine if this generic GSO reference link is valid and select the appropriate threshold*~~

~~*If the generic GSO reference link is valid, then*~~

~~*{*~~

~~*Step 1: Derive the probability density function (PDF) of the rain fade to use in the convolution*~~

~~*Step 2: Recommendation ITU-R S.1503 should be used to derive the PDF of the EPFD from the non-GSO FSS system*~~

~~*Step 3: Perform a modified convolution (space-to-Earth) or convolution (Earth-to-space) with the PDF of the rain fade and the PDF of the EPFD. This convolution yields a PDF of C/N and C/(N+I)*~~

~~*Step 4: Use the C/N and C/(N+I) PDFs to determine compliance with No.* ***22.5L***~~

~~*}*~~

~~*}*~~

~~*If the non-GSO system under examination is found to comply with No.* ***22.5L*** *with respect to all generic GSO reference links, then the result of the evaluation is pass otherwise it is an unfavourable finding.*~~

~~Each of these steps are described further in Appendices **1** and **2** to this Annex for the space-to-Earth and Earth-to-space procedures, respectively.~~

~~APPENDIX 1 TO ANNEX 2 TO RESOLUTION 770 (WRC-19)~~

~~**Algorithm steps to be applied in the space-to-Earth direction to determine compliance with No. 22.5L**~~

~~By applying the following steps, the single-entry interference impact from a non-GSO system on the availability and spectral efficiency of a generic GSO reference link is determined. The generic GSO reference link parameters of Annex 1 to this Resolution are used, considering all possible parametric permutations, in conjunction with the worst-case geometry ("WCG") epfd output of the latest version of Recommendation ITU-R S.1503. The output of Recommendation ITU-R S.1503 is a set of interference statistics that a non-GSO system creates. These interference statistics are then used to determine the effect of the interference into each generic GSO reference link.~~

~~**Step 0: Verification of the generic GSO reference link and selection of *C/N* threshold**~~

~~The following steps should be used to determine if the generic GSO reference link is valid and if so, which of the thresholds~~ $\left(\frac{C}{N}\right)_{Thr,i}$ ~~should be used. It is assumed that~~ $R_s = 6\,378.137$ ~~km,~~ $R_{geo} = 42\,164$ ~~km and~~ $k_{dB} = -228.6$ ~~dB(J/K). Note that the term "cumulative distribution function" is meant to include the concept of the complementary cumulative distribution function depending upon context.~~

~~1) Calculate the peak gain of the ES in dBi using:~~

~~for~~ $20 \leq D/\lambda \leq 100$

$$G_{max} = 20 \log\left(\frac{D}{\lambda}\right) + 7.7 \qquad \text{dBi}$$

~~for~~ $D/\lambda > 100$

$$G_{max} = 20 \log\left(\frac{D}{\lambda}\right) + 8.4 \qquad \text{dBi}$$

~~2) Calculate the slant distance in km using:~~

$$d_{km} = R_s\left(\sqrt{\frac{R_{geo}^2}{R_s^2} - \cos^2(\varepsilon)} - \sin(\varepsilon)\right)$$

~~3) Calculate the free-space path loss in dB using:~~

$$L_{fs} = 92.45 + 20\log(f_{GHz}) + 20\log(d_{km})$$

~~4) Calculate the wanted signal power in the reference bandwidth in dBW accounting for additional link losses:~~

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o$$

~~5) Calculate the total noise power in the reference bandwidth in dBW/MHz using:~~

$$N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra} + M_{ointer}$$

~~6) For each threshold~~ $(C/N)_{Thr,i}$, ~~derive the margin available for precipitation for that case in dB:~~

$$A_{rain,i} = C - N_T - \left(\frac{C}{N}\right)_{Thr,i}$$

~~7) If for each threshold~~ $(C/N)_{Thr,i}$ ~~the margin~~ $A_{rain,i} \leq A_{min}$, ~~then this generic GSO reference link is not valid.~~

~~8) For each of the thresholds~~ $(C/N)_{Thr,i}$ ~~for which~~ $A_{rain,i} > A_{min}$, ~~undertake step 9:~~

~~9) Using the precipitation model in Recommendation ITU-R P.618 together with the selected rain rate, ES height, rain height, ES latitude, elevation angle, frequency, calculated rain fade margin and an assumed polarization of vertical, calculate the associated percentage of time,~~ $p_{rain,i}$.

~~10) If for each threshold~~ $(C/N)_{Thr,i}$ ~~the associated percentage of time is not within the range:~~

$$0.001\% \leq p_{rain,i} \leq 10\%$$

~~then this generic GSO reference link is not valid.~~

~~11) If at least one threshold meets the criteria in steps 7 and 10, then the lowest threshold,~~ $(C/N)_{Thr}$ ~~that meets these criteria is used in the analysis.~~

~~NOTE –~~ A_{min} ~~is 3 dB.~~

~~Step 1: Generation of precipitation fade PDF~~

~~The precipitation fade PDF should be generated using Recommendation ITU-R P.618 from the selected rain rate, ES height, ES latitude, rain height, elevation angle, frequency and an assumed polarization of vertical as follows:~~

~~1) Calculate the maximum fade depth~~ A_{max} ~~using~~ $p = 0.001\%$

~~2) Create a set of 0.1 dB bins of precipitation fade~~ A_{rain} ~~between 0 dB and~~ A_{max}

~~3) For each of the bins, determine the associate probability~~ p ~~to create a cumulative distribution function (CDF) of~~ A_{rain}

~~4) For each of the bins, convert this CDF into a PDF of~~ A_{rain}

~~When using Recommendation ITU-R P.618, the precipitation attenuation should be 0 dB for time percentages above~~ p_{max} ~~where~~ p_{max} ~~is the minimum value of a) 10% and b) the probability of rain attenuation on a slant path calculated from § 2.2.1.2. of Recommendation ITU-R P.618-13.~~

~~A bin size of 0.1 dB should be used to ensure consistency with the output from Recommendation ITU-R S.1503. Each bin of the CDF contains the probability that the precipitation fade is at least~~ A_{rain} ~~dB. Each bin of the PDF contains the probability that the precipitation fade is between~~ A_{rain} ~~and~~ A_{rain} ~~+ 0.1 dB. During implementation, the array of bins can be capped at the minimum of~~ A_{max} ~~and the fade for which the resulting~~ C/N ~~would lead to the link being unavailable or have zero through-put.~~

~~Step 2: Generation of epfd PDF~~

~~Recommendation ITU-R S.1503 should be used to determine the epfd CDF from the non-GSO FSS parameters and the frequency, dish size and ES gain pattern. The epfd CDF will be calculated at the worst-case geometry from Recommendation ITU-R S.1503.~~

~~The epfd CDF should then be converted into a PDF.~~

~~Step 3: Creation of *C/N* and *C/(N+I)* CDFs by modified convolution of precipitation fade PDF with epfd PDF~~

~~For the selected generic GSO reference link, the *C/N* and *C/(N+I)* PDFs should be generated using the following steps to undertake the modified discrete convolution:~~

~~*Initialize the C/N and C/(N+I) distributions with bin size of 0.1 dB*~~

~~*Calculate the effective area of an isotropic antenna at wavelength λ using:*~~

$$\cancel{A_{ISO} = 10\log\left(\frac{\lambda^2}{4\pi}\right)}$$

~~*Calculate the wanted signal power accounting for additional link losses and gain at edge of coverage:*~~

$$\cancel{C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o}$$

~~*Calculate the system noise power using:*~~

$$\cancel{N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra}}$$

~~*For each value*~~ $\cancel{A_{rain}}$ ~~*in the precipitation fade PDF*~~

~~{~~

~~*Calculate the faded wanted signal power using:*~~

$$\cancel{C_f = C - A_{rain}}$$

~~*Calculate the C/N using:*~~

$$\cancel{\frac{C}{N} = C_f - N_T}$$

~~*Update the C/N distribution with this C/N and the probability associated with this*~~ $\cancel{A_{rain}}$

~~*For each value EPFD in the EPFD PDF*~~

~~{~~

~~*Calculate the interference from the EPFD taking into account the precipitation fading using:*~~

$$\cancel{I = EPFD + G_{peak} + A_{iso} - A_{rain}}$$

~~*Calculate the noise plus interference using:*~~

$$\cancel{(N_T + I) = 10\log\left(10^{N_T/10} + 10^{I/10}\right)}$$

~~*Calculate the C/(N+I) using:*~~

$$\cancel{\frac{C}{N+I} = C_f - (N_T + I)}$$

~~*Identify the relevant C/(N+I) bin for this C/(N+I) value*~~

~~*Increment this bin's probability with the product of the probabilities of this precipitation fade and EPFD*~~

~~}~~

~~}~~

~~Step 4: Use of *C/N* and *C/(N+I)* distributions with the criteria in No. 22.5L~~

~~The C/N and $C/(N+I)$ distributions should then be used to check against the availability and spectral efficiency criteria in No. **22.5L** as follows:~~

~~*Step 4A: Check on unavailability increase*~~

~~Using the selected threshold~~ $\cancel{\left(\frac{C}{N}\right)_{Thr}}$ ~~for the generic GSO reference link, determine the following:~~

$\cancel{U_R}$ ~~= Sum of the probabilities from all bins for which~~ $\cancel{C/N < \left(\frac{C}{N}\right)_{Thr}}$

$\cancel{U_{RI}}$ ~~= Sum of the probabilities from all bins for which~~ $\cancel{C/(N+I) < \left(\frac{C}{N}\right)_{Thr}}$

~~Then the condition to be verified for compliance is:~~

$$\cancel{U_{RI} \leq 1.03 \times U_R}$$

~~*Step 4B: Check on the time-weighted average spectral efficiency decrease*~~

~~Determine the long-term time-weighted average spectral efficiency,~~ $\cancel{SE_R}$~~, assuming precipitation only by:~~

~~*Set*~~ $\cancel{SE_R = 0}$

~~*For all bins in the C/N PDF above the threshold*~~ $\cancel{\left(\frac{C}{N}\right)_{Thr}}$

~~*{*~~

~~*Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/N to a spectral efficiency*~~

~~*Increment*~~ $\cancel{SE_R}$ ~~*by the spectral efficiency multiplied by the probability associated with this C/N*~~

~~*}*~~

~~Determine the long-term time-weighted average spectral efficiency,~~ $\cancel{SE_{RI}}$~~, assuming precipitation and interference by:~~

~~*Set*~~ $\cancel{SE_{RI} = 0}$

~~*For all bins in the C/(N+I) PDF above the threshold*~~ $\cancel{\left(\frac{C}{N}\right)_{Thr}}$

~~*{*~~

~~*Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/(N+I) to a spectral efficiency*~~

~~*Increment*~~ $\cancel{SE_{RI}}$ ~~*by the spectral efficiency multiplied by the probability associated with this C/(N+I)*~~

~~*}*~~

~~Then the condition to be verified for compliance is:~~

$$\cancel{SE_{RI} >= SE_R*(1 - 0.03)}$$

~~APPENDIX 2 TO ANNEX 2 TO RESOLUTION 770 (WRC-19)~~

~~Algorithm steps to be applied in the Earth-to-space direction to determine compliance with No. 22.5L~~

~~By applying the following steps, the single-entry interference impact from a non-GSO system on the availability and spectral efficiency of a generic GSO reference link is determined. The generic GSO reference link parameters of Annex 1 to this Resolution are used, considering all possible parametric permutations, in conjunction with the worst-case geometry ("WCG") epfd output of the latest version of Recommendation ITU-R S.1503. The output of Recommendation ITU-R S.1503 is a set of interference statistics that a non-GSO system creates. These interference statistics are then used to determine the effect of the interference into each generic GSO reference link.~~

~~Step 0: Verification of the generic GSO reference link and selection of *C*/*N* threshold~~

~~The following steps should be used to determine if the generic GSO reference link is valid and if so, which of the thresholds~~ $\left(\frac{C}{N}\right)_{Thr,i}$ ~~should be used. It is assumed that~~ $R_s = 6\,378.137$ ~~km,~~ $R_{geo} = 42\,164$ ~~km and~~ $k_{dB} = -228.6$ ~~dB(J/K). Note that the term cumulative distribution function is meant to include the concept of the complementary cumulative distribution function depending upon context.~~

~~1) Calculate the slant distance in km using:~~

$$d_{km} = R_s \left(\sqrt{\frac{R_{geo}^2}{R_s^2} - \cos^2(\varepsilon)} - \sin(\varepsilon) \right)$$

~~2) Calculate the free-space path loss in dB using:~~

$$L_{fs} = 92.45 + 20\log(f_{GHz}) + 20\log(d_{km})$$

~~3) Calculate the wanted signal power in the reference bandwidth in dBW accounting for additional link losses and gain at edge of coverage:~~

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o + G_{rel}$$

~~4) Calculate the total noise power in the reference bandwidth in dBW/MHz using:~~

$$N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra} + M_{ointer}$$

~~5) For each threshold~~ $(C/N)_{Thr,i}$, ~~derive the precipitation margin for that case in dB:~~

$$A_{rain,i} = C - N_T - \left(\frac{C}{N}\right)_{Thr,i}$$

~~6) If for each threshold~~ $(C/N)_{Thr,i}$ ~~the margin~~ $A_{rain,i} \leq A_{min}$, ~~then this generic GSO reference link is not valid.~~

~~7) For each of the thresholds~~ $(C/N)_{Thr,i}$ ~~for which~~ $A_{rain,i} > A_{min}$, ~~undertake step 8:~~

~~8) Using the precipitation model in Recommendation ITU-R P.618 together with the selected rain rate, ES height, rain height, ES latitude, elevation angle, frequency, calculated precipitation fade margin and an assumed polarization of vertical, calculate the associated percentage of time,~~ $p_{rain,i}$.

9) If for each threshold $(C/N)_{Thr,i}$ the associated percentage of time is not within the range:

$$0.001\% \le p_{rain,i} \le 10\%$$

then this generic GSO reference link is not valid.

10) If at least one threshold meets the criteria in steps 6 and 9, then the lowest threshold, $(C/N)_{Thr}$ that meets these criteria should be used in the analysis.

NOTE – A_{min} is 3 dB and the gain relative to peak towards the ES, G_{rel} = –3 dB.

Step 1: Generation of precipitation fade PDF

The precipitation fade PDF should be generated using Recommendation ITU-R P.618 from the selected rain rate, ES height, ES latitude, rain height, elevation angle, frequency and an assumed polarization of vertical as follows:

1) Calculate the maximum fade depth A_{max} using p = 0.001%

2) Create a set of 0.1 dB bins between 0 dB and A_{max}

3) For each of the bins, determine the associate probability p to create a cumulative distribution function (CDF) of A_{rain}

4) For each of the bins, convert this CDF into a PDF of A_{rain}

When using Recommendation ITU-R P.618, the precipitation attenuation should be 0 dB for time percentages above p_{max} where p_{max} is the minimum value of a) 10% and b) the probability of rain attenuation on a slant path calculated from § 2.2.1.2. of Recommendation ITU-R P.618-13.

A bin size of 0.1 dB should be used to ensure consistency with the output from Recommendation ITU-R S.1503. Each bin of the CDF contains the probability that the precipitation fade is at least A_{rain} dB. Each bin of the PDF contains the probability that the precipitation fade is between A_{rain} and A_{rain} + 0.1 dB. During implementation, the array of bins can be capped at the minimum of A_{max} and the fade for which the resulting C/N would lead to the link being unavailable or have zero through-put.

Step 2: Generation of epfd PDF

Recommendation ITU-R S.1503 should be used to determine the epfd CDF from the non-GSO FSS parameters and the frequency, dish size and ES gain pattern. The epfd CDF will be calculated at the worst-case geometry from Recommendation ITU-R S.1503.

The epfd CDF should then be converted into a PDF.

Step 3: Creation of C/N and $C/(N+I)$ CDFs by convolution of precipitation fade PDF with epfd PDF

For the selected generic GSO reference link, the C/N and $C/(N+I)$ PDFs should be generated using the following steps to undertake the discrete convolution:

Initialize the C/N and C/(N+I) distributions with bin size of 0.1 dB

Calculate the effective area of an isotropic antenna at wavelength λ using:

$$A_{ISO} = 10\log\left(\frac{\lambda^2}{4\pi}\right)$$

Calculate the wanted signal power accounting for additional link losses and gain at edge of coverage:

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o + G_{rel}$$

~~*Calculate the system noise power using:*~~

$$\cancel{N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra}}$$

~~*For each value*~~ $\cancel{A_{rain}}$ ~~*in the precipitation fade PDF*~~

~~{~~

~~*Calculate the faded wanted signal power using:*~~

$$\cancel{C_f = C - A_{rain}}$$

~~*Calculate the C/N using:*~~

$$\cancel{\frac{C}{N} = C_f - N_T}$$

~~*Update the C/N distribution with this C/N and the probability associated with this*~~ $\cancel{A_{rain}}$

~~*For each value EPFD in the EPFD PDF*~~

~~{~~

~~*Calculate the interference from the EPFD:*~~

$$\cancel{I = EPFD + G_{peak} + A_{iso}}$$

~~*Calculate the noise plus interference using:*~~

$$\cancel{(N_T + I) = 10\log\left(10^{N_T/10} + 10^{I/10}\right)}$$

~~*Calculate the C/(N+I) using:*~~

$$\cancel{\frac{C}{N+I} = C_f - (N_T + I)}$$

~~*Identify the relevant C/(N+I) bin for this C/(N+I) value*~~

~~*Increment this bin's probability with the product of the probabilities of this precipitation fade and EPFD*~~

~~}~~

~~}~~

~~**Step 4: Use of *C/N* and *C/(N+I)* distributions with the criteria in No. 22.5L**~~

~~The *C/N* and *C/(N+I)* distributions should then be used to check against the availability and spectral efficiency criteria in No. **22.5L** as follows:~~

~~*Step 4A: Check on unavailability increase*~~

~~Using the selected threshold~~ $\cancel{\left(\frac{C}{N}\right)_{Thr}}$ ~~for the generic GSO reference link, determine the following:~~

$$\cancel{U_R = \text{Sum of the probabilities from all bins for which } C/N < \left(\frac{C}{N}\right)_{Thr}}$$

$$\cancel{U_{RI} = \text{Sum of the probabilities from all bins for which } C/(N+I) < \left(\frac{C}{N}\right)_{Thr}}$$

~~Then the conditions to be verified for compliance are:~~

$$\cancel{U_{RI} \leq 1.03 \times U_R}$$

~~*Step 4B: Check on the time-weighted average spectral efficiency decrease*~~

~~Determine the long-term time-weighted average spectral efficiency,~~ ~~SE_R,~~ ~~assuming precipitation only by:~~

~~*Set*~~ ~~$SE_R = 0$~~

~~*For all bins in the C/N PDF above the threshold*~~ ~~$\left(\frac{C}{N}\right)_{Thr}$~~

~~{~~

~~*Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/N to a spectral efficiency*~~

~~*Increment*~~ ~~SE_R~~ ~~*by the spectral efficiency multiplied by the probability associated with this C/N*~~

~~}~~

~~Determine the long-term time-weighted average spectral efficiency,~~ ~~SE_{RI},~~ ~~assuming precipitation and interference by:~~

~~*Set*~~ ~~$SE_{RI} = 0$~~

~~*For all bins in the C/(N+I) PDF above the threshold*~~ ~~$\left(\frac{C}{N}\right)_{Thr}$~~

~~{~~

~~*Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/(N+I) to a spectral efficiency*~~

~~*Increment*~~ ~~SE_{RI}~~ ~~*by the spectral efficiency multiplied by the probability associated with this C/(N+I)*~~

~~}~~

~~Then the conditions to be verified for compliance are:~~

$$\cancel{SE_{RI} \geq SE_R * (1 - 0.03)}$$

4/7/8 Topic H – Enhanced protection of RR Appendices 30/30A in Regions 1 and 3 and RR Appendix 30B

4/7/8.1 Executive summary

Statistics provided by the Bureau to ITU-R studies have demonstrated that for the case of both Regions 1 and 3 RR Appendices **30/30A** BSS Plan assignments and for RR Appendix **30B** FSS allotments, the reference situation can be degraded due to the "implicit agreement" aspect of these Appendices, leading to a situation where these assignments/allotments become effectively unusable.

The scope of Topic H under agenda item 7 is limited to:

1) reviewing the possible removal of the provisions associated with implicit agreement in Regions 1 and 3 RR Appendices **30/30A** and RR Appendix **30B**, where appropriate;

2) consideration of applying a degradation tolerance of 0.25 dB in terms of the Equivalent Protection Margin (EPM) degradation for assignments in the Regions 1 and 3 RR Appendix **30/30A** Plan, as opposed to the current trigger of 0.45 dB.

Regulatory solutions are proposed for protection of the BSS and FSS Plans. These solutions consist of:

– Modifications of Article 4 and its Annex 1 of the RR Appendices **30** and **30A**;

– Modifications of Article 6 and its Annex 1 of the RR Appendix **30B**;

– Modifications to Article 7 of the RR Appendices **30** and **30A** in Method H1B option 2 and Method H1D.

4/7/8.2 Background

4/7/8.2.1 Implicit agreement

Before WRC-15, in accordance with § 4.1.10 of Article 4 of RR Appendices **30/30A**, an administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of its BR IFIC referred to in § 4.1.5 shall be deemed to have agreed to the proposed assignment. This concept of "implicit agreement" since WRC-2000 had led to a situation in which the reference situation (EPM) of many assignments in the BSS Plans has severely been degraded.

WRC-15 modified the above-mentioned § 4.1.10 indicating that an Administration that has not notified its agreement within a period of four months following the date of the BR IFIC referred to in § 4.1.5 shall be deemed to have not agreed to the proposed assignment unless the provisions of §§ 4.1.10a to 4.1.10d and § 4.1.21 are applied.

However, if the provisions of §§ 4.1.10a to 4.1.10d and § 4.1.21 are applied, the use of the concept of "implicit agreement" would lead to the same situation in which the "reference situation" (EPM) of many assignments in the BSS Plans would severely be degraded. It is noted that § 4.1.10d provides only 30 days to an administration to react. In respect of RR Appendix **30B**, a similar situation can also occur under the provisions of 6.10-6.15.

4/7/8.2.2 EPM degradation tolerance in Appendices 30/30A in Regions 1 and 3

The revision of the Regions 1 and 3 Plan by WRC-2000 was accompanied with an increase in the equivalent downlink protection margin from 0.25 dB to a value of 0.45 dB to facilitate the replanning. However, after revising the Plans the tolerance was maintained at 0.45 dB, despite Plan assignments holding a higher status than List assignments.

EPM has been used together with the power flux-density (pfd) criterion to determine the compatibility among assignments in RR Appendices **30/30A** Regions 1 and 3 Plan and List. In accordance with Section 1 of Annex 1 to RR Appendix **30** and Section 4 of Annex 1 to RR Appendix **30A**, EPM of an assignment is allowed to be degraded up to 0.45 dB below 0 dB or, if already negative, not more than 0.45 dB.

4/7/8.3 Summary and analysis of the results of ITU-R studies

4/7/8.3.1 Implicit agreement

Many assignments in the Plans have been degraded due to the addition of "List" networks, some to the extent of preventing any effective use of those assignments.

Statistics provided by the Bureau to ITU-R studies have demonstrated that for the case of both Regions 1 and 3 BSS Plan (RR Appendices **30/30A**) assignments and for RR Appendix **30B** allotments, the reference situation can be degraded due to the "implicit agreement" aspect of these Appendices, leading to a situation where these assignments/allotments become effectively unusable. The tables below provide some examples of the impact that the implicit agreement aspect of the Plans can have over time on the reference situation for the assignments/allotments in those Plans.

Examples of impact of implicit agreement on EPM for downlink RR Appendix 30 Plan assignments over time

Adm	WRC-2000			Oct. 2021	
	Position (deg.E)	Min.EPM (dB)	Max.EPM (dB)	Min.EPM (dB)	Max.EPM (dB)
AFG	50	−0.5	5.68	−14.24	−4.52
AFS	4.8	4.54	10.68	−18.8	−16.6
ALB	62	8.55	36.43	−21.37	−17.78
ARM	22.8	0.43	5.42	−18.38	−12.63
ARS	17	−0.39	10.31	−21.38	0.1
ARS	17	1.98	7.83	−14.53	1.59
AZE	23.2	−0.05	7.7	−18.82	−15.22
BDI	11	3.03	6.26	−17.72	−15.37
BEL	38.2	1.73	5.78	−19.35	−16.7
BIH	56	5.88	8.43	−14.14	−11.31
BLR	37.8	1.33	5.39	−11.92	−6.67
BOT	−0.8	0.85	4.29	−21	−17.81
BRM	104	−0.08	8.38	−12.31	1.15
BRU	74	4.48	7.03	−17.29	−16.2
BTN	86	8.87	14.55	−10.78	−7.42
CAF	−13.2	1.35	7.3	−13.61	−4.68
CBG	86	9.65	13.31	−9.78	−1.98
ZWE	−0.8	2.59	8.46	−23.25	−20.86

Examples of impact of implicit agreement on RR Appendix 30B Allotments over time for 10/11-12/13 GHz bands

Adm	Nominal Orbital Position (degrees)	Difference in Min aggregate C/I ration (dB) (2009 - 2021)	Difference in Max aggregate C/I ration (dB) (2009 - 2021)	Comment
AND	−41	−36.64	−36.64	Degradation due to implicit agreement applied
ATG	−77.7	−24.49	−24.49	Degradation due to implicit agreement applied
BDI	−3.5	−27.91	−29.46	Degradation due to implicit agreement applied
BOT	21.2	−7.97	−9.00	Degradation due to implicit agreement applied
BRB	−29.6	−27.98	−27.98	Degradation due to implicit agreement applied
BTN	59.1	−18.12	−17.84	Degradation due to implicit agreement applied
CLN	121.5	−17.37	−17.61	Degradation due to implicit agreement applied
COG	−16.35	−28.09	−28.76	Degradation due to implicit agreement applied
CVA	59	−19.52	−19.52	Degradation due to implicit agreement applied

The full information provided by the Bureau is attached in the Excel spreadsheet.

Reference situation development.xlsx

These findings highlight the problems created by the addition of List systems in the various Plans.

4/7/8.3.2 EPM degradation tolerance in RR Appendices 30/30A in Regions 1 and 3

With regard to the EPM degradation tolerances, below are the views expressed:

View 1

It is recalled that the value of 0.45 dB was merely used to facilitate the revision of the Regions 1 and 3 Plan by WRC-2000. Now that the Regions 1 and 3 Plan has been revised, there is no need to increase the EPM degradation tolerance of 0.25 dB to 0.45 dB with respect to the BSS Plan assignments or an assignment with national coverage. Furthermore, 0.25 dB overall EPM degradation tolerance is used in BSS Planned bands in Region 2.

View 2

Suggestions have been made on the reduction of the EPM degradation tolerance from its current 0.45 dB to 0.25 dB. Regarding such a possible reduction, a study made the following points and conclusions:

1) Historically, the EPM degradation tolerance was relaxed from 0.25 dB to 0.45 dB at WRC-2000. The reason for this relaxation was the adoption of digital modulation in the Regions 1 and 3 Plans which is more robust than analogue modulation. For the same reason, the protection ratio value for downlink co-channel signals was reduced to 21 dB from 23 dB (section 3.4 of Annex 5 to RR Appendix **30**), in addition to the relaxation of the EPM degradation tolerance.

2) Therefore, the modification of the EPM degradation tolerance, even if it applies to the Plan only, would create inconsistencies to the basis of the Plan in WRC-2000 and sharing criterion, since the Plan from WRC-2000 is based on the EPM degradation tolerance of 0.45 dB.

3) There are two criteria for the sharing BSS frequency for Regions 1 and 3 in Annex 1 to RR Appendix **30**, EPM degradation tolerance and pfd masks (see Figure 4/7/8.3.2-1 for orbital separations of 3 deg. and 6 deg.). By reducing the EPM degradation tolerance from 0.45 dB (left side of Figure 4/7/8.3.2-1) to 0.25 dB (right side of Figure 4/7/8.3.2-1), the allowable interference becomes stricter by about 3 dB if the Ref. EPM is already below 0 dB. However, around the Ref. EPM of 0 dB the pfd criterion is applicable since the allowable interference is less stringent than the EPM criterion. Therefore, the reduction of the EPM degradation tolerance from 0.45 dB to 0.25 dB does not work in this area except for e.i.r.p. of 57 dBW, which corresponds to normal Plan assignments. However, for such a high e.i.r.p., if both interfering and interfered-with satellites suffered from low EPM, both satellites would severely interfere with each other. One of the causes of this large degradation, for example 10 dB degradation of EPM, is due to the provisions of the implicit agreement, even though the Plan assignments were recognized as significantly affected by the result of examination using EPM criterion or pfd criterion, and therefore the reduction of the EPM degradation tolerance from 0.45 dB to 0.25 dB does not contribute to solve the problem for the Plan assignments.

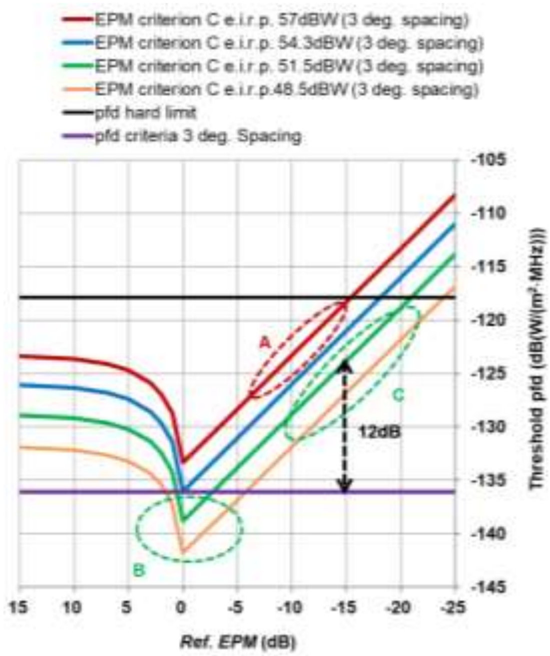
It is worth mentioning that the phenomenon around the Ref. EPM of 0 dB, the pfd criterion is applicable when the allowable interference is less stringent than the EPM criterion. This view is drawn based on the two specific sharing scenarios of 3 and 6 degrees spacing and full frequency overlap. The phenomenon may not be applicable to other sharing scenarios between Plan assignments and additional uses noting that the orbital separation ranges from 0 degrees to 9 degrees and level of frequency overlap ranges from partial to full overlap. Therefore, further study is needed to verify whether the view that the reduction of the EPM degradation tolerance from 0.45 dB to 0.25 dB does not contribute to solve the very low EPM problem for the Plan assignments is valid for other cases.

FIGURE 4/7/8.3.2-1

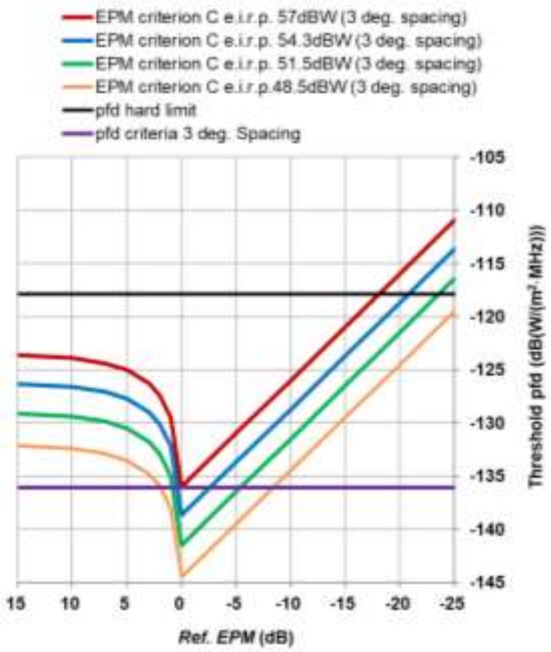
Application of EPM and pfd criteria

(a) 3 deg spacing

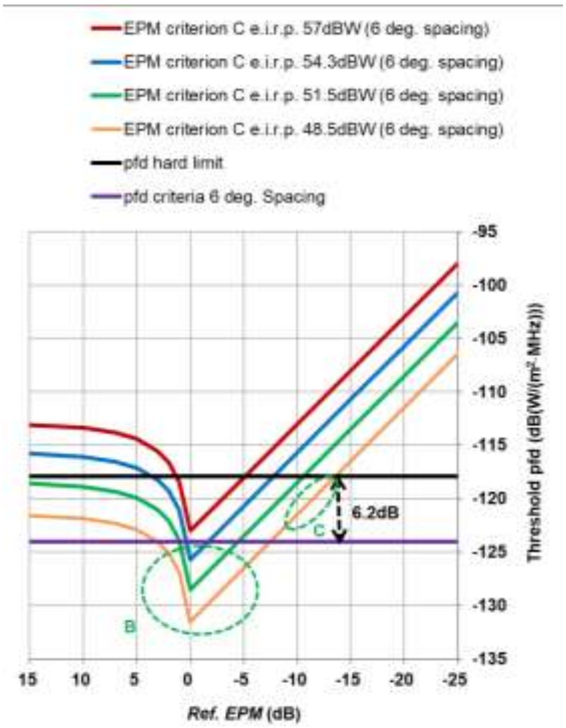
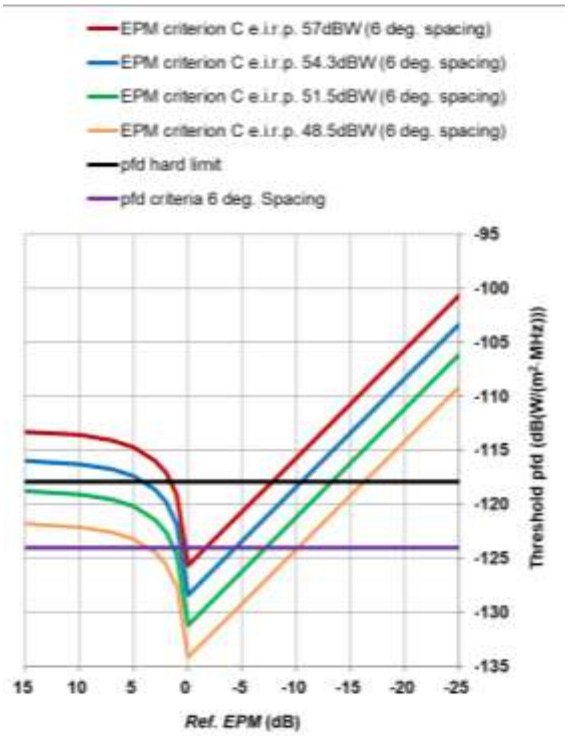
EPM degradation of −0.45 dB
(Report ITU-R BO.2497)



EPM degradation of −0.25 dB



(b) 6 deg spacing

EPM degradation of −0.45 dB (Report ITU-R BO.2497)	**EPM degradation of −0.25 dB**
	

4) Calculation results on the mechanism of EPM degradation in BSS in Regions 1 and 3 showed that the cumulative EPM degradation resulted to be between −0.9 dB (−0.45 dB by one satellite network at +3 degrees and −0.45 dB by another satellite network at −3 deg.) and −2.7 dB depending on the surrounding beam shapes of six interfering satellite networks under the condition of the EPM degradation tolerance of 0.45 dB.

4/7/8.4 Methods to satisfy Topic H

In order to satisfy this topic for protecting the BSS and FSS Plans, the following methods have been identified.

4/7/8.4.1 Methods related to implicit agreement in RR Appendices 30/30A/30B

4/7/8.4.1.1 Method H1A

No change to the Radio Regulations.

4/7/8.4.1.2 Method H1B

Option 1 includes removal of implicit agreement within the RR Appendices **30**, **30A** and **30B**:

It is proposed to remove the implicit agreement applicable to:

– an assignment in the RR Appendices **30** and **30A** Regions 1 and 3 Plans or an assignment intended to enter in those Plans;

– an allotment in the RR Appendix **30B** Plan or an assignment intended to enter in that Plan that would be identified by the Bureau as affected by an incoming network.

Option 2 expands Option 1 to include removal of implicit agreement for Region 2 FSS potentially affecting Regions 1 and 3 Appendices **30** and **30A**:

It is proposed to remove the implicit agreement applicable to:

– an assignment in the RR Appendices **30** and **30A** Regions 1 and 3 Plans or an assignment intended to enter in those Plans when the affecting network is an addition of "List" networks;

– an assignment in the RR Appendices **30** and **30A** Regions 1 and 3 Plans, an assignment intended to enter in those Plans, List or proposed new or modified assignments in the List, when the affecting network is a Region 2 FSS in the frequency band 11.7-12.2 GHz;

– an allotment in the RR Appendix **30B** Plan or an assignment intended to enter in that Plan

that would be identified by the Bureau as affected by an incoming network.

Reasons: The purpose is to remove the implicit not just for the case that the affecting network is an addition to the List but also in the case that the affecting network is a Region 2 non-Plan FSS. Regarding the second case, the implicit agreement shall not apply to both Plan and List considering that the frequency band 11.7 to 12.2 GHz is not allocated to FSS in Regions 1 and 3.

4/7/8.4.1.3 Method H1C

This method proposes to replace the implicit agreement in case of no comments of an affected Regions 1 and 3 BSS Plan assignment or RR Appendix **30B** allotment from an additional use in due time, by a new mechanism. Under such a new mechanism, the administration of the Regions 1 and 3 BSS Plan assignment or of the RR Appendix **30B** allotments allows the administration of the additional use to operate until the bringing into use of its national assignment/allotment. At that time, the administration of the additional use commits to respect some constraints as pfd levels in respect of the affected national assignment/allotment or localization of the transmit earth station. As the national allotment/assignment will not operate simultaneously on the same frequency over the same area as the additional use, mutual interference is not considered.

4/7/8.4.1.4 Method H1D

This method proposes to replace the implicit agreement in case of no comments of an affected Regions 1 and 3 BSS Plan assignment or RR Appendix **30B** allotment from an additional use in due time, by a new mechanism. Under such a new mechanism, the administration of the Regions 1 and 3 BSS Plan assignment or of the RR Appendix **30B** allotments allows the administration of the additional use to operate considering that it is entered into the list provisionally until the bringing into use of its national assignment/allotment. At that time, the administration of the additional use commits to respect all constraints including pfd levels in respect of the affected national assignment/allotment or localization of the transmit earth station, so that the administration whose assignment was the basis of the disagreement is not considered as affected. As the national allotment/assignment will not operate simultaneously on the same frequency over the same area as the additional use, mutual interference is not considered.

This method also proposes that after the termination of the temporary agreement, the notifying administration of the assignment in question, requires updating the technical characteristics of its assignment to reflect the operational characteristics and in accordance with the commitment resulting from the termination of the temporal agreement. For this modification there is no need to restart the Article 4 procedure and original date of protection will be kept. Furthermore, to make the obligation mentioned for updating the characteristics enforceable, a deadline and consequences for not complying with it have been specified.

This method also proposes to remove the implicit agreement applicable to an assignment in the RR Appendices **30** and **30A** Regions 1 and 3 Plans, an assignment intended to enter in those Plans, List or proposed new or modified assignments in the List, when the affecting network is a Region 2 non-Plan FSS.

Reasons: After the termination of the temporary agreement, the notifying administration shall respect all the limits so that the administration whose assignment was the basis of the disagreement is not considered as affected. Furthermore, it is proposed that the implicit agreement does not apply to both Plan and List considering that the frequency band 11.7 to 12.2 GHz is not allocated to FSS in Regions 1 and 3.

4/7/8.4.2 Methods related to EPM degradation tolerance in RR Appendices 30/30A in Regions 1 and 3

4/7/8.4.2.1 Method H2A

No change to the Radio Regulations.

4/7/8.4.2.2 Method H2B

It is proposed to apply EPM degradation tolerance of 0.25 dB instead of 0.45 dB for protection of an assignment in the RR Appendices **30/30A** Regions 1 and 3 Plans or assignments with national coverage from a submission of non-national coverage.

4/7/8.5 Regulatory and procedural considerations

In the following subsections, example regulatory text in respect of the various methods described in Section 4/7/8.4 is provided.

4/7/8.5.1 For Methods related to implicit agreement in RR Appendices 30/30A/30B

4/7/8.5.1.1 For Method H1A

NOC

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

NOC

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

NOC

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

4/7/8.5.1.2 For Method H1B

Option 1 for Method H1B for RR Appendix **30**:

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

MOD

ARTICLE 4 (REV.WRC-~~19~~23)

Procedures for modifications to the Region 2 Plan or for additional uses in Regions 1 and 3[3]

4.1 Provisions applicable to Regions 1 and 3

ADD

4.1.10e The course of action described in §§ 4.1.10a to 4.1.10d does not apply to an assignment in the Plan in Regions 1 and 3 or an assignment intended to enter in the Regions 1 and 3 Plan. (WRC-23)

Option 2 for Method H1B for RR Appendix **30** adds to Option 1 the Article 7 changes below:

---

* The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. See also Annex 7 for the orbital limitations. (WRC-2000)

1 The Regions 1 and 3 List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

3 The provisions of Resolution **49 (Rev.WRC-15)** apply. (WRC-15)

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in the bands 11.7-12.2 GHz (in Region 2), 12.2-12.7 GHz (in Region 3) and 12.5-12.7 GHz (in Region 1), and to stations in the broadcasting-satellite service in the band 12.5-12.7 GHz (in Region 3) when frequency assignments to broadcasting-satellite stations in the bands 11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3 are involved[22]

ADD

7.1*bis* The course of action described in §§ 9.60 to 9.62 of Article **9** does not apply to an assignment in the Appendix **30** Regions 1 and 3 Plan, an assignment intended to enter in this Plan, List or proposed new or modified assignments in the List, when the affecting network is a fixed-satellite service (space-to-Earth) in the band 11.7-12.2 GHz in Region 2. (WRC-23)

NOTE: Further to the issue raised in this method, it was indicated that to maintain the same treatment for the coordination, notification and recording of unplanned FSS or BSS assignments of one region with respect to the BSS Plans of another region, modifications similar to the ones described above would have to be considered for the removal of the concept associated with implicit agreement in Article 7 of the RR Appendix **30** that apply to an assignment in the Region 2 BSS Plan when the affecting network is a Region 1 or 3 unplanned FSS or BSS network.

[22] These provisions do not replace the procedures prescribed in Articles **9** and **11** when stations other than those in the broadcasting-satellite service subject to a Plan are involved. (WRC-03)

Option 1 for Method H1B for RR Appendix **30A**:

APPENDIX 30A (REV.WRC-19)

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD

ARTICLE 4 (REV.WRC-~~19~~23)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

ADD

4.1.10e The course of action described in §§ 4.1.10a to 4.1.10d does not apply to an assignment in the Regions 1 and 3 Plan or an assignment intended to enter in the Plan in Regions 1 and 3. (WRC-23)

Option 2 for Method H1B for RR Appendix **30A** adds to Option 1 the Article 7 changes below:

---

[1] The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)**[**]). (WRC-03)

[**] *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

[2] This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Region 1 in the frequency band 17.3-18.1 GHz and in Regions 2 and 3 in the frequency band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in countries listed in Resolution 163 (WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution 164 (WRC-15) in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3 or in the frequency band 17.3-17.8 GHz in Region 2 are involved[28] (Rev.WRC-19)

ADD

7.1*bis* The course of action described in §§ 9.60 to 9.62 of Article **9** does not apply to an assignment in the Appendix **30A** Regions 1 and 3 Plan, an assignment intended to enter in this Plan, List or proposed new or modified assignments in the List, when the affecting network is fixed-satellite service (space-to-Earth) in the band 17.7-18.1 GHz in Region 2. (WRC-23)

NOTE: Further to the issue raised in this method, it was indicated that to maintain the same treatment for the coordination, notification and recording of unplanned FSS assignments of one region with respect to the BSS Plans of another region, modifications similar to the ones described above would have to be considered for the removal of the concept associated with implicit agreement in Article **7** of the RR Appendix **30A** that apply to an assignment in the Region 2 BSS Plan when the affecting network is a Region 1 or 3 unplanned FSS network. Within Region 2, the case of an assignment in the Region 2 BSS Plan affected by an unplanned BSS network would also have to be considered.

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[28] These provisions do not replace the procedures prescribed in Articles **9** and **11** when stations other than those for feeder links in the broadcasting-satellite service subject to a Plan are involved. (WRC-03)

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

MOD

ARTICLE 6 (REV.WRC-~~19~~23)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*] (WRC-19)

MOD

6.15*bis* The course of action described in §§ 6.13 to 6.15 ~~do~~ does not apply to the agreement requested under § 6.6 or to allotments in the Plan or an assignment treated under Article 6 in accordance with § 7.7 of Article 7. (WRC-~~19~~23)

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[1] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 6.7 and/or 6.23 and the corresponding entries in the List under § 6.23 and/or 6.25, as appropriate, and reinstate any allotments back into the Plan after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. See also Resolution **905 (WRC-07)***.

* *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

[2] Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

[2*bis*] Resolution **170 (WRC-19)** applies. (WRC-19)

4/7/8.5.1.3 For Method H1C

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

MOD

ARTICLE 4 (REV.WRC-~~19~~23)

Procedures for modifications to the Region 2 Plan or for additional uses in Regions 1 and 3[3]

4.1 Provisions applicable to Regions 1 and 3

MOD

4.1.10d If no decision is communicated to the Bureau within 30 days after the date of dispatch of the reminder under § 4.1.10b and the identification is of:

– an assignment in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~no objection to the proposed assignment and an agreement under § 4.1.13*bis* is considered as concluded between the administration of the affected assignment in the Regions 1 and 3 Plan and the notifying administration of the proposed assignment; or

– an assignment not in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-~~15~~23)

* The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. See also Annex 7 for the orbital limitations. (WRC-2000)

1 The Regions 1 and 3 List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

3 The provisions of Resolution **49 (Rev.WRC-15)** apply. (WRC-15)

ADD

4.1.13*bis* When an agreement under this provision is concluded with an administration of the affected assignment in the Regions 1 and 3 Plan, the notifying administration of the proposed assignment shall commit to respect a power flux-density limit shown in Annex 1 at any point within the territory, situated inside the −3 dB contour of the associated beam area, of this administration whose assignment was the basis of the disagreement at the date on which the frequency assignment in the Regions 1 and 3 Plan is to be brought into use as communicated under § 5.1.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 5.1.10*bis*, whichever comes later. (WRC-23)

ADD

4.1.13*ter* Upon the conclusion of agreements under § 4.1.13*bis*, when entering the assignment in the List, the Bureau shall indicate those administrations whose assignments in the Regions 1 and 3 Plan were the basis of the agreement. (WRC-23)

ADD

4.1.30 When an assignment is entered in the List referred to in § 4.1.13*ter*, that assignment shall not be taken into account in updating the reference situation of those assignments in the Regions 1 and 3 Plan with which an agreement under § 4.1.13*bis* was concluded. (WRC-23)

ADD

4.1.31 If the Bureau is informed that a commitment under § 4.1.13*bis* is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 4.1.13*bis*. (WRC-23)

ADD

4.1.32 If, in spite of the application of § 4.1.31, conditions specified in § 4.1.13*bis* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

MOD

ARTICLE 5 (REV.WRC-~~19~~23)

Notification, examination and recording in the Master International Frequency Register of frequency assignments to space stations in the broadcasting-satellite service[18] (WRC-07)

5.1 Notification

ADD

5.1.6*bis* Upon receipt of a complete notice, the Bureau shall immediately send a telefax to administrations which applied § 4.1.13*bis* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 5.1.1 of this notice and the date on which the frequency assignment, subject of § 4.1.13*bis* agreement, is planned to be brought into use. (WRC-23)

[18] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.6 and the corresponding entries in the Master Register under § 5.2.2, 5.2.2.1, 5.2.2.2 or 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. See also Resolution **905 (WRC-07)**[*]. (WRC-07)

[*] *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD

ARTICLE 4 (REV.WRC-~~19~~23)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

MOD

4.1.10d If no decision is communicated to the Bureau within 30 days after the date of dispatch of the reminder under § 4.1.10b and the identification is of:

– an assignment in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~no objection to the proposed assignment and an agreement under § 4.1.13*bis* is considered as concluded between the administration of the affected assignment in the Regions 1 and 3 Plan and the notifying administration of the proposed assignment; or

– an assignment not in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-~~15~~23)

ADD

4.1.13*bis* When an agreement under this provision is concluded with the administration of an affected assignment in the Regions 1 and 3 Plan, the notifying administration shall commit to

* The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. (WRC-03)

[1] The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

[2] This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

respect a power flux-density of −197.0 − GRx[zz] dB(W/(m^2 · Hz)) arriving at the receiving space station of this administration whose assignment was the basis of the disagreement at the date on which the frequency assignment in the Regions 1 and 3 Plan is to be brought into use communicated under § 5.1.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 5.1.10*bis*, whichever comes later. (WRC-23)

ADD

4.1.13*ter* Upon the conclusion of agreements under § 4.1.13*bis*, when entering the assignment in the List, the Bureau shall indicate those administrations whose assignments in the Regions 1 and 3 Plan were the basis of the agreement. (WRC-23)

ADD

4.1.30 When an assignment is entered in the List referred to in § 4.1.13*ter*, that assignment shall not be taken into account in updating the reference situation of those assignments in the Regions 1 and 3 Plan with which an agreement under § 4.1.13*bis* was concluded. (WRC-23)

ADD

4.1.31 If the Bureau is informed that a commitment under § 4.1.13*bis* is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 4.1.13*bis*. (WRC-23)

ADD

4.1.32 If, in spite of the application of § 4.1.31, conditions specified in § 4.1.13*bis* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

[zz] GRx is the relative receive antenna gain of the space station of the national allotment of the administration with which an agreement under § 4.1.13*bis* was concluded in the direction of the location of the feeder-link earth station of the notifying administration. (WRC-23)

MOD

ARTICLE 5 (REV.WRC-~~19~~-23)

Coordination, notification, examination and recording in the Master International Frequency Register of frequency assignments to feeder-link transmitting earth stations and receiving space stations in the fixed-satellite service[21, 22] (WRC-19)

5.1 Coordination and notification

ADD

5.1.10*bis* Upon receipt of a complete notice, the Bureau shall immediately send a telefax to administrations which applied § 4.1.13*bis* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 5.1.1 of this notice and the date on which the frequency assignment, subject of § 4.1.13*bis* agreement, is planned to be brought into use. (WRC-23)

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[21] Notification of assignments to transmitting feeder-link earth stations included in the Region 2 feeder-link Plan after 2 June 2000, or included in the feeder-link List, following successful application of Article 4, shall be effected applying the provisions of Article **11** following completion of the procedure of Article **9**. (WRC-03)

[22] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.10 and the corresponding entries in the Master Register under § 5.2.2, § 5.2.2.1, § 5.2.2.2 or § 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. (WRC-19)

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ARTICLE 6 (REV.WRC-19)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*] (WRC-19)

ADD

6.4*bis* When the examination of each assignment in a notice received under § 6.1, to convert an allotment into an assignment, with respect to § 6.3 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations for which § 6.15*quat* was applied with regard to this notice. This telefax shall inform these administrations of the reception under § 6.1 of this notice. (WRC-23)

MOD

6.15 If no decision is communicated to the Bureau within thirty days after the date of dispatch of the reminder under § 6.14 and the identification is of:

a) an allotment in the Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~ no objection to the proposed assignment until this administration plans to bring into use its allotment in the Plan and an agreement under § 6.15*quat* is considered as concluded between the administration of the affected allotment in the Plan and the notifying administration of the proposed assignment; or

b) an assignment, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-23)

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[1] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 6.7 and/or 6.23 and the corresponding entries in the List under § 6.23 and/or 6.25, as appropriate, and reinstate any allotments back into the Plan after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. See also Resolution **905 (WRC-07)***.

* *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

[2] Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

[2*bis*] Resolution **170 (WRC-19)** applies. (WRC-19)

ADD

6.15*quat* When an agreement under this provision is concluded with the administration of an affected allotment in the Plan, the notifying administration of the proposed assignment shall commit to respect the power flux-density limits shown in Section 2.2 of Annex 4 of Appendix **30B** (Rev.WRC-19) at any point within the territory, situated inside the −3 dB contour of the associated beam area, of the administration whose allotment was the basis of the disagreement at the date on which the frequency assignment, stemming from the conversion of an affected allotment, is to be brought into use as communicated under § 8.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 8.10*bis*, whichever comes later. (WRC-23)

ADD

6.15*quin* Upon conclusion of agreements under § 6.15*quat*, when entering the assignment in the List, the Bureau shall indicate those administrations whose allotments were the basis of the agreement. (WRC-23)

ADD

6.27*bis* When an assignment is entered in the List referred to in § 6.15*quin*, that assignment shall not be taken into account in updating the reference situation of those allotments with which an agreement under § 6*.15quat* was concluded. (WRC-23)

ADD

6.29*bis* If the Bureau is informed that obligations under § 6.15*quat* is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 6.15*quat*. (WRC-23)

ADD

6.29*ter* If, in spite of the application of § 6.29*bis*, conditions specified in § 6.15*quat* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

ARTICLE 8 (WRC-15)

Procedure for notification and recording in the Master Register of assignments in the planned bands for the fixed-satellite service[11, 12] (WRC-19)

ADD

8.10*bis* When the examination with respect to § 8.9 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 8.1 of this notice and the date on which the frequency assignment stemming from the conversion of an allotment, subject of § 6.15*quin* agreement, into an assignment, is planned to be brought into use. (WRC-23)

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[11] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in §§ 8.5 and 8.12 and the corresponding entries in the Master Register under § 8.11 or § 8.16*bis*, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action and that any resubmitted notice shall be considered to be a new notice. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. (WRC-19)

[12] Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

4/7/8.5.1.4 For Method H1D

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

MOD

ARTICLE 4 (REV.WRC-~~19~~23)

Procedures for modifications to the Region 2 Plan or for additional uses in Regions 1 and 3[3]

4.1 Provisions applicable to Regions 1 and 3

MOD

4.1.10d If no decision is communicated to the Bureau within 30 days after the date of dispatch of the reminder under § 4.1.10b and the identification is of:

– an assignment in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~no objection to the proposed assignment and an agreement under § 4.1.13*bis* is considered as concluded between the administration of the affected assignment in the Regions 1 and 3 Plan and the notifying administration of the proposed assignment; or

– an assignment not in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-~~15~~23)

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* The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. See also Annex 7 for the orbital limitations. (WRC-2000)

1 The Regions 1 and 3 List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

3 The provisions of Resolution **49 (Rev.WRC-15)** apply. (WRC-15)

ADD

4.1.13*bis* When an agreement under this provision is concluded with administration of the an affected assignment in the Regions 1 and 3 Plan, the notifying administration of the proposed assignment shall commit to respect all the limitations mentioned in Annex 1 including the power flux-density limit shown in Annex 1 at any point within the territory, situated inside the −3 dB contour of the associated beam area, of the administration whose assignment was the basis of the disagreement, so that the concerned administration is not considered as affected, at the date on which the frequency assignment in the Regions 1 and 3 Plan is to be brought into use as communicated under § 5.1.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 5.1.10*bis*, whichever comes later. Prior to this date, the notifying administration shall submit to the Bureau updated characteristics within the envelope of the assignment in question so that the administration whose assignment was the basis of the disagreement is not considered as affected. The Bureau shall reflect the updated characteristics of that assignment in the List and Master Register while keeping its original date of protection. (WRC-23)

Reasons: After the termination of the temporary agreement, the notifying administration shall respect all the limits set out in Annex 1. Furthermore, the assignment in the List needs to be modified in order to reflect the commitments resulting from the termination of the temporary agreement.

ADD

4.1.13*ter* Upon the conclusion of agreements under § 4.1.13*bis*, the Bureau shall provisionally and for a temporary period of time as mentioned in § 4.1.13*bis*, enter the assignment in the Regions 1 and 3 List with an indication of those administrations whose assignments were the basis of the disagreement. (WRC-23)

Reasons: The status of entering the List should be provisional, for a temporary period of time and not definitive because the explicit agreement has not been obtained.

ADD

4.1.13*quater* Should the request for modification and all relevant information have not been received by the Bureau prior to the deadline referred to in § 4.1.13*bis*, the Bureau shall delete the assignment from the List and publish this information in a Special Section of its BR IFIC. (WRC-23)

Reasons: There should be a deadline for amending the characteristics of assignments proportional to the commitments resulting from the termination of the temporary agreement.

ADD

4.1.30 When an assignment is provisionally entered in the List referred to in § 4.1.13*ter*, that assignment shall not be taken into account in updating the reference situation of those assignments in the Regions 1 and 3 Plan with which an agreement under § 4.1.13*bis* was concluded. (WRC-23)

ADD

4.1.31 If the Bureau is informed that a commitment under § 4.1.13*bis* is not respected by an assignment in the List, or by an assignment already removed from the List by the application of § 4.1.13*quater*, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 4.1.13*bis* or immediately cease of the emission due to § 4.1.13*quater*. (WRC-23)

Reasons: In the case an assignment has been removed from the List due to application of § 4.1.13*quater* then no emission is expected.

ADD

4.1.32 If, in spite of the application of § 4.1.31, conditions specified in § 4.1.13*bis* are still not respected by an assignment in the List or by an assignment already removed from the List by the application of § 4.1.13*quater*, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in the bands 11.7-12.2 GHz (in Region 2), 12.2-12.7 GHz (in Region 3) and 12.5-12.7 GHz (in Region 1), and to stations in the broadcasting-satellite service in the band 12.5-12.7 GHz (in Region 3) when frequency assignments to broadcasting-satellite stations in the bands 11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3 are involved[22]

ADD

7.1*bis* The course of action described in §§ 9.60 to 9.62 of Article **9** does not apply to an assignment in the Appendix **30** Regions 1 and 3 Plan, an assignment intended to enter in this Plan, List or proposed new or modified assignments in the List, when the affecting network is a fixed-satellite service (space-to-Earth) in the band 11.7-12.2 GHz in Region 2. (WRC-23)

NOTE: Further to the issue raised in this method, it was indicated that to maintain the same treatment for the coordination, notification and recording of unplanned FSS or BSS assignments of one region with respect to the BSS Plans of another region, modifications similar to the ones described above would have to be considered for the removal of the concept associated with implicit agreement in Article 7 of the RR Appendix **30** that apply to an assignment in the Region 2 BSS Plan when the affecting network is a Region 1 or 3 unplanned FSS or BSS network.

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[22] These provisions do not replace the procedures prescribed in Articles **9** and **11** when stations other than those in the broadcasting-satellite service subject to a Plan are involved. (WRC-03)

MOD

ARTICLE 5 (REV.WRC-~~19~~23)

Notification, examination and recording in the Master International Frequency Register of frequency assignments to space stations in the broadcasting-satellite service[18] (WRC-07)

5.1 Notification

ADD

5.1.6*bis* Upon receipt of a complete notice, the Bureau shall immediately send a telefax to administrations which applied § 4.1.13*bis* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 5.1.1 of this notice and the date on which the frequency assignment, subject of § 4.1.13*bis* agreement, is planned to be brought into use. (WRC-23)

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[18] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.6 and the corresponding entries in the Master Register under § 5.2.2, 5.2.2.1, 5.2.2.2 or 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. See also Resolution **905 (WRC-07)**[*]. (WRC-07)

[*] *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

APPENDIX 30A (REV.WRC-19)[*]

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD

ARTICLE 4 (REV.WRC-~~19~~23)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

MOD

4.1.10d If no decision is communicated to the Bureau within 30 days after the date of dispatch of the reminder under § 4.1.10b and the identification is of:

– an assignment in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~no objection to the proposed assignment and an agreement under § 4.1.13*bis* is considered as concluded between the administration of the affected assignment in the Regions 1 and 3 Plan and the notifying administration of the proposed assignment; or

– an assignment not in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-~~15~~23)

ADD

4.1.13*bis* When an agreement under this provision is concluded with the administration of an affected assignment in the Regions 1 and 3 Plan, the notifying administration of the proposed

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[*] The expression "frequency assignment to a space station", wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. (WRC-03)

[1] The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)**[**]). (WRC-03)

[**] *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

[2] This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

assignment shall commit to respect a power flux-density of −197.0 − GRx[zz] dB(W/(m^2 · Hz)) arriving at the receiving space station of this administration whose assignment was the basis of the disagreement, so that the concerned administration is not considered as affected, at the date on which the frequency assignment in the Regions 1 and 3 Plan is to be brought into use communicated under § 5.1.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 5.1.10*bis*, whichever comes later. Prior to this date, the notifying administration shall submit to the Bureau updated characteristics within the envelope of the assignment in question so that the administration whose assignment was the basis of the disagreement is not considered as affected. The Bureau shall reflect the updated characteristics of that assignment in the List and Master Register while keeping its original date of protection. (WRC-23)

Reasons: After the termination of the temporary agreement, the notifying administration shall reduce its pfd arriving at the receiving space station so that the concerned administration is not considered as affected. Furthermore, the assignment in the List needs to be modified in order to reflect the commitments resulting from the termination of the temporary agreement.

ADD

4.1.13*ter* Upon the conclusion of agreements under § 4.1.13*bis*, the Bureau shall provisionally and for a temporary period of time as mentioned in § 4.1.13*bis* enter the assignment in the Regions 1 and 3 List with an indication of those administrations whose assignments were the basis of the disagreement. (WRC-23)

Reasons: The status of entering the List should be provisional, for a temporary period of time and not definitive because the explicit agreement has not been obtained.

ADD

4.1.13*quater* should the request for modification and all relevant information have not been received by the Bureau prior to the deadline referred to in § 4.1.13*bis*, the Bureau shall delete the assignment from the List and publish this information in a Special Section of its BR IFIC. (WRC-23)

Reasons: There should be a deadline for amending the characteristics of assignments proportional to the commitments resulting from the termination of the temporary agreement.

ADD

4.1.30 When an assignment is provisionally entered in the List referred to in § 4.1.13*ter*, that assignment shall not be taken into account in updating the reference situation of those assignments in the Regions 1 and 3 Plan with which an agreement under § 4.1.13*bis* was concluded. (WRC-23)

ADD

4.1.31 If the Bureau is informed that a commitment under § 4.1.13*bis* is not respected by an assignment in the List, or by an assignment that has already been deleted from the List by the application of § 4.1.13*quater*, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in

[zz] GRx is the relative receive antenna gain of the space station of the national allotment of the administration with which an agreement under § 4.1.13*bis* was concluded in the direction of the location of the feeder-link earth station of the notifying administration. (WRC-23)

§ 4.1.13*bis* or requesting the immediate cease of the emission in the case that § 4.1.13*quater* has already been applied. (WRC-23)

Reasons: In the case an assignment has been deleted from the List due to application of § 4.1.13*quater* then no emission is expected.

ADD

4.1.32 If, in spite of the application of § 4.1.31, conditions specified in § 4.1.13*bis* are still not respected by an assignment in the List or by an assignment already removed from the List by the application of § 4.1.13*quater*, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

MOD

ARTICLE 5 (REV.WRC-~~19~~-23)

Coordination, notification, examination and recording in the Master International Frequency Register of frequency assignments to feeder-link transmitting earth stations and receiving space stations in the fixed-satellite service[21, 22] (WRC-19)

5.1 Coordination and notification

ADD

5.1.10*bis* Upon receipt of a complete notice, the Bureau shall immediately send a telefax to administrations which applied § 4.1.13*bis* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 5.1.1 of this notice and the date on which the frequency assignment, subject of § 4.1.13*bis* agreement, is planned to be brought into use. (WRC-23)

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[21] Notification of assignments to transmitting feeder-link earth stations included in the Region 2 feeder-link Plan after 2 June 2000, or included in the feeder-link List, following successful application of Article 4, shall be effected applying the provisions of Article **11** following completion of the procedure of Article **9**. (WRC-03)

[22] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.10 and the corresponding entries in the Master Register under § 5.2.2, § 5.2.2.1, § 5.2.2.2 or § 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. (WRC-19)

MOD

ARTICLE 7 (REV.WRC-~~19~~23)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Region 1 in the frequency band 17.3-18.1 GHz and in Regions 2 and 3 in the frequency band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in countries listed in Resolution 163 (WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution 164 (WRC-15) in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3 or in the frequency band 17.3-17.8 GHz in Region 2 are involved[28] (Rev.WRC-19)

ADD

7.1*bis* The course of action described in §§ 9.60 to 9.62 of Article **9** does not apply to an assignment in the Appendix **30A** Regions 1 and 3 Plan, an assignment intended to enter in this Plan, List or proposed new or modified assignments in the List, when the affecting network is fixed-satellite service (space-to-Earth) in the band 17.7-18.1 GHz in Region 2. (WRC-23)

NOTE: Further to the issue raised in this method, it was indicated that to maintain the same treatment for the coordination, notification and recording of unplanned FSS assignments of one region with respect to the BSS Plans of another region, modifications similar to the ones described above would have to be considered for the removal of the concept associated with implicit agreement in Article 7 of the RR Appendix **30A** that apply to an assignment in the Region 2 BSS Plan when the affecting network is a Region 1 or 3 unplanned FSS network. Within Region 2, the case of an assignment in the Region 2 BSS Plan affected by an unplanned BSS network would also have to be considered.

[28] These provisions do not replace the procedures prescribed in Articles **9** and **11** when stations other than those for feeder links in the broadcasting-satellite service subject to a Plan are involved. (WRC-03)

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ARTICLE 6 (REV.WRC-19)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*] (WRC-19)

ADD

6.4*bis* When the examination of each assignment in a notice received under § 6.1, to convert an allotment into an assignment, with respect to § 6.3 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations for which § 6.15*quat* was applied with regard to this notice. This telefax shall inform these administrations of the reception under § 6.1 of this notice. (WRC-23)

MOD

6.15 If no decision is communicated to the Bureau within thirty days after the date of dispatch of the reminder under § 6.14 and the identification is of:

a) an allotment in the Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~ no objection to the proposed assignment until this administration plans to bring into use its allotment in the Plan and an agreement under § 6.15*quat* is considered as concluded between the administration of the affected allotment in the Plan and the notifying administration of the proposed assignment; or

b) an assignment, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-23)

---

1 If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 6.7 and/or 6.23 and the corresponding entries in the List under § 6.23 and/or 6.25, as appropriate, and reinstate any allotments back into the Plan after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. See also Resolution **905 (WRC-07)**[*].

[*] *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

2 Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

2*bis* Resolution **170 (WRC-19)** applies. (WRC-19)

ADD

6.15*quat* When an agreement under this provision is concluded with the administration of an affected allotment in the Plan, the notifying administration of the proposed assignment shall commit to respect the power flux-density limits shown in Section 2.2 of Annex 4 of Appendix **30B** (Rev.WRC-19) at any point within the territory, situated inside the −3 dB contour of the associated beam area, of the administration whose allotment was the basis of the disagreement at the date on which the frequency assignment, stemming from the conversion of an affected allotment, is to be brought into use as communicated under § 8.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 8.10*bis*, whichever comes later. (WRC-23)

ADD

6.15*quin* Upon conclusion of agreements under § 6.15*quat*, when entering the assignment in the List, the Bureau shall indicate those administrations whose allotments were the basis of the agreement. (WRC-23)

ADD

6.27*bis* When an assignment is entered in the List referred to in § 6.15*quin*, that assignment shall not be taken into account in updating the reference situation of those allotments with which an agreement under § 6.*15quat* was concluded. (WRC-23)

ADD

6.29*bis* If the Bureau is informed that obligations under § 6.15*quat* is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 6.15*quat*. (WRC-23)

ADD

6.29*ter* If, in spite of the application of § 6.29*bis*, conditions specified in § 6.15*quat* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

ARTICLE 8 (WRC-15)

Procedure for notification and recording in the Master Register of assignments in the planned bands for the fixed-satellite service[11, 12] (WRC-19)

ADD

8.10*bis* When the examination with respect to § 8.9 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 8.1 of this notice and the date on which the frequency assignment stemming from the conversion of an allotment, subject of § 6.15*quin* agreement, into an assignment, is planned to be brought into use. (WRC-23)

4/7/8.5.2 For methods related to EPM degradation tolerance in RR Appendices 30/30A in Regions 1 and 3

4/7/8.5.2.1 For Method H2A

NOC

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

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[11] If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in §§ 8.5 and 8.12 and the corresponding entries in the Master Register under § 8.11 or § 8.16*bis*, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action and that any resubmitted notice shall be considered to be a new notice. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. (WRC-19)

[12] Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

NOC

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

4/7/8.5.2.2 For Method H2B

APPENDIX 30 (REV.WRC-19)*

Provisions for all services and associated Plans and List[1] for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1) and 12.2-12.7 GHz (in Region 2) (WRC-03)

ANNEX 1 (REV.WRC-19)

Limits for determining whether a service of an administration is affected by a proposed modification to the Region 2 Plan or by a proposed new or modified assignment in the Regions 1 and 3 List or when it is necessary under this Appendix to seek the agreement of any other administration[25]

MOD

1 Limits for the interference into frequency assignments in conformity with the Regions 1 and 3 Plan or with the Regions 1 and 3 List or into new or modified assignments in the Regions 1 and 3 List

...

b) the effect of the proposed new or modified assignments in the List is that the equivalent downlink protection margin[27] corresponding to a test point of its assignment in the Regions 1 and 3 Plan or List, or for which the procedure of Article 4 has been initiated, including cumulative effect of any previous modification to the List or any previous agreement, does not fall more than 0.45[XX] dB below 0 dB or, if already negative, more than 0.45[XX] dB below the value resulting from:

[XX] For protection of an assignment in the Regions 1 and 3 Plan or an assignment with national coverage from a submission of non-national coverage, 0.25 dB shall be used instead. (WRC-23)

– the Regions 1 and 3 Plan and List as established by WRC-2000; *or*

– a proposed new or modified assignment to the List in accordance with this Appendix; *or*

– a new entry in the Regions 1 and 3 List as a result of a successful application of Article 4 procedures.

NOTE – In performing the calculation, the effect at the receiver input of all the co-channel and adjacent-channel signals is expressed in terms of one equivalent co-channel interfering signal. This value is usually expressed in decibels. (WRC-03)

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List[1] for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz[2] and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

ANNEX 1 (REV.WRC-19)

Limits for determining whether a service of an administration is considered to be affected by a proposed modification to the Region 2 feeder-link Plan or by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List or when it is necessary under this Appendix to seek the agreement of any other administration (Rev.WRC-03)

MOD

4 Limits to the interference into frequency assignments in conformity with the Regions 1 and 3 feeder-link Plan or with the Regions 1 and 3 feeder-link List or proposed new or modified assignments in the Regions 1 and 3 feeder-link List (WRC-03)

…

* The expression “frequency assignment to a space station”, wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. (WRC-03)

[1] The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution **542 (WRC-2000)****). (WRC-03)

** *Note by the Secretariat*: This Resolution was abrogated by WRC-03.

[2] This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

However, an administration is not considered as being affected if, under assumed free-space propagation conditions, the effect of the proposed new or modified assignments in the feeder-link List is that the feeder-link equivalent protection margin[35] corresponding to a test point of its assignment in the feeder-link Plan or the feeder-link List or for which the procedure of Article 4 has been initiated, including the cumulative effect of any previous modification to the feeder-link List or any previous agreement, does not fall more than 0.45[XX1] dB below 0 dB, or, if already negative, more than 0.45[XX1] dB below the value resulting from:

– the Regions 1 and 3 feeder-link Plan and List as established by WRC-2000; *or*

– a proposed new or modified assignment to the feeder-link List in accordance with this Appendix; *or*

– a new entry in the Regions 1 and 3 feeder-link List as a result of the successful application of Article 4 procedures. (WRC-03)

For a proposed new or modified assignment to the feeder-link List, in the interference analysis, for each test point, the antenna characteristics described in § 3.5 of Annex 3 shall apply. (WRC-03)

Note by the Secretariat: Reference to an Article with the number in roman is referring to an Article in this Appendix.

[35] For the definition of the equivalent protection margin, see § 1.7 of Annex 3.

[XX1] For protection of an assignment in the Regions 1 and 3 feeder-link Plan or an assignment with national coverage from a submission of non-national coverage, 0.25 dB shall be used instead. (WRC-23)

4/7/9 Topic I – Special agreements under RR Appendix 30B

4/7/9.1 Executive summary

Following application of § 6.15 of RR Appendix **30B**, some national allotments currently possess low overall aggregate carrier-to-interference levels, lower than 21 dB. To restore adequate overall aggregate carrier-to-interference levels without changing the orbital position of the national allotment, a proposed method is considered under this Topic. The method consists of defining a new type of agreement between notifying administrations of a national allotment and of an assignment, respectively. Under such an agreement, the administration of the national allotment allows the assignment to operate until the bringing into use of its assignment stemming from the national allotment, at which time the administration of the assignment commits to respect the section 2.2 of Annex 4 pfd levels over the territory of the national allotment. Given that the national allotment and the allowed assignments will not simultaneously use the same frequency over the same area, mutual interference is not considered.

4/7/9.2 Background

When an administration intends to convert an allotment into an assignment or when an administration, or one acting on behalf of a group of named administrations, intends to introduce an additional system or modify the characteristics of assignments in the List that have been brought into use in RR Appendix **30B**, the administration shall submit to the Radiocommunication Bureau all required information as specified in RR Appendix **4**. Then, the Bureau determines administrations whose allotments in the Plan, or assignments in the List or pending assignments are considered as being affected by this assignment under § 6.5 of RR Appendix **30B**.

Affected administrations have 4 months after the publication of the Special Section of this assignment to comment on it (§ 6.10) plus an additional period of 1 month subject to application of § 6.13. If, after this period, despite several reminders sent by the Bureau (i.e. § 6.9, § 6.11, § 6.14, § 6.14*bis*), the affected administration has not given a decision, this administration is considered as having given its implicit agreement to this assignment under § 6.15.

At the time of the Part B submission of this assignment under § 6.17 or § 6.25, as appropriate, the final characteristics of this assignment could impact the overall aggregate carrier-to-interference levels of the allotment of the administration which did not give their decision in due time. These overall aggregate carrier-to-interference levels are used to determine the protection of this allotment or assignment for future submissions under § 6.1 and if an allotment can still be put into operation with decent services. Implicit agreements could lead to a situation that no decent services can be provided because of very low overall aggregate carrier-to-interference levels.

It is also important to note that the same consequence would occur if the affected administration signed an explicit agreement and the targeted area for the assignment submitted under § 6.1 is close to the territory of this administration which signed an explicit agreement.

4/7/9.3 Summary and analysis of the results of ITU-R studies

Technical and regulatory solutions were envisaged to restore adequate overall aggregate carrier-to-interference levels of national allotments subject to agreements under § 6.15 of RR Appendix **30B** without changing the orbital position of the national allotment.

Nevertheless, the final operational characteristics of a space station are mainly based on final parameters of the assignment in the List including coverage area. Therefore, when an agreement under § 6.15 of RR Appendix **30B** was completed between an assignment and a national allotment, it could be difficult, in some cases, for an assignment in the List to protect this national allotment based on the criteria in Annex 4 of RR Appendix **30B** or by adjusting its own traffic accordingly.

4/7/9.4 Methods to satisfy Topic I

4/7/9.4.1 Method I1

No changes to the Radio Regulations.

4/7/9.4.2 Method I2

Method I2 proposes to:

– define a new type of agreement between notifying administrations of a national allotment and of an assignment, respectively. Under such an agreement, the administration of the national allotment allows the assignment to operate until the bringing into use of its national allotment. At that time (that is to say, from the moment that the national allotment is brought into use), the administration of the assignment commits to respect the section 2.2 of Annex 4 pfd levels over the territory of the national allotment. As the national allotment and the assignment will not operate simultaneously the same frequency over the same area, mutual interference is not considered.

– develop a new Resolution allowing the notifying administration of a national allotment, subject to agreements under § 6.15 of RR Appendix **30B**:

  • to sign this new type of agreement with the notifying administration of the concerned assignments,

  • to request the Bureau to update the reference situation without reviewing the previous examinations, and

  • to request the notifying administrations of assignments for which the procedures of Article 6 of RR Appendix **30B** have not yet been completed and which have been examined by the Bureau before the signature of such agreement to make their utmost efforts to take into account the new reference situation of this national allotment.

4/7/9.5 Regulatory and procedural considerations

4/7/9.5.1 For Method I1

NOC

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

4/7/9.5.2 For Method I2

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

ARTICLE 6 (REV.WRC-19)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List[1, 2, 2*bis*] (WRC-19)

ADD

6.4*bis* When the examination of each assignment in a notice received under § 6.1, to convert an allotment into an assignment, with respect to § 6.3 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice. This telefax shall inform these administrations of the reception under § 6.1 of this notice. (WRC-23)

ADD

6.15*quat* The agreement of the administrations affected with regard to their allotments in the Plan may also be obtained in accordance with this paragraph. When this specific agreement under this paragraph is signed with an affected administration, the notifying administration shall commit to respect the power flux-density limits shown in section 2.2 of Annex 4 at any point within the territory, situated inside the −3 dB contour of the associated beam area, of the administration whose allotment was the basis of the disagreement at the date on which the frequency assignment is to be brought into use communicated under § 8.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 8.10*bis*, whichever comes later. (WRC-23)

ADD

6.15*quin* Upon receipt of agreements under § 6.15*quat*, when entering the assignment in the List, the Bureau shall indicate those administrations whose allotments were the basis of the agreement. (WRC-23)

ADD

6.27*bis* When an assignment is entered in the List referred to in § 6.15*quin*, that assignment shall not be taken into account in updating the reference situation of those allotments which were the basis for the agreement under § 6.15*quat*. (WRC-23)

ADD

6.29*bis* Should the commitment under § 6.15*quat* not be respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment requesting an immediate respect of conditions specified in § 6.15*quat*. (WRC-23)

ADD

6.29*ter* If, in spite of the application of § 6.29*bis,* the conditions specified in § 6.15*quat* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

ARTICLE 8 (WRC-15)

Procedure for notification and recording in the Master Register of assignments in the planned bands for the fixed-satellite service[11, 12] (WRC-19)

ADD

8.10*bis* When the examination with respect to § 8.9 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice, if any. This telefax shall inform these administrations of the notification under § 8.1 of this notice and the date on which the frequency assignment is to be brought into use. (WRC-23)

ADD

DRAFT NEW RESOLUTION [A7(I)-METHOD I2] (WRC-23)

Temporary regulatory measures in Appendix 30B to improve the reference situation of severely impacted national allotments

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that some national allotments, especially those of developing countries, have low overall aggregate carrier-to-interference values in Appendix **30B**;

b) that implementation of a national allotment with a low overall aggregate carrier-to-interference value could be difficult,

recognizing

a) that the special procedure outlined in this Resolution may be difficult to implement when the territory of a national allotment is a neighbour to the territories included in the service area of the assignment in the List for which § 6.15 of Appendix **30B** has been applied;

b) that Article 44 of the ITU Constitution stipulates that: "In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries";

c) that the administration of an assignment in the List which applied § 6.15 of Appendix **30B** with regard to a national allotment can sign an agreement under § 6.15*quat* of Appendix **30B** (WRC-23),

resolves

1 that the special procedure outlined in this Resolution shall only be applied by administrations of assignments in the List and administrations of national allotments for which § 6.15 of Appendix **30B** was respectively applied;

2 that, when agreements under § 6.15*quat* of Appendix **30B** are received by the Radiocommunication Bureau (BR) in accordance with *recognizing c)*, the BR shall immediately apply § 6.15*quin*, § 6.27*bis* of Appendix **30B** (WRC-23) and update the reference situation without reviewing the previous examinations;

3 to request the notifying administrations of assignments for which the procedures of Article 6 of Appendix **30B** have not yet been completed and which have been examined by the Bureau before its application of *resolves* 2 to make their utmost efforts to take into account the new reference situations of national allotments, which applied the special procedure of this Resolution, when submitting their notice under § 6.17 or § 6.25 of Appendix **30B**,

instructs the Radiocommunication Bureau

1 to take the necessary actions to implement this Resolution, in particular to draw the attention of the notifying administrations to *resolves* 3 and to provide necessary assistance to the notifying administrations in implementing *resolves* 3;

2 to report to the relevant meetings of the Radio Regulations Board the efforts undertaken by the notifying administrations in implementing *resolves* 3 for further consideration;

3 to report any difficulties it encounters in the implementation of this Resolution to each future world radiocommunication conference,

instructs the Radio Regulations Board

to provide a report to each future world radiocommunication conference on the actions taken by the notifying administrations in implementing *resolves* 3.

4/7/10 Topic J – Modifications to Resolution 76 (Rev.WRC-15)

4/7/10.1 Executive summary

Resolution **76 (Rev.WRC-15)** calls for the development of Recommendations on procedures ensuring that the aggregate epfd limits are not exceeded and calls for collaboration among administrations to jointly ensure those levels are not exceeded. While the aggregate epfd limits are specified in Tables 1A to 1D of the Resolution, there is no clear methodology nor procedures outlined in Resolution **76 (Rev.WRC-15)** for the administrations involved to collaboratively determine whether these aggregate levels are exceeded. This Topic J aims to address a part of this deficiency by developing or calling for the development of a consultation process to be applied to non-GSO fixed-satellite service (FSS) systems operators to avoid and potentially remedy any exceedance of the aggregate interference levels in Tables 1A to 1D of the Resolution based on accurate modelling of non-GSO systems.

Five methods are proposed in the following, noting that some aspects such as the criteria for participation and terms of reference for such consultations still need further discussion.

In relation to this, methods and technical procedures are under development in the ITU-R towards establishing one or more new Recommendations to be used during the consultations.

The methods are:

- Method J1: No change to Resolution **76 (Rev.WRC-15)**;
- Method J2: Modify Resolution **76 (Rev.WRC-15)** to introduce the concept of "consultation process/meetings" among administrations of non-GSO systems so that they can agree cooperatively to reduce their aggregate epfd if there is an exceedance;
- Method J3: Modify Resolution **76 (Rev.WRC-15)** to comply with the aggregate epfd levels included in the same Resolution through a consultation process/meetings taking into account only non-GSO operational systems;
- Method J4: Modify Resolution **76 (Rev.WRC-15)** to comply with the aggregate epfd levels included in the same Resolution through a consultation process/meetings taking into account both non-GSO operational and planned systems;
- Method J5: Modify Resolution **76 (Rev.WRC-15)** to call for further study on accurate modelling of non-GSO systems and a regulatory procedure for assuring compliance with the aggregate emission limits.

4/7/10.2 Background

While the aggregate epfd limits are specified in Tables 1A to 1D of the Resolution, and the obligation to comply with the limits is imposed on all administrations operating non-GSO FSS in RR No. **22.5K**, there is no recent and comprehensive ITU-R Recommendation[29] which takes into account accurate modelling of interference from multiple non-GSO systems for the purposes of assessing compliance with aggregate epfd limits, nor is there a methodology or procedures for the administrations involved to collaboratively determine whether these aggregate levels are exceeded. There also is no clear guidance or procedure on what are the "necessary measures" non-GSO FSS systems should take – individually or collectively – under *resolves* 2 of the Resolution to expeditiously reduce the aggregate epfd levels to those given in Tables 1A to 1D of the Resolution, or to higher levels where those levels are acceptable to the affected GSO administration.

[29] It is noted that Recommendation ITU-R S.1588, which calculates aggregate epfd levels, appears not to be sufficient for this purpose.

It is recognized that whereas all administrations that operate or plan to operate non-GSO FSS should collaborate to reduce predicted aggregate emissions below the levels in Tables 1A to 1D, this is not simply a theoretical exercise whereby single-entry epfd levels from all satellite filings as verified by the Bureau would simply be aggregated, but rather the aggregate calculations must be based on realistic parameters, assumptions and modelling of interference. Similarly, any action to be taken by individual administrations to make modifications to the operations of their non-GSO FSS systems must be based on real operational characteristics of those systems including those systems that would operate imminently. Doing otherwise would penalize operational systems by forcing them to make modifications to their operations.

It is therefore necessary to develop methodologies that would include, for example:

1) A methodology for calculating the aggregate epfd produced by non-GSO FSS systems operating or planning to operate co-frequency in the frequency bands referred to in Resolution **76 (Rev.WRC-15)**.

2) A methodology to correct any exceedance of the aggregate epfd limits by all those operational non-GSO FSS systems that would meet the criteria in a potential revision of Resolution **76 (Rev.WRC-15)** or one or more ITU-R Recommendations, as appropriate.

4/7/10.3 Summary and analysis of the results of ITU-R studies

4/7/10.3.1 Calculation of aggregate epfd

In some cases, non-GSO satellite systems are being split in multiple Coordination Requests submitted to the Bureau through the same administration or different administrations. As a result, not only can identifying under which Coordination Requests a real system operates be challenging, but so is the case also for identical systems filed by multiple administrations. These two issues may make the verification of compliance with aggregate epfd limits difficult.

Furthermore, these practices create regulatory challenges for the evaluation and reduction of epfd levels of a single non-GSO FSS system since it is unclear how to evaluate the aggregate epfd produced by these systems. Aggregation is a complex issue because it takes place at multiple levels, including the impact of multiple filings for one system, belonging to different administrations; the impact of all the systems from a single administration; and the impact of all systems of all administrations. Nevertheless, it is easier to associate a single space station to one system whose notification information has been submitted from one administration only.

Therefore, the actions expected from one administration may be limited to interference from the space stations it is responsible for.

ITU-R studies have shown that the underlying Recommendation used to evaluate epfd interference between non-GSO FSS systems and GSO network, Recommendation ITU-R S.1503-3, does not accurately model the interference from certain non-GSO FSS systems into GSO FSS and BSS networks, and may over-estimate the actual epfd levels.

4/7/10.3.2 Consultation meetings

It is important to establish methodologies and procedures to be adopted by the ITU-R with respect to the assessment of the aggregate epfd produced by all operational non-GSO satellite systems and, the reduction of this aggregate epfd level as appropriate. The concept of "consultation process/meetings" has been established in other regulatory frameworks – specifically, in Resolutions **769 (WRC-19)** and **609 (Rev.WRC-07)** – to provide a means for administrations to evaluate aggregate interference and assure compliance with aggregate interference limits between multiple systems (non-GSO in the case of Resolution **769 (WRC-19)** and non-GSO and GSO in the case of Resolution **609 (Rev.WRC-07)**).

It is noted that the frequency bands identified in Resolution **76 (Rev.WRC-15)** include challenges that are different from those included in the frequency bands identified in Resolution **769 (WRC-19)** and Resolution **609 (Rev.WRC-07)**.

4/7/10.4 Methods to satisfy Topic J

Five methods have been proposed to satisfy Topic J.

4/7/10.4.1 Method J1: No change to Resolution 76 (Rev.WRC-15)

This method proposes no change to the Radio Regulations, and it relies on the approach to comply with aggregate epfd limits as outlined in Resolution **76 (Rev.WRC-15)**.

4/7/10.4.2 Method J2: Modify Resolution 76 (Rev.WRC-15) to introduce the concept of "consultation process/meetings"

This method proposes to incorporate the concept of consultation meetings between administrations operating or planning to operate non-GSO FSS systems. Such meetings would provide a forum for them to discuss and agree cooperatively on sharing the aggregate epfd in a manner to achieve the level of protection for GSO satellite networks. Details of the meeting, including decisions, would be sent to the BR.

This method is not meant to address any of the technical aspects relating to the calculation of the aggregate epfd nor the reduction of such aggregate epfd when exceeding the level prescribed in the RR.

Under this method, it is proposed to amend Resolution **76 (Rev.WRC-15)** to incorporate the concept of consultation meetings. These meetings would provide administrations with a forum and a framework to discuss and agree cooperatively on sharing the aggregate epfd in a manner to achieve the level of protection for GSO satellite networks.

This method is not meant to address any of the technical aspects relating to the calculation of the aggregate epfd nor the reduction of such aggregate epfd when exceeding the level prescribed in the RR.

Option 1:

Under this option, it is proposed that the consultation meeting be held on a regular basis. The meetings could begin once the Recommendation on the methodology to calculate the aggregate epfd is approved by SG 4. Criteria is defined for the participation of notifying administrations of non-GSO systems. Only operating non-GSO systems are included in the calculation of the aggregate epfd and take the necessary measures to reduce the aggregate epfd.

Option 2:

Under this option, it is proposed that the consultation meeting be held on a regular basis. The meetings could begin once the Recommendation on the methodology to calculate the aggregate epfd is approved by SG 4. Criteria is defined for the participation of notifying administrations for non-GSO systems. Both operating or planning to operate non-GSO systems are included in the calculation of the aggregate epfd, and take the necessary measures to reduce the aggregate epfd. Non-GSO systems planning to operate are defined by an initial launch date to occur within the period of 18 months.

4/7/10.4.3 Method J3: Modify Resolution 76 (Rev.WRC-15) to comply with the aggregate epfd levels included in the same Resolution through a consultation process/meetings

This method proposes to amend Resolution **76 (Rev.WRC-15)**, as appropriate, to make administrations able to comply with the aggregate epfd levels included in the same Resolution through a consultation process/meetings.

In this method it is proposed that the consultation meetings begin once the Recommendations on the two Methodologies (Option 1) or first Methodology (Option 2) are approved by ITU-R Study Group 4.

Two methodologies are currently under development at ITU-R:

– A first methodology to calculate the aggregate epfd produced by all non-GSO systems;

– A second methodology to adapt the operations of all non-GSO systems when the aggregate epfd levels given in Tables 1A to 1D of Annex 1 are exceeded.

Until the relevant methodologies are available, in case the aggregate epfd limits in Tables 1A to 1D are exceeded, the protection of GSO is ensured by the provisions of RR No. **22.5K** and request non-GSO FSS administrations to take all necessary measures to reduce the aggregate epfd levels.

In the aggregate calculation, only non-GSO operational systems will be taken into account.

The Terms of Reference (ToR) for the first consultation meeting are provided in Annex 3.

4/7/10.4.4 Method J4: Modify Resolution 76 (Rev.WRC-15) to comply with the aggregate epfd levels included in the same Resolution through a consultation process/meetings

This method proposes to amend Resolution **76 (Rev.WRC-15)**, as appropriate, to make administrations able to comply with the aggregate epfd levels included in the same Resolution through a consultation process/meetings.

In this method it is proposed that the consultation meetings begin once the Recommendations on the methodologies are approved by SG 4.

Two methodologies are currently under development at ITU-R:

– A first methodology to calculate the aggregate epfd produced by all non-GSO systems;

– A second methodology to adapt the operations of all non-GSO systems when the aggregate epfd levels given in Tables 1A to 1D of Annex 1 are exceeded.

Until the methodologies are available, in case the aggregate epfd limits in Tables 1A to 1D are exceeded, the protection of GSO is ensured by the provisions RR No. **22.5K** and request non-GSO FSS administrations to take all necessary measures to reduce the aggregate epfd levels.

In the aggregate calculation, both non-GSO operational and planned systems to operate within one year will be taken into account.

The ToR for the first consultation meeting are provided in Annex 3. Consultation meetings will be held yearly.

4/7/10.4.5 Method J5: Modify Resolution 76 (Rev.WRC-15) to call for further study on accurate modelling of non-GSO systems and a regulatory procedure for assuring compliance with the aggregate emission limits

This method proposes to modify and update Resolution **76 (Rev.WRC-15)** to call specifically for further study on a consultation process for non-GSO FSS systems operating in the frequency bands specified in *considering a)* of the Resolution to comply with the aggregate epfd limits in Tables 1A to 1D of the Resolution.

4/7/10.5 Regulatory and procedural considerations

4/7/10.5.1 For Method J1: No change to Resolution 76 (Rev.WRC-15)

This method would lead to no regulatory changes to either Resolution **76 (Rev.WRC-15)** or RR No. **22.5K**, and would rely on the ITU-R to develop the techniques and methodologies referred to in Resolution **76 (Rev.WRC-15)**.

ARTICLE 22

Space services[1]

Section II − Control of interference to geostationary-satellite systems

NOC

22.5K

NOC

RESOLUTION 76 (REV.WRC-15)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

*Note: In any of the methods below proposing amendments to Resolution **76 (WRC-15)**, none proposes to amend its Annex 1. Therefore, Annex 1 to Resolution **76 (WRC-15)** is not reproduced in each of the relevant methods in order to reduce the number of pages of this text.*

4/7/10.5.2 For Method J2: Modify Resolution 76 (Rev.WRC-15) to introduce the concept of "consultation process/meetings"

Note: This draft modification is presented to stimulate discussions as other modifications not identified in this document may still be required.

MOD

RESOLUTION 76 (REV.WRC-~~15~~23)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

considering

a) that WRC-97 adopted, in Article **22**, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary fixed-satellite service (non-GSO FSS) systems in order to protect GSO FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;

b) that WRC-2000 revised Article **22** to ensure the limits contained therein provide adequate protection to GSO systems without placing undue constraints on any of the systems and services sharing these frequency bands;

c) that WRC-2000 decided that a combination of single-entry validation, single-entry operational and, for certain antenna sizes, single-entry additional operational epfd limits, contained in Article **22**, along with the aggregate limits in Tables 1A to 1D as contained in Annex 1 to this Resolution, which apply to non-GSO FSS systems, protects GSO networks in these frequency bands;

d) that these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D in Annex 1, assuming a maximum effective number of non-GSO FSS systems of 3.5;

e) that the effective number of non-GSO FSS systems is not the same as the actual number of systems since each operational system may cause an epfd curve which is well below, at least in certain portions of the cumulative distribution curve, the curve of the epfd limits;

~~e~~f) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these frequency bands into GSO FSS systems should not exceed the aggregate epfd levels in Tables 1A to 1D in Annex 1;

g) that, in case the aggregate epfd limits are exceeded and in order to achieve the objective in *considering f)*, administrations option 1: operating / option 2: operating or planning to operate non-GSO FSS systems will need to agree cooperatively through consultation meetings on sharing the aggregate epfd option 1: by implementing measures to reduce their respective epfd levels / option 2: to ensure that the operations of those non-GSO systems do not exceed the aggregate level of protection for GSO FSS systems;

h) that administrations planning to operate non-GSO FSS systems may also participate in such meetings, but their system would only be considered in the aggregate calculations once it becomes operational;

~~f~~i) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in the frequency bands in question are to mutually coordinate the use of frequencies in these frequency bands under the provisions of No. **9.12**;

~~g~~j) that the orbital characteristics of such systems are likely to be inhomogeneous;

~~h~~k) that, as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems will not be directly related to the actual number of systems sharing a frequency band~~, and the number of such systems operating co-frequency is likely to be small~~;

~~i~~l) that the possible misapplication of single-entry limits should be avoided~~.~~;

m) that Resolution 219 (Bucharest, 2022) of the Plenipotentiary Conference on sustainability of the radio-frequency spectrum and associated satellite-orbit resources used by space services noted the urgency of addressing the continued and expanded launch and operation of a large number of non-GSO systems in outer space before they are launched and operational,

Note: Some views were expressed that the connection between Resolution 219 (Bucharest, 2022) of the Plenipotentiary Conference and Resolution **76 (Rev.WRC-15)** is still to be reviewed.

recognizing

a) that non-GSO FSS systems may~~are likely to~~ need to implement interference mitigation techniques to mutually share frequencies;

b) that coordination amongst systems will prevent simultaneous transmissions from several such systems into the main beam of a GSO earth station;~~that, on account of the use of such interference mitigation techniques, it is likely that the number of non-GSO systems will remain small, as will the aggregate interference caused by non-GSO FSS systems into GSO systems;~~

c) that, notwithstanding *considering d), e)* and *~~e~~f)* and *recognizing b)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables 1A to 1D in Annex 1;

d) that administrations option 1: operating / option 2: operating or planning to operate GSO systems may wish to ensure that the aggregate epfd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables 1A to 1D in Annex 1,

noting

Recommendation ITU-R S.1588 "Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network",

resolves

1 that administrations option 1: operating / option 2: operating or planning to operate non-GSO FSS systems within the next 18 months, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, shall take all possible steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels given in Tables 1A to 1D in Annex 1 to be exceeded (see No. **22.5K**);

2 that, in the event that the aggregate interference levels in Tables 1A to 1D are exceeded, administrations option 1: operating / option 2: operating or planning to operate as per *resolves* 1 non-GSO FSS systems in these frequency bands and for which the relevant information as per Annex 2 has been provided shall take all necessary measures expeditiously to reduce the aggregate epfd levels to those given in Tables 1A to 1D in Annex 1, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**)~~.~~;

3 that administrations, in carrying out their obligations under *resolves* 1 and 2 above, shall take into account all the non-GSO FSS systems option 1: operating / option 2: operating or planning to operate as per *resolves* 1 in the frequency bands covered in Tables 1A to 1D in Annex 1 that have met all the criteria listed in Annex 2 of this Resolution with the relevant information, as well as any other relevant technical and operational parameters required for the epfd calculation, have been provided to the consultation meetings referred to in *considering g)*;

The following *resolves* are meant to implement option 2 in *resolves* 3

5 that the aggregate epfd calculations performed in the scope of the consultation meetings shall undertake two assessment outputs, one considering operational non-GSO systems and another considering operational and planned non-GSO systems as per *resolves* 1 included in the criteria defined in Annex 3;

6 that the aggregate epfd calculations referred to in *resolves* 5 considering operational and planned non-GSO systems as per *resolves* 1 included in the criteria defined in Annex 3 are for information only;

7 that administrations, in carrying out their obligations under *resolves* 1 and 2 above, shall ensure that the aggregate interference allowance into GSO FSS and BSS networks is shared equitably among non-GSO systems operating co-frequency in the frequency bands covered in Tables 1A to 1D,

End of option 2;

5 that those participating in this process of epfd calculation should hold consultation meetings on a regular basis (e.g. yearly) but not before the methodology mentioned in *invites the ITU Radiocommunication Sector* 1 is approved and made available to the membership;

6 that the administrations participating in the consultation meeting shall designate one administration to:

i) communicate to the Bureau the results of any aggregate sharing determinations made in application of *resolves* 2 above, without regard to whether such determinations result in any modifications to the published characteristics of their respective systems or networks;

ii) provide a draft record of each consultation meeting; and

iii) provide the Radiocommunication Bureau (BR) with the approved record as per Annex 1,

invites the ITU Radiocommunication Sector

1 to continue its studies on the subject and ~~to~~ develop~~,~~, ~~as appropriate,~~ as a matter of urgency and taking into account existing and relevant ITU-R Recommendations, a Recommendation on a suitable methodology for calculating the aggregate epfd produced by all non-GSO FSS systems operating or planning to operate as per *resolves* 1 co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels given in Tables 1A to 1D in Annex 1~~;~~,

2 to develop, as a matter of urgency, a Recommendation containing procedures to be used by administrations in cases referred to in *resolves* 2,

~~2 to continue its studies and to develop a Recommendation on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above, in order to assist administrations planning or operating~~

~~non-GSO FSS systems in their efforts to limit the aggregate epfd levels produced by their systems into GSO networks, and to provide guidance to GSO network designers on the maximum epfd↓ levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;~~

~~3 to develop a Recommendation containing procedures to be used among administrations in order to ensure that the aggregate epfd limits given in Tables 1A to 1D are not exceeded by operators of non-GSO FSS systems;~~

~~4 to attempt to develop measurement techniques to identify the interference levels from non-GSO systems in excess of the aggregate limits given in Tables 1A to 1D, and to confirm compliance with these limits,~~

~~*instructs the Director of the Radiocommunication Bureau*~~

~~1 to assist in the development of the methodology referred to in *invites the ITU Radiocommunication Sector* 1 above;~~

~~2 to report to a future competent conference on the results of studies in *invites the ITU Radiocommunication Sector* 1 and 3 above.~~

instructs the Radiocommunication Bureau

1 to participate in consultation meetings mentioned under *resolves* 6 and to observe carefully the results of the epfd calculation mentioned in *resolves* 5;

2 to publish in the International Frequency Information Circular (BR IFIC) the information referred to in *resolves* 6 and *instructs the Radiocommunication Bureau* 1;

3 to develop aggregate epfd calculation tools based on relevant ITU-R Recommendations,

invites administrations

1 to participate in the discussions and determinations mentioned under *resolves* 6, as appropriate;

2 to address non-GSO FSS intersystem matters, as required;

3 to provide to the Bureau, and to all participants in the consultation meetings, access to software developed, taking into consideration the methodology referred to in *invites the ITU Radiocommunication Sector* 1, to calculate the epfd level mentioned under *resolves* 1.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-~~15~~23)

…

ANNEX 2 TO RESOLUTION 76 (REV.WRC-23)

Results of the aggregate epfd calculation

– Summary record of the meeting;

– Detailed description of methodology used to calculate the aggregate interference;

– All input materials submitted to the meeting; and

– Studies conducted prior to or at the meeting as well as any other materials deemed necessary for demonstrating compliance with Tables 1A to 1D.

ANNEX 3 TO RESOLUTION 76 (REV.WRC-23)

List of criteria for the application of *resolves* 3

Option 1:

A Satellite system information

1) Name/Identification of the satellite system;

2) Name of the notifying administration;

3) Country symbol;

4) Reference to the request for coordination, or the notification information, if available;

5) Total number of space stations deployed into each notified orbital plane of the satellite system with the capability of transmitting or receiving the frequency assignments;

6) Orbital plane number indicated in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments into which each space station is deployed.

B Launch information to be provided for each deployed space station

1) Name of the launch vehicle provider;

2) Name of the launch vehicle;

3) Name and location of the launch facility;

4) Launch date.

C Space station characteristics for each space station deployed

1) Frequency bands as per 4) under section A above in which the space station can transmit or receive;

2) Orbital characteristics of the space station (altitude of the apogee and perigee, inclination, and argument of the perigee);

3) Name of the space station.

Option 2:

1 Submission of appropriate coordination and/or notification information for non-GSO FSS systems.

2 Entry into satellite manufacturing or procurement agreement, and entry into satellite launch agreement.

3 Initial launch date to occur within the period of 18 months.

The non-geostationary FSS system operator should possess:

i) evidence of a binding agreement for the manufacture or procurement of its satellites; and

ii) evidence of a binding agreement to launch its satellites.

The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision, and the launch agreement should identify the launch date, launch site and launch service provider. The notifying administration is responsible for authenticating the evidence of an agreement.

The information required under this criterion may be submitted in the form of a written commitment by the responsible administration.

4/7/10.5.3 For Method J3: Modify Resolution 76 (Rev.WRC-15) to introduce the concept of "consultation process/meetings"

Note: This draft modification is presented to stimulate discussions as other modifications not identified in this document may still be required.

MOD

RESOLUTION 76 (REV.WRC-~~15~~23)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

considering

a) that WRC-97 adopted, in Article **22**, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary fixed-satellite service (non-GSO FSS) systems in order to protect GSO FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;

b) that WRC-2000 revised Article **22** to ensure the limits contained therein provide adequate protection to GSO systems without placing undue constraints on any of the systems and services sharing these frequency bands;

c) that WRC-2000 decided that a combination of single-entry validation, single-entry operational and, for certain antenna sizes, single-entry additional operational epfd limits, contained in Article **22**, along with the aggregate limits in Tables 1A to 1D as contained in Annex 1 to this Resolution, which apply to non-GSO FSS systems, protects GSO networks in these frequency bands;

d) that these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D of Annex 1, assuming a maximum effective number of non-GSO FSS systems of 3.5;

e) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these frequency bands into GSO FSS systems should not exceed the aggregate epfd limits~~levels~~ in Tables 1A to 1D of Annex 1;

f) that to achieve the objective in *considering e)*, administrations operating non-GSO FSS systems would need to establish in collaboration, through consultation meetings, the evaluation of aggregate interference levels of all concerned space stations and the implementation of measures to ensure that those non-GSO FSS space stations do not exceed the aggregate epfd limits for the protection of GSO FSS networks;

~~f~~g) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in the frequency bands in question are to mutually coordinate the use of frequencies in these frequency bands under the provisions of No. **9.12**;

~~g~~h) that the orbital characteristics of such systems are likely to be inhomogeneous;

~~h~~i) that, as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems will not be directly related to the actual number of systems sharing a frequency band~~, and the number of such systems operating co-frequency is likely to be small~~;

~~i~~j) that the possible misapplication of single-entry limits should be avoided,

recognizing

a) that non-GSO FSS systems ~~are likely to~~may need to implement interference mitigation techniques to mutually share frequencies;

~~*b)* that, on account of the use of such interference mitigation techniques, it is likely that the number of non-GSO systems will remain small, as will the aggregate interference caused by non-GSO FSS systems into GSO systems;~~

Reason for deletion: speculating on whether the number of non-GSO systems will remain small may not be appropriate.

~~c~~b) that, notwithstanding *considering d)* and *e)*~~ and *recognizing b)*~~, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables 1A to 1D of Annex 1;

~~d~~c) that administrations operating GSO systems may wish to ensure that the aggregate epfd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables 1A to 1D of Annex 1~~,~~;

d) that there is no suitable methodology for calculating the aggregate epfd produced by non-GSO FSS systems that meet the applicable criteria indicated in Annex 2 operating co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks;

e) that there is no existing methodology to adapt the operation of all non-GSO FSS systems that meet the applicable criteria indicated in Annex 2 operating co-frequency in the frequency bands referred to in *considering a)* above to ensure that the aggregate epfd limits given in Tables 1A to 1D of Annex 1 are met;

Note: In order to comply with the provisions of *resolves* 2, two methodologies are under development to calculate the aggregate epfd produced by all non-GSO systems and to adapt the operations of all non-GSO systems when applicable criteria are exceeded;

f) that, until the methodology mentioned in *recognizing d)* above is available, in the event that an administration operating a GSO FSS network identifies epfd from non-GSO FSS systems in excess of the aggregate limits in Tables 1A to 1D, this administration can immediately apply the provisions of No. **22.5K** to request administrations operating those non-GSO FSS systems to take all necessary measures expeditiously to reduce the aggregate epfd levels to the limits given in Tables 1A to 1D, or to higher levels where those levels are acceptable to the affected GSO administration(s);

g) that any administration may attend those consultation meetings as observers,

noting

Recommendation ITU-R S.1588 "Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network",

resolves

1 that administrations operating or planning to operate non-GSO FSS systems, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, shall take all possible steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels given in Tables 1A to 1D of Annex 1 to be exceeded (see No. **22.5K**);

2 that, in the event that the aggregate interference levels in Tables 1A to 1D of Annex 1 are exceeded, administrations operating non-GSO FSS systems complying with the applicable criteria indicated in Annex 2 in these frequency bands shall take all necessary measures expeditiously to reduce the aggregate epfd levels to the limits~~those~~ given in Tables 1A to 1D of Annex 1, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**)~~.~~;

3 that administrations, when evaluating aggregate power levels under *resolves* 1 and 2 above, shall take into account all those satellites included in the relevant information communicated to the Bureau under the applicable provisions of Resolution **35 (WRC-19)** submitted by administrations operating non-GSO FSS systems complying with the applicable criteria indicated in Annex 2 in the frequency bands covered in Tables 1A to 1D of Annex 1 along with the relevant information provided to the consultation meetings referred to in *considering f)*;

3*bis* that, in order to identify the non-GSO systems mentioned in *resolves* 3 above, the criteria listed in Annex 2 shall be used;

4 that administrations engaged in consultation meetings, in developing agreements to carry out their obligations under *resolves* 1 and 2 above, shall establish mechanisms to ensure that all administrations are given full visibility of the process;

Option 1:

5 that, since the limits of Tables 1A to 1D of Annex 1 were based on the assumption that 3.5 non-GSO FSS systems would operate simultaneously, once at least [4] non-GSO systems in each of the frequency bands indicated in Tables 1A to 1D of Annex 1 satisfy the applicable criteria included in Annex 2, the concerned administrations participating in this process of epfd calculation should hold consultation meetings as needed, but not earlier than when the methodologies mentioned in *invites the ITU Radiocommunication Sector* 1 and 2 are approved and made available to the membership;

Option 2:

5 that, since the limits of Tables 1A to 1D of Annex 1 were based on the assumption that 3.5 non-GSO FSS systems would operate simultaneously, once at least [4] non-GSO systems in each of the frequency bands indicated in Tables 1A to 1D of Annex 1 satisfy the applicable criteria included in Annex 2, the concerned administrations participating in this process of epfd calculation should hold consultation meetings as needed, but not earlier than when the methodology mentioned in *invites the ITU Radiocommunication Sector* 1 are approved and made available to the membership;

Note: Views were expressed that if such methodology developed by a limited number of countries during consultation meetings is not included into the Radio Regulation, administrations are not bound by this methodology.

5*bis* that administrations notifying GSO networks that meet the applicable criteria indicated in Annex 2 and operating in the frequency bands indicated in Tables 1A to 1D of Annex 1 can participate in the process mentioned in *resolves* 5 above and make comments with respect to the results of the computations;

5*ter* that the Terms of Reference included in Annex 3 shall be used to regulate the first consultation meeting mentioned in *resolves* 5 above;

6 that those administrations participating in the consultation meeting shall designate one administration that shall communicate to the Bureau the results of any technical or operational amendment to the relevant non-GSO FSS systems following the application of *resolves* 2 above;

7 that any amendment to the relevant non-GSO FSS systems mentioned in *resolves* 6 shall not affect the regulatory status of the affected non-GSO systems, including following any modifications to their published characteristics,

invites the ITU Radiocommunication Sector

1 to continue its studies and to develop~~-~~, as appropriate and as a matter of urgency, a suitable methodology for calculating the aggregate epfd produced by all non-GSO FSS systems that meet the applicable criteria indicated in Annex 2 operating ~~or planning to operate~~ co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels given in Tables 1A to 1D of Annex 1, taking into account relevant elements of Recommendation ITU-R S.1588 and Recommendation ITU-R S.1503, as appropriate;

2 to develop, as a matter of urgency, a suitable methodology to adapt the operation of all non-GSO FSS systems that meet the applicable criteria indicated in Annex 2 operating co-frequency in the frequency bands referred to in *considering a)* above to ensure that the aggregate power levels given in Tables 1A to 1D of Annex 1 are met,

~~2 to continue its studies and to develop a Recommendation on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above, in order to assist administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate epfd levels produced by their systems into GSO networks, and to provide guidance to GSO network designers on the maximum epfd↓ levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;~~

~~3 to develop a Recommendation containing procedures to be used among administrations in order to ensure that the aggregate epfd limits given in Tables 1A to 1D are not exceeded by operators of non-GSO FSS systems;~~

~~4 to attempt to develop measurement techniques to identify the interference levels from non-GSO systems in excess of the aggregate limits given in Tables 1A to 1D, and to confirm compliance with these limits,~~

~~*instructs the Director of the Radiocommunication Bureau*~~

~~1 to assist in the development of the methodology referred to in *invites the ITU Radiocommunication Sector* 1 above;~~

~~2 to report to a future competent conference on the results of studies in *invites the ITU Radiocommunication Sector* 1 and 3 above.~~

instructs the Radiocommunication Bureau

1 to participate in consultation meetings mentioned under *resolves* 6 and to observe carefully the results of the epfd calculation mentioned in *resolves* 5;

2 to publish in the International Frequency Information Circular (BR IFIC) the information referred to in *resolves* 6 and *instructs the Radiocommunication Bureau* 1.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-~~15~~23)

…

ANNEX 2 TO RESOLUTION 76 (REV.WRC-23)

Criteria to identify non-GSO systems and GSO networks, as applicable, that shall be taken into account to evaluate the aggregate epfd levels, in compliance with *resolves* 1 and 2

A Criteria for non-GSO systems

1 Submission of appropriate Notification information under No. **11.2** of the Radio Regulations; and

2 Submission of the information referred to in *resolves* 2 or 3, as applicable, of Resolution **35 (WRC-19)**.

Note: These criteria determine which non-GSO systems will be taken into account in the computation of aggregated epfd, but it is worth to mention that only the operational satellites will be used for computation that could lead to application of *resolves* 2.

B Criteria for GSO networks

1 Submission of appropriate Notification information under No. **11.2** of the Radio Regulations; and,

2 Submission of the information referred to in No. **11.44B** of the Radio Regulations.

Note (related to option 2): Taking into account that the aggregate epfd limit are defined to protect all existing and future GSO networks, the necessity to establish criteria for the participation of notifying administration for GSO networks need to be further considered.

ANNEX 3 TO RESOLUTION 76 (REV.WRC-23)

Terms of Reference regulating the first Consultation Meetings taking place in application of *resolves* 5

1 Consultation Meetings between administrations operating non-GSO systems in the fixed-satellite service (FSS) in the frequency bands indicated in Tables 1A to 1D of Annex 1 will be held in accordance with this Resolution. These meetings will ensure that the epfd produced by all

non-GSO satellite systems operating does not exceed the relevant limits specified in Annex 1 to this Resolution;

2 The notifying administrations of GSO operators can participate in the Consultation Meetings in compliance with *resolves* 5*bis* and 5*ter* of this Resolution. The Bureau can participate in the Consultation Meetings as observer and shall also carry out the functions assigned to it in the *instructs the Director of the Radiocommunication Bureau* 1 and 2 of this Resolution;

3 For each Consultation Meeting, a convening administration is appointed. The appointment is made at the end of the previous Consultation Meeting and decided by the administrations of those systems under which the participating non-GSO systems operate. The convening administration is responsible for:

a) organizing the work to be conducted during the Consultation Meeting; and

b) preparing a draft summary record of the Consultation Meeting and a report containing the results, for discussion and approval by the participating administrations with the final report approved and submitted to the Bureau not later than 45 days after the end of the meeting;

4 No later than six (6) months before the Consultation Meeting, the convening administration shall provide participants with practical information about the meeting venue;
5 No later than six (6) months before the Consultation Meeting, the Bureau should provide the participants with a list of non-GSO systems and GSO networks submitted under No. **11.2** of the Radio Regulations and having assignments in the subject frequency bands. The Bureau shall also provide all information required for the application of the methodology mentioned in *invites the ITU Radiocommunication Sector* 1;

6 No later than four (4) months before the Consultation Meeting, taking into account the criteria included in Annex 2 to this Resolution, administrations should indicate which of its non-GSO satellite systems and GSO networks shall be taken into account in the Consultation Meetings. For each of these systems and networks, administrations should provide the following information (a copy of such information shall be sent to the Bureau):

a) ITU satellite name and publication references (IFIC number, IFIC publication date, Special Section references) for each of the non-GSO systems and GSO networks;

b) the technical information for each of the non-GSO satellite systems, as indicated in Annex 4 to this Resolution;

7 Where multiple ITU filings[1] correspond to a single operating non-GSO satellite system, the filings will be treated as a single operating non-GSO satellite system for the purposes of performing aggregate epfd calculations. The notifying administration or administrations involved shall identify the subject filings to the participants;

8 No later than four (4) months before the Consultation Meeting, administrations will submit (after having performed a conformity check on the data to be submitted) all information option 1: on operational parameters of their non-GSO FSS systems needed to compute the single-entry epfd Probability Density Functions (PDF) and Cumulative Density Functions (CDF) to enable the computation of the aggregate epfd using the methodology mentioned in *invites the ITU Radiocommunication Sector* 1 option 2: as per the methodology developed at ITU-R;

[1] The term “ITU filing” indicates the CR/C and/or Notification publications relative to a non-GSO satellite system, as applicable, included in the BR International Frequency Information Circular (BR IFIC).

9 No later than one (1) month before the Consultation Meeting, administrations should provide (after having performed a conformity check on the data to be submitted) all participants with results, per each non-GSO system, of the single-entry epfd Probability Density Functions (PDF) and Cumulative Density Functions (CDF). Each administration is responsible for the software used to calculate the single-entry epfd PDF and CDF;

10 After receiving the results of § 9 above and before the Consultation Meeting, the convening administration should perform a conformity check to verify the format of the single-entry input data received, in order to ensure that the aggregate epfd based on the methodology mentioned in *invites the ITU Radiocommunication Sector* 1;

11 Each Consultation Meeting should at least perform:

a) conformity check of the input data received;

b) execution of all the cases of aggregate epfd based on the methodology mentioned in *invites the ITU Radiocommunication Sector* 1;

c) analysis of the results: indication of "Pass" or "Fail" for every convolution;

12 If, following the methodology developed in application of *invites the ITU Radiocommunication Sector* 1, all cases of aggregate epfd verify that the aggregate limits are met, no action is required until the next Consultation Meeting;

Option 1

13 If one or more cases of aggregate epfd do not pass the aggregate epfd limits check, the Consultation Meeting shall apply the methodology developed in application of *invites the ITU Radiocommunication Sector* 2;

Option 2

13 If the aggregate interference based on the methodology in *invites the ITU Radiocommunication Sector* 1 do not pass the aggregate epfd limits check, the Consultation Meeting shall apply the methodology developed in application of *invites the ITU Radiocommunication Sector* 2 if available, or take all necessary measures expeditiously to reduce the aggregate epfd levels to the limits indicated in Annex 1 to this Resolution;

Option 3

13 In case of exceedance of the aggregate limits, the administrations of the participating non-GSO systems shall work together to ensure that the exceedance is removed in a reasonable time after the meeting;

14 By the end of the Consultation Meeting, all aggregate epfd limits indicated in Annex 1 to this Resolution shall be met;

15 At the end of each Consultation Meeting, the convening administration should draft a report that the Bureau shall publish on the ITU website promptly;

16 After the Consultation Meeting report is available, all administrations can provide comments that the Bureau shall publish on the ITU website promptly.

ANNEX 4 TO RESOLUTION 76 (REV.WRC-23)

Information to be provided for each non-GSO satellite system

1 ITU System Name:

2 Technical parameters of the non-GSO system

2.1 Orbital parameters

TBD

2.2 Operational parameters (as required for the application of the methodology included in Recommendation ITU-R S.1503)

- Maximum number of non-GSO satellite beams transmitting/receiving at the same frequency towards the same point;
- Minimum elevation;
- Minimum satellite tracking duration;
- TBD, based on the possible revision of Recommendation ITU-R S.1503.

3 Single-entry epfd results

epfd bin	No. of occurrences	PDF	CDF
−210			100
−209.9			99.99
−209.8			…
…			

4/7/10.5.4 For Method J4: Modify Resolution 76 (Rev.WRC-15) to introduce the concept of "consultation process/meetings"

Note: This draft modification is presented to stimulate discussions as other modifications not identified in this document may still be required.

MOD

RESOLUTION 76 (REV.WRC-~~15~~23)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

considering

a) that WRC-97 adopted, in Article **22**, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary fixed-satellite service (non-GSO FSS) systems in order to protect GSO FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;

b) that WRC-2000 revised Article **22** to ensure the limits contained therein provide adequate protection to GSO systems without placing undue constraints on any of the systems and services sharing these frequency bands;

c) that WRC-2000 decided that a combination of single-entry validation, single-entry operational and, for certain antenna sizes, single-entry additional operational epfd limits, contained in Article **22**, along with the aggregate limits in Tables 1A to 1D as contained in Annex 1 to this Resolution, which apply to non-GSO FSS systems, protects GSO networks in these frequency bands;

d) that these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D of Annex 1, assuming a maximum effective number of non-GSO FSS systems of 3.5;

e) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these frequency bands into GSO FSS systems should not exceed the aggregate epfd limits~~levels~~ in Tables 1A to 1D of Annex 1;

f) that to achieve the objective in *considering e)*, administrations operating non-GSO FSS systems would need to establish in collaboration, through consultation meetings, the evaluation of aggregate interference levels of all concerned space stations and the implementation of measures to ensure that those non-GSO FSS space stations do not exceed the aggregate epfd limits required for the protection of GSO FSS networks;

~~f~~g) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in the frequency bands in question are to mutually coordinate the use of frequencies in these frequency bands under the provisions of No. **9.12**;

~~g~~h) that the orbital characteristics of such systems are likely to be inhomogeneous;

~~h~~i) that, as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems will not be directly related to the actual number of systems sharing a frequency band~~, and the number of such systems operating co-frequency is likely to be small~~;

~~i~~j) that the possible misapplication of single-entry limits should be avoided,

recognizing

a) that non-GSO FSS systems ~~are likely to~~may need to implement interference mitigation techniques to mutually share frequencies;

~~*b)* that, on account of the use of such interference mitigation techniques, it is likely that the number of non-GSO systems will remain small, as will the aggregate interference caused by non-GSO FSS systems into GSO systems;~~

Reason for deletion: speculating on whether the number of non-GSO systems will remain small may not be appropriate.

~~c~~b) that, notwithstanding *considering d)* and *e)*~~ and *recognizing b)*~~, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables 1A to 1D of Annex 1;

~~d~~c) that administrations operating GSO systems may wish to ensure that the aggregate epfd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables 1A to 1D of Annex 1,

noting

Recommendation ITU-R S.1588 "Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network",

resolves

1 that administrations operating or planning to operate non-GSO FSS systems, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, shall take all possible steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels given in Tables 1A to 1D of Annex 1 to be exceeded (see No. **22.5K**);

2 that, in the event that the aggregate interference levels in Tables 1A to 1D of Annex 1 are exceeded, administrations operating non-GSO FSS systems complying with the applicable criteria indicated in Annex 2 in these frequency bands shall take all necessary measures expeditiously to reduce the aggregate epfd levels to the limits~~those~~ given in Tables 1A to 1D of Annex 1, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**)~~.~~;

3 that administrations, when evaluating aggregate power levels under *resolves* 1 and 2 above, shall take into account all those non-GSO FSS systems complying with the applicable criteria indicated in Annex 2 in the frequency bands covered in Tables 1A to 1D of Annex 1 along with the relevant information provided to the consultation meetings referred to in *considering f)*;

3*bis* that aggregate epfd calculations shall include the operational satellites of each non-GSO system prior to the consultation meeting, and also the satellites of non-GSO systems that will be planned to be in operation within one year from the date of the meeting; with the assumption that the consultation meeting will be held yearly;

4 that administrations engaged in consultation meetings, in developing agreements to carry out their obligations under *resolves* 1 and 2 above, shall establish mechanisms to ensure that all administrations are given full visibility of the process;

5 that, since the limits of Tables 1A to 1D of Annex 1 were based on the assumption that 3.5 non-GSO FSS systems would operate simultaneously, once at least [4] non-GSO systems in each of the frequency bands indicated in Tables 1A to 1D of Annex 1 satisfy the applicable criteria included in Annex 2, the concerned administrations participating in this process of epfd calculation should hold consultation meetings as needed, whereas the first consultation meeting shall be held during one year after the methodologies mentioned in *invites the ITU Radiocommunication Sector* 1 and 2 are approved and made available to the membership;

5*bis* that administrations notifying GSO networks that meet the applicable criteria indicated in Annex 2 and operating in the frequency bands indicated in Tables 1A to 1D of Annex 1 can participate in the process mentioned in *resolves* 5 above;

*Editor's note: The issue of waiting for the approval of the recommendation on the methodology to trigger consultation was identified. The following 5*ter *was proposed for consideration to solve this issue but might need further refinement.*

5*ter* that the Terms of Reference included in Annex 3 shall be used to regulate the first consultation meeting mentioned in *resolves* 5 above;

6 that those administrations participating in the consultation meeting shall designate one administration that shall communicate to the Bureau the results of any technical or operational amendment to the relevant non-GSO FSS systems following the application of *resolves* 2 above;

7 that any amendment to the relevant non-GSO FSS systems mentioned in *resolves* 6 shall not affect the regulatory status of the affected non-GSO systems, including following any modifications to their published characteristics,

invites the ITU Radiocommunication Sector

1 to continue its studies and to develop~~,~~, as appropriate and as a matter of urgency, a suitable methodology for calculating the aggregate epfd produced by all non-GSO FSS systems that meet the applicable criteria indicated in Annex 2 operating ~~or planning to operate~~ co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels given in Tables 1A to 1D of Annex 1, taking into account relevant elements of Recommendation ITU-R S.1588 and Recommendation ITU-R S.1503, as appropriate;

2 to develop, as a matter of urgency, a suitable methodology to adapt the operation of all non-GSO FSS systems that meet the applicable criteria indicated in Annex 2 operating co-frequency in the frequency bands referred to in *considering a)* above to ensure that the aggregate power levels given in Tables 1A to 1D of Annex 1 are met,

~~2 to continue its studies and to develop a Recommendation on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above, in order to assist administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate epfd levels produced by their systems into GSO networks, and to provide guidance to GSO network designers on the maximum epfd↓ levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;~~

~~3 to develop a Recommendation containing procedures to be used among administrations in order to ensure that the aggregate epfd limits given in Tables 1A to 1D are not exceeded by operators of non-GSO FSS systems;~~

~~4 to attempt to develop measurement techniques to identify the interference levels from non-GSO systems in excess of the aggregate limits given in Tables 1A to 1D, and to confirm compliance with these limits,~~

~~*instructs the Director of the Radiocommunication Bureau*~~

~~1 to assist in the development of the methodology referred to in *invites the ITU Radiocommunication Sector* 1 above;~~

~~2 to report to a future competent conference on the results of studies in *invites the ITU Radiocommunication Sector* 1 and 3 above.~~

instructs the Radiocommunication Bureau

1 to participate in consultation meetings mentioned under *resolves* 6 and to observe carefully the results of the epfd calculation mentioned in *resolves* 5;

2 to publish in the International Frequency Information Circular (BR IFIC) the information referred to in *resolves* 6 and *instructs the Radiocommunication Bureau* 1.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-~~15~~23)

…

ANNEX 2 TO RESOLUTION 76 (REV.WRC-23)

Criteria to identify non-GSO systems and GSO networks, as applicable, that shall be taken into account to evaluate the aggregate epfd levels, in compliance with *resolves* 1 and 2

A Criteria for non-GSO systems

1 Submission of appropriate Notification information under No. **11.2** of the Radio Regulations; and

2 Submission of the information referred to in *resolves* 2, 3, 7 and/or 8, as applicable, of Resolution **35 (WRC-19)**.

3 The operational satellites of each non-GSO system prior to the consultation meeting, and also the satellites of non-GSO systems that will be planned to be in operation within one year from the date of the meeting.

B Criteria for GSO networks

1 Submission of appropriate Notification information under No. **11.2** of the Radio Regulations; and,

2 Submission of the information referred to in No. **11.44B** of the Radio Regulations.

Note: Taking into account that the aggregate epfd limit are defined to protect all existing and future GSO networks, the necessity to establish a criteria for the participation of notifying administration for GSO networks need to be further considered.

ANNEX 3 TO RESOLUTION 76 (REV.WRC-23)

Terms of Reference regulating the first Consultation Meetings taking place in application of *resolves* 5

1 Consultation Meetings between administrations operating non-GSO systems in the fixed-satellite service (FSS) in the frequency bands indicated in Tables 1A to 1D of Annex 1 will be held in accordance with this Resolution. These meetings will ensure that the epfd produced by all non-GSO satellite systems operating does not exceed the relevant limits specified in Annex 1 to this Resolution.

2 The notifying administrations of GSO operators can participate in the Consultation Meetings in compliance with *resolves* 5*bis* and 5*ter* of this Resolution. The Bureau can participate in the Consultation Meetings as observer and shall also carry out the functions assigned to it in the *instructs the Director of the Radiocommunication Bureau* 1 and 2 of this Resolution.

3 For each Consultation Meeting, a convening administration is appointed. The appointment is made at the end of the previous Consultation Meeting and decided by the administrations of those systems under which the participating non-GSO systems operate. The convening administration is responsible for:

a) organizing the work to be conducted during the Consultation Meeting; and

b) preparing a draft summary record of the Consultation Meeting and a report containing the results, for discussion and approval by the participating administrations with the final report approved and submitted to the Bureau not later than 45 days after the end of the meeting.

4 No later than six (6) months before the Consultation Meeting, the convening administration shall provide participants with practical information about the meeting venue.

5 No later than six (6) months before the Consultation Meeting, the Bureau should provide the participants with a list of non-GSO systems and GSO networks submitted under No. **11.2** of the Radio Regulations and having assignments in the subject frequency bands. The Bureau shall also indicate the worst-case geometry configuration, relevant for the computation of the single-entry epfd limits and computed in accordance with Recommendation ITU-R S.1503, for each of these systems.

6 No later than four (4) months before the Consultation Meeting, taking into account the criteria included in Annex 2 to this Resolution, administrations should indicate which of its non-GSO satellite systems and GSO networks shall be taken into account in the Consultation Meetings. For each of these systems and networks, administrations should provide the following information (a copy of such information shall be sent to the Bureau):

a) ITU satellite name and publication references (IFIC number, IFIC publication date, Special Section references) for each of the non-GSO systems and GSO networks;

b) the technical information for each of the non-GSO satellite systems, as indicated in Annex 4 to this Resolution.

7 Where multiple ITU filings[1] correspond to a single operating non-GSO satellite system, the filings will be treated as a single operating non-GSO satellite system for the purposes of performing aggregate epfd calculations. The notifying administration or administrations involved shall identify the subject filings to the participants.

8 No later than four (4) months before the Consultation Meeting, administrations will submit (after having performed a conformity check on the data to be submitted) all worst-case geometry configurations (as calculated by Recommendation ITU-R S.1503) of each non-GSO system they are responsible for.

9 No later than one (1) month before the Consultation Meeting, administrations should provide (after having performed a conformity check on the data to be submitted) all participants with results, per each non-GSO system, of the single-entry epfd Probability Density Functions (PDF) and Cumulative Density Functions (CDF). Each administration is responsible for the software used to calculate the single-entry epfd PDF and CDF.

10 After receiving the results of § 9 above and before the Consultation Meeting, the convening administration should perform a conformity check to verify the format of the single-entry input data received, in order to ensure that the convolution process can be performed properly.

11 Each Consultation Meeting should at least perform:

a) conformity check of the input data received;

b) execution of all convolutions;

c) analysis of the results: indication of "Pass" or "Fail" for every convolution.

12 If, following the methodology developed in application of *invites the ITU Radiocommunication Sector* 1, all convolutions verify that the aggregate limits are met, no action is required until the next Consultation Meeting.

13 If one or more convolutions do not pass the aggregate epfd limits check, the Consultation Meeting shall apply the methodology developed in application of *invites the ITU Radiocommunication Sector* 2.

14 By the end of the Consultation Meeting, in case of exceedance of the aggregate epfd limits, the notifying administrations of the participating non-GSO systems shall cooperate to meet all aggregate epfd limits indicated in Annex 1 to this Resolution within one (1) month after the meeting.

15 At the end of each Consultation Meeting, the convening administration should draft a report that the Bureau shall publish on the ITU website promptly.

16 After the Consultation Meeting report is available, all administrations can provide comments that the Bureau shall publish on the ITU website promptly.

[1] The term "ITU filing" indicates the CR/C and/or Notification publications relative to a non-GSO satellite system, as applicable, included in the BR International Frequency Information Circular (BR IFIC).

ANNEX 4 TO RESOLUTION 76 (REV.WRC-23)

Information to be provided for each non-GSO satellite system

1 ITU System Name:

2 Technical parameters of the non-GSO system

2.1 Orbital parameters

TBD

2.2 Operational parameters (as required for the application of the methodology included in Recommendation ITU-R S.1503)

- Maximum number of non-GSO satellite beams transmitting/receiving at the same frequency towards the same point;
- Minimum elevation;
- Minimum satellite tracking duration;
- TBD, based on the possible revision of Recommendation ITU-R S.1503.

3 Single-entry epfd results

epfd bin	**No. of occurrences**	**PDF**	**CDF**
−210			100
−209.9			99.99
−209.8			…
…			

4/7/10.5.5 For Method J5: Modify Resolution 76 (Rev.WRC-15) to call for further study on accurate modelling of non-GSO systems and a regulatory procedure for assuring compliance with the aggregate emission limits

MOD

RESOLUTION 76 (REV.WRC-~~15~~23)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

considering

a) that WRC-97 adopted, in Article **22**, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary fixed-satellite service (non-GSO FSS) systems in order to protect GSO FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;

b) that WRC-2000 revised Article **22** to ensure the limits contained therein provide adequate protection to GSO systems without placing undue constraints on any of the systems and services sharing these frequency bands;

c) that WRC-2000 decided that a combination of single-entry validation, single-entry operational and, for certain antenna sizes, single-entry additional operational epfd limits, contained in Article **22**, along with the aggregate limits in Tables 1A to 1D as contained in Annex 1 to this Resolution, which apply to non-GSO FSS systems, protects GSO networks in these frequency bands;

d) that these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D, assuming a maximum effective number of non-GSO FSS systems of 3.5;

e) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these frequency bands into GSO FSS systems should not exceed the aggregate epfd limits~~levels~~ in Tables 1A to 1D;

f) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in the frequency bands in question are to mutually coordinate the use of frequencies in these frequency bands under the provisions of No. **9.12**;

g) that the orbital characteristics of such systems are likely to be inhomogeneous;

h) that, as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems will not be directly related to the actual number of systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small;

i) that the possible misapplication of single-entry limits should be avoided,

recognizing

a) that non-GSO FSS systems are likely to need to implement interference mitigation techniques to mutually share frequencies;

b) that, on account of the use of such interference mitigation techniques, it is likely that the number of non-GSO systems will remain small, as will the aggregate interference caused by non-GSO FSS systems into GSO systems;

c) that, notwithstanding *considering d)* and *e)* and *recognizing b)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables 1A to 1D;

d) that administrations operating GSO systems may wish to ensure that the aggregate epfd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables 1A to 1D~~,~~;

e) that previous WRCs have adopted the use of a consultation meeting procedure in Resolutions **609 (Rev.WRC-07)** and **769 (WRC-19)** to ensure that non-GSO systems meet their obligations to not exceed limits on unacceptable aggregate interference to other services or applications,

noting

Recommendation ITU-R S.1588 "Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network",

resolves

1 that administrations operating or planning to operate non-GSO FSS systems, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, shall take all possible steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels given in Tables 1A to 1D to be exceeded (see No. **22.5K**);

2 that, in the event that the aggregate interference levels in Tables 1A to 1D are exceeded, administrations operating non-GSO FSS systems in these frequency bands shall take all necessary measures expeditiously to reduce the aggregate epfd levels to those given in Tables 1A to 1D, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**),

invites the ITU Radiocommunication Sector

1 to continue its studies and to develop, as a matter of urgency, ~~as appropriate,~~ a suitable methodology ~~for calculating~~ to calculate the aggregate epfd produced by all non-GSO FSS systems operating or planning to operate co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels given in Tables 1A to 1D;

2 to continue its studies and to develop, as a matter of urgency, a Recommendation on the accurate modelling ~~of~~ to calculate the aggregate interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above, and taking into account the coordination of frequency use among non-GSO systems, in order to assist administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate

epfd levels produced by their systems into GSO networks, and to provide guidance to GSO network designers on the maximum epfd↓ levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;

3 taking into account *recognizing e)*, to continue its studies and develop, as a matter of urgency, a Recommendation and/or providing the basis for a processes or ~~containing~~ procedures to be used among administrations in order to ensure that the aggregate epfd limits given in Tables 1A to 1D are not exceeded by operators of non-GSO FSS systems;

4 to work on the ~~attempt to~~ development of measurement techniques to identify the interference levels from non-GSO systems in excess of the aggregate limits given in Tables 1A to 1D, and to confirm compliance with these limits,

instructs the Director of the Radiocommunication Bureau

1 to assist in the development of the methodology referred to in *invites the ITU Radiocommunication Sector* 1 above;

2 to report to ~~a future competent conference~~ WRC-27 on the results of studies in *invites the ITU Radiocommunication Sector* ~~1 and 3~~ above~~.~~,

invites the 2027 World Radiocommunication Conference

to establish a procedure or process, based on the results of studies in *invites the ITU Radiocommunication Sector* above, whereby administrations operating or planning to operate non-GSO FSS to ensure that operations of all non-GSO FSS networks do not exceed the aggregate level of protection for GSO networks.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-~~15~~23)

…

ARTICLE 22

Space services[1]

Section II − Control of interference to geostationary-satellite systems

MOD

22.5K 8) Administrations operating or planning to operate non-geostationary-satellite systems in the fixed-satellite service in the frequency bands listed in Tables **22-1A** to **22-1D** of No. **22.5C** will apply the provisions of Resolution **76 (Rev.WRC-~~15~~23)** to ensure that the actual aggregate interference into geostationary fixed-satellite service and geostationary broadcasting-satellite service networks caused by such systems operating co-frequency in these frequency bands does not exceed the aggregate power levels shown in Tables **1A** to **1D** of Resolution **76 (Rev.WRC-~~15~~23)** In the event that an administration operating a geostationary-satellite network in conformity with the Radio Regulations identifies equivalent power flux-density levels from non-geostationary-satellite systems in the fixed-satellite service which may be in excess of the aggregate limits contained in Tables **1A** to **1D** of Resolution **76 (Rev.WRC-~~15~~23)**, the administrations responsible for the non-geostationary-satellite systems in the fixed-satellite service will apply the provisions contained in *resolves* 2 of Resolution **76 (Rev.WRC-~~15~~23)**. (WRC-~~19~~23)

4/7/11 Topic K – Modification to Resolution 553 (Rev.WRC-15) to remove certain restrictions that prevent administrations from taking effective advantage of the Resolution

4/7/11.1 Executive summary

Topic K under agenda item 7 of WRC-23 was established to remove certain restrictions in Resolution **553 (Rev.WRC-15)** that could prevent administrations from effectively using the Resolution. These restrictions can be summarized as follows:

– The restriction that makes the Resolution applicable only once by an administration regardless of whether that administration has succeeded in notifying the intended network.

– The restriction that prevents an administration to apply the Resolution if it has even one pending request under the normal procedure of coordination in the relevant frequency band.

In response to this Topic, two methods as outlined in sections 4/7/11.4 and 4/7/11.5 have been developed. Method K1 is no change and Method K2 removes the above-mentioned restrictions by modifications to the relevant paragraphs of the Attachment to Resolution **553 (Rev.WRC-15)**. This method increases the chances of effective use of the Resolution by administrations, however, it does not remove those limitations according to which an administration cannot notify more than one network under the special procedure described in the Resolution and cannot apply the Resolution if it has a notified network in the relevant frequency bands.

4/7/11.2 Background

Resolution **553 (Rev.WRC-15)** titled "*Additional regulatory measures for broadcasting-satellite networks in the frequency band 21.4-22 GHz in Regions 1 and 3...*" has been adopted to enhance equitable access to this frequency band.

Resolution **553 (Rev.WRC-15)** was adopted to provide a better situation regarding equitable access compared with the planning approach. As stated in *considering further a)* to this Resolution, a priori planning for BSS networks in this frequency band was avoided as it "freezes access according to technological assumptions at the time of planning and then prevents flexible use taking account of real-world demand and technical developments".

Some of the current provisions could contradict the above objective of the Resolution and could permanently deprive administrations of being effectively benefited from the Resolution without even once having a notified network in this frequency band.

4/7/11.3 Summary and analysis of the results of ITU-R studies

The conducted studies show that there are certain restrictions in Resolution **553 (Rev.WRC-15)** that could make it challenging to achieve the goals of the Resolution to enhance equitable access in the relevant frequency band.

The first restriction prevents an administration from applying the Resolution if it had already a submission under the Resolution that was not notified before the ITU deadline. As a consequence, even an unsuccessful effort under this Resolution will deprive an administration of additional regulatory measures predicted for equitable access to this frequency band and such administration will be treated like administrations that have notified networks in the frequency band. This situation has been experienced by two administrations that have implemented the Resolution so far. It is necessary to emphasize that the same difficulty is very likely to be repeated in the future for other administrations, especially for developing countries, many of which face economic, political, technological, and other unfavourable prevailing circumstances.

Regarding the first difficulty, it is proposed to modify the above restriction so that administrations without a notified network, will be eligible to apply the Resolution for one network at a given time until they benefit from the Resolution.

The second restriction makes Resolution **553 (Rev.WRC-15)** not applicable by an administration that has networks successfully examined under RR No. **9.34** and published under RR No. **9.38** in the relevant frequency band. Therefore, administrations cannot apply the Resolution if they have a pending request under the normal procedure of coordination.

Regarding the second difficulty, the proposal is to modify the restriction in such a way that administrations with only one submission under the normal procedure at the same orbital position as the special procedure described in the Resolution are still eligible to apply the Resolution. The objective of this modification is to allow administrations to make effort for achieving characteristics beyond those specified in the Resolution while not preventing them from submitting a parallel request under the special procedure.

The following reasons explain the necessity of the second proposed modification:

– Submission under the normal procedure is the only option through which an administration can make effort to achieve a network that has characteristics beyond those specified in Resolution **553 (Rev.WRC-15)** such as national coverage and national service area.

– Submission under the normal procedure leads to a greater number of coordination requirements which is more difficult to be completed compared to the case of special procedures, however, the proposed modification allows administrations to work on both requests in parallel.

– Having a pending request and having a notified network are not of the same state so they can be treated differently at least in the case of one pending request of an administration at the same orbital position as the special procedure described in the Resolution.

The result of the studies indicate that the proposed modifications will not adversely affect existing allocations and services due to the following reasons:

– According to the current provisions an administration can notify a maximum of one network under the special procedure and this limitation will remain.

– According to the current provisions, administrations with notified networks in the relevant frequency band are not eligible to apply the Resolution and this limitation will remain.

4/7/11.4 Methods to satisfy Topic K

There are two methods proposed under agenda item 7, Topic K. Method K1 is no change and Method K2 removes certain restrictions in Resolution **553 (Rev.WRC-15)** through modifications to the relevant paragraphs of the Attachment to this Resolution.

4/7/11.4.1 Method K1

No changes to Resolution **553 (Rev.WRC-15)**.

4/7/11.4.2 Method K2

This method proposes to modify paragraphs 1 and 2 of the Attachment to Resolution **553 (Rev.WRC-15)** to remove the intended restrictions in the Resolution.

4/7/11.5 Regulatory and procedural considerations

4/7/11.5.1 For Method K1

NOC

RESOLUTION 553 (REV.WRC-15)

Additional regulatory measures for broadcasting-satellite networks in the frequency band and 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band

4/7/11.5.2 For Method K2

MOD

RESOLUTION 553 (REV.WRC-~~15~~23)

Additional regulatory measures for broadcasting-satellite networks in the frequency band and 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band

The World Radiocommunication Conference (~~Geneva, 2015~~Dubai, 2023),

…

ATTACHMENT TO RESOLUTION 553 (REV.WRC-~~15~~23)

Special procedure to be applied for an assignment for a BSS system in the frequency band 21.4-22 GHz in Regions 1 and 3

1 The special procedure described in this attachment can only be applied ~~once~~to one network at a time (except as described in § 3 below) by an administration or an administration acting on behalf of a group of named administrations when for the frequency band 21.4-22 GHz none of those administrations have~~-~~:

– a network in the MIFR, notified under Article **11** or

– more than one network successfully examined under No. **9.34** and published under No. **9.38** at the same orbital position as the one of this special procedure or

– a network successfully examined under No. **9.34** and published under No. **9.38** at an orbital position different from the one of this special procedure.

~~for the frequency band 21.4-22 GHz.~~ In case of countries complying with § 3 below, the special procedure~~s~~ described in this attachment can also be applied[1] by an administration when this administration has networks in the MIFR, notified under Article **11** or more than one network successfully examined under No. **9.34** and published under No. **9.38** at the same orbital position as the one in this special procedure or a network successfully examined under No. **9.34** and published under No. **9.38** at an orbital position different from the one in this special procedure for the frequency band 21.4-22 GHz, but which, combined, do not include its entire territory in the service area. Each one of the administrations in a group will lose its right to apply this special procedure~~s~~ individually or as a member of another group.

2 In the case that an administration that has already made a submission under this special procedure, either individually or as a part of a group (except as described in § 3 below), at a later stage submits a new submission, this new submission cannot benefit from this special procedure except if the network associated with the previous submission under this special procedure has not been notified prior to the ITU regulatory deadline.

2*bis* In order to benefit from application of the special procedure, the submitting administration may either withdraw or modify its submission previously sent to the Radiocommunication Bureau (BR) under the normal procedure and successfully examined under No. **9.34** and published under No. **9.38**. In the case of modification, it shall be within the envelope characteristics of the previous submission in order to retain the original date of receipt. If the previous assignment includes several frequency bands, the modification can be applied to the frequency band 21.4-22 GHz to be separated as an independent submission under the special procedure.

…

Reasons: For an administration that cannot apply the Resolution because of their previous submissions, to be eligible to benefit from the Resolution through withdrawal or modification of the previous submissions.

[1] The number of submissions shall not exceed the number of orbital locations for national assignments in the Appendix **30** Plan, reduced by the number of orbit locations of that administration for networks in the MIFR, submissions notified under Article **11** and submissions successfully examined under No. **9.34** and published under No. **9.38**.

CHAPTER 5

General issues

(Agenda items 2, 4 and 9.1 topics a), b), c) and d))

CONTENTS

Agenda item 2

2 to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with further resolves *of Resolution **27 (Rev.WRC-19)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in* resolves *of that Resolution;*

Resolution **27 (Rev.WRC-19)** – *Use of incorporation by reference in the Radio Regulations*

5/2/1 ITU-R Recommendations incorporated by reference in the Radio Regulations which have been revised and approved since WRC-19

According to Resolution **27 (Rev.WRC-19)**, the CPM Report shall include a list of those ITU-R Recommendations incorporated by reference in the Radio Regulations (RR), which have been revised and approved during the elapsed study period. Since WRC-19, the following ITU-R Recommendation falls in this category:

– Recommendation ITU-R M.585-8 "Assignment and use of identities in the maritime mobile service";

Administrations are invited to examine the most recent version of the above ITU-R Recommendation, namely Recommendation ITU-R M.585-9, with a view to considering the possible updating of the relevant references in the RR.

It should be noted that future possible draft revisions of some other ITU-R Recommendations, also incorporated by reference in the RR, may be in the course of the ITU-R approval process to be ended before WRC-23. Further information about the approval or otherwise of these Recommendations will be provided later on.

It should also be noted that some ITU-R Recommendations are incorporated by reference in RR provisions or WRC Resolutions that are being or could be considered under specific WRC-23 agenda items or topics. For instance:

– Recommendation ITU-R TF.460-6 in relation with Resolution **655 (WRC-15)** and RR No. **1.14**, as appropriate;

– Recommendations ITU-R S.672-4 and ITU-R S.1428-1 under WRC-23 agenda item 1.19;

– Recommendations ITU-R RA.769-2, ITU-R RA.1513-2, ITU-R M.1583-1 and ITU-R RA.1631-0 under WRC-23 agenda item 1.13.

The cross-reference list of the regulatory provisions, including footnotes and Resolutions, incorporating ITU-R Recommendations is contained in the 2020 Edition of RR Volume **4** together with the text of the ITU-R Recommendations incorporated by reference.

5/2/2 Lists of RR provisions and footnotes containing references to ITU-R Recommendations or to WRC Resolutions containing references to ITU-R Recommendations

According to Resolution **27 (Rev.WRC-19)**, the Director of the Radiocommunication Bureau is instructed:

"to identify the provisions and footnotes of the Radio Regulations containing references to ITU-R Recommendations and make suggestions on any further action to the second session of the Conference Preparatory Meeting (CPM) for its consideration and inclusion in the CPM Report".

The list of the RR provisions and footnotes containing references to ITU-R Recommendations is provided in Table 5/2-1.

"to identify the provisions and footnotes of the Radio Regulations containing references to WRC Resolutions that contain references to ITU-R Recommendations and make suggestions on any further action to the second session of the CPM for its consideration and inclusion in the CPM Report".

The list of the RR provisions and footnotes containing references to WRC Resolutions that contain references to ITU-R Recommendations is provided in Table 5/2-2.

Administrations are invited to submit proposals to WRC-23, taking into account the CPM Report.

TABLE 5/2-1

List of RR provisions and footnotes containing references to ITU-R Recommendations

RR provisions or footnotes	**Recommendation ITU-R ***	**Included in RR Volume 4**
No. **5.54A**	RS.1881 (most recent version of)	NO
No. **5.79**	M.2010 (most recent version of)	NO
No. **5.82C**	M.2010 (most recent version of)	NO
No. **5.208A**	RA.769 (most recent version of)	**-**
No. **5.228**	M.1371 (most recent version of)	NO
No. **5.279A**	**RS.1260-2**	**YES**
Nos. **5.287**, **5.288**	**M.1174-4**	**YES**
No. **5.372**	**RA.769-2**, **RA.1513-2**, **M.1583-1**, **RA.1631-0**	**YES (all)**
No. **5.391**	**SA.1154-0**	**YES**
No. **5.447E**	**F.1613-0**	**YES**
No. **5.474B**	**RS.2066-0**	**YES**
No. **5.474C**	**RS.2065-0**	**YES**
Nos. **5.504B, 5.504C**, **5.508A**, **5.509A**	**M.1643-0**	**YES**
No. **5.511C**	**S.1340-0**	**YES**
No. **5.530A**	P.452 (most recent version of), BO.1898 (most recent version of)	NO (both)
No. **5.536A**	SA.1862 (most recent version of)	NO
No. **5.551H**	**S.1586-1, RA.1631-0**	**YES (both)**
No. **5.559B**	M.2057 (most recent version of)	NO
Nos. **16.2, 16.6**	SM.1139 (most recent version of)	NO
No. **19.48**	**M.1172-0**	**YES**
No. **19.83**	**M.476-5, M.625-4**	**YES (both)**
No. **19.96A**	**M.476-5**	**YES**
Nos. **19.99**, **19.102**	**M.585-8 Annex 1 *****	**YES**
No. **19.108A**	M.585 (most recent version of)	**-**
No. **19.111**	**M.585-8 Annex 1 *****	**YES**

RR provisions or footnotes	**Recommendation ITU-R ***	**Included in RR Volume 4**
Nos. **21.2.2**, **21.4.1** ****	SF.765 (most recent version of)	NO
No. **22.5A**	**S.1256-0**	**YES**
Table **22-1A**, Table **22-1B**, Table **22-1C** (and No. **22.5C.6**)	**S.1428-1**	**YES**
Table **22-1D** (and No. **22.5C.11)**	**BO.1443-3 Annex 1**	**YES**
Table **22-2** (and No. **22.5D.3),** Table **22-3** (and No. **22.5F.3)**	**S.672-4**	**YES**
No. **22.5L.1**	S.1503 (most recent version of)	NO
No. **22.36**	S.732 (most recent version of)	NO
No. **25.6**	M.1544 (most recent version of)	NO
No. **29.12**	RA.769 (most recent version of)	NO
No. **32.5**	M.493 (most recent version of) M.541 (most recent version of)	NO -
No. **32.7**	M.1172 (most recent version of)	-
No. **32.13E**	M.541 (most recent version of)	-
Nos. **32.19B**, **32.21A**	M.493 (most recent version of) M.541 (most recent version of)	NO -
No. **32.53C**	M.493 (most recent version of)	NO
Nos. **33.8**, **33.20A**	M.493 (most recent version of) M.541 (most recent version of)	NO -
No. **34.1**	**M.633-4**	**YES**
Nos. **34.2, 51.25**	M.493 (most recent version of)	NO
No. **51.35**	**M.541-10**	**YES**
No. **51.41**	**M.476-5**, **M.625-4** M.627 (most recent version of)	**YES (both)** NO
No. **51.71**	M.1171 (most recent version of) M.1170 (most recent version of)	- NO
No. **51.77**	**M.489-2**	**YES**
No. **52.112**	**M.541-10** M.493 (most recent version of)	**YES** NO
Nos. **52.149**, **52.153**	**M.541-10**	**YES**
No. **52.181**	**M.1173-1**	**YES**
Nos. **52.192**, **52.195**, **52.213, 52.224**	**M.1171-0**	**YES**
No. **52.229**	**M.1173-1**	**YES**
No. **52.231**	**M.489-2**	**YES**
Nos. **52.234**, **52.240**	**M.1171-0**	**YES**
No. **52.264**	M.1798 (most recent version of)	NO
No. **54.2**	M.493 (most recent version of) **M.541-10**	NO **YES**
No. **55.1**	M.1170 (most recent version of)	NO
No. **56.2**	**M.492-6**	**YES**
No. **57.1**	**M.1171-0**	**YES**
Appendix **1** (§ 1 and § 2)	**SM.1138-3**	**YES**

RR provisions or footnotes	Recommendation ITU-R *	Included in RR Volume 4
Appendix **3**:		
§ 4	SM.329 (most recent version of)	NO
§ 9	M.1177 (most recent version of)	NO
§ 10	SM.329 (most recent version of), M.1177 (most recent version of)	NO (both)
§ 13 (Note 14 to Table I)	M.1177 (most recent version of)	NO
Annex 1 (§ 1 and § 3)	SM.1541 (most recent version of)	NO
Appendix **4**:		
Annex 1, Footnotes to Tables 1 and 2 (§ 1)	SF.675 (most recent version of)	NO
Annex 1, Table 2, items 3.5.c.a, 3.5.d, 3.5.e, 3.5.f	F.1500 (most recent version of)	NO
Annex 2, Information related to the data listed in the following tables	S.1503 (most recent version of), SM.1413 (most recent version of)	NO (both)
Annex 2, Footnotes to Tables A, B, C, D (§ 2)	SF.675 (most recent version of)	NO
Annex 2, Table B, items B.4.a.3.a.1, B.4.a.3.a.2	SM.1413 (most recent version of)	NO
Annex 2, Table B, item B.5.d, Table C, item C.10.d.9	S.1855 (most recent version of)	NO
Annex 2, Table C, item C.11.b	**M.1187-1**	**YES**
Appendix **5**, Annex 1:		
§ 1.2.1	M.1143 (most recent version of)	NO
§ 1.2.3.1, Note 6	SF.357 (most recent version of)	NO
§ 1.2.3.2	M.1143 (most recent version of)	NO
Appendix **7**, § 1.4, footnote 4	SM.1448 **	NO
Appendix **7**, Annex 4, § 1, Annex 5, § 2.1 and Annex 6, § 4	SM.1448 (most recent version of)	NO
Appendix **10**, footnote 3	M.1172 (most recent version of)	-
Appendix **15**:		
Table 15-2	**M.690-3**	**YES**
Legend: AIS	M.1371 (most recent version of)	NO
Appendix **17**		
Part A (notes *p), t)* and *v)*)	M.1798 (most recent version of)	NO
Part A (note *pp)*)	M.2058 (most recent version of)	NO
Part B, Section I (§ 2; § 6 a) and b))	**M.1173-1**	**YES**
Part B, Section IV (Note 1 to the table)	M.1798 (most recent version of)	NO
Appendix **18**:		
NOTE B (prior to the table)	**M.1084-5 Annex 4, Tables 1 and 3** M.1842 (most recent version of)	**YES** NO
General notes, e)	M.1084 (most recent version of) **M.489-2**	- **YES**
Specific notes, f)	M.2135 (most recent version of)	NO
Specific notes, l)	M.1371 (most recent version of)	NO
Specific notes, r)	M.2135 (most recent version of)	NO
Specific notes, s)	M.1371 (most recent version of)	NO

RR provisions or footnotes	Recommendation ITU-R *	Included in RR Volume 4
Specific notes, w)	M.1084 (most recent version of), M.2092 (most recent version of)	- NO
Specific notes, wa)	M.1084 (most recent version of), M.1842 (most recent version of)	- NO
Specific notes, z)	M.2092 (most recent version of)	NO
Appendix **30**:		
Article 11, Col. 6	BO.1445	NO
Article 11, Col. 9; Annex 3, § 2.4.1	BO.1213 **	NO
Annex 5, § 2.1	P.837-1 **, P.618-5 **	NO (both)
Annex 5, § 3.1.1	F.405-1 (suppressed by RA-03)	NO
Annex 5, § 3.2.4	BO.1212	NO
Annex 5, § 3.4	**BO.1293-2** BO.1297	**YES** NO
Annex 5, § 3.7.2	BO.1213 **	NO
Annex 5, § 3.13.3	BO.1445	NO
Annex 6, Part A, § 1.1	BO.1213 **, S.580-5 **	NO (both)
Annex 6, Part B, § 1.5	S.483-3	NO
Annex 6, Part B, § 1.6, footnote 54	BT.500-7 **	NO
Annex 6, Part B, § 2.1	S.465-5 **	NO
Appendix **30A**:		
Article 9A, Col. 6	BO.1296	NO
Article 9A, Col. 9	BO.1295	NO
Annex 3, § 2.1	P.837-1 **	NO
Annex 3, § 2.2	P.618-5 **, P.841 ** **P.838-3**	NO (both) **YES**
Annex 3, § 2.4	P.618-5 **	NO
Annex 3, § 3.3	**BO.1293-2** BO.1297	**YES** NO
Annex 3, § 3.5.3	BO.1295	NO
Annex 3, § 3.7.3	BO.1296	NO
Annex 3, § 3.9	BO.1212	NO
Appendix **30B**:		
Annex 1, Section A. § 1.2	P.676-7 **, P.618-9 **	NO (both)
Annex 1, Section A, § 1.3	P.837-5 **	NO

* Numbers in bold indicate that these versions of the Recommendations are incorporated by reference and included in RR Volume 4.

** This is not the most recent version of this Recommendation.

*** This Recommendation incorporated by reference has been revised and approved since WRC-19.

**** In these RR provisions, the reference to "(see Resolution **27 (Rev.WRC-03)**)" may be considered as redundant and deleted.

TABLE 5/2-2

List of RR provisions and footnotes containing references to WRC Resolutions that contain references to ITU-R Recommendations

RR provisions or footnotes	WRC Resolution	Recommendation ITU-R*	Included in RR Volume 4
No. **5.547**	**75 (WRC-2000) ****	SA.1157 **, SA.1396	NO (both)
-	**75 (Rev.WRC-12)**	SA.1157 **, SA.1396, F.1760, F.1765	NO (all)
No. **22.5K**	**76 (Rev.WRC-15)**	S.1588 S.1428 **, BO.1443 Annex 1 **	NO -
No. **59.8**	**85 (WRC-03)**	S.1503 **	NO
Nos. **5.444**, **5.444A**	**114 (Rev.WRC-15)**	S.1342	NO
No. **59.6**	**122 (Rev.WRC-2000) ****	RA.769 ** SA.1029 ****	- NO
No. **59.8**	**122 (Rev.WRC-03) ****	SF.1481 *****, F.1500	NO (both)
No. **5.552A**; Appendix **4**, Annex 1, Table 2, item 1.14.r	**122 (Rev.WRC-19)**	F.1500, SF.1843	NO (both)
No. **22.5CA**	**140 (Rev.WRC-15)**	S.1715	NO
No. **5.516B**	**143 (WRC-19)**	S.524 (most recent version of), S.1594 (most recent version of), S.1783 (most recent version of)	NO (all)
No. **59.8**	**145 (Rev.WRC-03) ****	RA.769 ** SF.1601 **, F.1609 **	- NO (both)
No. **5.537A**	**145 (Rev.WRC-19)**	SF.1601 **, F.1609 **	NO (both)
No. **5.457**; Appendix **4**, Annex 1, Table 2, items 1.14.d, 1.14.e	**150 (WRC-12)**	F.1891, F.2011	NO (both)
No. **5.484B**	**155 (WRC-15) ****	RA.769 (most recent version of), RA.1513 (most recent version of)	-
-	**155 (Rev.WRC-19)**	RA.769 (most recent version of), RA.1513 (most recent version of)	-
No. **5.530E**; Appendix **4**, Annex 1, Table 2, items 1.14.f, 1.14.g, 1.14.h	**165 (WRC-19)**	P.618 **, SF.1395	NO (both)
Nos. **5.532AA**, **5.534A**; Appendix **4**, Annex 1, Table 2, items 1.14.i, 1.14.j	**166 (WRC-19)**	P.452 (most recent version of), P.452 **, P.618 **, SF.1395	NO (all)
No. **5.543B**; Appendix **4**, Annex 1, Table 2, items 1.14.k, 1.14.l, 1.14.m, 1.14.n	**167 (WRC-19)**	P.452 (most recent version of), P.618 **, SF.1395	NO (all)
No. **5.550D**; Appendix **4**, Annex 1, Table 2, items 1.14.o, 1.14.p, 1.14.q	**168 (WRC-19)**	P.452 (most recent version of), P.676 **	NO (both)

RR provisions or footnotes	**WRC Resolution**	**Recommendation ITU-R***	**Included in RR Volume 4**
No. **5.517A**; Appendix **4**, Annex 2, Table A, items A.20, A.20.a, A.21, A.21.a, A.22, A.22.a	**169 (WRC-19)**	SM.1541 **	NO
No. **5.265**	**205 (Rev.WRC-19)**	SM.1051 **, M.1478 **	NO (both)
No. **5.351A**	**212 (Rev.WRC-07) ****	-	-
No. **5.388**	**212 (Rev.WRC-15) ****	-	-
-	**212 (Rev.WRC-19)**	M.1036 (latest version of), F.1336 **	NO (both)
Nos. **5.162A**, **5.291A**	**217 (WRC-97)**	M.1085-1, M.1226, M.1227 **	NO (all)
No. **59.8**	**221 (Rev.WRC-03) ****	M.1456, M.1457 **	NO (both)
No. **5.388A**; Appendix **4**, Annex 1, Table 2, items 1.14.b, 1.14.c	**221 (Rev.WRC-07)**	M.1456, M.1457 **	NO (both)
Nos. **5.341A**, **5.341B**, **5.341C**, **5.384A**, **5.388**	**223 (Rev.WRC-15) ****	M.819 **, M.1308, M.1457 **, M.1645, M.2012 **	NO (all)
Nos. **5.346**, **5.346A**, **5.429B**, **5.429D**, **5.429F**, **5.441A**, **5.441B**	**223 (Rev.WRC-19)**	M.819 **, M.1308, M.1457 **, M.1645, M.2012 **	NO (all)
Nos. **5.286AA**, **5.295**, **5.296A**, **5.308A**, **5.312A**, **5.316B**, **5.317A**	**224 (Rev.WRC-19)**	M.819 **, M.1036 **, M.1645	NO (all)
Nos. **5.446A**, **5.447**, **5.447F**, **5.450A**, **5.453**	**229 (Rev.WRC-19)**	RS.1166 **, S.1426, M.1450 (most recent version of), M.1454, RS.1632, M.1653 M.1652 ** **M.1652-1 Annex 1 and Annex 5**	NO (all) - YES
No. **5.559AA**	**241 (WRC-19)**	M.2003 **, M.2083	NO (both)
Nos. **5.532AB**, **5.536A**, **5.536B**	**242 (WRC-19)**	SM.329 **, M.2083, M.2101	NO (all)
Nos. **5.550B**, **5.553B**	**243 (WRC-19)**	M.2083, M.2101	NO (both)
No. **5.553A**	**244 (WRC-19)**	M.2083	NO
No. **32.10A**	**349 (Rev.WRC-19)**	M.493 (most recent version of)	NO
Nos. **52.101**, **52.189**	**354 (WRC-07)**	M.1171, M.1172	-
No. **59.8**	**413 (WRC-03) ****	SM.1009 (most recent version of), BS.1114 **	NO (both)
No. **5.197A**	**413 (Rev.WRC-07) ****	SM.1009 (most recent version of), BS.1114 **	NO (both)
-	**413 (Rev.WRC-12)**	SM.1009 (most recent version of), BS.1114 **	NO (both)
No. **5.327A**	**417 (Rev.WRC-15)**	**M.2013-0 Annex 1**	YES
Nos. **5.444B**, **5.446C**, **5.446D**	**418 (Rev.WRC-19)**	M.1828, M.1829, M.2122	NO (all)

RR provisions or footnotes	**WRC Resolution**	**Recommendation ITU-R***	**Included in RR Volume 4**
No. **5.436**	**424 (WRC-15)**	M.2067, M.2085	NO (both)
No. **5.134**; Appendix **11**, Part B, § 1.1	**517 (Rev.WRC-19)**	BS.1514 **	NO
Appendix **11,** Part C, § 1.1, § 2.5	**543 (Rev.WRC-19)**	BS.1514 **, BS.1615 **	NO (both)
No. **A.9.8**; Appendix **5**, Table 5-1, No. **9.7**, 6*bis*)	**553 (WRC-12) ****	BO.1900	NO
-	**553 (Rev.WRC-15)**	BO.1900	NO
No. **5.329**	**608 (Rev.WRC-19)**	M.1902 **	NO
No. **21.18**	**609 (Rev.WRC-03) ****	M.1642 **	-
No. **5.328A**	**609 (Rev.WRC-07)**	**M.1642-2**	YES
Nos. **5.132A**, **5.145A**, **5.161A**; Appendix **4**, Annex 1, Table 1, items 3A1, 3A2	**612 (Rev.WRC-12)**	P.368-9 **, P.372-10 **	NO (both)
No. **1.14**	**655 (WRC-15)**	**TF.460-6**	YES
No. **29A.1**	**673 (Rev.WRC-12)**	RS.1859 **, RS.1883 **	NO (both)
Nos. **5.389A**, **5.389C**	**716 (Rev.WRC-2000) ****	F.1098 **	NO
-	**716 (Rev.WRC-12)**	F.1098 **, F.1335	NO (both)
No. **5.564A**	**731 (Rev.WRC-19)**	RA.769 **, RA.1513 ** RS.2017	- NO
No. **5.208B**	**739 (Rev.WRC-19)**	S.1586 ** RA.1513 **, M.1583 ** RA.1631 **RA.1631-0**	NO - - YES
No. **5.443B**; Appendix **4**, Annex 2, Table A, items A.17.b.1, A.17.b.3	**741 (Rev.WRC-15)**	RA.769 **, RA.1513 ** M.1583 **, RA.1631 **M.1583-1, RA.1631-0**	- - YES
No. **5.379D**	**744 (Rev.WRC-07)**	M.1799	NO
No. **5.444B**	**748 (Rev.WRC-19)**	**P.525-4, P.526-15, M.1827-1**	YES (all)
Nos. **5.316B**, **5.317A**	**749 (Rev.WRC-19)**	BT.1368 **, BT.1368 (most recent version of), BT.1895 (most recent version of), BT.2033 **, BT.2033 (most recent version of)	NO (all)
No. **5.338A**	**750 (Rev.WRC-19)**	RS.2017	NO
Nos. **5.312A**, **5.317A**	**760 (Rev.WRC-19)**	M.1036 **, BT.1368 **, BT.1368 (most recent version of), BT.1895 (most recent version of), BT.2033 **, BT.2033 (most recent version of), M.2090, M.2090 (most recent version of)	NO (all)

RR provisions or footnotes	**WRC Resolution**	**Recommendation ITU-R***	**Included in RR Volume 4**
Nos. **5.346**, **5.346A**; Appendix **5**, Table 5-1, No. **9.11**	**761 (Rev.WRC-19)**	M.1459	NO
No. **11.32A.2**	**762 (WRC-15)**	BO.1213 **	NO
No. **22.5M**	**769 (WRC-19)**	S.1503 **	NO
Nos. **5.550C**, **22.5L.1**, **22.5M**	**770 (WRC-19)**	P.618 **, P.618-13 S.672 ** S.1503 **, S.1503 (latest version of), S.2131-0 **	NO (both) - NO (all)
Appendix **5**, Table 5-1, No. **9.7**, 7) and 8)	**901 (Rev.WRC-07) ** **	-	-
-	**901 (Rev.WRC-15)**	S.1780	NO
Nos. **5.457A**, **5.457B**, **5.506A**, **5.506B**, **59.8**	**902 (WRC-03)**	SF.1650 **	NO

* Numbers in bold indicate that this version of the Recommendations are incorporated by reference and included in RR Volume **4**.

** This is not the most recent version of this Recommendation or Resolution.

*** This Recommendation incorporated by reference has been revised and approved since WRC-19.

**** This Recommendation has been replaced by Recommendation ITU-R RS.1029 and is not the most recent version.

***** This Recommendation was suppressed on 12 January 2012 (see CACE/556 of 13 January 2012).

Agenda item 4

*4 in accordance with Resolution **95 (Rev.WRC-19)**, to review the Resolutions and Recommendations of previous conferences with a view to their possible revision, replacement or abrogation;*

Resolution **95 (Rev.WRC-19)** – *General review of the Resolutions and Recommendations of world administrative radio conferences and world radiocommunication conferences*

Resolution **95 (Rev.WRC-19)** instructs the Director of the Radiocommunication Bureau:

> *"1 to conduct a general review of the Resolutions and Recommendations of previous conferences and, after consultation with the Radiocommunication Advisory Group and the chairmen and vice-chairmen of the radiocommunication study groups, submit a report to the second session of the Conference Preparatory Meeting (CPM) in respect of* resolves *and* invites future competent world radiocommunication conferences *1, including an indication of any associated agenda items;*
>
> *2 to include in the above report, with the cooperation of the chairmen of the radiocommunication study groups, the progress reports of ITU-R studies on the issues which have been requested by Resolutions and Recommendations of previous conferences but which are not placed on the agendas of the forthcoming two conferences,"*

5/4/1 Review of WARC/WRC Resolutions and Recommendations

In response to Resolution **95 (Rev.WRC-19)**, the Bureau performed an initial study in this respect with consultation as appropriate with the chairmen and vice-chairmen of ITU-R Study Groups (SGs). The study is presented to CPM23-2, for consideration (Document CPM23-2/7). The CPM23-2 received additional contributions from membership. Annex 5/4-1 contains the result of the consideration during the CPM23-2 taking into account the comments provided in these contributions[30]. Regional organizations and administrations are still in the process of preparing for WRC-23 agenda item 4. Additional information on views and proposals may be available on websites of ITU and regional organizations.

The CPM wishes to emphasize that the indications in the column "Possible follow-up" should not be considered as proposals for the work of the conference, but merely as suggestions concerning the possible course of action to be taken in respect of the relevant Resolution/Recommendation.

The CPM refrained from indicating any possible course of action in respect of those Resolutions/Recommendations that are explicitly on the WRC-23 agenda (see Resolution **811 (WRC-19)**) or on the WRC-27 preliminary agenda (see Resolution **812 (WRC-19)**), or for which modifications are foreseen in the draft CPM Report to WRC-23.

Annex: 1

[30] Resolutions in grey shaded rows are those explicitly on the current and future agenda items as specified in Resolution **811 (WRC-19)** and Resolution **812 (WRC-19)**.

ANNEX 5/4-1

Review of WARC/WRC Resolutions and Recommendations in response to Resolution 95 (Rev.WRC-19)

PART I – WARC/WRC RESOLUTIONS

Res. No.	**Subject / Title**	**Remark**	**Possible follow-up under WRC-23 agenda item 4**
1	Notification of frequency assignments	(Rev.WRC-97) Still relevant; the necessity of footnote 1 associated with the title may need to be considered and possibly be deleted. (Referred to in RR App. **26**, No. 26/5.2)	NOC/MOD
2	Equitable use of GSO and other satellite orbits and frequency bands for space services	(Rev.WRC-03) Still relevant. (Referred to in Res. **4 (Rev.WRC-03)**, Res. **170 (WRC-19)**, Res. **172 (WRC-19)** and Res. **173 (WRC-19)**)	NOC
4	Period of validity of frequency assignments to GSO and other satellite orbits' space systems	(Rev.WRC-03) Still relevant. (Referred to in RR App. **4**, Annex 2, item A.2.b)	NOC
5	Technical cooperation – Propagation in tropical areas	(Rev.WRC-15) Still relevant; it may be appropriate to update the organization's name (URTNA) referred in *resolves to instruct the Secretary-General.*	NOC/MOD
7	National radio-frequency management	(Rev.WRC-19) Still relevant; supported by BR and studies in SG 1 with respect to spectrum management systems for developing countries; also supported by BR world and regional seminars.	NOC
10	Wireless communications by the International Red Cross and Red Crescent Movement	(Rev.WRC-2000) Still relevant.	NOC
12	Assistance and support to Palestine	(Rev.WRC-19) Still relevant; may be modified depending on the progress made in the implementation of this resolution, as expected to be indicated in the Director's Report to WRC-23 and in other relevant information.	NOC/MOD
13	Formation of call signs	(Rev.WRC-97) Still relevant; the implementation of this resolution will be reported to WRC-23 in the Director's Report, but no consequential modifications to Res. **13 (Rev.WRC-97)** were identified. (Referred to in RR No. **19.32**)	NOC
15	International cooperation in space radiocommunications	(Rev.WRC-03) Still relevant; implemented through liaison with ITU-D study groups and BR/BDT seminars/workshops.	NOC
18	Identification and announcement of ships and aircraft position of States non-parties in an armed conflict	(Rev.WRC-15) Still relevant; modification may be considered to reflect current aeronautical and maritime practices, as well as the developments under WRC-23 agenda item 1.11, especially concerning the removal of telegraphy, mentioned in *resolves* 1.	NOC/MOD

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
20	Technical cooperation – Aeronautical service	(Rev.WRC-03) Still relevant. (Referred to in Res. **724 (WRC-07)**)	NOC
22	Measures to limit unauthorized uplink transmissions from earth stations	(WRC-19) Still relevant; Res. **958 (WRC-15)** referred to in *considering a)* has been abrogated by WRC-19.	NOC/MOD
25	Operation of Global Satellite Systems for personal communications	(Rev.WRC-03) Still relevant. (Referred to in Res. **156 (WRC-15)**)	NOC
26	Review of footnotes	(Rev.WRC-19) Still relevant (permanent agenda item at each WRC (see WRC-23 agenda item 8)). (Referred to in Res. **811 (WRC-19)**, Res. **812 (WRC-19)** and Rec. **34 (Rev.WRC-12)***) (* Reference(s) to former version of this Res.)	-
27	Use of incorporation by reference in the Radio Regulations (principles)	(Rev.WRC-19) Still relevant (permanent agenda item at each WRC (see WRC-23 agenda item 2)). (Referred to in RR Nos. **21.2.2***, **21.4.1***, Res. **811 (WRC-19)** and Res. **812 (WRC-19)**) (* Reference(s) to former version of this Res.)	-
32	Regulatory procedures for frequency assignments to non-geostationary-satellite networks or systems identified as short-duration mission not subject to the application of Section II of Article **9**	(WRC-19) Still relevant; Section 4 of the Annex may be reviewed to take into account the corresponding Rules of Procedure under WRC-23 agenda item 9; the *instructs the Director of the Radiocommunication Bureau* 3 "to report to WRC-23 on the implementation of this Resolution" should be reviewed. (Referred to in RR Nos. **5.203C**, **5.218A**, **A.9.4**, **9.3.1**, **A.11.2**, App. **4**, Annex 2, items A.1.g, A.2.a, A.2.b, A.24.a and Res. **660 (WRC-19)**)	NOC/MOD
34	BSS in the band 12.5-12.75 GHz in R3	(Rev.WRC-19) Still relevant. (Referred to in RR App. **30**, footnote 31)	NOC
35	A milestone-based approach for the implementation of frequency assignments to space stations in a non-geostationary-satellite system in specific frequency bands and services	(WRC-19) Still relevant; is being considered with possible MOD under WRC-23 agenda item 7, Topics A and B. (Referred to in RR No. **11.51** and App. **4**, Annex 2, item A.23)	-
40	Use of one space station to bring frequency assignments to geostationary-satellite networks at different orbital locations into use within a short period of time	(Rev.WRC-19) Still relevant. Actions on this resolution could be based on the Director's Report to WRC-23 under agenda item 9. (Referred to in RR Nos. **11.44B** and **11.49.1**; App. **30**, footnote 20*bis*; App. **30A**, footnote 24*bis* and App. **30B**, footnote 14*ter*)	NOC/MOD

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
42	Interim systems in R2 (BSS and FSS) in AP**30/30A** bands	(Rev.WRC-19) Still relevant; although rarely used. (Referred to in RR Nos. **A.9.3*** and **A.11.1***; App. **30**, footnote 20, § 5.2.1 *e)*, § 5.2.2.2, § 10.2, § 9/GR *a)*; App. **30A**, § 3.3, § 4.2.1, § 5.2.1 *e)*, § 5.2.2.2, § 9.2 remark 9/GR *a)* and Annex 1, sections 3 and 5) (* Reference(s) to former version of this Res.)	NOC
49	Administrative due diligence	(Rev.WRC-19) Still relevant; requires updates to remove obsolete provisions and inconsistency with current practice; for the *resolves*, change from "… orbit positions …" to "… orbital positions"; for references to App. **30**, **30A** and **30B**, remove the "(Rev.WRC-19)" part for consistency. (Referred to in RR Nos. **A.9.4**, **A.11.2**, **11.44.1**, **11.48**, **59.4***, **59.6***, App. **30**, footnote 1*bis*, footnote 3*, § 4.1.3*bis**, § 4.1.25 *b)**, § 4.2.6*bis**, § 11.2 7*b)**, Annex 1 section 6, App. **30A**, footnote 3*bis*, § 4.1.3*bis**, § 4.1.25 *b)**, § 4.2.6*bis**, App. **30B** footnote 2*, § 6.31*bis**, footnote 12*, Res. **55 (Rev.WRC-19)**, Res. **81 (Rev.WRC-15)*** and Res. **558 (WRC-19)***) (* Reference(s) to former version of this Res.)	NOC/MOD
55	Electronic submission of notice forms for satellite networks, earth stations and radio astronomy stations	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **59.6*** and **59.10***) (* Reference(s) to former version of this Res.)	NOC
63	Protection from ISM equipment	(Rev.WRC-12) Still relevant; *invites ITU-R* 1 and 2 may need to be updated in view of the recent developments between ITU-R Study Group 1 and CISPR (see **Doc. 1/1**)	NOC/MOD
72	Regional preparations	(Rev.WRC-19) Still relevant. (Referred to in Res. **804 (Rev.WRC-19)**)	NOC
74	Continuing updating of technical bases of Appendix **7**	(Rev.WRC-03) Still relevant. (Referred to in Res. **75 (Rev.WRC-12)**)	NOC
75	Development of the technical basis for determining the coordination area for coordination of a receiving ES in the SRS (deep space) with transmitting stations of HD applications in the FS in bands 31.8-32.3 GHz and 37-38 GHz	(Rev.WRC-12) Still relevant; related to Resolution **74 (Rev.WRC-03)**. The ITU-R studies invited in this Resolution have been completed. Based on item 1 of *resolves* of Resolution **95 (Rev.WRC-19)**, this Resolution could be suppressed. (Referred to in RR No. **5.547***) (* Reference(s) to former version of this Res.)	NOC/SUP

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
76	Development of calculation methodologies concerning aggregate epfd produced by non-GSO in the band 10.7-30 GHz	(Rev.WRC-15) *Resolves* part still relevant; *invites ITU-R* may need to be updated taking account of Recommendations ITU-R S.1588 and ITU-R S.1503 in force; Annex 1 may also need to be updated taking into account the incorporation by reference of Recommendations ITU-R S.1428 and ITU-R BO.1443 and their versions in force; is being considered with possible MOD under WRC-23 agenda item 7, Topic J. (Referred to in RR No. **22.5K** and Res. **140 (Rev.WRC-15)***) (* Reference(s) to former version of this Res.)	-
80	Due diligence in applying the principles embodied in the Constitution	(Rev.WRC-07) Still relevant (permanent agenda item at each WRC (see WRC-23 agenda item 9.3). (Referred to in Res. **811 (WRC-19)** and Res. **812 (WRC-19)**)	-
81	Evaluation of administrative due diligence	(Rev.WRC-15) Still relevant; references to Res. **49 (Rev.WRC-19)** and Res. **51 (WRC-97)** may be updated. So-called "paper satellite" issue has been already solved. Superseded by Resolution **49 (Rev.WRC-19)** which implemented this issue.	NOC/MOD/ SUP
85	Protection of GSO systems (FSS and BSS) from non-GSO FSS systems	(WRC-03) Still relevant. Requires updates to reflect the publication of Circular Letter CR/414, to reflect the decision of WRC-15 to maintain the application of Resolution **85 (WRC-03)** when the software available may not be adequate to model certain non-GSO FSS and to remove outdated references to Circular Letters CR/176 and CR/182; may also need to be updated when new modifications to Recommendation ITU-R S.1503 are adopted; new RR Appendix **4** parameters for Recommendation ITU-R S.1503 updates are being considered under WRC-23 agenda item 7, Topic D2. May be suppressed and replaced by a rule of procedure as ITU-R SG 4 regularly studies updates to Recommendation ITU-R S.1503 and a version of the validation software is now available for the BR to assess expected epfd levels. (Referred to in RR No. **59.8**)	MOD/ SUP
86	Criteria for implementation of Resolution 86 (Rev.PP-02)	(Rev.WRC-07) Still relevant (permanent agenda item at each WRC (see WRC-23 agenda item 7)). (Referred to in Res. **769 (WRC-19**), Res. **770 (WRC-19)**, Res. **811 (WRC-19)** and Res. **812 (WRC-19)**)	-
95	Review of WARC and WRC Resolutions/ Recommendations	(Rev.WRC-19) Still relevant (permanent agenda item at each WRC (see WRC-23 agenda item 4)). (Referred to in Res. **811 (WRC-19)** and Res. **812 (WRC-19)**)	-
99	Provisional application of certain provisions of RR as revised by WRC-19 and abrogation of certain Res./Rec.	(Rev.WRC-19) Should be revised to serve a similar purpose after WRC-23. (Referred to in RR Nos. **59.14*** and **59.16**) (* Reference(s) to former version of this Res.)	MOD

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
111	Planning of the FSS in 18/20/30 GHz	(Orb-88) Still relevant; the necessity of footnote 1 associated with the title may need to be considered and possibly be deleted.	NOC/MOD
114	FSS (feeder links for MSS) in 5 GHz	(Rev.WRC-15) Still relevant. (Referred to in RR Nos. **5.444**, **5.444A** and Res. **748 (Rev.WRC-19)**)	NOC
122	HAPS in 47/48 GHz	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.552A**, **59.6***, **59.8***, App. **4** Annex 1, Table 2, item 1.14.r and Res. **176 (WRC-19)**) (* Reference(s) to former version of this Res.)	NOC
125	Frequency sharing in the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz between the mobile-satellite service and the radio astronomy service	(Rev.WRC-12) Still relevant; future competent WRC to review the ongoing sharing studies between the MSS and RAS; Report ITU-R M.2459-0 was approved in July 2019 and outcomes of studies under WRC-23 agenda item 1.11 may also be relevant.	MOD
140	Epfd limits in 19.7-20.2 GHz	(Rev.WRC-15) Still relevant; Resolution **76 (Rev.WRC-15)** referred to in *considering b)* has a newer version. (Referred to in RR No. **22.5CA**)	NOC/MOD
143	Guidelines for implementation of high-density applications in the FSS in identified frequency bands	(Rev.WRC-19) Still relevant; Recommendations ITU-R S.524-9, ITU-R S.1594-0 and ITU-R S.1783-0 in force. (Referred to in RR No. **5.516B** and Res. **243 (WRC-19)**)	NOC
144	Special requirements for small or narrow countries operating earth stations in the FSS in the band 13.75-14 GHz	(Rev.WRC-15) Still relevant.	NOC
145	Use of the band 27.9-28.2 GHz by HAPS in the fixed service	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.537A** and **59.8***) (* Reference(s) to former version of this Res.)	NOC
147	Pfd limits for FSS using highly-inclined orbits in the band 17.7-19.7 GHz	(WRC-07) Still relevant. (Referred to in RR Nos. **21.16.6B** and **21.16.6C**)	NOC
148	Satellite systems formerly listed in Part B of Appendix **30B** (WARC Orb-88)	(Rev.WRC-15) Still relevant. (Referred to in RR App. **30B**, § 2.2*bis* and § 2.4)	NOC
149	Submissions from new Member States of the Union relating to Appendix **30B** of the Radio Regulations	(Rev.WRC-12) Still relevant; may be considered under WRC-23 agenda item 7, Topic E. (Referred to in RR No. **59.10***) (* Reference(s) to former version of this Res.)	NOC/MOD

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
150	Use of the bands 6 440-6 520 MHz and 6 560-6 640 MHz by gateway links for high-altitude platform stations in the fixed service	(WRC-12) Still relevant. (Referred to in RR No. **5.457** and App. **4** Annex 1, Table 2 items 1.14.d and 1.14.e.	NOC
154	Consideration of technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1	(Rev.WRC-15) Still relevant.	NOC
155	Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices **30**, **30A** and **30B** for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces	(Rev.WRC-19) For consideration under WRC-23 agenda item 1.8. (Referred to in RR No. **5.484B***, Res. **171 (WRC-19)** and Res. **811 (WRC-19)**) (* Reference(s) to former version of this Res.)	-
156	Use of the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz by earth stations in motion communicating with geostationary space stations in the fixed-satellite service	(WRC-15) Still relevant; it may be appropriate to update *recognizing e)* to reflect the actual provision dealing with ESIM communicating with GSO FSS space stations in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz and the associated class of station (UF) as there is no UC Class of station in the Preface to the BR IFIC. (Referred to in RR No. **5.527A**; App. **4**, Annex 2, item A.19.b; Res. **155 (Rev.WRC-19)**; Res. **172 (WRC-19)**; Res. **173 (WRC-19)** and Res. **176 (WRC-19)**)	NOC/MOD
160	Facilitating access to broadband applications delivered by high-altitude platform stations	(WRC-15) Obsolete after consideration of the issue under WRC-19 agenda item 1.14 (suppression was overlooked at WRC-19)	SUP

Res. No.	**Subject / Title**	**Remark**	**Possible follow-up under WRC-23 agenda item 4**
161	Studies relating to spectrum needs and possible allocation of the frequency band 37.5-39.5 GHz to the fixed-satellite service	(WRC-15) Was included in item 2.4 of the preliminary agenda for WRC-23 (see Res. **810 (WRC-15)**) but no longer in the WRC-23 agenda (see Res. **811 (WRC-19)**) and in the WRC-27 preliminary agenda (see Res. **812 (WRC-19)**) Might be considered as obsolete and suppressed, unless proposed in the WRC-27 agenda or in the following WRC preliminary agenda	MOD/SUP
163	Deployment of earth stations in some Regions 1 and 2 countries in the frequency band 14.5-14.75 GHz in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service	(WRC-15) Still relevant; "Turkey" in *resolves* needs to be modified to "Türkiye", included in the Director's Report to WRC-23 under agenda item 9. (Referred to in RR Nos. **5.509B**, **5.509C**, **5.509D**, **5.509E**, **5.509F**, **5.510**, **22.40** and App. **4**, Annex 2, items A.7.f, C.10.d.7, App. **30A**, § 4.1.1 *d)*, Article 7 title, § 7.1, § 7.2*bis*, Annex 1, section 6 and Annex 4, section 3)	NOC
164	Deployment of earth stations in some Region 3 countries in the frequency band 14.5-14.8 GHz in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service	(WRC-15) Still relevant. (Referred to in RR Nos. **5.509B**, **5.509C**, **5.509D**, **5.509E**, **5.509F**, **5.510**, **22.40**, App. **4**, Annex 2, items A.7.f, C.10.d.7; App. **30A**, § 4.1.1 *d)*, Article 7 title, § 7.1, § 7.2*bis*, Annex 1, section 6 and Annex 4, section 3)	NOC
165	Use of the frequency band 21.4-22 GHz by high-altitude platform stations in the fixed service in Region 2	(WRC-19) Still relevant. (Referred to in RR No. **5.530E** and App. **4**, Annex 1, Table 2, items 1.14.f, 1.14.g and 1.14.h)	NOC
166	Use of the frequency band 24.25-27.5 GHz by high-altitude platform stations in the fixed service in Region 2	(WRC-19) Still relevant. (Referred to in RR Nos. **5.532AA**, **5.534A** and App. **4**, Annex 1, Table 2, items 1.14.i and 1.14.j)	NOC
167	Use of the frequency band 31-31.3 GHz by high-altitude platform stations in the fixed service	(WRC-19) Still relevant. (Referred to in RR No. **5.543B** and App. **4**, Annex 1, Table 2, items 1.14.k, 1.14.l, 1.14.m and 1.14.n)	NOC
168	Use of the frequency band 38-39.5 GHz by high-altitude platform stations in the fixed service	(WRC-19) Still relevant. (Referred to in RR No. **5.550D** and App. **4**, Annex 1, Table 2, items 1.14.o, 1.14.p and 1.14.q)	NOC

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
169	Use of the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz by earth stations in motion communicating with geostationary space stations in the fixed-satellite service	(WRC-19) Still relevant (Referred to in RR No. **5.517A**; App. **4**, Annex 2, items A.20, A.20.a, A.21, A.21.a, A.22, A.22.a; Res. **172 (WRC-19)** and Res. **173 (WRC-19)**)	NOC
170	Additional measures for satellite networks in the fixed-satellite service in frequency bands subject to Appendix **30B** for the enhancement of equitable access to these frequency bands	(WRC-19) Still relevant; might be updated to editorially correct the reference to Res. **553 (Rev.WRC-15)** in the *considering further a)*; is being considered with possible MOD under WRC-23 agenda item 7, Topic E. Remove the redundancy of the values of the "hard" pfd limits in Appendix 1 to Attachment 1 to Resolution **170 (WRC-19)**; to clearly indicate where the corresponding protection criteria are found in Appendix 2 to Attachment 1 to Resolution **170 (WRC-19)** (Referred to in App. **30B** footnote 2*bis*) and Res. **172 (WRC-19)**)	-/MOD
171	Review and possible revision of Resolution **155 (Rev.WRC-19)** and No. **5.484B** in the frequency bands to which they apply	(WRC-19) For consideration under WRC-23 agenda item 1.8. (Referred to in Res. **811 (WRC-19)**)	-
172	Operation of earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space)	(WRC-19) For consideration under WRC-23 agenda item 1.15. (Referred to in Res. **811 (WRC-19)**)	-
173	Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service	(WRC-19) For consideration under WRC-23 agenda item 1.16. (Referred to in Res. **811 (WRC-19)**)	-
174	Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2	(WRC-19) For consideration under WRC-23 agenda item 1.19. (Referred to in Res. **811 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
175	Use of International Mobile Telecommunications systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis	(WRC-19) For consideration under WRC-23 agenda item 9.1, 3rd topic (9.1-c). (Referred to in Res. **811 (WRC-19)**)	-
176	Use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed-satellite service	(WRC-19) Under study; included in item 2.2 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
177	Studies relating to spectrum needs and possible allocation of the frequency band 43.5-45.5 GHz to the fixed-satellite service	(WRC-19) Under study; included in item 2.3 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
178	Studies of technical and operational issues and regulatory provisions for non-geostationary fixed-satellite service satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space)	(WRC-19) Under study; included in item 2.7 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
205	Protection of MSS in 406-406.1 MHz	(Rev.WRC-19) Still relevant; the implementation of this Resolution will be reported to WRC-23; the status of the 406 MHz search and rescue system in *noting a)* may be updated. (Referred to in RR No. **5.265** and Res. **646 (Rev.WRC-19)**)	NOC/MOD
207	Monitor MMS/AM(R)S	(Rev.WRC-15) Still relevant.	NOC
212	Implementation of IMT	(Rev.WRC-19) Still relevant; ongoing studies in SG 4/WP 4C. (Referred to in RR Nos. **5.351A***, **5.388***, Res. **221 (Rev.WRC-07)***, Res. **223 (Rev.WRC-19)**, Res. **225 (Rev.WRC-12)*** and Rec. **206 (Rev.WRC-19)***) (* Reference(s) to former version of this Res.)	NOC

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
215	Coordination among MSS systems	(Rev.WRC-12) Still relevant.	NOC
217	Wind profiler radars	(WRC-97) Still relevant. (Referred to in RR Nos. **5.162A** and **5.291A**); Rec. ITU-R RS.1260-2 in RR Vol. IV)	NOC
221	HAPS for IMT in the bands around 2 GHz	(Rev.WRC-07) Still relevant; is being considered with some possible MOD under WRC-23 agenda item 1.4. (Referred to in RR Nos. **5.388A**, **59.8***, App. **4** Annex 1 Table 2 items 1.14.b and 1.14.c, and Res. **247 (WRC-19)**) (* Reference(s) to former version of this Res.)	-
222	Use of the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz by the MSS and studies for long-term availability for AMS(R)S	(Rev.WRC-12) Still relevant. (Referred to in RR Nos. **5.353A*** and **5.357A**) (* Reference(s) to former version of this Res.)	NOC
223	Additional bands identified for IMT	(Rev.WRC-19) For consideration under WRC-23 agenda item 1.1. (Referred to in RR Nos. **5.341A***, **5.341B***, **5.341C***, **5.346**, **5.346A**, **5.384A***, **5.388***, **5.429B**, **5.429D**, **5.429F**, **5.441A**, **5.441B**, Res. **225 (Rev.WRC-12)***, Res. **811 (WRC-19)** and Res. **903 (Rev.WRC-19)**) (* Reference(s) to former version of this Res.)	-
224	Frequency bands for the terrestrial component of IMT below 1 GHz.	(Rev.WRC-19) Still relevant; is being considered with some possible MOD under WRC-23 agenda item 1.5. (Referred to in RR Nos. **5.286AA**, **5.295**, **5.296A**, **5.308A**, **5.312A**, **5.316B**, **5.317A**, Res. **223 (Rev.WRC-19)**, Res. **225 (Rev.WRC-12)***, Res. **251 (WRC-19)**, Res. **749 (Rev.WRC-19)** and Res. **760 (Rev.WRC-19)**) (* Reference(s) to former version of this Res.)	-
225	Use of additional bands for the satellite component of IMT	(Rev.WRC-12) Still relevant; a work plan for a working document towards a preliminary draft new (PDN) Report ITU-R M.[S-MSS&IMT SHARING] has been developed (see Annex 12 to Doc. 4C/333). However, no consequential changes to Res. **225 (Rev.WRC-12)** resulting from this working document have been identified so far. (Referred to in RR No. **5.351A*** and Res. **223 (Rev.WRC-19)**) (* Reference(s) to former version of this Res.)	NOC/MOD
229	Use of bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz for WAS including RLAN	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.446A**, **5.447**, **5.447F**, **5.450A** and **5.453**)	NOC
235	Review of the spectrum use of the frequency band 470-960 MHz in Region 1	(WRC-15) For consideration under WRC-23 agenda item 1.5. (Referred to in Res. **811 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
240	Spectrum harmonization for railway radiocommunication systems between train and trackside within the existing mobile-service allocations	(WRC-19) Still relevant; ongoing studies in SG 5/WP 5A.	NOC
241	Use of the frequency band 66-71 GHz for International Mobile Telecommunications and coexistence with other applications of the mobile service	(WRC-19) Still relevant. (Referred to in RR No. **5.559AA**)	NOC
242	Terrestrial component of International Mobile Telecommunications in the frequency band 24.25-27.5 GHz	(WRC-19) Still relevant; studies in response to *invites ITU-R* 2 have been completed (see Recommendation ITU-R SA.2142); ongoing studies in SG 5/WP 5D. (Referred to in RR Nos. **5.532AB**, **5.536A** and **5.536B**)	MOD
243	Terrestrial component of International Mobile Telecommunications in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz	(WRC-19) Still relevant; studies in response to *invites ITU-R* 3 have been completed (see Recommendation ITU-R SA.2142); ongoing studies in SG 5/WP 5D. (Referred to in RR Nos. **5.550B** and **5.553B**)	MOD
244	International Mobile Telecommunications in the frequency band 45.5-47 GHz	(WRC-19) Still relevant. (Referred to in RR No. **5.553A**)	NOC
245	Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications identification in the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz	(WRC-19) For consideration under WRC-23 agenda item 1.2. (Referred to in Res. **811 (WRC-19)**)	-
246	Studies to consider possible allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1	(WRC-19) For consideration under WRC-23 agenda item 1.3. (Referred to in Res. **811 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
247	Facilitating mobile connectivity in certain frequency bands below 2.7 GHz using high-altitude platform stations as International Mobile Telecommunications base stations	(WRC-19) For consideration under WRC-23 agenda item 1.4. (Referred to in Res. **811 (WRC-19)**)	-
248	Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems	(WRC-19) For consideration under WRC-23 agenda item 1.18 and included in item 2.13 of the preliminary agenda for WRC-27. (Referred to in Res. **811 (WRC-19)** and Res. **812 (WRC-19)**)	-
249	Study of technical and operational issues and regulatory provisions for space-to-space transmissions in the Earth-to-space direction in the frequency bands [1 610-1 645.5 MHz and 1 646.5-1 660.5 MHz] and the space-to-Earth direction in the frequency bands [1 525-1 544 MHz], [1 545-1 559 MHz], [1 613.8-1 626.5 MHz] and [2 483.5-2 500 MHz] among non-geostationary and geostationary satellites operating in the mobile-satellite service	(WRC-19) Under study; included in item 2.8 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
250	Studies on possible allocations to the land mobile service (excluding International Mobile Telecommunications) in the frequency band 1 300-1 350 MHz for use by administrations for the future development of terrestrial mobile-service applications	(WRC-19) Under study; included in item 2.9 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
251	Removal of the limitation regarding aeronautical mobile in the frequency range 694-960 MHz for the use of International Mobile Telecommunications user equipment by non-safety applications	(WRC-19) Under study; included in item 2.12 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
331	Operation of the Global Maritime Distress and Safety System (GMDSS)	(Rev.WRC-12) Still relevant; the requested ITU-R studies have not been conducted so far.	NOC
339	Coordination of NAVTEX services	(Rev.WRC-07) Still relevant. (Referred to in RR No. **5.79A** and App. **15** Table 15-1)	NOC
343	Certificates (vessels using GMDSS equipment on a non-compulsory basis)	(Rev.WRC-12) Still relevant; (to ensure intercommunication between SOLAS and non-SOLAS vessels). (Referred to in RR Nos. **47.27A** and **48.7***) (* Reference(s) to former version of this Res.)	NOC
344	Exhaustion of MMSI	(Rev.WRC-19) Still relevant. Reference to "Inmarsat" in *noting a)* might need to be considered with a replacement by a generic term (e.g. "recognized mobile satellite system"); the implementation of this resolution is expected to be included in the Director's Report to WRC-23.	NOC/MOD
349	False alerts in GMDSS	(Rev.WRC-19) Still relevant; is being considered with some possible MOD under WRC-23 agenda item 1.11. (Referred to in RR No. **32.10A** *b)*)	-
352	Use of carrier frequencies 12 290 kHz and 16 420 kHz for safety-related calling to and from rescue coordination centres	(WRC-03) Still relevant; The term "general communications" needs to be reviewed in *noting a)* and *b)* based on the revised SOLAS Regulation IV/4. (Referred to in RR No. **52.221A** and App. **17** Part B Section I § 5)	NOC/MOD
354	Distress and safety radiotelephony procedures for 2 182 kHz	(WRC-07) Still relevant; reference in the Annex to direct-printing telegraphy may need to be reviewed. (Referred to in RR Nos. **52.101** and **52.189**)	NOC/MOD
356	ITU maritime service information registration	(Rev.WRC-19) Still relevant; ITU-R consultation invited in this Resolution is a constant process at WP 5B and in IMO based on new maritime system requirements; perhaps to change *invites ITU-R* "to consult on a regular basis…"	NOC/MOD
361	Consideration of regulatory provisions for modernization of the GMDSS and related to the implementation of e-navigation	(Rev.WRC-19) For consideration under WRC-23 agenda item 1.11. (Referred to in Res. **811 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
363	Considerations to improve utilization of the VHF maritime frequencies in Appendix **18**	(WRC-19) Under study; included in item 2.10 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
405	Frequencies for AM(R)S in RR AP**27** bands	(WARC-79) Still relevant; the necessity of footnote 1 associated with the title may need to be considered and possibly be deleted.	NOC/MOD
413	Use of the band 108-117.975 MHz by the aeronautical mobile (R) service (AM(R)S)	(Rev.WRC-12) Still relevant. (Referred to in RR Nos. **5.197A***, **59.8*** and Res. **428 (WRC-19)**) (* Reference(s) to former version of this Res.)	NOC
416	Use of the bands 4 400-4 940 MHz and 5 925-6 700 MHz by an aeronautical mobile telemetry application	(WRC-07) Still relevant. (Referred to in RR Nos. **5.440A**, **5.442** and **5.457C**)	NOC
417	Use of the band 960-1 164 MHz by the AM(R)S	(Rev.WRC-15) Still relevant. (Referred to in RR No. **5.327A**)	NOC
418	Use of the band 5 091-5 250 MHz by AMS for telemetry applications	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.444B**, **5.446C** and **5.446D**)	NOC
422	Development of methodology to calculate aeronautical mobile-satellite (R) service spectrum requirements within the frequency bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space)	(WRC-12) Implemented following the approval of Recommendation ITU-R M.2091. (Referred to in Res. **222 (Rev.WRC-12)**)	SUP
424	Use of WAIC in the frequency band 4 200-4 400 MHz	(WRC-15) Still relevant. (Referred to in RR No. **5.436**)	NOC
425	Use of the frequency band 1 087.7-1 092.3 MHz by the aeronautical mobile-satellite (R) service (Earth-to-space) to facilitate global flight tracking for civil aviation	(Rev.WRC-19) Still relevant. (Referred to in RR No. **5.328AA**)	NOC
427	Updating provisions related to aeronautical services in the Radio Regulations	(WRC-19) Might be updated or suppressed depending on the progress of the ITU-R studies which will be included in the Director's Report to WRC-23 under agenda item 9.1, as appropriate.	MOD/SUP

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
428	Studies on a possible new allocation to the aeronautical mobile-satellite (R) service within the frequency band 117.975-137 MHz in order to support aeronautical VHF communications in the Earth-to-space and space-to-Earth directions	(WRC-19) For consideration under WRC-23 agenda item 1.7. (Referred to in Res. **811 (WRC-19)**)	-
429	Consideration of regulatory provisions for updating Appendix **27** of the Radio Regulations in support of aeronautical HF modernization	(WRC-19) For consideration under WRC-23 agenda item 1.9. (Referred to in Res. **811 (WRC-19)**)	-
430	Studies on frequency-related matters, including possible additional allocations, for the possible introduction of new non-safety aeronautical mobile applications	(WRC-19) For consideration under WRC-23 agenda item 1.10. (Referred to in Res. **811 (WRC-19)**)	-
506	GSO only, in BSS 12 GHz bands	(Rev.WRC-97) Still relevant.	NOC
507	Agreements/Plans for BSS	(Rev.WRC-19) Still relevant. (Referred to in RR No. **11.37.2**, App. **30** Article 12 title and § 12.1, Res. **34 (Rev.WRC-19)** and Res. **553 (Rev.WRC-15)***) (* Reference(s) to former version of this Res.)	NOC
517	Introduction of digitally modulated emissions in the HFBC	(Rev.WRC-19) Still relevant. (Referred to in RR No. **5.134**, App. **11** Part B Section 1.1), Res. **543 (Rev.WRC-19)**, Res. **550 (Rev.WRC-19)** and Rec. **503 (Rev.WRC-19))**	NOC
526	Additional provisions for HDTV	(Rev.WRC-12) Still relevant.	NOC
528	BSS (sound) in 1.5 GHz	(Rev.WRC-19) Still relevant; for consideration by a future WRC. (Referred to in RR Nos. **5.345**, **5.393**, **5.418** and Res. **539 (Rev.WRC-19)**)	NOC
535	Application of Article **12**	(Rev.WRC-19) Still relevant.	NOC
536	BSS satellites serving other countries	(WRC-97) Still relevant.	NOC
539	Use of the band 2 630-2 655 MHz for non-GSO BSS	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.418**, **59.6***, **59.8***, App. **5** Table 5-1, Res. **212 (Rev.WRC-19)** and Res. **903 (Rev.WRC-19)**) (* Reference(s) to former version of this Res.)	NOC

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
543	Provisional RF protection ratios for analogue and digital emissions in HFBC	(Rev.WRC-19) Still relevant. (Referred to in App. **11** Part C Section 1.1, Section 2.5, Res. **517 (Rev.WRC-19)** and Res. **535 (Rev.WRC-19)**)	NOC
548	Application of the grouping concept in AP**30/30A** in Regions 1 and 3	(Rev.WRC-12) Still relevant. (Referred to in RR App. **30** footnote 7*bis* and App. **30A** footnote 9*bis*)	NOC
550	Information relating to HF broadcasting service	(Rev.WRC-19) Still relevant.	NOC
552	Long-term access to and development in the band 21.4-22 GHz in Regions 1 and 3	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **A.9.4**, **A.11.2**, **11.44.1**, **11.48.1** and Res. **553 (Rev.WRC-15)***) (* Reference(s) to former version of this Res.)	NOC
553	Additional regulatory measures for broadcasting-satellite networks in the band 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this band	(Rev.WRC-15) Still relevant; §§ 8 and 9 of the Attachment to this resolution need to be updated because the submission of advance publication information is no longer required; is being considered with some possible MOD under WRC-23 agenda item 7, Topic K. (Referred to in RR No. **A.9.8***, App. **5** Table 5-1* and Res. **170 (WRC-19)***) (* Reference(s) to former version of this Res.)	-
554	Application of pfd masks to coordination under No. **9.7** for broadcasting-satellite service networks in the band 21.4-22 GHz in Regions 1 and 3	(WRC-12) Content is still relevant; may be moved to RR Appendix **5**. (Referred to in RR No. **A.11.7** and App. **5** Table 5-1)	NOC/SUP
558	Protection of implemented broadcasting-satellite service networks in the orbital arc of the geostationary satellite orbit between 37.2° W and 10° E in the frequency band 11.7-12.2 GHz	(WRC-19) Still relevant. (Referred to in RR App. **30** footnote 55)	NOC
559	Additional temporary regulatory measures following the deletion of part of Annex 7 to Appendix **30** (Rev.WRC-15) by WRC-19	(WRC-19) Still relevant; partly implemented.	MOD
608	Use of 1 215-1 300 MHz band by systems in the RNSS (space-to-Earth)	(Rev.WRC-19) Still relevant; in *recognizing b)* “Turkey” needs to be modified to “Türkiye”, included in the Director’s Report to WRC-23 under agenda item 9.2. (Referred to in RR No. **5.329**)	NOC

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
609	Protection of ARNS from the equivalent epfd produced by RNSS networks and systems in the 1 164-1 215 MHz band	(Rev.WRC-07) Still relevant. (Referred to in RR Nos. **5.328A**, **21.18*** and Rec. **608 (Rev.WRC-07)**) (* Reference(s) to former version of this Res.)	NOC
610	Coordination of RNSS networks and systems in the bands 1 164-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz	(Rev.WRC-19) Still relevant. (Referred to in RR No. **5.328B***) (* Reference(s) to former version of this Res.)	NOC
612	Use of the radiolocation service between 3 and 50 MHz to support oceanographic radar operations	(Rev.WRC-12) Still relevant. (Referred to in RR Nos. **5.132A**, **5.145A**, **5.161A**, App. **4** Annex 1 Table 1 items 3.1 and 3.2)	NOC
642	Earth stations in the amateur-satellite service	(WARC-79) May be suppressed since the resolution is rarely used, RR No. **11.14** indicates that frequency assignments to earth stations in the amateur-satellite service shall not be notified under RR Article **11**.	NOC/SUP
646	Public protection and disaster relief	(Rev.WRC-19) Still relevant; Report ITU-R M.2291-2 has been approved since WRC-19; ongoing studies to revise Report ITU-R M.2377-1. (Referred to in Res. **224 (Rev.WRC-19)**, Res. **647 (Rev.WRC-19)** and Rec. **206 (Rev.WRC-19)**)	NOC
647	Radiocommunication aspects, including spectrum management guideline for early warning, disaster prediction, detection, mitigation and relief operations relating to emergencies and disasters	(Rev.WRC-19) Still relevant.	NOC
655	Definition of time-scale and dissemination of time signals via radiocommunication systems	(WRC-15) Still relevant; actions on this Resolution are expected at WRC-23 (see the *resolves* part) based on the progress of the ITU-R studies which will be included in the Director's Report under WRC-23 agenda item 9, as appropriate. Referred to in RR No. **1.14**) WRC-23 may decide to consider modification of this resolution under agenda item 9.1	**-**
656	Possible secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders in the range of frequencies around 45 MHz	(Rev.WRC-19) For consideration under WRC-23 agenda item 1.12. (Referred to in Res. **811 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
657	Protection of radio spectrum-reliant space weather sensors used for global prediction and warnings	(Rev.WRC-19) For consideration under WRC-23 agenda item 9.1, 1st topic (9.1-a) and included in item 2.6 of the preliminary agenda for WRC-27. (Referred to in Res. **811 (WRC-19)** and Res. **812 (WRC-19)**)	-
660	Use of the frequency band 137-138 MHz by non-geostationary satellites with short-duration missions in the space operation service	(WRC-19) Still relevant. (Referred to in RR No. **5.203C**)	NOC
661	Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz	(WRC-19) For consideration under WRC-23 agenda item 1.13. (Referred to in Res. **811 (WRC-19)**)	-
662	Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors	(WRC-19) For consideration under WRC-23 agenda item 1.14. (Referred to in Res. **811 (WRC-19)**)	-
663	New allocations for the radiolocation service in the frequency band 231.5-275 GHz, and a new identification for radiolocation service applications in frequency bands in the frequency range 275-700 GHz	(WRC-19) Under study; included in item 2.1 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
664	Use of the frequency band 22.55-23.15 GHz by the Earth exploration-satellite service (Earth-to-space)	(WRC-19) Under study; included in item 2.11 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
673	Earth observation applications	(Rev.WRC-12) Still relevant. (Referred to in RR No. **29A.1**)	NOC
703	Interference criteria for the shared bands	(Rev.WRC-07) Still relevant. (Referred to in Res. **34 (Rev.WRC-19)** and Res. **528 (Rev.WRC-19)**).	NOC
705	Protection of services in 70-130 kHz	(Rev.WRC-15) Still relevant.	NOC

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
716	Use of bands around 2 GHz	(Rev.WRC-12) Still relevant. (Referred to in RR Nos. **5.389A*** and **5.389C***) (*reference(s) to former version of this Res.).	NOC
729	Adaptive systems at MF/HF	(Rev.WRC-07) Still relevant. (Referred to in RR App. **4,** Annex 1, Table 1, items 1.5.1, 1.5.7, 1.5.8, 8.6 and 8.7)	NOC
731	Sharing and adjacent-band compatibility between passive and active services above 71 GHz	(Rev.WRC-19) Still relevant; might be updated depending on the progress of the ITU-R studies. (Referred to in RR No. **5.564A** and Res. **776 (WRC-19)**)	NOC/MOD
732	Sharing between active services above 71 GHz	(Rev.WRC-12) Still relevant.	NOC
739	Compatibility between RAS and active space services	(Rev.WRC-19) Still relevant; may be updated to editorially add the full name of IUCAF (Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science) in Table 1-2 of Annex 1. (Referred to in RR No. **5.208B** and Res. **776 (WRC-19)**)	NOC/MOD
741	Protection of RAS in the bands 4 990-5 000 MHz	(Rev.WRC-15) Still relevant. (Referred to in RR No. **5.443B** and App. **4** Annex 2 items A.17.b.1 and A.17.b.3)	NOC
743	Protection of single-dish RAS stations in the band 42.5-43.5 GHz	(WRC-03) Still relevant; Note 1 should be updated. (Referred to in RR Nos. **5.551H**, **5.551I** and **59.8**)	NOC/MOD
744	Sharing between MSS (Earth-to-space) and other services in the band 1 668.4-1 675 MHz	(Rev.WRC-07) Still relevant. (Referred to in RR No. **5.379D**)	NOC
748	Compatibility between AM(R)S and FSS (Earth-to-space) in the band 5 091-5 150 MHz	(Rev.WRC-19) Still relevant. (Referred to in RR No. **5.444B** and Res. **418 (Rev.WRC-19)**)	NOC
749	Use of the frequency band 790-862 MHz in countries of Region 1 and the Islamic Republic of Iran by mobile applications and by other services	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.316B**, **5.317A** and Res. **251 (WRC-19)**)	NOC
750	Compatibility between EESS (passive) and relevant active services	(Rev.WRC-19) Still relevant. (Referred to in RR No. **5.338A**, Res. **161 (WRC-15)***, Res. **176 (WRC-19)**, Res. **178 (WRC-19)**, Res. **242 (WRC-19)**, Res. **773 (WRC-19)**, Res. **775 (WRC-19)** and Res. **776 (WRC-19)**) (*Reference(s) to former version of this Res.).	NOC
751	Use of the band 10.6-10.68 GHz	(WRC-07) Still relevant. (Referred to in RR No. **5.482A**)	NOC

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
752	Use of the band 36-37 GHz	(WRC-07) Still relevant. (Referred to in RR No. **5.550A**)	NOC
759	Technical studies on the coexistence of the radiolocation service and the amateur, amateur-satellite and radio astronomy services in the frequency band 76-81 GHz	(WRC-15) Still relevant.	NOC
760	Provisions relating to the use of the frequency band 694-790 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.312A**, **5.317A** and Res. **251 (WRC-19)**)	NOC
761	Compatibility of International Mobile Telecommunications and broadcasting-satellite service (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3	(Rev.WRC-19) Still relevant. (Referred to in RR Nos. **5.346**, **5.346A** and App. **5**, Table 5-1)	NOC
762	Application of power flux-density criteria to assess the potential for harmful interference under No. **11.32A** for fixed-satellite and broadcasting-satellite service networks in the 6 GHz and 10/11/12/14 GHz frequency bands not subject to a Plan	(WRC-15) Still relevant; The "*instructs the Director of the Radiocommunication Bureau*" part might be modified or deleted if no longer relevant, as appropriate, since it refers to WRC-19. (Referred to in RR No. **11.32A.2**)	NOC/MOD

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
768	Need for coordination of Region 2 fixed-satellite service networks in the frequency band 11.7-12.2 GHz with respect to the Region 1 broadcasting-satellite service assignments located further west than 37.2° W and of Region 1 fixed-satellite service networks in the frequency band 12.5-12.7 GHz with respect to the Region 2 broadcasting-satellite service assignments located further east than 54° W	(WRC-19) Still relevant. (Referred to in RR App. **30** footnote 56)	NOC
769	Protection of geostationary fixed-satellite service, broadcasting-satellite service and mobile-satellite service networks from the aggregate interference produced by multiple non-geostationary fixed-satellite service systems in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz	(WRC-19) Still relevant. (Referred to in RR No. **22.5M** and Res. **770 (WRC-19)**)	NOC
770	Application of Article **22** of the Radio Regulations to the protection of geostationary fixed-satellite service and broadcasting-satellite service networks from non-geostationary fixed-satellite service systems in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz	(WRC-19) Still relevant; is being considered with possible MOD under WRC-23 agenda item 7, Topic G. (Referred to in RR Nos. **5.550C**, **22.5L.1**, **22.5M** and Res. **769 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
771	Use of the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-48.9 GHz, 48.9-50.2 GHz and 50.4-51.4 GHz (Earth-to-space) by non-geostationary-satellite systems in the fixed-satellite service and 39.5-40.5 GHz (space-to-Earth) by non-geostationary-satellite systems in the mobile-satellite service	(WRC-19) Still relevant.	NOC
772	Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles	(WRC-19) For consideration under WRC-23 agenda item 1.6. (Referred to in Res. **811 (WRC-19)**)	-
773	Study of technical and operational issues and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz	(WRC-19) For consideration under WRC-23 agenda item 1.17. (Referred to in Res. **811 (WRC-19)**)	-
774	Studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the radionavigation-satellite service (space-to-Earth)	(WRC-19) For consideration under WRC-23 agenda item 9.1, 2nd topic (9.1-b). (Referred to in Res. **811 (WRC-19)**)	-
775	Sharing between stations in the fixed service and satellite services in the frequency bands 71-76 GHz and 81-86 GHz	(WRC-19) Under study; included in item 2.4 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
776	Conditions for the use of the frequency bands 71-76 GHz and 81-86 GHz by stations in the satellite services to ensure compatibility with passive services	(WRC-19) Under study; included in item 2.5 of the preliminary agenda for WRC-27. (Referred to in Res. **812 (WRC-19)**)	-
804	Principles for establishing agendas for WRC	(Rev.WRC-19) Still relevant; actions on this resolution might be taken under WRC-23 agenda item 10. (Referred to in Res. **811 (WRC-19)** and Res. **812 (WRC-19)**)	-

Res. No.	Subject / Title	Remark	Possible follow-up under WRC-23 agenda item 4
811	Agenda for WRC-23	(WRC-19) Obsolete in view of the action taken by Council (see Resolution 1399 (C-20)).	SUP
812	Preliminary agenda for WRC-27	(WRC-19) For consideration under WRC-23 agenda item 10.	-
901	Determination of the orbital arc separation	(Rev.WRC-15) Still relevant; updating "*further noting*" may be desirable taking into account WRC-19 decisions. (Referred to in RR App. **5** Table 5-1*) (*Reference(s) to former version of this Res.)	NOC/MOD
902	Provisions related to earth stations located on board vessels, in FSS networks in 5 925-6 425 MHz and 14-14.5 GHz	(WRC-03) Still relevant. (Referred to in RR Nos. **5.457A**, **5.457B**, **5.506A**, **5.506B**, **59.8** and Rec. **37 (WRC-03)**)	NOC
903	Transitional measures for BSS/FSS in the band 2 500-2 690 MHz	(Rev.WRC-19) Still relevant. (Referred to in RR No. **21.16.3A**)	NOC
904	Transitional measures for coordination between MSS (Earth-to-space) and SRS (passive) in the band 1 668-1 668.4 MHz	(WRC-07) The concerned space station was notified and recorded in the MIFR. (Referred to in RR No. **5.379B**)	SUP
906	Submission of notice for terrestrial services to BR	(Rev.WRC-15) Still relevant.	NOC
907	Use of modern electronic means of communication for administrative correspondence related to satellite networks and earth stations	(Rev.WRC-15) Still relevant; actions on this resolution could be taken based on the Director's Report to WRC-23 under agenda item 9. Merger with Resolution **55 (Rev.WRC-19)** may be considered.	NOC/MOD/ SUP
908	Electronic submission and publication of advance publication information	(Rev.WRC-15) Still relevant; actions on this resolution could be taken based on the Director's Report to WRC-23 under agenda item 9; merger with Resolution **55 (Rev.WRC-19)** may be considered.	NOC/MOD/ SUP

Some suggestions for modifications to some WRC Resolutions were submitted by Member States to the CPM23-2 and were not reviewed nor agreed. Those suggestions are noted here only for information purposes (Documents CPM23-2/27, 99, 104).

PART II – WARC/WRC RECOMMENDATIONS

Rec. No.	Subject	Remark	Possible follow-up under WRC-23 agenda item 4
7	Standard forms for licences	(Rev.WRC-97) Still relevant.	NOC
8	Automatic identification of stations	(WARC-79) Still relevant.	NOC
9	Measures to be taken to prevent the operation of broadcasting stations on board ships/aircraft outside national territories	(WARC-79) Still relevant; the necessity of footnote 1 associated with the title may need to be considered and possibly be deleted.	NOC/MOD
16	Interference management for stations that may operate under more than one terrestrial radiocommunication service	(Rev.WRC-19) Still relevant.	NOC
34	Principles for allocation of frequency bands	(Rev.WRC-12) Still relevant; consider updating the *recognizing* and the *recommends that future world radiocommunication conferences* 3 to refer to Res. **26 (Rev.WRC-19)**. (Referred to in Res. **160 (WRC-15)**)	MOD
36	International monitoring of emissions from space stations	(Rev.WRC-19) Still relevant; studies in SG 1.	NOC
37	Operational procedures for ESV	(WRC-03) Still relevant. (Referred to in Res. **902 (WRC-03)**)	NOC
63	Calculation of necessary bandwidth	(Rev.WRC-19) Still relevant; ongoing studies.	NOC
71	Type approval	(WARC-79) Still relevant; the necessity of footnote 1 associated with the title may need to be considered and possibly be deleted.	NOC/MOD
75	Study of boundary between out-of-band and spurious domains of primary radars using magnetrons	(Rev.WRC-15) Still relevant.	NOC
76	Deployment and use of cognitive radio systems	(WRC-12) Still relevant; in view of the ongoing studies within several ITU-R study groups; may need a modification to consider results of studies already completed and/or RA-23 decisions on Resolution ITU-R 58.	NOC/MOD
100	Bands for troposcatter	(Rev.WRC-03) Still relevant.	NOC
206	Integrated MSS	(Rev.WRC-19) Still relevant.	NOC
207	Future IMT systems	(Rev.WRC-19) Still relevant.	NOC
208	Harmonization of frequency bands for evolving Intelligent Transport Systems applications under mobile-service allocations	(WRC-19) Still relevant.	NOC

Rec. No.	Subject	Remark	Possible follow-up under WRC-23 agenda item 4
316	Use of ship earth stations within harbours and other waters under national jurisdiction	(Rev.WRC-19) Still relevant.	NOC
401	Use of worldwide frequencies in AP**27**	(WARC-79) Still relevant.	NOC
503	HFBC	(Rev.WRC-19) Still relevant.	NOC
506	Harmonics in BSS	(WARC-79) Still relevant; the necessity of footnote 1 associated with the title may need to be considered and possibly be deleted.	NOC/MOD
520	Elimination of out-of-band HFBC emissions	(WARC-92) Still relevant.	NOC
522	Coordination of HFBC schedules	(WRC-97) Still relevant.	NOC
608	Guidelines for consultation meetings established by Res. **609 (Rev.WRC-07)**	(Rev.WRC-07) Still relevant. (Referred to in Res. **609 (Rev.WRC-07)**)	NOC
622	Sharing of bands 2 025-2 110 MHz and 2 200-2 290 MHz	(WRC-97) Still relevant; relevant ITU-R Recommendations have been adequately updated along with this Recommendation.	NOC
707	Sharing in 32-33 GHz	(WARC-79) Still relevant; Should be updated to adjust the ISS frequency band allocation mentioned in *considering a)*; It may be also necessary to reflect the study completed in response to this Recommendation (i.e. Recommendation ITU-R S.1151-0 in force); Still no sharing criteria included in RR Article **21** to specifically cover the situation between RNS and ISS; RR Table **21-4** pfd limits applicable to ISS to protect terrestrial services in the frequency band 32.3-33 GHz are used by the BR; these values do not correspond to values indicated in Rec. ITU-R S.1151-0. The necessity of footnote 1 associated with the title may need to be considered and possibly be deleted. (Referred to in RR No. **5.548**)	MOD
724	Use by civil aviation of allocations to FSS	(WRC-07) Still relevant.	NOC

Agenda item 9.1

9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention;

9.1 on the activities of the Radiocommunication Sector since WRC-19:

NOTE: Four topics have been identified by CPM23-1 under this agenda item.

Regarding Resolution **655 (WRC-15)**, two details have to be noted: first, a CPM is not entitled to change Resolutions of WRC or ITU-R; second, Resolution **655 (WRC-15)** was not addressed by CPM23-1 under agenda item 9.1. In the study cycle 2019-2023, ITU-R undertook relevant studies as requested by the Resolution, which also includes the task to the BR Director to summarize on these activities. Noting the related results, as summarized in Part 2 of the preliminary draft of the Report of the Director to WRC-23 on the activities of the Radiocommunication Sector (see Doc. CPM23-2/236), administrations expressed their view at CPM23-2 that Resolution **655 (WRC-15)** should be revised at WRC-23 in order to reflect the current situation. Contributions with information on possible revisions can be found in Documents CPM23-2/100 and CPM23-2/105.

Agenda item 9.1(9.1-a)

5/9.1-a In accordance with Resolution 657 (Rev.WRC-19), review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services;

Resolution **657 (Rev.WRC-19)** – *Protection of radio spectrum-reliant space weather sensors used for global prediction and warnings*

Summary of the results of ITU-R studies

Space weather observations from ground-based and space-based systems are becoming more and more important, in particular for the detection of solar activity events that can harmfully affect national economies, human welfare and national security. Currently these systems are deployed in a limited number of locations for observation on a worldwide basis with significant involvement by a large number of countries and institutions, and they operate relatively free of harmful interference; however, the radio interference environment could change as a result of changes made to the Radio Regulations (RR). Since some of the sensors operate by receiving signals of opportunity, and low-level natural emissions from the sun or Earth's atmosphere, they can be very sensitive to harmful interference.

Example space weather definition

During the study cycle leading to this report, ITU-R Working Party (WP) 7C realized that space weather is not defined anywhere in the RR and that there is no link between space weather and a radiocommunication service. The RR are founded on the principle that every "transmission, *emission* and/or reception of *radio waves* for specific *telecommunication* purposes" is identified under a radiocommunication service. However, space weather is described in the ITU-R Handbook on radio astronomy, 2013 edition, as well as in the World Meteorological Organization (WMO) OSCAR database.

Although all these definitions are not exactly the same, they all clearly show that space weather is characterized by phenomena that are generated primarily from the sun that affect technologies and human activity in the near-Earth space, but does not exclude phenomena generated from near Earth's environments.

ITU-R WP 7C provided the following definition to the ITU Coordination Committee for Terminology (CCT): "*Space Weather*: information relating to the characteristics of natural phenomenon in space and in high atmosphere that impact Earth's environment and human activities."

CCT mentioned to ITU-R WP 7C that the expression "high atmosphere" was too vague and does not correspond to a precise level. CCT also highlighted that usually proposed terms and definitions are included in source draft recommendations or reports being developed.

ITU-R WP 7C reviewed its proposal by using terms already used in the RR, an example for definition in the RR Article **1** that could be considered is:

> "*space weather:* natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere, that impact Earth's environment and human activities."

Potential radio service designation

Resolution **657 (Rev.WRC-19)** invites ITU-R to conduct studies with the objective of determining the appropriate radiocommunication service or services that would apply to space weather sensors. ITU-R conducted a review of existing radiocommunications services as potential candidates under which space weather sensors can operate.

Receive-only space weather sensors enable observations through the detection of signals from natural origin as well as receiving signals of opportunity from other radiocommunication services (e.g. radionavigation-satellite service (RNSS)). All receive-only space weather observations should be operated in the same radiocommunication service, in order to allow for a consistent framework for the protection of these applications. Thus, the appropriate radiocommunication service for the receive-only usage of space weather sensors needs to have a suitable definition which can cover all of these different types of sensors and observation methodologies. While the radio astronomy service (RAS) could be an appropriate radiocommunication service for sensors observing signals from cosmic origin, its definition does not cover the observations of signals of opportunity. On the other hand, the definition of the meteorological aids service (MetAids) may be able to accommodate all space weather sensors.

The MetAids is defined in RR No. **1.50** as a "radiocommunication service used for meteorological, including hydrological, observations and exploration." To further differentiate the space weather use under the MetAids, a subset of the MetAids (*space weather*) could be considered. This would ensure that any regulatory protection provided for space weather applications under the MetAids can be applied only to space weather sensor applications and not to other applications that also fall under the MetAids (e.g. radiosondes, dropsondes, lightning detection).

Active space sensors generally emit radio pulses which are then mainly reflected by the ionosphere back to the same sensor system. The reflection in the high atmospheric layers depends on the applied frequency of the radio pulse, where the reflected signal provides information on the physical characteristics of these layers which are important for characterizing impacts on RNSS and HF signals in general. Active sensor systems could also be included under the MetAids, with the same possible subset of the MetAids (*space weather*).

The inclusion of space weather systems under the MetAids, with a subset of the MetAids (*space weather*) should ensure that there will be no negative impact on any space weather observations currently using RAS allocations.

It should be noted that frequency selection for the sensor systems is dependent upon the scientific parameters being measured and their associated physics. Existing MetAids allocations will not meet the scientific requirements for conducting space weather measurements.

It became clear that, in order to fully satisfy the recognition and protection of space weather, and due to the complexity of the issue, it may be necessary to have an approach in two steps:

- First step: to associate space weather with a radiocommunication service under which the majority of space weather sensors can operate. Without this first step completed, any attempt to start doing sharing studies would be meaningless since ITU-R studies are performed between radiocommunication services. Therefore, it is noted that there is an urgency to provide recognition in the RR by identifying space weather under a radiocommunication service.
- Second step: WRC-23 should re-examine the preliminary agenda item approved by WRC-19 (agenda item 2.6) to consider studies for the appropriate changes in the RR in order to ensure the protection of space weather applications.

Deferring the decision to the next Conference (WRC-27) would be counterproductive and a waste of ITU-R resources, since this would mean that an agenda item would have to be created for the next Conference to make the appropriate changes in the RR taking into account the nature of the space weather application (active or receive-only). In addition, it could consider accommodating the possibility for an administration which desires to notify a passive space weather sensor station to be included in the Master Register. Furthermore, considering that each Conference has a limited number of agenda items, this course of action would eventually lead to an important future agenda item being dropped from the final list of WRC-27 agenda items.

Possible solution under RR for covering recognition (step 1)

Resolution **657 (Rev.WRC-19)** invites ITU-R to develop potential solutions to describe in the RR, in Articles **1** and **4**, and/or as a WRC resolution, if deemed appropriate, for consideration by WRC-23.

Potential solutions were proposed and were studied in order to resolve the space weather recognition issue. Below are some examples of provisions that WRC-23 could implement to solve the recognition issue previously discussed.

One such example could be to modify RR Article **1**, Section VIII by adding a new definition for space weather that could read:

> "*space weather:* natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere, that impact Earth's environment and human activities."

To make the connection between space weather and the MetAids, introduction of a new provision in RR Article **4** is proposed. The new provision could, for example, read:

> "Space weather sensor systems may operate under the meteorological aids service (space weather) allocations."

Due to the lack of existing definition of active and receive-only space weather sensors, it is necessary to specify the difference between these sensors by the introduction of their definitions in a new WRC Resolution (see Attachment and proposed views (A and B) regarding this draft new WRC Resolution).

Note: It has to be noted that in case WRC-23 approves modifications of RR Articles **1** and **4** and a possible WRC resolution, an additional regulatory mechanism to avoid notification under the MetAids (*space weather*) service from administrations is needed (see views C and D below) until a subsequent WRC will decide new MetAids (*space weather*) allocations in RR Article **5**.

Sharing studies for covering protection (step 2)

Resolution **657 (Rev.WRC-19)** asks for necessary sharing studies with incumbent systems operating in frequency bands used by space weather sensors.

To achieve the objectives under *resolves* 2 and 4 of Resolution **657 (Rev.WRC-19)**, the candidate frequency bands to be protected need to be finalized.

All sharing studies and identification of new allocations to the MetAids (*space weather*) for space weather sensors in frequency bands currently not allocated to the MetAids could be done at WRC-27. In fact, Resolution **812 (WRC-19)** already contains a preliminary future agenda item dealing with this topic.

Should the agenda of WRC-27 include space weather as an agenda item, it is necessary that the supporting Resolution for this new agenda item includes, *inter alia*, protection of services to which the band is allocated as well as services in the adjacent band.

Potential new WRC-23 Resolution on the importance of space weather sensor systems and other WRC Resolutions

It should be noted that this WRC-23 draft new Resolution does not intend to define a possible new WRC-27 agenda item.

View A:

Some administrations are of the view that changes to the RR are outside the scope of WRC-23 agenda item 9.1, and the inclusion of a new WRC Resolution in the draft CPM text for WRC-23 agenda item 9.1 topic a) is not appropriate and premature. In addition, requisite studies called for in Resolution ***657 (Rev.WRC-19)*** *will not be fully completed in time for WRC-23; therefore, the draft CPM text should not contain proposed regulatory considerations that are not supported by these studies.*

View B:

Some administrations are of the view that the above-described changes to the RR Articles ***1*** *and* ***4*** *follow* resolves *3 of Resolution* ***657 (Rev.WRC-19)*** *and are thus covered by the Resolution. These changes are essential to allow for recognition of space weather sensors in the RR as asked for by the Resolution. Additionally, following* resolves *3 of Resolution* ***657 (Rev.WRC-19)****, a WRC-23 draft new Resolution* ***[XXX-SW Importance]*** *on the importance of space weather sensor systems (see Attachment) is necessary to describe space weather sensor systems and their corresponding usage. This WRC-23 draft new Resolution is meant to reinforce the high interest of space weather measurements, to set the foundation for possible future studies on space weather sensors, by e.g. defining active and receive-only space weather sensors, and to encourage administrations to consider the importance of space weather observations.*

View C:

Regarding the potential notification issue some administrations are of the view that this could be resolved until a subsequent WRC will decide new MetAids (space weather) allocations made in RR Article ***5****.*

View D:

Regarding the potential notification issue, some administrations are of the view that the idea of RR Articles ***1*** *and* ***4*** *with link of the space weather sensors under MetAids (space weather) could be resolved by the elaboration of a WRC Resolution related for a new space weather agenda item, in that case no need for modifications of RR Articles* ***1*** *and* ***4****. This will avoid any modification of the RR at WRC-23.*

ATTACHMENT

DRAFT NEW RESOLUTION [XXX SW IMPORTANCE] (WRC-23)

The importance of MetAids (space weather) service application

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the collection and exchange of space weather data are important for detecting solar activity events including solar flare, high energetic particles and its relevant consequences to the Earth's geomagnetic and ionospheric conditions that impact services critical to the economy, safety and security of administrations and their population;

b) that space weather data is critical for forecasting and providing alerts of space weather events and important to understand the physical process to develop prediction models for space weather events and their impacts on social-infra services;

c) that space weather data is important to understand the physical process to provide prediction models for space weather events and their impacts;

d) that spectrum-reliant space weather sensor technology has been developed and operational systems have been deployed without much regard for domestic or international spectrum regulations, or for the potential need for protection from interference;

e) that spectrum-reliant space weather sensors may be vulnerable to interference from both terrestrial and spaceborne systems;

f) that some of the space weather sensors operate by receiving signals of low-level natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere, that impact Earth's environment and therefore may suffer harmful interference at levels which could be tolerated by other radiocommunication applications;

g) that the importance of space weather radiocommunication applications has been stressed by a number of international bodies, such as the World Meteorological Organization (WMO), the Intergovernmental Panel on Climate Change (IPCC), United Nations Office for Disaster Risk Reduction (UNDRR), International Civil Aviation Organization (ICAO), United Nations Committee on the Peaceful Uses of Outer Space (UN/COPUOS), and that ITU-R collaboration with these bodies is essential;

h) that space weather data collection is performed for the benefit of the whole international community and the data is generally made freely available to users,

recalling

a) the Plan of Action of the World Summit on the Information Society (Geneva, 2003), on e-environment, calling for the establishment of monitoring systems, using information and communication technologies (ICT), to forecast and monitor the impact of natural and man-made disasters, particularly in developing countries, least developed countries and small economies;

b) Resolution 136 (Rev. Bucharest, 2022) of the Plenipotentiary Conference, on the use of telecommunications/information and communication technologies for monitoring and management in emergency and disaster situations for early warning, prevention, mitigation and relief;

c) Resolution 182 (Rev. Bucharest, 2022) of the Plenipotentiary Conference, on the role of telecommunications/information and communication technologies on climate change and the protection of the environment for monitoring and management in emergency and disaster situations for early warning, prevention, mitigation and relief;

d) the Global Framework for Climate Services (GFCS) as identified at the Eighteenth World Meteorological Congress (Geneva, June 2019), which provides information to help society adapt to climate variability and change;

e) that the UNDRR and the International Science Council (ISC) identified hazards related to space weather in the initial list of the hazards for disaster risk management in 2021 under the Sendai Framework for Disaster Risk Reduction 2015-2030;

f) the United Nations General Assembly Resolution 76/3 of 25 October 2021, "The 'Space2030' Agenda: space as a driver of sustainable development", under objective 3: Increase awareness of the risks of adverse space weather and mitigate those risks, in order to ensure increased global resilience against space weather effects, and improve the international coordination of space weather-related activities, including outreach, communication and capacity-building, as well as the establishment of an international mechanism to promote increased high-level coordination in relation to space weather and increased global resilience against space weather effects;

g) Amendment 78 to Annex 3 to the Convention on International Civil Aviation (the International Standards and Recommended Practices, Meteorological Service for International Air Navigation) adopted on 7 March 2018 at the 213th Session of its Council, which has introduced space weather advisory information services on space weather phenomena expected to affect aeronautical radiocommunication and radio navigation systems,

recognizing

a) that Report ITU-R RS.2456-0, on space weather sensor systems using radio spectrum, contains:

– a summary of spectrum-reliant space weather sensors; and

– the documentation of the systems used for operational space weather monitoring, prediction and warnings deployed globally;

b) that the ITU-R Handbook on radio astronomy contains further information on space weather observations;

c) that an active space weather sensor is a system in the meteorological aids service (MetAids) (space weather) by means of which information is obtained by transmission and reception of radio waves;

d) that a receive-only space weather sensor is a system in the MetAids (space weather) by means of which information is obtained by reception of radio waves of natural origin or by the opportunistic reception of transmissions of other specific radiocommunication services;

e) that existing services, their systems and applications should be protected in the bands used for MetAids (space weather) observations and no undue constraints should be imposed on the future development of these services,

noting

a) that *in situ* and remote space weather capabilities depend on the availability of radio frequencies;

b) that, according to the United Nations Office for Outer Space Affairs (UNOOSA), society is becoming increasingly dependent on space-based systems and it is vital to understand how space weather could affect space systems and human space flight, electric power transmission, high-frequency radiocommunications, and global navigation satellite system (GNSS) signals;

c) that certain frequency bands used by space weather applications have unique physical characteristics, so that migration to alternative frequency bands is not possible,

resolves

1 to recognize the importance of the spectrum usage by space weather applications for monitoring space weather phenomena and events that impact services critical to the economy, safety and security of administrations and their population;

2 to urge administrations to take into account space weather radio-frequency requirements and in particular protection of the related frequency bands;

3 to encourage administrations to consider the importance of the use and availability of spectrum for space weather applications prior to taking decisions that would negatively impact their operations.

Agenda item 9.1(9.1-b)

5/9.1-b Review the amateur service and the amateur-satellite service allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the radionavigation-satellite service (space-to-Earth) operating in the same band in accordance with Resolution 774 (WRC-19);

Resolution **774 (WRC-19)** – *Studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the radionavigation-satellite service (space-to-Earth)*

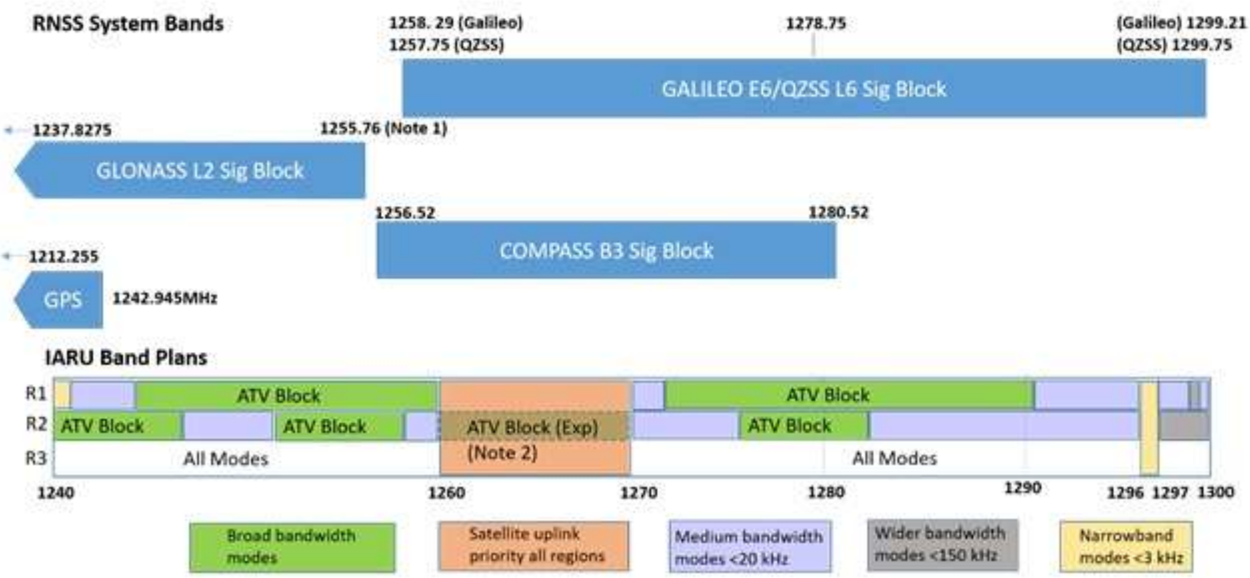
Summary of the results of ITU-R studies

The frequency band 1 240-1 300 MHz is allocated to the radionavigation-satellite service (RNSS) on a primary basis and used by various global and regional RNSS systems (e.g. GALILEO, GLONASS, COMPASS, GPS, QZSS) in different portions of the frequency band 1 240-1 300 MHz, for various applications, including high-accuracy location services with ubiquitous deployment of RNSS receivers. Furthermore, the band is allocated to the amateur and amateur-satellite services on a secondary basis.

Preliminary draft new Report ITU-R M.[AMATEUR.CHARACTERISTICS] provides the detailed information on the review of amateur and amateur-satellite service applications and a compilation of appropriate and relevant parameters and operational characteristics for the studies, while Report ITU-R M.2513 details the potential interference analysis and related studies.

FIGURE 5/9.1-B-1

The relationship between the various RNSS systems usage across the range 1 240-1 300 MHz and the amateur and amateur-satellite services band plans



Note 1: GLONASS navigation receivers manufactured before 2006 can receive navigation signals in the frequency band from 1 237.8275 MHz to 1 260.735 MHz.
Note 2: In Region 2, amateur television (ATV) is also identified for experimental use in this range.

The review of amateur and amateur-satellite applications reveals a range of narrowband and wideband emission types across the frequency range organized according to regional band plans. Operational data indicate a relatively low population of actively transmitting stations across the frequency band 1 240-1 300 MHz and operating characteristics suggest that emissions from the most common amateur stations are neither of long duration nor persistent in nature, which may help to achieve compatibility with RNSS (space-to-Earth).

Some cases of harmful interference caused by transmission from stations in the amateur service into RNSS (space-to-Earth) receivers have occurred, as recognized in Resolution **774 (WRC-19)**. As mandated by this Resolution, ITU-R has carried out studies and measurement campaigns.

Studies

Minimum coupling loss studies using the propagation model described in Recommendation ITU-R P.1546 considering typical propagation model parameters for worst-case and average scenarios were undertaken in order to provide the assessment of the geographical extent of interference which could be caused by a representative set of transmitting stations of the amateur service into RNSS (space-to-Earth) receivers. The studies indicate areas around radio amateur stations which show the potential for harmful interference into RNSS (space-to-Earth) receivers the extent of which depends on specific conditions such as using narrowband or wideband applications and clutter.

Receiver measurement campaigns

One measurement campaign was performed in Germany after the transmission of one amateur television station caused harmful interference to an RNSS (space-to-Earth) reference receiver operating in the frequency band 1 260-1 300 MHz. Signals representative of amateur stations were injected into the antenna port of an RNSS (space-to-Earth) receiver with 30 MHz bandwidth, at the Galileo E6 centre frequency and with frequency offsets dependent on the type of amateur emission in accordance with the International Amateur Radio Union (IARU) band plan (see Figure 5/9.1-B-1). Measurements of the post-correlation C/N_0 degradation led to the observation that the worst case occurs when an interfering signal is applied on the E6 centre frequency, while frequency separation from the E6 centre frequency yields significantly lower interference levels in the Galileo E6 receiver, in particular when this interfering signal falls outside the 30 MHz bandwidth specified for the receiver used in the measurement campaign. The impact of the interfering signal on non-E6 RNSS (space-to-Earth) receivers operating in other parts of the frequency band 1 240-1 300 MHz were not considered.

An additional interference suppression unit (ISU) used in some measurement setups resulted in significant interference reduction for narrowband signals (up to 150 kHz bandwidth) at arbitrary frequency positions. The ISU did not affect the reception quality when no interferer was present. The ISU did not perform well in equalizing wideband amateur television signals.

Like the case without an ISU, the measurements with an ISU have shown that a frequency offset of a possible interferer, relative to the Galileo E6 centre frequency, helps the RNSS (space-to-Earth) receiver retain its performance.

Another measurement campaign was performed in Italy after a frequency modulated signal transmitted by an amateur radio repeater station caused harmful interference to Galileo E6 receivers multiple times. The effect of amateur service transmissions with different power levels and different central frequencies was assessed using three different RNSS (space-to-Earth) receivers characterized by different front-end bandwidths spanning approximately from 30 MHz to 40 MHz.

Results show that of the four measured amateur applications the two which show the highest compatibility potential with RNSS (space-to-Earth) receivers, provided that power levels remain below certain thresholds, are narrowband FM and digital data. On the other hand, wideband amateur television applications caused harmful interference even at lower power, and offer lower compatibility potential.

View 1:

Some administrations have a view that the frequency band 1 240-1 300 MHz is also allocated worldwide on a primary basis to the RNSS in the space-to-space direction and to the Earth exploration-satellite service (EESS) (active) with clear understanding that Resolution ***774 (WRC-19)*** *concentrate only on the protection of the RNSS (space-to-Earth) receivers.*

However, the output of the agenda item 9.1(9.1-b) presented in the working document towards a preliminary draft new (WDPDN) Recommendation ITU-R M.[AS.GUIDANCE] proposes a power level of 100 W/1 MHz at a gain of 18 dB in a number of frequency ranges for the amateur and amateur-satellite services. Such output creates a risk of unacceptable interference to RNSS and EESS (active) space receivers.

Calculations from only one source of potential interference in the amateur service to typical RNSS and EESS space receivers in the frequency band 1 240-1 300 MHz indicated that:

– *the level of exceedance of the RNSS space receiver protection criteria by a station in the amateur service can be as high as 13 dB;*

– *the level of exceedance of the EESS space receiver protection criteria by a station in the amateur service can be as high as 38.7 dB (assuming with respect to the EESS that the receiver antenna gain of the space station subject to the interference is 10 dB in the direction of the interference source).*

Detailed technical calculations are presented in Tables 1 and 2 of Document CPM23-2/102.

Based on the information presented above, it is necessary to take into account the need to ensure protection for RNSS (space-to-space) and EESS (active) space receivers. Therefore, it is proposed to modify Resolution ***774 (WRC-19)*** *so that the necessary additional studies could be carried out and work on Recommendation ITU-R M.[AS.GUIDANCE] could be continued. The results of such studies should be included in the Report of the Director of the Radiocommunication Bureau to WRC-27 for the purpose of considering appropriate actions.*

View 2:

Other administrations are of the view that the issues raised in View 1 above are completely out of scope for WRC-23 agenda item 9.1, topic b) and Resolution ***774 (WRC-19)****. The BR Director's Report is intended to report on the activities of the ITU-R. It is not intended to create new studies. If there is a need for studies with respect to RNSS (space-to-space) and EESS (active) as mentioned in View 1, it is appropriate to deal with the issue under WRC-23 agenda item 10 to propose a future agenda item for WRC-27.*

In order to satisfy this topic, the development of Recommendation ITU-R M.[AS.GUIDANCE] needs to be completed and approved for WRC-23.

View 3:

Some administrations consider that the work undertaken for agenda item 9.1, topic b) has been carried out in full agreement with the resolves *of Resolution* ***774 (WRC-19)****, focused on the protection of RNSS (space-to-Earth) receivers from amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz. Additional studies related to the protection of other services in* *this frequency range can be carried out in the normal work of the ITU-R between the relevant Working Parties.*

Summary

Some cases of harmful interference caused by transmissions from stations in the amateur service operating on a secondary basis into RNSS (space-to-Earth) receivers operating on a primary basis have been observed, documented and reported in two countries. More information can be found in Report ITU-R M.2513.

Recommendation ITU-R M.1902 provides the characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 215-1 300 MHz which were considered when developing studies. These subsequent studies and measurements, presented in Report ITU-R M.2513, provided an estimate of potential interference distance and confirmed that the impact of interference generally depends on the bandwidth, power of the interfering signal but also upon the antenna installation height. Furthermore, these studies and measurements predicted that RNSS (space-to-Earth) receiver protection criteria could be exceeded by co-frequency emissions from typical amateur stations. Operational data indicate a relatively low population of actively transmitting stations across the frequency band 1 240-1 300 MHz and operating characteristics suggest that emissions from the most common amateur stations are neither of long duration nor persistent in nature, which may help to achieve compatibility with RNSS.

ITU-R is developing a Recommendation ITU-R M.[AS.GUIDANCE] providing guidelines in order to avoid such cases of harmful interference to the RNSS (space-to-Earth) receivers in the future. This Recommendation could include encouragement for the amateur and amateur-satellite services to use specific sub-bands with sufficient frequency offsets from the spectrum main lobes of RNSS signals, maximum emission power level and emission bandwidth restrictions to enhance the protection of RNSS (space-to-Earth) receivers in the bands under consideration.

These guidelines are intended to assist administrations and the amateur and amateur-satellite services to ensure the protection of the RNSS (space-to-Earth) in the frequency band 1 240-1 300 MHz.

Agenda item 9.1(9.1-c)

5/9.1-c Study the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis, in accordance with Resolution 175 (WRC-19);

Resolution **175 (WRC-19)** – *Use of International Mobile Telecommunications systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis*

Summary of the results of ITU-R studies

Examples were provided for some relevant published ITU-R Recommendations, Reports, and Handbook of fixed wireless access (see Documents 5A/19 – 5C/13). When these initial publications were developed, the expectations for fixed wireless applications were very different than those of today, including fixed wireless access, backhaul, core, transport and others. Therefore, WPs 5A and 5C found it timely to progress this work by revising the existing relevant publications and to develop any new ones as required to reflect the new technological capabilities and approaches of fixed wireless applications, according to input contributions received.

Input contributions were received proposing updates to some of these existing ITU-R Recommendations/Reports. Other input contributions proposed new ITU-R Reports and Recommendations to address required studies by WRC-23 agenda item 9.1, topic c). All input contributions were introduced in the joint activity of WPs 5A and 5C but were not fully discussed and no agreement was found on a single way forward. In the view of the above, the following two approaches are proposed:

Approach 1

Proceed with development of new ITU-R Recommendation(s), Report(s) and Handbook through submission of contribution to the subsequent relevant ITU-R meetings in that regard. Such a contribution should include arguments that current ITU-R Recommendation(s), Report(s) and Handbook either do not address or do not adequately address the objectives of WRC-23 agenda item 9.1, topic c), as referred to in the above-mentioned Resolution.

Approach 2

Proceed with the revision of Recommendation(s), Report(s) and Handbook through submission of contribution to relevant ITU-R subsequent meetings. Such a contribution should include arguments that current Recommendation(s), Report(s) and Handbook cover partially or adequately the objectives of WRC-23 agenda item 9.1, topic c) as referred to in Resolution **175 (WRC-19)**. Upon receipt of the above-mentioned contributions, WPs 5A and 5C would proceed accordingly. Should such a revision still not satisfy the requirements of this topic, then new Recommendation(s), Report(s), and/or Handbook can be developed in the ITU-R.

The discussions during this study cycle focused on the meaning of fixed wireless broadband (FWB) despite the clarifications provided by the Chairmen of WPs 5A and 5C (Documents 5A/19 – 5C/13).

There are a number of ITU-R publications, covering a variety of technologies and interfaces that could be also of relevance for the use of IMT technologies for fixed wireless applications including backhaul, core, transport and others which need further consideration.

The published ITU-R Recommendations and Reports on various types of fixed wireless and Handbook on "Fixed wireless access" are summarized in the "Guide to the use of ITU-R texts relating to the land mobile service, including wireless access in the fixed service", available on the

WP 5A and WP 5C webpages, which can be considered relevant to WRC-23 agenda item 9.1, topic c). This list is non-exhaustive as this roster of publications addresses some, but not all types of fixed wireless applications (backhaul, core, transport and others).

As a starting point, proposals were received to revise and update Recommendations ITU-R F.1401-1 and ITU-R F.1763-1, so that they are more reflective of the current state of technology including IMT technology for broadband fixed wireless access. Proposals were also received to revise other relevant F-Series Recommendations/Reports fixed wireless applications (access and backhaul). Other proposals of new ITU-R Reports and Recommendations (see also Annex 18 to Document 5A/221) with regards to the new capabilities of IMT systems and technologies to support various applications of fixed wireless broadband within the fixed service, including access and backhauling capabilities have been received. All proposals will need further consideration.

Accordingly, a new ITU-R Question may be developed, if necessary, to progress the work on existing or new ITU-R Reports, Recommendations and Handbook. There was also proposal to consider the extension of the study completion date of Question ITU-R 215-4/5, as it is currently 2019.

There was discussion regarding the use of the terms “IMT Technology” and “IMT System”. It was clarified that this topic concerned the fixed wireless applications that use of IMT technologies in the frequency bands allocated to the fixed service on a primary basis.

Concluding remarks

View 1: Discussions on the following alternatives referring to RA-23 or WRC-23 Resolutions are subject to the input contributions of administrations to RA-23 and/or WRC-23.

View 2: Input contributions to RA-23 and/or WRC-23 regarding the RA-23 and/or WRC-23 Resolutions in the following alternatives will be further discussed considering potential solutions proposed.

On the issue of a response to the objectives of Resolution **175 (WRC-19)** there were two alternatives:

Alternative 1:

Some administrations have the view that Resolution **175 (WRC-19)** needs to be revised to continue conducting the studies requested by WRC-23 agenda item 9.1, topic c), or draft a new Resolution for WRC-27, since there was no progress in this study cycle regarding the AI scope and mandates, and there were no discussions on the contents of the proposals by multiple administrations for new Recommendations/Reports or revising existing publications. In addition, continuing the studies by WRC-27 was agreed by WRC-19 as per the minutes of the 12th Plenary Meeting in items 28.105 and 28.106 as follow:

> “28.105 … the following text be included in the minutes of the meeting to reflect decisions taken by the conference:
>
> “Agenda item 9.1 “c” invites ITU-R to conduct studies to identify the potential frequency bands for the use of IMT for fixed wireless broadband within the frequency bands allocated to the fixed service on a primary basis. Accordingly, an agenda item for WRC-27 will be developed to consider those identified bands.”
>
> 28.106 It was so agreed.”

In addition, a draft new WRC/ITU-R Resolution was proposed along with a new Question to support the future development and use of IMT systems and technologies for broadband fixed wireless applications in the frequency bands allocated to the fixed service on a primary basis (see Attachment 1).

Accordingly, the mandate by WRC-23 agenda item 9.1, topic c), was not achieved nor satisfied, and the scope was not addressed, since discussions were only limited to terminologies of FWB meaning and difference between IMT systems and technologies with objections to any progress on the administrations' proposals.

Additional modifications to the related part of Attachment 1 are provided in Doc. CPM23-2/39).

Alternative 2:

Other administrations are of the view that there is no need to have any draft new or revised Resolution on this matter in the draft CPM text (see Attachment 2) and doing so would be outside the scope of the Resolution **175 (WRC-19)** *resolves* and consequently is not compliant with Resolution ITU-R 2-8, Annex 1 (Working methods), § A1.2.8. Therefore, these administrations support no change to the Radio Regulations under agenda item 9.1, topic c), except for suppression of Resolution **175 (WRC-19)**.

Regarding the minutes of WRC-19 referred to above in Alternative 1, they refer to an agreement to include the text proposed by a delegate of one administration in the minutes of the conference. This cannot be assumed as a formal decision of the conference to include an agenda item at WRC-27. If this was to be a formal decision of the conference, then WRC-19 would have taken a formal decision, for example by including a provisional agenda item for WRC-27. Furthermore, conferences are sovereign and this text in the minutes cannot be taken as one conference binding a future conference to take a particular action in this case.

ATTACHMENT 1

Draft new Resolution [[XXX] (WRC-23) / ITU-R [XXX]] / revision of Resolution 175 (WRC-19) for consideration and approval by WRC-23 or RA-23 (Options A and B)

Option A) Draft new Resolution XXX for consideration and approval by WRC-23 or RA-23

RESOLUTION XXX

Use of IMT technologies in the frequency bands allocated to the fixed service on a primary basis

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the use of harmonized frequency bands for International Mobile Telecommunications (IMT) systems is desirable in order to achieve the benefits of economies of scale worldwide;

b) that the use of IMT systems for fixed wireless broadband can assist in meeting global demands to bridge the digital divide, support the broadband agenda in developing countries and provide cost-effective broadband services to rural and underserved areas,

recognizing

a) that Resolution 139 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference calls for bridging the digital divide worldwide through the use of telecommunications/information and communication technologies to bridge the digital divide and build an inclusive information society;

b) that Resolution 37 (Rev. Buenos Aires, 2017) of the World Telecommunication Development Conference calls for bridging the digital divide;

c) that the ITU Radiocommunication Sector (ITU-R) Handbook on fixed wireless access addresses the use of early technologies of IMT systems for fixed wireless access, and Recommendation ITU-R M.819 contains specific requirements pertaining to fixed wireless access;

d) IMT capabilities are emerging rapidly to support integrated access and backhaul solution to facilitate networks deployment,

resolves to invite the ITU Radiocommunication Sector

to revise existing, and to develop new, ITU-R Handbooks, Recommendations and Reports on harmonizing the use of IMT technologies for fixed wireless broadband applications in the frequency bands allocated to the fixed service on a primary basis,

invites administrations

to participate in these studies.

Option B) Revision to Resolution 175 (WRC-19)

[Note: Under the approach A, revision to Resolution ***175 (WRC-19)*** *may also be considered.]*

ATTACHMENT 2

The ITU-R membership may continue studies, taking into account existing and new Study Questions, or revising existing publications, or considering new ITU-R documents, to support the future development of fixed wireless applications including those that use IMT technologies in the frequency bands allocated to the fixed service. This activity is already in progress in WP 5A and WP 5C and can continue through the course of work.

Below is an analysis which illustrates why neither an RA Resolution, nor a WRC Resolution such as the one present in Attachment 1, is needed.

Analysis

One contribution received from a Member State proposing a draft new WRC-23/ITU-R Resolution. The title and operative parts of that Resolution are reproduced below:

DRAFT NEW RESOLUTION WRC-23 / ITU-R

(…)

resolves to invite the ITU Radiocommunication Sector

to revise existing, and/or develop new, ITU-R studies, Handbooks, Recommendations and Reports on the use of IMT systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis,

invites administrations

to participate in these studies.

After extensive discussion at several sessions of the responsible ITU-R groups, there was no consensus to include the above-mentioned draft new Resolution in the draft CPM text relating to WRC-23 agenda item 9.1, topic c), for the following reasons:

– the ITU-R Study Groups/Working Parties responsible for any agenda item and the associated contributing groups are not eligible to propose any agenda item for the future WRC due to the fact that only the Member States through WRC-23 agenda item 10 could propose a new agenda item to the subsequent WRC;

– moreover, a detailed analysis of the proposed draft new Resolution was carried out, the results of which are summarized below.

The below is a comparison of text from Resolution **175 (WRC-19)** and of text from the proposed draft new Resolution.

RESOLUTION 175 (WRC-19)

(…)

resolves to invite the ITU Radiocommunication Sector

to conduct any necessary studies on the use of IMT systems for fixed wireless broadband in the frequency bands allocated to the fixed service on primary basis, taking into account the relevant ITU-R studies, Handbooks, Recommendations and Reports,

instructs the Director of the Radiocommunication Bureau

to report to WRC-23 on the results of these studies,

invites administrations

to participate in these studies in the process of preparation for WRC-23.

Draft new Resolution proposed by one Administration

(…)

resolves to invite the ITU Radiocommunication Sector

to revise existing, and/or develop new, ITU-R studies, Handbooks, Recommendations and Reports on the use of IMT systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis,

invites administrations

to participate in these studies.

The proposal from that administration is almost similar to the action being taken by ITU-R pursuant to Resolution **175 (WRC-19)**, namely:

> to conduct any necessary studies on the use of IMT systems for fixed wireless broadband in the frequency bands allocated to the fixed service on primary basis, taking into account the relevant ITU-R studies, Handbooks, Recommendations and Reports,

Consequently, ITU-R is already taking necessary actions on the operative part of Resolution **175 (WRC-19)** which is, to a great extent, similar to the action proposed in the potential draft new Resolution proposed by that administration.

If the proposed draft new Resolution by that administration is submitted to WRC-23, the following course of action would be required:

a) Consensus for the need to have such a draft new Resolution.

b) Modality/vehicle to implement that draft new Resolution.

One possible course of action which could be taken if the proposed draft Resolution is agreed by WRC-23 is:

c) the Conference adopt a topic under agenda item 9.1, or

d) the Conference adopt, strictly speaking, a new independent agenda item.

Both of the above approaches mentioned in *c)* and *d)* above would lead to the same circumstance that ITU-R is currently facing.

In view of the above, there would be no need to adopt any agenda item as mentioned in *c)* and *d)* above.

In regard to the need to have a draft new ITU-R Resolution at RA-23, it is necessary to indicate that a Radiocommunication Assembly Resolution is normally dealing with issues related to all ITU-R Study Groups, whereas the subject matter is merely related to/under the Terms of Reference of Study Group 5.

In regard to the need to have a new Question, it is worth mentioning that under No. 149A of the ITU Convention:

Quote

149A 1 *bis*) The radiocommunication study groups shall also study topics identified in resolutions and recommendations of world radiocommunication conferences. The results of such studies shall be included in recommendations or in the reports prepared in accordance with No. 156 below.

Unquote

Consequently, there is no need to have a new Question in this regard.

Therefore it was not agreed to include the proposed draft new WRC-23/ITU-R Resolution in the draft CPM text on WRC-23 agenda item 9.1, topic c).

The proposed draft is attached as Attachment 1 to the draft CPM text on WRC-23 agenda item 9.1, topic c), for information.

Agenda item 9.1(9.1-d)

5/9.1-d Protection of EESS (passive) in the frequency band 36-37 GHz from non-GSO FSS space stations;

See WRC-19 Document 535, 2nd section of the Annex.

Summary of the results of ITU-R studies

Under WRC-23 agenda item 9.1, topic d), which is a continuation of study matters that began but were not fully resolved under WRC-19 agenda item 1.6, there are two potential interference scenarios that were studied, while taking into account the fixed-satellite service (FSS) characteristics provided by the relevant ITU-R contributing group and the Earth exploration-satellite service (EESS) (passive) characteristics contained in Recommendation ITU-R RS.1861-1:

– interference into the sensing channel of EESS (passive) from non-geostationary-satellite orbit (non-GSO) FSS constellations operating in the frequency band 37.5-38 GHz at a lower altitude than EESS (passive) sensors;

– interference into the cold calibration channel of EESS (passive) from non-GSO FSS constellations operating in the frequency band 37.5-38 GHz at a higher altitude than EESS (passive) sensors.

With regard to the first scenario, the results of one study considering two different non-GSO FSS systems indicate that an unwanted emission power density limit of −31 dBW/100 MHz in the frequency band 36-37 GHz would be needed. This would be applicable to non-GSO FSS constellations operating at altitudes below 970 km (maximum altitude of EESS (passive) sensors in this frequency band). The results of another study considering one non-GSO FSS system show that there is a minimum positive margin of 10-15 dB to the EESS (passive) protection criteria. Both studies consider a side lobe level of 0 dBi, no additional satellite body blockage loss, and no apportionment of the EESS (passive) protection criterion. When considering an additional attenuation provided by the FSS satellite body of more than 18 dB, all studies conclude that no specific unwanted emission limit would be needed to cover this scenario.

With regard to the second scenario, the results of two studies considering three different non-GSO FSS systems indicate that an unwanted emission power density limit of −31 dBW/100 MHz in the frequency band 36-37 GHz would be needed, without apportionment of the EESS (passive) protection criterion. This would be applicable to non-GSO FSS constellations operating at altitudes above 407 km (minimum altitude of EESS (passive) sensors in this frequency band) and below 2 000 km (limited to LEO constellations). Another study that considers a different set of operational FSS characteristics has shown that there is a minimum margin of approximately 7 dB to the EESS (passive) protection criteria when only assessing interference from the particular constellation considered, and this study concludes that no specific unwanted emission limit would be needed to cover this scenario.

In addition, Administrative Circular CA/251 (Results of CPM23-1) stipulates that "WRC-19 invites ITU-R to conduct further study of this topic and develop Recommendations and/or Reports, as appropriate, and report back to WRC-23 to take action, if necessary".

Administrative Circular CA/251 also stipulates that "WRC-19 agreed that modifications to Resolution **750 (Rev.WRC-19)** should not be considered under these studies since the frequency band 36-37 GHz is not referenced in No. **5.340**".

ANNEX 1 TO THE CPM REPORT

Information on WRC-23 agenda item 10

Agenda item 10

10 to recommend to the Council items for inclusion in the agenda for the next WRC, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the Convention and Resolution ***804 (Rev.WRC-19)***

Resolution **804 (Rev.WRC-19)** – *Principles for establishing agendas for world radiocommunication conferences*

This Annex is for information of the regional groups and the membership of ITU-R in their preparation of WRC-23 agenda item (AI) 10. It is expected that the membership will take utmost account of the provided information together with the need to limit the number of WRC-27 agenda items and consequently the necessary study activities on the preparation for WRC-27. The volume of the agenda of a WRC and the workload of the preparatory work needed to be kept at a manageable level.

Some contributions to CPM addressed possible approaches to enhance the process of developing agenda items in accordance with Resolution **804 (Rev.WRC-19)** as well as the process of studies on WRC-23 agenda items by ITU-R. Document CPM23-2/111 outlines some principles for consideration:

– Issues that can be resolved under the standing agenda items of WRCs or through the regular activities of ITU-R should not be converted into separate agenda items of WRCs.

– Topic/subject under agenda item 9.1 should, as much as possible, be avoided since some of them are more complex than standard agenda items (these are also considered as hidden agenda items).

– Consistency between the title of agenda item and title of the supporting resolutions as well as operative parts of the resolutions is absolutely necessary and needs to be fully respected. In addition, every effort to be made in selecting Terms, Language and wording of the resolutions, in particular *resolves* parts, to be non-ambiguous, meaningful and clear.

– The preamble of any/all resolutions should be reduced to the absolute minimum necessary which are needed to justify the operative parts. In particular, *recognizing* parts of the resolution should only be factual statements already agreed by ITU-R and ITU.

– Reference to the protection of other services (in band and adjacent band if necessary) should be clearly specified in the resolution.

When preparing agenda item 10, there is a need to apply the outline and principles not only to new proposals but also to preliminary agenda items as outlined in Resolution **812 (WRC-19)**.

Furthermore, contributions to WRC-23 regarding possible new agenda items for WRC-27 will be considered.

SECTION 1

Suggestions on WRC-27 preliminary agenda items, see Resolution 812 (WRC-19)

A1/2.1 WRC-27 preliminary agenda item 2.1

2.1 to consider, in accordance with Resolution ***663 (WRC-19)****, additional spectrum allocations to the radiolocation service on a co-primary basis in the frequency band 231.5-275 GHz and an identification for radiolocation applications in frequency bands in the frequency range 275-700 GHz for millimetre and sub-millimetre wave imaging systems;*

Resolution **663 (WRC-19)** – *New allocations for the radiolocation service in the frequency band 231.5-275 GHz, and a new identification for radiolocation service applications in frequency bands in the frequency range 275-700 GHz*

There have been contributions to AI 2.1 outlined in Document CPM23-2/98.

A1/2.2 WRC-27 preliminary agenda item 2.2

2.2 to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed-satellite service, in accordance with Resolution ***176 (WRC-19)****;*

Resolution **176 (WRC-19)** – *Use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed-satellite service*

There have been contributions to AI 2.2 outlined in Document CPM23-2/103

A1/2.3 WRC-27 preliminary agenda item 2.3

2.3 to consider the allocation of all or part of the frequency band [43.5-45.5 GHz] to the fixed-satellite service, in accordance with Resolution ***177 (WRC-19)****;*

Resolution **177 (WRC-19)** – *Studies relating to spectrum needs and possible allocation of the frequency band 43.5-45.5 GHz to the fixed-satellite service*

A1/2.4 WRC-27 preliminary agenda item 2.4

2.4 the introduction of power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) limits in Article ***21*** *for the frequency bands 71-76 GHz and 81-86 GHz in accordance with Resolution* ***775 (WRC-19)****;*

Resolution **775 (WRC-19)** – *Sharing between stations in the fixed service and satellite services in the frequency bands 71-76 GHz and 81-86 GHz*

There have been contributions to AI 2.4 outlined in Documents CPM23-2/98, CPM23-2/103 and CPM23-2/110.

A1/2.5 WRC-27 preliminary agenda item 2.5

2.5 the conditions for the use of the 71-76 GHz and 81-86 GHz frequency bands by stations in the satellite services to ensure compatibility with passive services in accordance with Resolution ***776 (WRC-19)****;*

Resolution **776 (WRC-19)** – *Conditions for the use of the frequency bands 71-76 GHz and 81-86 GHz by stations in the satellite services to ensure compatibility with passive services*

In preparation for WRC-23, no studies have been performed on the technical conditions for satellite services in the frequency band 81-86 GHz in order to protect the Earth exploration-satellite (passive) and the space research (passive) services in the frequency band 86-92 GHz. There have been no studies performed on the technical conditions for satellite services regarding protecting the radio astronomy service in the co-primary (81-86 GHz) and adjacent frequency bands (76-77.5 GHz, 79-81 GHz, and 86-92 GHz).

Recommendation ITU-R RS.1861-1 contains up-to-date technical and operational characteristics of Earth exploration-satellite service (passive) systems, including in the 86-92 GHz band.

Report ITU-R RA.2510-0 includes technical and operational characteristics of radio astronomy stations in these frequency bands.

A1/2.6 WRC-27 preliminary agenda item 2.6

2.6 to consider regulatory provisions for appropriate recognition of space weather sensors and their protection in the Radio Regulations, taking into account the results of ITU Radiocommunication Sector studies reported to WRC-23 under agenda item 9.1 and its corresponding Resolution ***657 (Rev.WRC-19)****;*

Resolution **657 (Rev.WRC-19)** – *Protection of radio spectrum-reliant space weather sensors used for global prediction and warnings*

Summary of the results of ITU-R preliminary studies

Preliminary WRC-27 agenda item 2.6 seeks to propose the continuity of the studies performed under WRC-23 agenda item 9.1, topic a) (see section 5/9.1-a in Chapter 5 of the CPM Report).

There have been contributions to AI 2.6 outlined in Documents CPM23-2/98 and CPM23-2/103.

A1/2.7 WRC-27 preliminary agenda item 2.7

2.7 to consider the development of regulatory provisions for non-geostationary fixed-satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space), in accordance with Resolution ***178 (WRC-19)****;*

Resolution **178 (WRC-19)** – *Studies of technical and operational issues and regulatory provisions for non-geostationary fixed-satellite service satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space)*

A1/2.8 WRC-27 preliminary agenda item 2.8

2.8 to study the technical and operational matters, and regulatory provisions, for space-to-space links in the frequency bands [1 525-1 544 MHz], [1 545-1 559 MHz], [1 610-1 645.5 MHz], *[1 646.5-1 660.5 MHz] and [2 483.5-2 500 MHz] among non-geostationary and geostationary satellites operating in the mobile-satellite service, in accordance with Resolution* ***249 (WRC-19)****;*

Resolution **249 (WRC-19)** – *Study of technical and operational issues and regulatory provisions for space-to-space transmissions in the Earth-to-space direction in the frequency bands [1 610-1 645.5 and 1 646.5-1 660.5 MHz] and the space-to-Earth direction in the frequency bands [1 525-1 544 MHz], [1 545-1 559 MHz], [1 613.8-1 626.5 MHz] and [2 483.5-2 500 MHz] among non-geostationary and geostationary satellites operating in the mobile-satellite service*

There have been contributions to AI 2.8 outlined in Document CPM23-2/13.

Note: see also section 4/1.17 in Chapter 4.

A1/2.9 WRC-27 preliminary agenda item 2.9

2.9 to consider possible additional spectrum allocations to the mobile service in the frequency band 1 300-1 350 MHz to facilitate the future development of mobile-service applications, in accordance with Resolution ***250 (WRC-19)****;*

Resolution **250 (WRC-19)** – *Studies on possible allocations to the land mobile service (excluding International Mobile Telecommunications) in the frequency band 1 300-1 350 MHz for use by administrations for the future development of terrestrial mobile-service applications*

There have been contributions to AI 2.9 outlined in Documents CPM23-2/16 and CPM23-2/98.

A1/2.10 WRC-27 preliminary agenda item 2.10

2.10 to consider improving the utilization of the VHF maritime frequencies in Appendix ***18****, in accordance with Resolution* ***363 (WRC-19)****;*

Resolution **363 (WRC-19)** – *Considerations to improve utilization of the VHF maritime frequencies in Appendix* ***18***

There have been contributions to AI 2.10 outlined in Documents CPM23-2/98 and CPM23-2/103.

A1/2.11 WRC-27 preliminary agenda item 2.11

2.11 to consider a new Earth exploration-satellite service (Earth-to-space) allocation in the frequency band 22.55-23.15 GHz, in accordance with Resolution ***664 (WRC-19)****;*

Resolution **664 (WRC-19)** – *Use of the frequency band 22.55-23.15 GHz by the Earth exploration-satellite service (Earth-to-space)*

A1/2.12 WRC-27 preliminary agenda item 2.12

2.12 to consider the use of existing International Mobile Telecommunications (IMT) identifications in the frequency range 694-960 MHz by consideration of the possible removal of the limitation regarding aeronautical mobile in IMT for the use of IMT user equipment by non-safety applications, where appropriate, in accordance with Resolution ***251 (WRC-19)****;*

Resolution **251 (WRC-19)** – *Removal of the limitation regarding aeronautical mobile in the frequency range 694-960 MHz for the use of International Mobile Telecommunications user equipment by non-safety applications*

There have been contributions to AI 2.12 outlined in Documents CPM23-2/84 and CPM23-2/103.

A1/2.13 WRC-27 preliminary agenda item 2.13

*2.13 to consider a possible worldwide allocation to the mobile-satellite service for the future development of narrowband mobile-satellite systems in frequency bands within the frequency range [1.5-5 GHz], in accordance with Resolution **248 (WRC-19)**;*

Resolution **248 (WRC-19)** – *Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems*

SECTION 2

Additional suggestions on possible new agenda items for WRC-27

Some suggestions for agenda items currently under consideration for inclusion on the agenda for WRC-27 were submitted to the CPM23-2 and noted here for information purposes (Documents CPM23-2/14, 84, 94, 96, 103, 110, 182, 213, 221).

Regional organizations and administrations are still in the process of preparing for AI 10 of WRC-23. It is expected that this process will take into account Resolution **804 (Rev.WRC-19)**. Additional information on views and proposals for agenda items for WRC-27 may be available on the following websites of ITU-R and regional organizations:

ITU Inter-regional Workshops on WRC-23 Preparation:
https://www.itu.int/en/ITU-R/conferences/wrc/2023/irwsp/Pages/default.aspx

African Telecommunications Union (ATU): http://www.atuuat.africa/

Arab Spectrum Management Group (ASMG)

Asia-Pacific Telecommunity (APT): https://www.apt.int/APTAPG

Inter-American Telecommunication Commission (CITEL):
http://www.citel.oas.org/en/Pages/PCCII

European Conference of Postal and Telecommunications Administrations (CEPT):
https://www.cept.org/ecc/groups/ecc/cpg/client/introduction/

Regional Commonwealth in the Field of Communications (RCC):
http://www.en.rcc.org.ru/

The membership and the regional organizations are invited to take this information into account when preparing for agenda item 10 of WRC-23.

SECTION 3

Other suggestions in relation to WRC-27

Some suggestions regarding the process of establishing an agenda for world radiocommunication conferences and the study period currently under consideration were submitted by Member States to the CPM23-2 and noted here for information purposes (Documents CPM23-2/109, 111).

Document CPM23-2/109 draws attention to the difficulty or impracticability for the relevant ITU-R study group/working party to properly reflect study results in the section "Methods to satisfy the agenda item". In order to resolve such problems, the following principles are proposed to be taken into account:

– to agree, to the maximum possible extent, on sharing and compatibility criteria, assumptions, and simulation process at the early stage of ITU-R studies relevant to WRC agenda items before interested membership begins with those studies;

– to use, to the extent practicable and available any sharing and compatibilities studies so far carried out in previous cycles, to avoid repeating studies previously performed;

– to investigate the extent to which in-band sharing and compatibility studies should be carried out, namely whether they should be limited to the services having primary status, or also include other services having secondary status, on an exceptional basis;

– to investigate the extent to which adjacent-band sharing and compatibility studies should be carried out, namely whether they should be limited to some sensitive services having primary status or also include other services irrespective of their sensitivities;

– to investigate the extent to which adjacent-band sharing and compatibility studies should be carried out, namely whether they should be limited to some sensitive services having primary status or also include other services irrespective of their sensitivities. This principle is also important due to the fact that a) the language used in the *resolves* part of the supporting resolution might have clearly mentioned the protection of adjacent band or whether that *resolves* is silent on the matter.

Document CPM23-2/111 proposes to modify Resolution **804 (Rev.WRC-19)** to improve the management of the work under WRC's standing agenda item for establishing agendas for future WRCs. The principles and procedures for development of agendas of WRCs are included in Resolution **804 (Rev.WRC-19)**. This Resolution therefore is the basis for development of future WRCs' agenda items and their supporting resolutions.

ANNEX 2 TO THE CPM REPORT

Reference list of ITU-R Resolutions, Recommendations and Reports, as well as other ITU and non-ITU publications, used in the CPM Report

CONTENTS

1 List of existing ITU-R Resolutions

Resolution ITU-R*	Latest publication	Resolution title	Agenda item	CPM chapter
1-8	Res. ITU-R 1-8 (RA-19)	Working methods for the Radiocommunication Assembly, the Radiocommunication Study Groups, the Radiocommunication Advisory Group and other groups of the Radiocommunication Sector	1.5	1
2-8	Res. ITU-R 2-8 (RA-19)	Conference Preparatory Meeting	1.3	1
			1.5	1
			9.1-c	5
58-2	Res. ITU-R 58-2 (RA-19)	Studies on the implementation and use of cognitive radio systems	4	5
59	Res. ITU-R 59-2 (RA-19)	Studies on availability of frequency bands for worldwide and/or regional harmonization and conditions for their use by terrestrial electronic news gathering systems	1.5	1
60-2	Res. ITU-R 60-2 (RA-19)	Reduction of energy consumption for environmental protection and mitigating climate change by use of ICT/radiocommunication technologies and systems	1.5	1
61-2	Res. ITU-R 61-2 (RA-19)	ITU-R's contribution in implementing the outcomes of the World Summit on the Information Society and the 2030 Agenda for Sustainable Development	1.5	1

2 List of preliminary draft new (PDN) or revised (PDR) ITU-R Resolution(s)

Resolution draft number*	Available document / status	Draft Resolution title	Agenda item	CPM chapter
–	–	–	–	–

* Reference(s) used in the the draft CPM Report.

3 List of existing ITU-R Recommendations

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
BO.1834		Rec. ITU-R BO.1834-0	Coordination between geostationary-satellite orbit fixed-satellite service networks and broadcasting-satellite service networks in the band 17.3-17.8 GHz and among the broadcasting-satellite service and associated feeder-link networks serving Region 2 in the bands 17.3-17.8 GHz and 24.75-25.25 GHz	1.19	4
BO.1834-0				1.19	4
BO.1835		Rec. ITU-R BO.1835-0	Sharing between broadcasting-satellite service (BSS) networks using the Region 2 17.3-17.8 GHz BSS allocation and feeder links of BSS networks using the worldwide 17.3-17.8 GHz fixed-satellite service (FSS) (Earth-to-space) allocation	1.19	4
BO.1835-0				1.19	4
BS.216-2		Rec. ITU-R BS.216-2	Protection ratio for sound broadcasting in the Tropical Zone	1.9	2
BS.559-2		Rec. ITU-R BS.559-2	Objective measurement of radio-frequency protection ratios in LF, MF and HF broadcasting	1.9	2
BS.560-4		Rec. ITU-R BS.560-4	Radio-frequency protection ratios in LF, MF and HF broadcasting	1.9	2
BS.639-0		Rec. ITU-R BS.639-0	Necessary bandwidth of emission in LF, MF and HF broadcasting	1.9	2
BS.703-0		Rec. ITU-R BS.703-0	Characteristics of AM sound broadcasting reference receivers for planning purposes	1.9	2
BS.1114-12		Rec. ITU-R BS.1114-12	Systems for terrestrial digital sound broadcasting to vehicular, portable and fixed receivers in the frequency range 30-3 000 MHz	1.12	3
BS.1514-2		Rec. ITU-R BS.1514-2	System for digital sound broadcasting in the broadcasting bands below 30 MHz	1.9	2
BT.1368		Rec. ITU-R BT.1368-13	Planning criteria, including protection ratios, for digital terrestrial television services in the VHF/UHF bands	1.5	1
BT.1368-13					

ITU-R Series / Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
BT.1895	Rec. ITU-R BT.1895-0	Protection criteria for terrestrial broadcasting systems	1.5	1
BT.1895-0			1.12	3
BT.1895-0			1.5	1
BT.1895-0			1.9	2
BT.2033	Rec. ITU-R BT.2033-2	Planning criteria, including protection ratios, for second generation of digital terrestrial television broadcasting systems in the VHF/UHF bands	1.5	1
BT.2033-1				
BT.2136-0	Rec. ITU-R BT.2136-0	Assessing interference into digital terrestrial television broadcasting from other services by means of Monte Carlo simulation	1.5	1
F.1245	Rec. ITU-R F.1245-3	Mathematical model of average and related radiation patterns for point-to-point fixed wireless system antennas for use in interference assessment in the frequency range from 1 GHz to 86 GHz	1.15	4
F.1245-3			1.10	2
F.1245-3			1.19	4
F.1336	Rec. ITU-R F.1336-5	Reference radiation patterns of omnidirectional, sectoral and other antennas for the fixed and mobile services for use in sharing studies in the frequency range from 400 MHz to about 70 GHz	1.3	1
F.1336-5			1.10	2
F.1336-5			1.19	4
F.1487-0	Rec. ITU-R F.1487-0	Testing of HF modems with bandwidths of up to about 12 kHz using ionospheric channel simulators	1.9	2
F.1494	Rec. ITU-R F.1494-0	Interference criteria to protect the fixed service from time varying aggregate interference from other services sharing the 10.7-12.75 GHz band on a co-primary basis	1.8	2
F.1495	Rec. ITU-R F.1495-2	Interference criteria to protect the fixed service from time varying aggregate interference from other radiocommunication services sharing the 17.7-19.3 GHz band on a co-primary basis	1.8	2
F.1495-2			1.10	2
F.1495-2			1.13	3
F.1495-2			1.19	4
F.1500	Rec. ITU-R F.1500-0	Preferred characteristics of systems in the fixed service using high altitude platforms operating in the bands 47.2-47.5 GHz and 47.9-48.2 GHz	1.4	1

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
F.1565		Rec. ITU-R F.1565-1	Performance degradation due to interference from other services sharing the same frequency bands on a co-primary basis, or from other sources of interference, with real digital fixed wireless systems used in the international and national portions of a 27 500 km hypothetical reference path at or above the primary rate	1.8	2
F.1565-1				1.10	2
F.1569-0		Rec. ITU-R F.1569-0	Technical and operational characteristics for the fixed service using high altitude platform stations in the bands 27.5-28.35 GHz and 31-31.3 GHz	1.17	4
M.476		Rec. ITU-R M.476-5 (incorporated by reference in the RR)	Direct-printing telegraph equipment in the maritime mobile service	1.11	2
M.492		Rec. ITU-R M.492-6 (incorporated by reference in the RR)	Operational procedures for the use of direct-printing telegraph equipment in the maritime mobile service	1.11	2
M.585-8		Rec. ITU-R M.585-9*	Assignment and use of identities in the maritime mobile service	2	5
M.585-9				2	5
M.625		Rec. ITU-R M.625-4 (incorporated by reference in the RR)	Direct-printing telegraph equipment employing automatic identification in the maritime mobile service	1.11	2
M.625-4				1.11	2
M.627		Rec. ITU-R M.627-1	Technical characteristics for HF maritime radio equipment using narrow-band phase-shift keying (NBPSK) telegraphy	1.11	2
M.632-3		Rec. ITU-R M.632-3	Transmission characteristics of a satellite emergency position-indicating radio beacon (satellite EPIRB) system operating through geostationary satellites in the 1.6 GHz band	1.11	2
M.819		Rec. ITU-R M.819-2	International Mobile Telecommunications-2000 (IMT-2000) for developing countries	9.1-c	5
M.1085		Rec. ITU-R M.1085-1	Technical and operational characteristics of wind profiler radars for bands in the vicinity of 400 MHz	1.5	1

* Rec. ITU-R M.585-8 is incorporated by reference in the RR.

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
M.1172		Rec. ITU-R M.1172-0 (incorporated by reference in the RR)	Miscellaneous abbreviations and signals to be used for radiocommunications in the maritime mobile service	1.11	2
M.1174		Rec. ITU-R M.1174-4 (incorporated by reference in the RR)	Technical characteristics of equipment used for on-board vessel communications in the bands between 450 and 470 MHz	1.5	1
M.1180		Rec. ITU-R M.1180-0	Availability of communication circuits in the aeronautical mobile-satellite (R) services (AMS(R)S)	1.8	2
M.1184-3		Rec. ITU-R M.1184-3	Technical characteristics of mobile satellite systems in the frequency bands below 3 GHz for use in developing criteria for sharing between the mobile-satellite service (MSS) and other services	1.11	2
M.1188-1		Rec. ITU-R M.1188-1	Impact of propagation on the design of non-GSO mobile-satellite systems not employing satellite diversity which provide service to handheld equipment	1.11	2
M.1226-0		Rec. ITU-R M.1226-0	Technical and operational characteristics of wind profiler radars in bands in the vicinity of 50 MHz	1.12	3
M.1231-0		Rec. ITU-R M.1231-0	Interference criteria for space-to-Earth links operating in the mobile-satellite service with non-geostationary satellites in the 137-138 MHz band	1.7	2
M.1232-0		Rec. ITU-R M.1232-0	Sharing criteria for space-to-Earth links operating in the mobile-satellite service with non-geostationary satellites in the 137-138 MHz band	1.7	2
M.1233		Rec. ITU-R M.1233-1	Technical considerations for sharing satellite network resources between the mobile-satellite service (MSS) (other than the aeronautical mobile-satellite (R) service (AMS(R)S)) and AMS(R)S	1.8	2
M.1314		Rec. ITU-R M.1314-1	Reduction of unwanted emissions of radar systems operating above 400 MHz	1.5	1
M.1372		Rec. ITU-R M.1372-1	Efficient use of the radio spectrum by radar stations in the radiodetermination service	1.8	2
M.1457		Rec. ITU-R M.1457-15	Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)	1.2	1

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
M.1458-0		Rec. ITU-R M.1458-0	Use of the frequency bands between 2.8-22 MHz by the aeronautical mobile (R) service for data transmission using class of emission J2D	1.9	2
M.1461		Rec. ITU-R M.1461-2	Procedures for determining the potential for interference between radars operating in the radiodetermination service and systems in other services	1.2	1
M.1461-2				1.10	2
M.1461-2				1.12	3
M.1461-2				1.19	4
M.1462		Rec. ITU-R M.1462-1	Characteristics of and protection criteria for radars operating in the radiolocation service in the frequency range 420-450 MHz	1.5	1
M.1465		Rec. ITU-R M.1465-4	Characteristics of and protection criteria for radars operating in the radiodetermination service in the frequency range 3 100-3 700 MHz	1.2	1
M.1583-1		Rec. ITU-R M.1583-1 (incorporated by reference in the RR)	Interference calculations between non-geostationary mobile-satellite service or radionavigation-satellite service systems and radio astronomy telescope sites	1.13	3
M.1583-1				2	5
M.1643		Rec. ITU-R M.1643-0 (incorporated by reference in the RR)	Technical and operational requirements for aircraft earth stations of aeronautical mobile-satellite service including those using fixed-satellite service network transponders in the band 14-14.5 GHz (Earth-to-space)	1.8	2
M.1644		Rec. ITU-R M.1644-0	Technical and operational characteristics, and criteria for protecting the mission of radars in the radiolocation and radionavigation service operating in the frequency band 13.75-14 GHz	1.8	2
M.1730		Rec. ITU-R M.1730-2	Characteristics of and protection criteria for the radiolocation service in the frequency band 15.4-17.3 GHz	1.8	2
M.1730-1				1.10	2
M.1730-1				1.19	4
M.1732-2		Rec. ITU-R M.1732-3	Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies	1.12	3
M.1732-3				1.12	3
M.1767		Rec. ITU-R M.1767-0	Protection of land mobile systems from terrestrial digital video and audio broadcasting systems in the VHF and UHF shared bands allocated on a primary basis	1.5	1

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
	M.1796	Rec. ITU-R M.1796-3	Characteristics of and protection criteria for radars operating in the radiodetermination service in the frequency band 8 500-10 680 MHz	1.2	1
	M.1797	Rec. ITU-R M.1797-0	Vocabulary of terms for the land mobile service	1.5	1
	M.1798	Rec. ITU-R M.1798-2	Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service	1.11	2
	M.1808	Rec. ITU-R M.1808-1	Technical and operational characteristics of conventional and trunked land mobile systems operating in the mobile service allocations below 869 MHz to be used in sharing studies in bands below 960 MHz	1.5	1
	M.1808-1			1.12	3
	M.1823	Rec. ITU-R M.1823-0	Technical and operational characteristics of digital cellular land mobile systems for use in sharing studies	1.5	1
	M.1824-1	Rec. ITU-R M.1824-2	System characteristics of television outside broadcast, electronic news gathering and electronic field production in the mobile service for use in sharing studies	1.15	4
	M.1825	Rec. ITU-R M.1825-0	Guidance on technical parameters and methodologies for sharing studies related to systems in the land mobile service	1.5	1
	M.1825-0			1.10	2
	M.1830	Rec. ITU-R M.1830-0	Technical characteristics and protection criteria of aeronautical radionavigation service systems in the 645-862 MHz frequency band	1.5	1
	M.1874-1	Rec. ITU-R M.1874-1	Technical and operational characteristics of oceanographic radars operating in sub-bands within the frequency range 3-50 MHz	1.12	3
	M.2008	Rec. ITU-R M.2008-1	Characteristics and protection criteria for radars operating in the aeronautical radionavigation service in the frequency band 13.25-13.40 GHz	1.8	2
	M.2008-1			1.15	4
	M.2010	Rec. ITU-R M.2010-2	Characteristics of a digital system, referred to as navigational data for broadcasting maritime safety and security related information from shore-to-ship in the 500 kHz band	1.11	2

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
M.2058		Rec. ITU-R M.2058-1	Characteristics of a digital system, referred to as navigational data for broadcasting maritime safety and security related information from shore-to-ship in the maritime HF frequency band	1.11	2
M.2068-0		Rec. ITU-R M.2068-0	Characteristics of and protection criteria for systems operating in the mobile service in the frequency range 14.5-15.35 GHz	1.13	3
M.2083		Rec. ITU-R M.2083-0	IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond	1.2	1
M.2089-0		Rec. ITU-R M.2089-0	Technical characteristics and protection criteria for aeronautical mobile service systems in the frequency range 14.5-15.35 GHz	1.10	2
M.2090		Rec. ITU-R M.2090-0	Specific unwanted emission limit of IMT mobile stations operating in the frequency band 694-790 MHz to facilitate protection of existing services in Region 1 in the frequency band 470-694 MHz	1.5	1
M.2091		Rec. ITU-R M.2091-0	Methodology to calculate spectrum requirements within the frequency bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space) for aeronautical mobile-satellite (R) service communications related to the priority categories 1 to 6 of Article **44** of the Radio Regulations	4	5
M.2092		Rec. ITU-R M.2092-1	Technical characteristics for a VHF data exchange system in the VHF maritime mobile band	1.11	2
M.2092-0				1.7	2
M.2101		Rec. ITU-R M.2101-0	Modelling and simulation of IMT networks and systems for use in sharing and compatibility studies	1.2	1
M.2101				1.4	1
M.2101				1.5	1
M.2101-0				1.2	1
M.2114		Rec. ITU-R M.2114-0	Technical and operational characteristics of and protection criteria for aeronautical mobile service systems in the frequency bands 22.5-23.6 GHz and 25.25-27.5 GHz	1.1	1
M.2114-0				1.10	2

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
M.2115		Rec. ITU-R M.2115-0	Technical and operational characteristics of and protection criteria for aeronautical mobile systems operating in the 45.5-47 GHz frequency range	1.1	1
M.2115-0				1.10	2
M.2120-0		Rec. ITU-R M.2120-0	Technical characteristics and protection criteria for aeronautical mobile systems operating in the mobile service in the frequency range 21.2-22 GHz	1.10	2
P.368-9		Rec. ITU-R P.368-10	Ground-wave propagation curves for frequencies between 10 kHz and 30 MHz	1.9	2
P.371-8		Rec. ITU-R P.371-8	Choice of indices for long-term ionospheric predictions	1.9	2
P.373-9		Rec. ITU-R P.373-9	Definitions of maximum and minimum transmission frequencies	1.9	2
P.528		Rec. ITU-R P.528-5	A propagation prediction method for aeronautical mobile and radionavigation services using the VHF, UHF and SHF bands	1.2	1
P.528				1.4	1
P.528-5				1.8	2
P.528-5				1.10	2
P.533-14		Rec. ITU-R P.533-14	Method for the prediction of the performance of HF circuits	1.9	2
P.534-5		Rec. ITU-R P.534-6	Method for calculating sporadic-E field strength	1.9	2
P.581-2		Rec. ITU-R P.581-3	The concept of "worst month"	1.9	2
P.620		Rec. ITU-R P.620-7	Propagation data required for the evaluation of coordination distances in the frequency range 100 MHz to 105 GHz	1.15	4
P.676		Rec. ITU-R P.676-13	Attenuation by atmospheric gases and related effects	1.2	1
P.676				1.15	4
P.676				1.16	4
P.676-12				1.10	2
P.845-3		Rec. ITU-R P.845-3	HF field-strength measurement	1.9	2
P.2001		Rec. ITU-R P.2001-4	A general purpose wide-range terrestrial propagation model in the frequency range 30 MHz to 50 GHz	1.2	1
P.2001				1.3	1

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
RA.769		Rec. ITU-R RA.769-2 (parts incorporated by reference in the RR)	Protection criteria used for radio astronomical measurements	1.2	1
RA.769				1.5	1
RA.769				1.7	2
RA.769				1.8	2
RA.769				1.13	3
RA.769-2				1.4	1
RA.769-2				1.8	2
RA.769-2				1.10	2
RA.769-2				1.11	2
RA.769-2				1.13	3
RA.769-2				2	5
RA.1031-3		Rec. ITU-R RA.1031-3	Protection of the radio astronomy service in frequency bands shared with active services	1.11	2
RA.1513		Rec. ITU-R RA.1513-2 (incorporated by reference in the RR)	Levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service on a primary basis	1.8	2
RA.1513				1.13	3
RA.1513-2				1.5	1
RA.1513-2				1.8	2
RA.1513-2				1.10	2
RA.1513-2				1.11	2
RA.1513-2				1.13	3
RA.1513-2				2	5
RA.1631-0		Rec. ITU-R RA.1631-0 (incorporated by reference in the RR)	Reference radio astronomy antenna pattern to be used for compatibility analyses between non-GSO systems and radio astronomy service stations based on the epfd concept	1.10	2
RA.1631-0				1.13	3
RA.1631-0				2	5
RS.577-7		Rec. ITU-R RS.577-7	Frequency bands and required bandwidths used for spaceborne active sensors operating in the Earth exploration-satellite (active) and space research (active) services	1.19	4

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
	RS.1260-2	Rec. ITU-R RS.1260-2 (incorporated by reference in the RR)	Feasibility of sharing between active spaceborne sensors and other services in the range 420-470 MHz	4	5
	RS.1861	Rec. ITU-R RS.1861-1	Typical technical and operational characteristics of Earth exploration-satellite service (passive) systems using allocations between 1.4 and 275 GHz	1.14	3
	RS.1861-1			1.2	1
	RS.1861-1			1.10	2
	RS.1861-1			1.14	3
	RS.1861-1 (section 6.20)			1.14	3
	RS.1861-1			9.1-d	5
	RS.1861-1			10 (WRC-27 preliminary agenda item 2.5)	Annex 1
	RS.2017	Rec. ITU-R RS.2017-0	Performance and interference criteria for satellite passive remote sensing	1.2	1
	RS.2017-0			1.10	2
	RS.2043	Rec. ITU-R RS.2043-0	Characteristics of synthetic aperture radars operating in the Earth exploration-satellite service (active) around 9 600 MHz	1.2	1
	RS.2065	Rec. ITU-R RS.2065-0 (incorporated by reference in the RR)	Protection of space research service (SRS) space-to-Earth links in the 8 400-8 450 MHz and 8 450-8 500 MHz bands from unwanted emissions of synthetic aperture radars operating in the Earth exploration-satellite service (active) around 9 600 MHz	1.2	1
	S.465	Rec. ITU-R S.465-6	Reference radiation pattern of earth station antennas in the fixed-satellite service for use in coordination and interference assessment in the frequency range from 2 to 31 GHz	1.3	1
	S.465			1.8	2
	S.465-6			1.10	2
	S.484	Rec. ITU-R S.484-3	Station-keeping in longitude of geostationary satellites in the fixed-satellite service	1.8	2

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
S.524		Rec. ITU-R S.524-9	Maximum permissible levels of off-axis e.i.r.p. density from earth stations in geostationary-satellite orbit networks operating in the fixed-satellite service transmitting in the 6 GHz, 13 GHz, 14 GHz and 30 GHz frequency bands	1.8	2
S.524-9				1.17	4
S.524-9				4	5
S.579		Rec. ITU-R S.579-6	Availability objectives for hypothetical reference circuits and hypothetical reference digital paths when used for telephony using pulse code modulation, or as part of an integrated services digital network hypothetical reference connection, in the fixed-satellite service operating below 15 GHz	1.8	2
S.580-6		Rec. ITU-R S.580-6	Radiation diagrams for use as design objectives for antennas of earth stations operating with geostationary satellites	1.10	2
S.580-6				1.17	4
S.672		Rec. ITU-R S.672-4 (incorporated by reference in the RR)	Satellite antenna radiation pattern for use as a design objective in the fixed-satellite service employing geostationary satellites	7, topic G	4
S.672-4				1.10	2
S.672-4				1.19	4
S.672-4				2	5
S.728		Rec. ITU-R S.728-1	Maximum permissible level of off-axis e.i.r.p. density from very small aperture terminals (VSATs)	1.8	2
S.734		Rec. ITU-R S.734-0	The application of interference cancellers in the fixed-satellite service	1.8	2
S.738		Rec. ITU-R S.738-0	Procedure for determining if coordination is required between geostationary-satellite networks sharing the same frequency bands	1.8	2
S.740		Rec. ITU-R S.740-0	Technical coordination methods for fixed-satellite networks	1.8	2
S.1062		Rec. ITU-R S.1062-4	Allowable error performance for a satellite hypothetical reference digital path operating below 15 GHz	1.8	2
S.1064		Rec. ITU-R S.1064-1	Pointing accuracy as a design objective for earthward antennas on board geostationary satellites in the fixed-satellite service	1.8	2

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
S.1151-0		Rec. ITU-R S.1151-0	Sharing between the inter-satellite service involving geostationary satellites in the fixed-satellite service and the radionavigation service at 33 GHz	4	5
S.1254		Rec. ITU-R S.1254-0	Best practices to facilitate the coordination process of fixed-satellite service satellite networks	1.8	2
S.1323		Rec. ITU-R S.1323-2	Maximum permissible levels of interference in a satellite network (GSO/FSS; non-GSO/FSS; non-GSO/MSS feeder links) in the fixed-satellite service caused by other codirectional FSS networks below 30 GHz	1.17	4
S.1340-0		Rec. ITU-R S.1340-0 (incorporated by reference in the RR)	Sharing between feeder links for the mobile-satellite service and the aeronautical radionavigation service in the Earth-to-space direction in the band 15.4-15.7 GHz	1.10	2
S.1424		Rec. ITU-R S.1424-0	Availability objectives for a hypothetical reference digital path when used for the transmission of B-ISDN asynchronous transfer mode in the fixed-satellite service by geostationary orbit satellite systems using frequencies below 15 GHz	1.8	2
S.1432		Rec. ITU-R S.1432-1	Apportionment of the allowable error performance degradations to fixed-satellite service (FSS) hypothetical reference digital paths arising from time invariant interference for systems operating below 30 GHz	1.8	2
S.1586-1		Rec. ITU-R S.1586-1 (incorporated by reference in the RR)	Calculation of unwanted emission levels produced by a non-geostationary fixed-satellite service system at radio astronomy sites	1.13	3
S.1588		Rec. ITU-R S.1588-0	Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network	4	5
S.1588				7, topic J	4
S.1594		Rec. ITU-R S.1594-0	Maximum emission levels and associated requirements of high density fixed-satellite service earth stations transmitting towards geostationary fixed-satellite service space stations in the 30 GHz range	4	5
S.1716		Rec. ITU-R S.1716-0	Performance and availability objectives for fixed-satellite telemetry, tracking and command systems	1.8	2

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
S.1783-0		Rec. ITU-R S.1783-0	Technical and operational features characterizing high-density applications in the fixed-satellite service	4	5
S.1806		Rec. ITU-R S.1806-0	Availability objectives for hypothetical reference digital paths in the fixed-satellite service operating below 15 GHz	1.8	2
S.1856		Rec. ITU-R S.1856-0	Methodologies for determining whether an IMT station at a given location operating in the band 3 400-3 600 MHz would transmit without exceeding the power flux-density limits in the Radio Regulations Nos. **5.430A**, **5.432A**, **5.432B** and **5.433A**	1.8	2
S.2099		Rec. ITU-R S.2099-0	Allowable short-term error performance for a satellite hypothetical reference digital path	1.8	2
S.2131		Rec. ITU-R S.2131-1	Method for the determination of performance objectives for satellite hypothetical reference digital paths using adaptive coding and modulation	1.8	2
S.2131				1.17	4
S.2131-0				7, topic G	4
S.2131-1				7, topic G	4
SA.363-5		Rec. ITU-R SA.363-5	Space operation systems	1.7	2
SA.363-5				1.12	3
SA.509-3		Rec. ITU-R SA.509-3	Space research earth station and radio astronomy reference antenna radiation pattern for use in interference calculations, including coordination procedures, for frequencies less than 30 GHz	1.10	2
SA.510-3		Rec. ITU-R SA.510-3	Feasibility of frequency sharing between the space research service and other services in bands near 14 and 15 GHz – Potential interference from data relay satellite systems	1.13	3
SA.609		Rec. ITU-R SA.609-2	Protection criteria for radiocommunication links for manned and unmanned near-Earth research satellites	1.13	3
SA.609-2				1.7	2
SA.1014		Rec. ITU-R SA.1014-3	Radiocommunication requirements for manned and unmanned deep space research	1.4	1
SA.1016		Rec. ITU-R SA.1016-1	Sharing considerations relating to space research service (deep space)	1.4	1
SA.1016-1				1.12	3

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
	SA.1026-5	Rec. ITU-R SA.1026-5	Aggregate interference criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit	1.7	2
	SA.1027-6	Rec. ITU-R SA.1027-6	Sharing criteria for space-to-Earth data transmission systems in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit	1.7	2
	SA.1414	Rec. ITU-R SA.1414-2	Characteristics of data relay satellite systems	1.13	3
	SA.1414-2			1.13	3
	SA.1626	Rec. ITU-R SA.1626-1	Feasibility of sharing between the space research service (space-to-Earth) and the fixed and mobile services in the band 14.8-15.35 GHz	1.13	3
	SA.1626-1			1.13	3
	SA.2141	Rec. ITU-R SA.2141-0	Characteristics of space research service systems in the frequency range 14.8-15.35 GHz	1.13	3
	SA.2141-0				
	SA.2142	Rec. ITU-R SA.2142-0	Methodologies for calculating coordination areas around Earth exploration satellite and space research earth stations to avoid harmful interference from IMT-2020 systems in the frequency bands 25.5-27 GHz and 37-38 GHz	4	5
	SF.1006	Rec. ITU-R SF.1006-0	Determination of the interference potential between earth stations of the fixed-satellite service and stations in the fixed service	1.8	2
	SF.1650	Rec. ITU-R SF.1650-1	The minimum distance from the baseline beyond which in-motion earth stations located on board vessels would not cause unacceptable interference to the terrestrial service in the bands 5 925-6 425 MHz and 14-14.5 GHz	1.8	2
	SF.1650-1			1.15	4
	SF.1719	Rec. ITU-R SF.1719-0	Sharing between point-to-point and point-to-multipoint fixed service and transmitting earth stations of GSO and non-GSO FSS systems in the 27.5-29.5 GHz band	1.17	4
	SM.337-6	Rec. ITU-R SM.337-6	Frequency and distance separations	1.10	2
	SM.1132-2	Rec. ITU-R SM.1132-2	General principles and methods for sharing between radiocommunication services or between radio stations	1.2	1

ITU-R Series	Recommendation number*	Latest publication	Recommendation title	Agenda item	CPM chapter
SM.1448		Rec. ITU-R SM.1448-1	Determination of the coordination area around an earth station in the frequency bands between 100 MHz and 105 GHz	1.17	4
TF.460-6		Rec. ITU-R TF.460-6 (incorporated by reference in the RR)	Standard-frequency and time-signal emissions	2	5

4 List of draft new (DN) or draft revised (DR) ITU-R Recommendations (may include preliminary draft new (PDN) or revised (PDR) ITU-R Recommendations and working documents toward preliminary draft new (WDPDN) or revised (WDPDR) ITU-R Recommendations)

ITU-R Series	Recommendation draft number *	Available document / status	Draft Recommendation title	Agenda item	CPM chapter
BO.1443		WDPDR Rec. ITU-R BO.1443-3 (incorporated by reference in the RR) (Doc. 4A/392, Annex 6)	Reference BSS earth station antenna patterns for use in interference assessment involving non-GSO satellites in frequency bands covered by RR Appendix **30**	4	5
BO.1443-3				1.19	4
BS.1615-2		PDR Rec. ITU-R BS.1615-2 (Doc. 6A/417, Ch.2 Annex 6)	"Planning parameters" for digital sound broadcasting at frequencies below 30 MHz	1.9	2
F.699		WDPDR Rec. ITU-R F.699-8 (Doc. 5C/345, Annex 2)	Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to ~~86~~180/330 GHz	1.15	4
F.699-8				1.10	2
F.699-8				1.19	4
F.758		PDR Rec. ITU-R F.758-7 (Doc. 5C/345, Annex 7)	System parameters and considerations in the development of criteria for sharing or compatibility between digital fixed wireless systems in the fixed service and systems in other services and other sources of interference	1.8	2
F.758				1.13	3
F.758-7				1.2	1
F.758-7				1.10	2
F.758-7				1.12	3
F.758-7				1.13	3
F.758-7				1.17	4
F.758-7				1.19	4

ITU-R Series	Recommendation draft number *	Available document / status	Draft Recommendation title	Agenda item	CPM chapter
F.1401-1		WDPDR Rec. ITU-R F.1401-1 (Doc. 5A/708, Annex 20)	Considerations for the identification of possible frequency bands for fixed wireless access and related sharing studies	9.1-c	5
F.1763-1		WDPDR Rec. ITU-R F.1763-1 (Doc. 5A/708, Annex 22)	Radio interface standards for broadband wireless access systems in the fixed service operating below 66 GHz	9.1-c	5
M.493		PDR Rec. ITU-R M.493-15 (Doc. 5B/731, Annex 1)	Digital selective-calling system for use in the maritime mobile service	1.11	2
M.541		PDR Rec. ITU-R M.541-10 (incorporated by reference in the RR) (Doc. 5B/731, Annex 2)	Operational procedures for the use of digital selective-calling equipment in the maritime mobile service	1.11	2
M.1036		[P]DR Rec. ITU-R M.1036-6 (Doc. 5D/1668, Annex 4.2)	Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations	1.4	1
M.1371		PDR Rec. ITU-R M.1371-5 (Doc. 5B/731, Annex 4)	Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band	1.11	2
M.1851		PDR Rec. ITU-R M.1851-1 (Doc. 5B/731, Annex 6)	Mathematical models for radiodetermination radar and aeronautical mobile systems antenna patterns for use in interference analyses	1.2	1
M.1851-1				1.10	2
M.2012		PDR Rec. ITU-R M.2012-5 (Doc. 5D/1668, Annex 5.3)	Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)	1.2	1
M.2116		PDR Rec. ITU-R M.2116-0 (Doc. 5B/731, Annex 7)	Technical and operational characteristics and protection criteria for ~~the~~ systems operating in the aeronautical and maritime mobile services ~~systems operating~~ within the 4 400-4 990 MHz frequency range	1.1	1
M.2116-0				1.10	2
M.2150		PDR Rec. ITU-R M.2150-1 (Doc. 5D/1668, Annex 5.2)	Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)	1.2	1
				1.3	1
M.[15.4-15.7_GHZ_ARNS]		WDPDN Rec. ITU-R M.[15.4-15.7_GHz_ARNS] (Doc. 5B/731, Annex 12)	Characteristics of and protection criteria for radars operating in the aeronautical radionavigation service in the frequency band 15.4-15.7 GHz	1.10	2

ITU-R Series	Recommendation draft number *	Available document / status	Draft Recommendation title	Agenda item	CPM chapter
M.[AS.GUIDANCE]		PDN Rec. ITU-R M.[AS GUIDANCE] (Doc. 5A/708, Annex 6)	Guidance on technical and operational measures for the use of the frequency band 1 240-1 300 MHz by the amateur and amateur-satellite service in order to protect the radionavigation-satellite service (space-to-Earth)	9.1-b	5
P.372-14		WDPDR Rec. ITU-R P.372-16 (Doc. 3L/86, Annex 9, Annex 10, Annex 11)	Radio noise	1.9	2
P.452		PDR Rec. ITU-R P.452-17 (Doc. 3M/364, Annex 3, Annex 4)	Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz	1.2	1
P.452				1.3	1
P.452				1.15	4
P.452-17				1.10	2
P.453-7		Proposed revision of Rec. ITU-R P.453-14 (Doc. 3J/225, Annex 2, Annex 3, Annex 4, Annex 15)	The radio refractive index: its formula and refractivity data	1.10	2
P.525		WDPDR Rec. ITU-R P.525-4 (incorporated by reference in the RR) (Doc. 3J/225, Annex 8)	Calculation of free-space attenuation	1.2	1
P.525-4				1.9	2
P.531-14		Preliminary draft document towards revision of Rec. ITU-R P.531-14 (Doc. 3L/86, Annex 4)	Ionospheric propagation data and prediction methods required for the design of satellite networks and systems	1.7	2
P.618		WDPDR Rec. ITU-R P.618-13 (Doc. 3M/253, Annex 4, Annex 6)	Propagation data and prediction methods required for the design of Earth-space telecommunication systems	7, topic G	4
P.618-13				7, topic G	4
P.619		WDPDR Rec. ITU-R P.619-5 (Doc. 3M/364, Annex 7)	Propagation data required for the evaluation of interference between stations in space and those on the surface of the Earth	1.2	1
P.619				1.4	1
P.619-5				1.10	2
P.835		PDR Rec. ITU-R P.835-6 (Doc. 3J/225, Annex 12, Annex 13, Annex 14)	Reference standard atmospheres	1.2	1
P.835-6				1.10	2

ITU-R Series	Recommendation draft number *	Available document / status	Draft Recommendation title	Agenda item	CPM chapter
P.1238		Working items for future revision of Rec. ITU-R P.1238-11 (Doc. 3K/264, Annex 9)	Propagation data and prediction methods for the planning of indoor radiocommunication systems and radio local area networks in the frequency range 300 MHz to 450 GHz	1.3	1
P.1409		WD towards a future revision of Rec. ITU-R P.1409-2 (Doc. 3M/364, Annex 6)	Propagation data and prediction methods for systems using high altitude platform stations and other elevated stations in the stratosphere at frequencies greater than about 0.7 GHz	1.10	2
P.1546-6		PDR Rec. ITU-R P.1546-6 (Doc. 3K/264, Annex 1)	Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 4 000 MHz	1.4	1
P.1546				9.1-b	5
P.2040		PDR Rec. ITU-R P.2040-2 (Doc. 3J/225, Annex 26)	Effects of building materials and structures on radiowave propagation above about 100 MHz	1.3	1
P.2108		WDPDR Rec. ITU-R P.2108-1 (Docs. 3K/264, Annex 15, Annex 17 and 3M/364, Annex 9, Annex 11)	Prediction of clutter loss	1.2	1
P.2108				1.3	1
P.2108				1.4	1
P.2108-1				1.2	1
P.2108-1				1.8	2
P.2109		WDPDR Rec. ITU-R P.2109-1 (Doc. 3K/178, Annex 10)	Prediction of building entry loss	1.4	1
RS.1166-4		PDR Rec. ITU-R RS.1166-4 (Doc. 7C/459, Annex 8)	Performance and interference criteria for active spaceborne sensors	1.19	4
RS.1813		PDR Rec. ITU-R RS.1813-1 (Doc. 7C/459, Annex 28)	Reference antenna pattern for passive sensors operating in the Earth exploration-satellite service (passive) to be used in compatibility analyses in the frequency range 1.4-~~100~~450 GHz	1.14	3
RS.1813-1				1.10	2
RS.2042		PDR Rec. ITU-R RS.2042-1 (Doc. 7C/459, Annex 1)	Typical technical and operating characteristics for spaceborne radar sounder systems using the 40-50 MHz band	1.12	3
RS.2042-1				1.12	3
RS.2105		Proposed draft revision to Rec. ITU-R RS.2105-1 (Doc. 7C/459, Annex 32)	Typical technical and operational characteristics of Earth exploration-satellite service (active) systems using allocations between 432 MHz and 238 GHz	1.2	1
RS.2105				1.15	4
RS.2105-1				1.19	4

ITU-R Series	Recommendation draft number *	Available document / status	Draft Recommendation title	Agenda item	CPM chapter
S.1428		WDPDR Rec. ITU-R S.1428-1 (incorporated by reference in the RR) (Doc. 4A/392, Annex 5)	Reference FSS earth-station radiation patterns for use in interference assessment involving non-GSO satellites in frequency bands between 10.7 GHz and 30 GHz	4	5
S.1428				7, topic G	4
S.1428-1				1.19	4
S.1428-1				2	5
S.1503		PDR Rec. ITU-R S.1503-3 (Doc. 4A/856, Annex 4)	Functional description to be used in developing software tools for determining conformity of non-geostationary-satellite orbit fixed-satellite service systems or networks with limits contained in Article **22** of the Radio Regulations	1.16	4
S.1503				1.19	4
S.1503				4	5
S.1503				7, topic D	4
S.1503				7, topic G	4
S.1503-3				7, topic D	4
S.1503-3				7, topic J	4
S.[RES.169_METH]		PDN Rec. ITU-R S.[RES.169_METH] (Doc. 4A/856, Annex 3)	Methodology for examining the compliance of aeronautical earth stations in motion (A-ESIM) communicating with geostationary space stations in the fixed-satellite service in the 27.5-29.5 GHz band with a set of pre-established pfd limits on the Earth's surface	1.15	4
				1.16	4
S.[RES 770]		PDN Rec. ITU-R S.[RES 770] (Doc. 4A/856, Annex 1)	Functional description to be used in developing software tools for determining conformity of non-geostationary-satellite orbit fixed-satellite service systems or networks in Q/V band with criteria contained in No. **22.5L** of the Radio Regulations	7, topic G	5
S.[QV-METH-REF-LINKS]		PDN Rec. ITU-R S.[QV-METH-REF-LINKS] (Doc. 4A/856, Annex 2)	Description of parameters and procedures for the evaluation of interference from any one non-GSO system into a global set of generic GSO reference links	7, topic G	4
SA.1743		PDR Rec. ITU-R SA.1743-0 (Doc. 7B/198, Annex 3)	Maximum allowable degradation to radiocommunication links of the space research and space operation services arising from interference from emissions and radiations from other radio sources	1.7	2
SA.1743				1.13	3
SM.328-11		WD with elements towards the revision of Rec. ITU-R SM.328-11 (Doc. 1A/226, Annex 5)	Spectra and bandwidth of emissions	1.9	2

ITU-R Series	Recommendation draft number *	Available document / status	Draft Recommendation title	Agenda item	CPM chapter
SM.329-12		PDR Rec. ITU-R SM.329-12 (Doc. 1A/226, Annex 6)	Unwanted emissions in the spurious domain	1.9	2
SM.1541		PDR Rec. ITU-R SM.1541-6 (Doc. 1A/226, Annex 9)	Unwanted emissions in the out-of-band domain	1.15	4
SM.1541				1.16	4
SM.1541-6				1.10	2
SM.1541-6				1.19	4

5 List of existing ITU-R Reports

ITU-R Series	Report number *	Latest publication	Report title	Agenda item	CPM chapter
BO.2497		Rep. ITU-R BO.2497-0	Characteristics and effectiveness of frequency sharing criteria for the broadcasting-satellite service in Regions 1 and 3 subject to RR Appendix **30**	7, topic H	4
BT.2215-7		Rep. ITU-R BT.2215-7	Measurements of protection ratios and overload thresholds for broadcast TV receivers	1.5	1
BT.2301-3		Rep. ITU-R BT.2301-4	National field reports on the introduction of IMT in the bands with co-primary allocation to the broadcasting and the mobile services	1.5	1
BT.2302-1		Rep. ITU-R BT.2302-1	Spectrum requirements for terrestrial television broadcasting in the UHF frequency band in Region 1 and the Islamic Republic of Iran	1.5	1
BT.2337		Rep. ITU-R BT.2337-1	Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz	1.5	1
BT.2337-1				1.5	1
BT.2338		Rep. ITU-R BT.2338-0	Services ancillary to broadcasting/services ancillary to programme making spectrum use in Region 1 and the implication of a co-primary allocation for the mobile service in the frequency band 694-790 MHz	1.5	1

ITU-R Series	Report number *	Latest publication	Report title	Agenda item	CPM chapter
BT.2339		Rep. ITU-R BT.2339-0	Co-channel sharing and compatibility studies between digital terrestrial television broadcasting and international mobile telecommunication in the frequency band 694-790 MHz in the GE06 planning area	1.5	1
BT.2470		Rep. ITU-R BT.2470-2	Use of Monte Carlo simulation to model interference into DTTB	1.5	1
BT.2470-1					
BT.2470-2					
F.2328		Rep. ITU-R F.2328-0	Sharing and compatibility between international mobile telecommunication systems and fixed service systems in the 3 400-4 200 MHz frequency range	1.3	1
F.2439		Rec. ITU-R F.2439-0	Deployment and technical characteristics of broadband high altitude platform stations in the fixed service in the frequency bands 6 440-6 520 MHz, 21.4-22.0 GHz, 24.25-27.5 GHz, 27.9-28.2 GHz, 31.0-31.3 GHz, 38.0 39.5 GHz, 47.2-47.5 GHz and 47.9-48.2 GHz used in sharing and compatibility studies	1.17	4
F.2475		Rep. ITU-R F.2475-0	Sharing and compatibility studies of High Altitude Platform Station systems in the fixed service in the 38-39.5 GHz frequency range	1.5	1
M.2014		Rep. ITU-R M.2014-3	Digital land mobile systems for dispatch traffic	1.5	1
M.2077		Rep. ITU-R M.2077-0	Traffic forecasts and estimated spectrum requirements for the satellite component of IMT 2000 and systems beyond IMT-2000 for the period 2010 to 2020	1.18	4
M.2109		Rep. ITU-R M.2109-0	Sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 and 4 500-4 800 MHz frequency bands	1.3	1
M.2110		Rep. ITU-R M.2110-0	Sharing studies between radiocommunication services and IMT systems operating in the 450-470 MHz band	1.5	1
M.2111		Rep. ITU-R M.2111-0	Sharing studies between IMT-Advanced and the radiolocation service in the 3 400-3 700 MHz bands	1.3	1
M.2119		Rep. ITU-R M.2119-0	Sharing between aeronautical mobile telemetry systems for flight testing and other systems operating in the 4 400-4 940 and 5 925-6 700 MHz bands	1.1	1

ITU-R Series	Report number *	Latest publication	Report title	Agenda item	CPM chapter
	M.2170-0	Rep. ITU-R M.2170-0	Compatibility analysis and results for radiolocation systems planned to operate in the 15.4 to 17.3 GHz band and aircraft landing system operating in the 15.4-15.7 GHz band as well as the radio astronomy service operating in the adjacent band 15.35-15.40 GHz, FSS systems and aeronautical radionavigation systems	1.10	2
	M.2171	Rep. ITU-R M.2171-0	Characteristics of unmanned aircraft systems and spectrum requirements to support their safe operation in non-segregated airspace	1.8	2
	M.2218	Rep. ITU-R M.2218-0	Traffic forecasts and estimated spectrum requirements for future development of the mobile-satellite service in the range 4-16 GHz	1.18	4
	M.2221	Rep. ITU-R M.2221-0	Feasibility of MSS operations in certain frequency bands	1.16	4
	M.2221			1.18	4
	M.2221-0			1.15	4
	M.2221-0			1.16	4
	M.2229-0	Rep. ITU-R M.2229-0	Compatibility study to support line-of-sight control and non-payload communications links for unmanned aircraft systems proposed in the frequency band 15.4-15.5 GHz	1.10	2
	M.2230-0	Rep. ITU-R M.2230-0	Frequency sharing between unmanned aircraft systems for beyond line of sight control and non-payload communications links and other existing and planned services in the frequency bands 13.25-13.40 GHz, 15.4-15.7 GHz, 22.5-22.55 GHz and 23.55-23.60 GHz	1.10	2
	M.2233	Rep. ITU-R M.2233-0	Examples of technical characteristics for unmanned aircraft control and non-payload communications links	1.8	2
	M.2291	Rep. ITU-R M.2291-2	The use of International Mobile Telecommunications (IMT) for broadband Public Protection and Disaster Relief (PPDR) applications	4	5
	M.2292	Rep. ITU-R M.2292-0	Characteristics of terrestrial IMT-Advanced systems for frequency sharing/interference analyses	1.5	1
	M.2320	Rep. ITU-R M.2320-0	Future technology trends of terrestrial IMT systems	1.2	1

ITU-R Series	Report number *	Latest publication	Report title	Agenda item	CPM chapter
M.2369-0		Rep. ITU-R M.2369-0	Use of non-geostationary orbit mobile satellite systems to enhance maritime safety	1.11	2
M.2370		Rep. ITU-R M.2370-0	IMT Traffic estimates for the years 2020 to 2030	1.2	1
M.2376		Rep. ITU-R M.2376-0	Technical feasibility of IMT in bands above 6 GHz	1.2	1
M.2377		Rep. ITU-R M.2377-1	Radiocommunication objectives and requirements for Public Protection and Disaster Relief (PPDR)	4	5
M.2410		Rep. ITU-R M.2410-0	Minimum requirements related to technical performance for IMT-2020 radio interface(s)	1.2	1
M.2418		Rep. ITU-R M.2418-0	Description of Railway Radiocommunication Systems between Train and Trackside (RSTT)	1.5	1
M.2435-0		Rep. ITU-R M.2435-0	Technical studies on the satellite component of the VHF data exchange system	1.12	3
M.2459-0		Rep. ITU-R M.2459-0	Introduction of additional mobile-satellite service systems into the Global Maritime Distress Safety systems	4	5
M.2477		Rep. ITU-R M.2477-0	Radiocommunications for suborbital vehicles	1.6	2
M.2478-0		Rep. ITU-R M.2478-0	Spectrum needs for the amateur service in the frequency band 50-54 MHz in Region 1 and sharing with mobile, fixed, radiolocation and broadcasting services	1.12	3
M.2481		Rep. ITU-R M.2481-0	In-band and adjacent band coexistence and compatibility studies between IMT systems in 3 300-3 400 MHz and radiolocation systems in 3 100-3 400 MHz	1.2	1
M.2481-0				1.2	1
M.2513		Rep. ITU-R M.2513-0	Studies regarding the protection of the primary radionavigation-satellite service (space-to-Earth) by the secondary amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz	9.1-b	5
RA.2131-0		Rep. ITU-R RA.2131-0	Supplementary information on the detrimental threshold levels of interference to radio astronomy observations in Recommendation ITU-R RA.769	1.11	2
RA.2188-0		Rep. ITU-R RA.2188-1	Power flux-density and e.i.r.p. levels potentially damaging to radio astronomy receivers	1.10	2

ITU-R Series	Report number *	Latest publication	Report title	Agenda item	CPM chapter
RA.2332		Rep. ITU-R RA.2332-0	Compatibility and sharing studies between the radio astronomy service and IMT systems in the frequency bands 608-614 MHz, 1 330-1 400 MHz, 1 400-1 427 MHz, 1 610.6-1 613.8 MHz, 1 660-1 670 MHz, 2 690-2 700 MHz, 4 800-4 990 MHz and 4 990-5 000 MHz	1.5	1
RA.2510-0		Rep. ITU-R RA.2510-0	Technical and operational characteristics of radio astronomy systems in the 67-116 GHz (3-4 mm) range	10 WRC-27 preliminary agenda item 2.5	Annex 1
RS.2096		Rep. ITU-R RS.2096-0	Sharing of the 10.6-10.68 GHz band by the fixed and mobile services and the Earth exploration-satellite service (passive)	1.2	1
RS.2178		Rep. ITU-R RS.2178-0	The essential role and global importance of radio spectrum use for Earth observations and for related applications	1.2	1
RS.2313		Rep. ITU-R RS.2313-0	Sharing analyses of wideband Earth exploration-satellite service (active) transmissions with stations in the radio determination service operating in the frequency bands 8 700-9 300 MHz and 9 900-10 500 MHz	1.2	1
S.2199		Rep. ITU-R S.2199-0	Studies on compatibility of broadband wireless access systems and fixed-satellite service networks in the 3 400-4 200 MHz band	1.3	1
S.2261		Rep. ITU-R S.2261-0	Technical and operational requirements for earth stations on mobile platforms operating in non-GSO FSS systems in the frequency bands from 17.3 to 19.3, 19.7 to 20.2, 27 to 29.1 and from 29.5 to 30.0 GHz	1.16	4
S.2365		Rep. ITU-R S.2365-0	Assessment on use of spectrum in the 10-17 GHz band for the GSO fixed-satellite service in Region 1	1.15	4
S.2367		Rep. ITU-R S.2367-0	Sharing and compatibility between International Mobile Telecommunication systems and fixed-satellite service networks in the 5 850-6 425 MHz frequency range	1.2	1
S.2368		Rep. ITU-R S.2368-0	Sharing studies between International Mobile Telecommunication-Advanced systems and geostationary	1.3	1

ITU-R Series	Report number *	Latest publication	Report title	Agenda item	CPM chapter
	S.2368-0		satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands in the WRC study cycle leading to WRC-15	1.2	1
	SA.2312	Rep. ITU-R SA.2312-0	Characteristics, definitions and spectrum requirements of nanosatellites and picosatellites, as well as systems composed of such satellites	1.18	4
	SA.2426-0	Rep. ITU-R SA.2426-0	Technical characteristics for telemetry, tracking and command in the space operation service below 1 GHz for non-GSO satellites with short duration missions	1.7	2
	SA.2488-0	Rep. ITU-R SA.2488-0	Characteristics to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services, and for conducting sharing studies	1.7	2

6 List of draft new (DN) or draft revised (DR) ITU-R Reports (may include preliminary draft new (PDN) or revised (PDR) ITU-R Reports and working documents toward preliminary draft new (WDPDN) or revised (WDPDR) ITU-R Reports)

ITU-R Series	Report draft number *	Available document / status	Report title	Agenda item	CPM chapter
	BT.2383-3	PDR Rep. ITU-R BT.2383-4 (Doc. 6A/417, Ch.3 Annex 9)	Typical frequency sharing characteristics for digital terrestrial television broadcasting systems in the frequency band 470-862 MHz	1.5	1
	BT.2383-4				
	F.2416-0	PDR Rep. ITU-R F.2416-0 (Doc. 5C/345, Annex 6)	Technical and operational characteristics and applications of the point-to-point fixed service applications operating in the frequency band 275-450 GHz	1.14	3
	M.2116	WDPDR Rep. ITU-R M.2116-2 (Doc. 5A/708, Annex 15)	Characteristics of broadband wireless access systems operating in the land mobile service for use in sharing studies	1.3	1
	M.2442	WDPDR Rep. ITU-R M.2442-0 (Doc. 5A/708, Annex 7)	Current and future usage of railway radiocommunication systems between train and trackside	1.5	1

ITU-R Series	Report draft number *	Available document / status	Report title	Agenda item	CPM chapter
M.	[ACS]	PDN Rep. ITU-R M.[ACS] (Doc. 5B/731, Annex 11)	Operational procedures for both ship and coast stations for automatic connection system using digital selective calling communications in the MF and HF bands	1.11	2
M.	[ADD_GSO_GMDSS]	WDPDN Rep. ITU-R M.[ADD GSO GMDSS] or Draft working document related to WRC-23 agenda item 1.11 (Doc. 4C/388, Annex 3)	Introduction of additional GSO MSS systems into the GMDSS (WRC-23 agenda item 1.11, *resolves* 3)	1.11	2
M.	[AERO-IMT.SHARING.C-BAND]	PDN Report ITU-R M.[AERO-IMT.SHARING.C-BAND] (Doc. 4-5-6-7/715, Annex 33)	Sharing and compatibility studies between aeronautical mobile[/ground mobile] applications and potential IMT systems in the 4 400-4 990 MHz band	1.1	1
M.	[AMATEUR.CHARACTERISTICS]	PDN Rep. ITU-R M.[AMATEUR.CHARACTERISTICS] (Doc. 5A/708, Annex 5)	Amateur and amateur-satellite services characteristics and usage in the 1 240-1 300 MHz frequency band	9.1-b	5
M.	[HIBS-CHARACTERISTICS]	[WD]PDN Rep. ITU-R M.[HIBS-CHARACTERISTICS] (Doc. 5D/1668, Annex 4.10)	Technical and operational characteristics for the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT	1.4	1
M.	[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES]	WDPDN Rep. ITU-R M.[NON-SAFETY AM(OR)S CHARACTERISTICS AND SHARING STUDIES] (Doc. 5B/731, Annex 15)	Various aspects of non-safety aeronautical mobile systems in the frequency bands 15.4-15.7 GHz and 22-22.21 GHz	1.10	2
M.	[SPACE-VHF]	PDN Rep. ITU-R M.[SPACE-VHF] (Doc. 5B/731, Annex 9)	Space-based aeronautical VHF communications in the frequency band 117.975-137 MHz	1.7	2
M.	[UA_PFD]	PDN Rep. ITU-R [UA_PFD] (Doc. 5B/355, (Annex 20)	Preliminary draft new Report ITU-R M.[UA_PFD] – Review of power flux-density limits in accordance with resolves 16 of Resolution **155 (Rev.WRC-19)**	1.8	2
RS.	2310-1	PDR Rep. ITU-R RS.2310-1 (Doc. 7C/459, Annex 9)	Worst-case interference levels from mainlobe-to-mainlobe antenna coupling of systems operating in the radiolocation service into active sensor receivers operating in the Earth exploration-satellite service (active) in the 35.5-36.0 GHz band	1.19	4

ITU-R Series	Report draft number *	Available document / status	Report title	Agenda item	CPM chapter
RS.	2456-0	PDR Rep. ITU-R RS.2456-0 (Doc. 7C/459, Annex 13)	Space weather sensor systems using radio spectrum	9.1-a	5
RS.	[231.5-252 GHz EESS]	PDN Rep. ITU-R RS.[231.5-252 GHz EESS] (Doc. 7C/459, Annex 21)	Studies related to possible EESS (passive) allocations in the frequency range 231.5-252 GHz	1.14	3
RS.	[SPACEBORNE VHF RADAR SOUNDER]	PDN Rep. ITU-R RS.[SPACEBORNE VHF RADAR SOUNDER] (Doc. 7C/459, Annex 2)	Results of sharing studies between a 45 MHz radar sounder and in-band and selected out-of-band incumbent services over the 40-50 MHz frequency range	1.12	3
SA.	[15 GHz SRS SHARING]	PDN Rep. ITU-R SA.[15 GHz SRS SHARING] (Doc. 7B/246, Annex 2)	Sharing and Compatibility Studies for the SRS in the band 14.8-15.35 GHz	1.13	3

7 Other ITU publications

Reference*	Publication	Title	Agenda item	CPM chapter
1/1	Doc. 1/1	Assignment of texts to the Study Group 1 Sub-Groups	4	5
3/41	Doc. 3/41	Draft revision of Recommendation ITU-R P.2108-0 – Prediction of clutter loss	1.4	1
3K/178	Doc. 3K/178	Report on the meeting of Working Party 3K (e-Meeting, 21 June – 1 July 2021)	1.4	1
4-5-6-7/715	Doc. 4-5-6-7/715	Report on the sixth and final meeting of Joint Task Group 4-5-6-7 (Geneva, 21-31 July 2014)	1.5	1
4-5-6-7/715 (Annex 7)	Doc. 4-5-6-7/715 (Annex 7)	Report on the sixth and final meeting of Joint Task Group 4-5-6-7 (Geneva, 21-31 July 2014) – Draft new Report ITU-R RA.[RAS-IMT] – Compatibility and sharing studies between the radio astronomy service and IMT systems in the frequency bands 608-614 MHz, 1 330-1 400 MHz, 1 400-1 427 MHz, 1 610.6-1 613.8 MHz, 1 660-1 670 MHz, 2 690-2 700 MHz, 4 800-4 990 MHz and 4 990-5 000 MHz	1.5	1

Reference*	Publication	Title	Agenda item	CPM chapter
4-5-6-7/715 (Annex 8)	Document 4-5-6-7/715 (Annex 8)	Report on the sixth and final meeting of Joint Task Group 4-5-6-7 (Geneva, 21-31 July 2014) – Draft new Report ITU-R BT.[SAB_SAP] - Services ancillary to broadcasting/services ancillary to programme making spectrum use in Region 1 and the implication of a co-primary allocation for the mobile service in the frequency band 694-790 MHz	1.5	1
4-5-6-7/715 (Annex 33)	Document 4-5-6-7/715 (Annex 33)	Report on the sixth and final meeting of Joint Task Group 4-5-6-7 (Geneva, 21-31 July 2014) – Preliminary draft new Report ITU-R M.[AERO-IMT.SHARING.C-BAND] – Sharing and compatibility studies between aeronautical mobile[/ground mobile] applications and potential IMT systems in the 4 400-4 990 MHz band	1.1	1
4C/388	Doc. 4C/388	Report of the twenty-ninth meeting of Working Party 4C (Geneva, 7-13 September 2022)	1.18	4
5A/19 – 5C/13	Doc. 5A/19 – 5C/13	Organization of the work on WRC-23 agenda item 9.1, topic c) (copy for information to Working Party 5D) – Study the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis, in accordance with Resolution **175 (WRC-19)**	9.1-c	5
5A/378	Doc. 5A/378	Reply liaison statement to Working Parties 4C, 5A and 7C – Characteristics of terrestrial component of IMT for sharing and compatibility studies in preparation for WRC-23	1.3	1
5A/384	Doc. 5A/384	Reply liaison statement to Working Party 5A (copy to Working Parties 4A, 5B, 5C and 5D for information) – WRC-23 agenda item 1.3 – Guidance on the use of ITU-R P-series Recommendations for interference prediction and sharing studies	1.3	1
5A/395	Doc. 5A/395	Reply liaison statement to ITU-R Working Party 5A – Technical and operational characteristics and protection criteria of FSS systems for sharing and compatibility studies on WRC-23 agenda item 1.3	1.3	1

Reference*	Publication	Title	Agenda item	CPM chapter
5D/722	Doc. 5D/722	Reply liaison statement to Working Party 5D (copy to Working Parties 1B, 4A, 4B, 4C, 5A, 5B, 5C, 7B, 7C and 7D for information) − WRC-23 agenda items 1.1 and 1.2	1.4	1
5D/1358	Doc. 5D/1358	Reply liaison statement to Working Party 5D − Clutter loss model (WRC-23 agenda items 1.2 and 1.4)	1.4	1
6-1/9	Doc. 6-1/9	Information on the preparation of texts for the draft CPM Report to WRC-23	1.5	1
6-1/28	Doc. 6-1/28	Reply liaison statement from Working Party 5D to Task Group 6/1 (copy to Working Parties 3K, 3M, 5A, 5B, 5C, 6A, 7D) – Preparations for WRC-23 agenda item 1.5 – Information for sharing and compatibility studies	1.5	1
6-1/41	Doc. 6-1/41	Assessment of the compatibility between DTTB and IMT-2020 in the band 470-694 MHz	1.5	1
6-1/43	Doc. 6-1/43	Results of IMT and broadcasting for sharing and compatibility studies in preparation for WRC-23 agenda item 1.5	1.5	1
6-1/57	Doc. 6-1/57	Responses to questions raised during Task Group 6/1 July meeting on Resolution **235 (WRC-15)**	1.5	1
6-1/63	Doc. 6-1/63	Assessment of the co-channel interference from IMT-2020 to DTTB in the band 470-694 MHz	1.5	1
6-1/65	Doc. 6-1/65	Revision 1 to Document 6/1-41 – Assessment of the compatibility between DTTB and IMT-2020 in the band 470-694 MHz	1.5	1
6-1/87	Doc. 6-1/87	Revision 1 to Document 6-1/63 – Assessment of the co-channel interference from IMT-2020 to DTTB in the band 470-694 MHz	1.5	1
6-1/91	Doc. 6-1/91	Responses from the Legal Affairs Unit (LAU) of ITU to the questions of France	1.5	1
6-1/96	Doc. 6-1/96	Sharing studies between IMT and DTT in the 470-694 MHz frequency band	1.5	1
6-1/97	Doc. 6-1/97	Sharing and compatibility study between mobile and broadcasting services for rural scenario in preparation for WRC-23 agenda item 1.5	1.5	1

Reference*	Publication	Title	Agenda item	CPM chapter
6-1/98	Doc. 6-1/98	Results of sharing and compatibility study between mobile and broadcasting services for urban scenario in preparation for WRC-23 agenda item 1.5	1.5	1
6-1/99	Doc. 6-1/99	Sharing study from IMT to broadcasting for border area scenario in preparation for WRC-23 agenda item 1.5	1.5	1
6-1/100	Doc. 6-1/100	Proposal for modifications of the working document towards draft CPM text for WRC-23 agenda item 1.5	1.5	1
6-1/102	Doc. 6-1/102	Results of sharing study between IMT and broadcasting services in preparation for WRC-23 agenda item 1.5	1.5	1
6-1/107	Doc. 6-1/107	Report of Task Group 6/1 Correspondence Group on sharing and compatibility studies	1.5	1
6-1/113	Doc. 6-1/113	Sharing and compatibility studies between IMT and broadcasting services in 470-694 MHz	1.5	1
6-1/119	Doc. 6-1/119	Co-channel sharing study between mobile and broadcasting services – Effect of some assumptions on the results of separation distances	1.5	1
6-1/121	Doc. 6-1/121	Proposed amendments to the working document on sharing and compatibility studies in Task Group 6/1 for WRC-23 agenda item 1.5	1.5	1
6-1/123	Doc. 6-1/123	Re-evaluation of sharing studies in Task Group 6/1 for WRC-23 agenda item 1.5	1.5	1
6-1/124	Doc. 6-1/124	Proposed modifications to the overall summary of the sharing studies in Task Group 6/1 for WRC-23 agenda item 1.5	1.5	1
6-1/125	Doc. 6-1/125	Proposed modifications to BNE submitted sharing studies in Task Group 6/1 for WRC-23 agenda item 1.5	1.5	1
6-1/126	Doc. 6-1/126	Proposed modifications to the overall summary of the sharing studies in Task Group 6/1 for WRC-23 agenda item 1.5	1.5	1
6-1/127	Doc. 6-1/127	Results of sharing study between IMT and broadcasting services in preparation for WRC-23 agenda item 1.5	1.5	1

Reference*	Publication	Title	Agenda item	CPM chapter
6-1/CGShaComp/1	Doc. 6-1/CGShaComp/1	Proposed modification to the working document on sharing and compatibility studies in the frequency band 470-694 MHz in Region 1	1.5	1
6/LCCE/78	Circular Letter 6/LCCE/78	Questionnaire on spectrum requirements for terrestrial television broadcasting in connection with WRC-15 agenda item 1.2	1.5	1
6/LCCE/104	Circular Letter 6/LCCE/104	Questionnaire on spectrum use and spectrum needs for terrestrial television broadcasting in the UHF frequency band in connection with WRC-23 agenda item 1.5	1.5	1
7C/196	Doc. 7C/196	Reply liaison statement to Working Party 7C – WRC-23 agenda item 1.14 – Fixed Service system characteristics to be used for sharing and compatibility studies in the frequency range 231.5-252 GHz	1.14	3
Annex 4.11 of Doc. 5D/1668	Annex 4.11 to Doc. 5D/1668	Possible pfd masks for protection of IMT terrestrial networks from proposed HIBS operations in the 694-960 MHz, 1 710-1 885 MHz, 1 885-1 980 MHz, 2 010-2 025 MHz, 2 110-2 170 MHz, and 2 500-2 690 MHz for information only	1.4	1
Annex 4.12 of the 43rd meeting of the Working Party 5D Chairman's Report (Document 5D/1668)	Annex 4.12 to Doc. 5D/1668	The spectrum needs for HIBS in some scenarios	1.4	1
Annex 12 to Doc. 4C/333	Annex 12 to Doc. 4C/333	Work plan on working document towards a preliminary draft new Report ITU-R M.[S-MSS&IMT SHARING]	4	5
Annex 19 to Document 4A/856	Annex 19 to Document 4A/856	Working document on WRC-23 agenda item 1.19	1.19	4
Annex 18 to Doc. 5A/221	Doc. 5A/221 (Annex 18)	Elements for a working document towards a preliminary draft new [Report/Recommendation] ITU-R F.[IMT-FWB] − Use of International Mobile Telecommunication system for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis	9.1-c	5

Reference*	Publication	Title	Agenda item	CPM chapter
Annex 3 of the Chairman's Report of the 5th meeting of TG 6/1 – Doc. 6-1/130	Doc. 6-1/130 (Annex 3)	Review of sharing and compatibility studies in frequency band 470-694 MHz taking into account the relevant ITU Radiocommunication Sector (ITU-R) studies, Recommendations and Reports	1.5	1
Annex 5 to Circular Letter CCRR/66	Annex 5 to Circular Letter CCRR/66	Draft Rules of Procedure	7, topic D	4
Annex 6 to Doc. 3K/178	Doc. 3K/178 (Annex 6)	Proposal for an update of the slant path clutter loss model of Recommendation ITU-R P.2108-0	1.2	1
Annexes 4.32 to 4.35 in Doc. 5D/1555	Annexes 4.32, 4.33, 4.34 to 4.35 in Doc. 5D/1555	Annex 4.32 – Annex 1 – Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) in the 694-960 MHz frequency range Annex 4.33 – Annex 2 – Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) in the 1 710-1 885 MHz frequency range Annex 4.34 – Annex 3 – Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) in 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz frequency ranges Annex 4.35 – Annex 4 – Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) in 2 500-2 690 MHz frequency range	1.4	1
Article 44 of the ITU Constitution	Article 44 of the ITU Constitution	Use of the Radio-Frequency Spectrum and of the Geostationary-Satellite and Other Satellite Orbits	1.15	4
			7, topic F	5
			7, topic I	5
BR IFIC 2936 / 22.12.2020	BR IFIC 2936 (22.12.2020)	BR International Frequency Information Circular	7, topic E	4
CA/251	BR Administrative Circular CA/251	Results of the first session of the Conference Preparatory Meeting for WRC-23 (CPM23-1)	1.3	1
			1.18	4
			9.1-d	5
Annex 4 to BR Administrative Circular CA/251			1.6	2
			1.7	2
			1.8	2

Reference*	Publication	Title	Agenda item	CPM chapter
			1.11	2
Annex 9 to BR Administrative Circular CA/251			1.5	1
CACE/963	Administrative Circular CACE/963	Spectrum use and spectrum needs of the IMT applications/systems in mobile (except aeronautical mobile) service within the frequency band 470-960 MHz in Region 1	1.5	1
CACE/966	Administrative Circular CACE/966	Spectrum use and spectrum needs of non-IMT applications/systems of the land mobile service within the frequency band 470-960 MHz in Region 1	1.5	1
Council Decision 482	Council Decision 482	Implementation of cost recovery for satellite network filings	7, topic D	4
			7, topic H	4
CR/176	Circular Letter CR/176	Submission of notices to the Radiocommunication Bureau for the publication of information relating to non-GSO FSS systems	4	5
CR/182	Circular Letter CR/182	Submission of notices to the Radiocommunication Bureau for the publication of information relating to non-GSO FSS systems	4	5
CR/414	Circular Letter CR/414	Examinations under Resolution 85 (WRC-03)	4	5
Document RRB23-1/6	Doc. RRB23-1/6	Report to the 92nd meeting of the Radio Regulations Board (20 - 24 March 2023)	7, topic B	4
Geneva 2006 Agreement (“GE06”)	Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz (RRC-06) (Geneva, 15 May - 16 June 2006)	Geneva 2006 Agreement (Regional Agreement relating to the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz (Geneva, 2006))	1.4	1
			1.5	1

Reference*	**Publication**	**Title**	**Agenda item**	**CPM chapter**
Guide to the use of ITU-R texts relating to the land mobile service, including wireless access in the fixed service	Guide to the use of ITU-R texts relating to the land mobile service, including wireless access in the fixed service	Guide to the use of ITU-R texts relating to the land mobile service, including wireless access in the fixed service	9.1-c	5
Handbook on "Fixed wireless access"	Land Mobile (including Wireless Access) – Volume 1: Fixed Wireless Access	Land Mobile (including Wireless Access) – Volume 1: Fixed Wireless Access	9.1-c	5
ITU Terms and Definitions database	ITU Terms and Definitions database	ITU Terms and Definitions database	1.5	1
ITU-R Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services (Maritime Manual)	ITU-R Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services (Maritime Manual)	ITU-R Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services (Maritime Manual)	1.11	2
List of Coast Stations and Special Service Stations (List IV)	List of Coast Stations and Special Service Stations (List IV)	List of Coast Stations and Special Service Stations (List IV)	1.11	2
Minutes of the 12th Plenary Meeting	WRC-19 Document 573	Minutes of the Twelfth Plenary Meeting – Thursday, 21 November 2019 at 0800 hours (WRC-19)	9.1-c	5
No. 149A of the ITU Convention	ITU Constitution	Constitution of the International Telecommunication Union	9.1-c	5
Plan of Action of the World Summit on the Information Society (Geneva, 2003)	Plan of Action of the World Summit on the Information Society (Geneva, 2003)	Plan of Action of the World Summit on the Information Society (Geneva, 2003 – Tunis, 2005)	9.1-a	5
Resolution 219 (Bucharest, 2022) of the Plenipotentiary Conference	Final Acts of the Plenipotentiary Conference, Bucharest, 2022 – Resolution 219 (Bucharest, 2022)	Sustainability of the radio-frequency spectrum and associated satellite-orbit resources used by space services	7, topic J	4

Reference*	Publication	Title	Agenda item	CPM chapter
Principle (3) in the Annex 3 to the ITU CVC meeting Report	Doc. CVC/5	Summary of the 18th meeting of Chairmen and Vice-Chairmen of Radiocommunication Study Groups (E-meeting, 24 January 2022)	1.5	1
Question ITU-R 215-4/5	Question ITU-R 215-4/5	Frequency bands, technical characteristics, and operational requirements for fixed wireless access systems in the fixed and/or land mobile services	9.1-c	5
Question ITU-R 259/5	Question ITU-R 259/5	Operational and radio regulatory aspects for planes operating in the upper level of the atmosphere	1.6	2
Report of the CVC meeting (Document CVC-16/2)	Doc. CVC-16/2	Summary of the sixteenth meeting of Chairmen and Vice-Chairmen of Radiocommunication Study Groups (CVC-16) (E-meeting, 18-19 June 2020)	1.5	1
Resolution 136 (Rev. Bucharest, 2022) of the Plenipotentiary Conference	Final Acts of the Plenipotentiary Conference, Bucharest, 2022 – Resolution 136 (Rev. Bucharest, 2022)	The use of telecommunications/information and communication technologies for humanitarian assistance and for monitoring and management in emergency and disaster situations, including health-related emergencies, for early warning, prevention, mitigation and relief	9.1-a	5
Resolution 139 (Rev. Dubai, 2018)	Final Acts of the Plenipotentiary Conference, Bucharest, 2022 – Resolution 139 (Rev. Bucharest, 2022)	Use of telecommunications/information and communication technologies to bridge the digital divide and build an inclusive information society	9.1-c	5
Resolution 182 (Rev. Bucharest, 2022) of the Plenipotentiary Conference	Final Acts of the Plenipotentiary Conference, Bucharest, 2022 – Resolution 182 (Rev. Bucharest, 2022)	The role of telecommunications/information and communication technologies in regard to climate change and the protection of the environment	9.1-a	5
Resolution 37 (Rev. Buenos Aires, 2017)	Final Report of the World Telecommunication Development Conference (WTDC-22) – Resolution 37 (Rev. Kigali, 2022) of the World Telecommunication Development Conference	Bridging the digital divide	9.1-c	5

Reference*	Publication	Title	Agenda item	CPM chapter
Rules of Procedure	Rules of Procedure approved by the Radio Regulations Board 2021 edition (+ rev.2)	Rules of Procedure approved by the Radio Regulations Board 2021 edition (+ rev.2) – For the application, by the Radiocommunication Bureau, of the provisions of the Radio Regulations, Regional Agreements, Resolutions and Recommendations of World and Regional Radiocommunication Conferences	1.9	2
Section 1/1.1/4.1.9.1 of the CPM Report to the 2015 World Radiocommuni-cation Conference	Report of the CPM to the 2015 World Radiocommunication Conference	Report of the CPM on operational and regulatory/procedural matters to the World Radiocommunication Conference 2015	1.1	1
Stockholm 1961 (ST61) Agreement Plan	Stockholm 1961 (ST61) Agreement Plan	Regional Agreement for the European Broadcasting Area (Stockholm, 1961)	1.12	3
Supporting material document in Annex 4.8 of Document 5D/1555	Supporting material for WRC-23 agenda item 1.1 (Doc. 5D/1555, Annex 4.8)	Technical and regulatory conditions for the protection of stations of the Aeronautical Mobile Service (AMS) and Maritime Mobile Service (MMS) located in international airspace or waters (i.e. outside national territories) and operating in the frequency band 4 800-4 990 MHz	1.1	1
WRC-19 Document CMR19/571 (10th Plenary Minutes), Section 10.5, paragraph 2	WRC-19 Document CMR19/571 (10th Plenary Minutes)	Minutes of the Tenth Plenary Meeting (WRC-19) – Wednesday, 20 November 2019 at 0905 hours	7, topic A	4
WRC-19 Document 500	WRC-19 Document 500	Eleventh Report from Committee 5 to Plenary	7, topic B	4
WRC-19 Document 535, 2nd section of the Annex	WRC-19 Document 535	Report from Ad-Hoc Group of the Plenary, WG 5A on agenda item 1.6	9.1-d	5
WRC-19 Document 571	WRC-19 Document 571	Minutes of the Tenth Plenary Meeting - Wednesday, 20 November 2019 at 0905 hours	7, topic B	4

8 Non-ITU publications

Reference*	Publication	Title	Agenda item	CPM chapter
1974 SOLAS Convention chapters III and IV	Safety of Life at Sea (SOLAS) Convention	International Convention for the Safety of Life at Sea (SOLAS), 1974 Chapter III – Life-saving appliances and arrangements Chapter IV – Radiocommunications	1.11	2
3GPP TR 37.840	3GPP TR 37.840	Study of Radio Frequency (RF) and Electromagnetic Compatibility (EMC) requirements for Active Antenna Array System (AAS) base station	1.2	1
3GPP TR 38.921 V17.1.0 (2022-03)	3GPP TR 38.921	Study on International Mobile Telecommunications (IMT) parameters for 6.425-7.025 GHz, 7.025-7.125 GHz and 10.0-10.5 GHz	1.2	1
Amendment 78 to Annex 3 to the Convention on International Civil Aviation	Convention on International Civil Aviation	Convention on International Civil Aviation done at Chicago on the 7th day of December 1944	9.1-a	5
Annex 10 to the Convention on International Civil Aviation	Convention on International Civil Aviation	Convention on International Civil Aviation done at Chicago on the 7th day of December 1944	1.6	2
Article 37 of the Convention on International Civil Aviation	Convention on International Civil Aviation	Convention on International Civil Aviation done at Chicago on the 7th day of December 1944	1.8	2
Convention on International Civil Aviation and its annexes	Convention on International Civil Aviation	Convention on International Civil Aviation done at Chicago on the 7th day of December 1944	1.6	2

Reference*	Publication	Title	Agenda item	CPM chapter
EN 303 979	ETSI EN 303 979 V2.1.1 (2016-05)	ETSI EN 303 979 V2.1.1 (2016-05) – Satellite Earth Stations and Systems (SES); Harmonised Standard for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in non-geostationary orbit, operating in the 27,5 GHz to 29,1 GHz and 29,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU	1.15	4
Global Framework for Climate Services (GFCS) as identified at the Eighteenth World Meteorological Congress (Geneva, June 2019)	Global Framework for Climate Services (GFCS) Eighteenth World Meteorological Congress (Geneva, June 2019)	Global Framework for Climate Services (GFCS) World Meteorological Congress – Abridged Final Report of the Eighteenth Session (Geneva, 3-14 June 2019)	9.1-a	5
IMO Master Plan of shore-based facilities for the GMDSS (GMDSS Master Plan)	IMO Master Plan of shore-based facilities for the GMDSS (GMDSS Master Plan)	Master Plan of shore-based facilities for the Global Maritime Distress and Safety System (GMDSS Master Plan)	1.11	2
IMO Resolution MSC.514(105)	IMO Resolution MSC.514(105)	Guidelines for the avoidance of false distress alerts	1.11	2
IMO Resolution MSC.529(106)	IMO Resolution MSC.529(106)	Statement of recognition of maritime mobile satellite services provided by CTTIC through BDMSS	1.11	2
MSC 81	IMO Resolution MSC.81	Revised Recommendation on testing of life-saving appliances	1.11	2
NCSR 9/10/3	Report NCSR 9/24; Report NCSR 9/10/3 (IMO web account required)	NCSR Report to the Maritime Safety Committee Analysis and assessment of the GMDSS performance of Inmarsat Global Limited	1.11	2
NCSR 9/10/4	Report NCSR 9/24; Report NCSR 9/10/4 (IMO web account required)	NCSR Report to the Maritime Safety Committee Analysis and assessment of the GMDSS performance of Iridium	1.11	2

Reference*	Publication	Title	Agenda item	CPM chapter
Section 6.3.4, Annex 10 to the Convention on International Civil Aviation – Aeronautical Telecommunications, Volume III – Communication Systems, ICAO	Convention on International Civil Aviation	Convention on International Civil Aviation done at Chicago on the 7th day of December 1944	1.7	2
Sendai Framework for Disaster Risk Reduction 2015-2030	Sendai Framework for Disaster Risk Reduction 2015-2030	Sendai Framework for Disaster Risk Reduction 2015-2030	9.1-a	5
UNCLOS Convention	United Nations Convention on the Law of the Sea	United Nations Convention on the Law of the Sea	1.1	1
United Nations General Assembly Resolution 76/3 of 25 October 2021	United Nations General Assembly Resolution 76/3 of 25 October 2021	The "Space2030" Agenda: space as a driver of sustainable development	9.1-a	5

Lists of abbreviations used in the CPM Report

Abbreviations	Radio services	RR definition
AMS	aeronautical mobile service	No. **1.32**
AM(R)S	aeronautical mobile (route) service	No. **1.33**
AMS(OR)S	aeronautical mobile-satellite (off-route) service	No. **1.34**
AMSS	aeronautical mobile-satellite service	No. **1.35**
AMS(R)S	aeronautical mobile-satellite (route) service	No. **1.36**
ARNS	aeronautical radionavigation service	No. **1.46**
ARNSS	aeronautical radionavigation-satellite service	No. **1.47**
ARS	amateur service	No. **1.56**
ARSS	amateur-satellite service	No. **1.57**
BS*	broadcasting service	No. **1.38**
BSS	broadcasting-satellite service	No. **1.39**
EESS	Earth exploration-satellite service	No. **1.51**
FS	fixed service	No. **1.20**
FSS	fixed-satellite service	No. **1.21**
ISS	inter-satellite service	No. **1.22**
LMS	land mobile service	No. **1.26**
LMSS	land mobile-satellite service	No. **1.27**
MetAids	meteorological aids service	No. **1.50**
MetSat	meteorological-satellite service	No. **1.52**
MMS	maritime mobile service	No. **1.28**
MMSS	maritime mobile-satellite service	No. **1.29**
MRNS	maritime radionavigation service	No. **1.44**
MRNSS	maritime radionavigation-satellite service	No. **1.45**
MS	mobile service	No. **1.24**
MSS	mobile-satellite service	No. **1.25**
RAS	radio astronomy service	No. **1.58**
RDS	radiodetermination service	No. **1.40**
RDSS	radiodetermination-satellite service	No. **1.41**
RLS	radiolocation service	No. **1.48**
RLSS	radiolocation-satellite service	No. **1.49**
RNS	radionavigation service	No. **1.42**
RNSS	radionavigation-satellite service	No. **1.43**
SFTSS	standard frequency and time signal service	No. **1.53**
SFTSSS	standard frequency and time signal-satellite service	No. **1.54**
SOS	space operation service	No. **1.23**
SRS	space research service	No. **1.55**

* In the CPM texts on WRC-23 agenda items 1.1, 1.2, 1.3, 1.4 and 1.5, this abbreviation stands for “base station” (see RR No. **1.71**) and is not used to refer to the “broadcasting service” therein.

Other abbreviations:

Abbreviations	Description
3GPP	Third-Generation Partnership Project
AAS	active antenna system / advanced antenna system
ACLR	Adjacent Channel Leakage Ratio
ACS	automatic connection system
ACU	antenna control unit
ADS-B	automatic dependent surveillance-broadcast
A-ESIM	aeronautical earth station in motion
AGG	aggregate
AI	agenda item
AIS	automatic identification system
ALS	automatic landing systems
AMT	aeronautical mobile telemetry
AP/App.	Appendix
API	advance publication information
ATC	air traffic control
ATSC	Advanced Television Systems Committee
ATV	Amateur Television
BAS	broadcast auxiliary services
BBIU	bringing back into use
BDMSS	BeiDou Message Service System
BDT	ITU Telecommunication Development Bureau
BER	bit error rate
BIU	bringing into use
bps	bits per second
BR	ITU Radiocommunication Bureau
BR IFIC	Radiocommunication Bureau International Frequency Information Circular
BW	bandwidth
BWA	Broadband Wireless Access
C/I	carrier-to-interference ratio
C/N	carrier-to-noise ratio
CA	Administrative Circular
CCDF	complementary cumulative distribution function
CCT	ITU Coordination Committee for Terminology
CDF	cumulative distribution function
CDMA	Code Division Multiple Access
CDMA MC	CDMA Multi-Carrier
CISPR	*Comité International Spécial des Perturbations Radioélectriques* (in English: International Special Committee on Radio Interference)
CNPC	command and non-payload communication
CONOPS	concept of operations

Abbreviations	Description
CPM	conference preparatory meeting
CR/C	coordination request
CTTIC	China Transport Telecommunication Information Group Co. Ltd
CVC	Chairmen and Vice-Chairmen
D&S-OPS	distress and safety operations
DAA	detect and avoid
dB	decibel
dBc	decibel relative to the carrier
dBi	decibel in relation to an isotropic antenna
dBm	decibel milliwatts
dBW	decibel watt
DECT	Digital Enhanced Cordless Telecommunications
Deg.	degrees
DL	data link
DN	draft new
DR	draft revision
DRM	Digital Radio Mondiale
DRS	data relay satellite
dRSS	desired received signal strength
DSA	Data Relay Satellite
DSC	digital selective calling
DTT	digital terrestrial television
DTTB	digital terrestrial television broadcasting
DVB-T	Digital Video Broadcasting – Terrestrial
e.i.r.p.	equivalent isotropically radiated power (see RR No. **1.161)**
E/S or ES	earth station
$EIRP_C$	computed off-axis e.i.r.p. in reference bandwidth based on pfd mask
$EIRP_R$	reference off-axis e.i.r.p. in reference bandwidth towards the ground
eMBB	enhanced mobile broadband
ENG	electronic news gathering
epfd/EPFD	equivalent power flux-density
EPIRB	emergency position indicating radio beacon
EPM	equivalent protection margin
E-s	Earth-to-space
ESIM	earth station in motion
ESV	earth stations on board vessel
FDD	frequency-division duplex
FM	Frequency Modulation
FSK	Frequency-shift keying
FSR	fixed service receiver
FWA	Fixed Wireless Access

Abbreviations	Description
FWB	Fixed Wireless Broadband Note: Fixed Wireless applications (when this term is in the text, please use small a)
GE06	Geneva 2006 Agreement (Regional Agreement relating to the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz (Geneva, 2006))
GES	Ground Earth Station
GFCS	Global Framework for Climate Services
GIBC	Graphical Interface for Batch Calculations
GIMS	Graphical Interference Management System
GISIS	Global Integrated Ship Information System
GLONASS	Global Navigation Satellite System
GMDSS	global maritime distress and safety system
GNSS	global navigation satellite system
GPR	ground penetrating radar
GPS	The Global Positioning System, (originally Navstar GPS)
GSO	geostationary-satellite orbit (see RR No. **1.190)**
HAPS	high altitude platform station
HD	high-density
HDTV	high-definition television
HEO	highly elliptical Earth orbit
HF	high frequency
HFBC	High Frequency Broadcasting
HIBS	high altitude platform stations as IMT base stations
HTTS	helicopter television transmission system
I/*N*	interference-to-noise ratio
IARU	International Amateur Radio Union
ICAO	International Civil Aviation Organization
ICI	Ice Cloud Imager
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronic Engineers
IEL	Interference Exceedance Level
IF	intermediate frequency
IMO	International Maritime Organization
IMSO	International Mobile Satellite Organization
IMT	International Mobile Telecommunications
INR	interference-to-noise ratio
IPC	interference protection criterion
IPCC	Intergovernmental Panel on Climate Change
ISC	International Science Council
ISM	industrial, scientific and medical (see RR No. **1.15)**
ISU	Interference Suppression Unit

Abbreviations	Description
ITU	International Telecommunication Union
ITU CS	ITU Constitution
ITU-D	ITU Telecommunication Development Sector
ITU-R	ITU Radiocommunication Sector
IUCAF	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science
JTG	Joint Task Group
LAU	Legal Affairs Unit of ITU
LEO	Low-Earth Orbit / low-Earth orbit
LF	low frequency
LHCP	Left Hand Circular Polarization
LNA	low noise amplifier
LNB	Low-noise block downconverter
LO	local oscillator
LOS	line-of-sight
MAI	mission area of interest
MCL	minimum coupling loss
MEO	medium-Earth orbit
M-ESIM	maritime earth station in motion
MF	medium frequency
MIFR	Master International Frequency Register (or Master Register)
MLS	Microwave Limb Sounder
MMSI	Maritime Mobile Service Identity
mMTC	massive machine-type communications
MSC	Maritime Safety Committee of IMO
MSI	maritime safety information
N/A	*not applicable*
NAVDAT	navigational data
NAVTEX	navigational text
NB	narrowband
NBDP	narrow-band direct-printing
NCMC	*Network Control and Monitoring Centre*
NCSR	Navigation, Communications and Search and Rescue (IMO sub-committee)
NGSO / non-GSO	non-geostationary-satellite orbit (see RR No. **1.190**)
No.	Number
NOC	No Change
Non-AAS	Non-advanced antenna system
NORAD	North American Aerospace Defense Command
NWP	Numerical Weather Prediction
OB	outside broadcasting
OFDM	orthogonal frequency division multiplexing
OOB / OoB	out-of-band

Abbreviations	Description
OOBE	out-of-band emission (see RR No. **1.144**)
OR	off-route (see RR No. **1.37**) (AI 1.7, AI 1.10, AI 1.11)
OSCAR	Observing Systems Capability Analysis and Review Tool (WMO database)
P	Primary
PD	power density
PDF	Probability Density Function
PDN	preliminary draft new
PDR	preliminary draft revision of
Pfd / pfd / PFD	power flux-density
PMP	point-to-multipoint
PMR	private radio mobile
PP	ITU Plenipotentiary Conference
PPDR	public protection and disaster relief
PSD	power spectral density
PSK	Phase Shift Keying
PTP	point-to-point
QAM	quadrature amplitude modulation
QPSK	Quadrature Phase-Shift Keying
QZSS	Quasi-Zenith Satellite System
RA	Radiocommunication Assembly
RAG	Radiocommunication Advisory Group
Rec.	Recommendation
Rep.	Report
Res.	Resolution
RFI	radio-frequency interference
RHCP	Right Hand Circular Polarization
RLAN	radio local area network
RoP	Rules of Procedure
RPA	Remotely Piloted Aircraft
RPS	Remote Pilot Station
RR	Radio Regulations
RRB	Radio Regulations Board
RRC	Regional Radiocommunication Conference
RSBN	Радиотехническая Система Ближней Навигации Radiotechnitscheskaja Sistema Blischnej Nawigazii, Russian for “Short Range Radio-navigation system”
RTP-COM	radiotelephony communications
Rx	receiving
S	secondary
SAB	services ancillary to broadcasting
SAC	Suburban Area Coverage
SAP	services ancillary to programme-making
SAR	search and rescue (AI 1.11, AI 1.19)

Abbreviations	Description
SAR	synthetic aperture radar (AI 1.2)
SARPs	standards and recommended practices
SART	Search And Rescue Transmitter
SAT-COM	Satellite Communications
SDL	supplemental downlink
SE	single-entry
s-E	space-to-Earth
SEAMCAT	Spectrum Engineering Advanced Monte Carlo Analysis Tool (Software which implements the Monte Carlo methodology applied to radiocommunication scenarios)
SG	Study Group
SL	spreading loss
SMCP	Standard Marine Communication Phrases
SOLAS	International Convention for the Safety of Life at Sea
s-s	space-to-space
SSL	sidelobe suppression level / suppression side lobe
SST	Sea Surface Temperature
TACAN	TACtical Air Navigation System
TBD	to be defined/determined/developed (according to the context, used as a placeholder)
TG	Task Group
TIG	total integrated gain
ToR	Terms of Reference
TRP	total radiated power
TT&C	tracking, telemetry and command
Tx	transmitting
UA	unmanned aircraft
UACS	unmanned aircraft control station
UAS	unmanned aircraft systems
UAV	unmanned aerial vehicles
UE	user equipment
UHF	ultra-high frequency
UN	United Nations
UN/COPUOS	United Nations Committee on the Peaceful Uses of Outer Space
UNCLOS	United Nations Convention on the Law of the Sea
UNDRR	United Nations Office for Disaster Risk Reduction
UNOOSA	United Nations Office for Outer Space Affairs
URLLC	ultra-reliable and low-latency communications
URTNA[*]	Union of National Radio and Television Organizations of Africa
US	United States
USA	United States of America

[*] *Note by the Secretariat:* In 2006, this Union was transformed into a new Union, under the name “The African Union of Broadcasting (AUB)”.

Abbreviations	Description
UT	User Terminal
UTC	Coordinated Universal Time (see RR No. **1.14**)
VDES	VHF data exchange system
VDL	VHF data link
VHF	very high frequency
VLA	very large array
VLBI	very long baseline interferometry
Vol.	Volume
VSAT	Very Small Aperture Terminal
WAIC	Wireless Avionics Intra-Communications
WARC	World Administrative Radio Conference
WARC-ORB-88	WARC Orbit Conference 1988
WAS	wireless access systems
WB	wideband
WB LOS DL	wideband line-of-sight data link
WD	Working document
WDPDN	Working document towards a preliminary draft new
WDPDR	Working document towards a preliminary draft revision of
WG	Working Group
WMO	World Meteorological Organization
WP	Working Party
WPR	Wind Profiler Radar
WRC	World Radiocommunication Conference
WSC	White Sands Complex

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