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| A close up of a sign  Description automatically generated | **World Radiocommunication Conference (WRC-23)Dubai, 20 November - 15 December 2023** |  |
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| PLENARY MEETING | **Addendum 17 toDocument 44-E** |
|  | **13 October 2023** |
|  | **Original: English** |
|  |
| Member States of the Inter-American Telecommunication Commission (CITEL) |
| PROPOSALS FOR THE WORK OF THE CONFERENCE |
|  |
| 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;

Background

Space station operations in low-Earth orbit are increasing at a rapid rate for scientific, academic, and commercial purposes. These stations vary in size from as large as the International Space Station to as small as single unit cubesats[[1]](#footnote-2)1 and have wide ranging data requirements. Users of these systems require moving data from space to Earth, or other satellite terminal locations in an efficient, fast, and cost-effective manner.

In light of the above, satellite manufacturers are developing technologies addressing this need, including the possible use of satellite-to-satellite links with transmissions limited to the same direction of transmission (e.g., Earth-to-space direction or space-to-Earth direction) of the GSO or non-GSO service providers’ space station.

The ITU‑R has conducted extensive sharing and compatibility studies to assess the feasibility of introducing satellite-to-satellite links in many of the frequency bands called out in Resolution **773 (WRC‑19)**. In addition, the ITU‑R conducted a spectrum needs analysis to determine the estimated spectrum required for future space science, Earth science and human exploration missions through the year 2040. At the CPM23-2 meeting in March-April, 2023 in Geneva, the CPM text was finalized. The CPM text now proposes only two Methods, Method A which is NOC and a single Method B (rather than the old Methods B1-B5). The reorganized Method B includes the introduction of new FSS (space-to-space) allocations or new ISS allocations, as well as alternative approaches for the regulatory, technical and operational implementation of satellite-to-satellite communications. While the CPM text no longer includes a Method for operation in an “expanded” cone of coverage, it still includes an option for operation within an “extended” cone of coverage.

Based on these studies, some CITEL Administrations propose that use of satellite-to-satellite links for space science, space operation, Earth science, human exploration missions, and industrial and medical activities in space be recognized in the Radio Regulations within the inter-satellite service (ISS) in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz with transmissions limited to the same direction of transmission (e.g., Earth-to-space direction or space-to-Earth direction) of the GSO or non-GSO service providers’ space station.

Further, non-GSO user space stations using satellite-to-satellite links shall only transmit and receive within the cone of coverage[[2]](#footnote-3)2 of the associated GSO or non-GSO service provider space stations. Non-GSO user space stations will always operate at an orbital altitude that is lower than the orbital altitude of the network or system with which it is communicating. The non-GSO user would operate inter-satellite links in a manner that would replicate the operations of other users of the service provider network or system. Other user space stations, e.g., a space science satellite, would include ISS frequencies and operate under a contract with the FSS network or system operator providing the inter-satellite service.

A proposed new WRC‑23 Resolution provides inter-satellite link operating conditions and regulatory provisions to ensure protection of incumbent services operations based on Method B of the CPM Report.

In addition, in the proposed regulatory text, there are two possible sharing mechanisms with non-GSO FSS systems:

*• Alternative non-GSO FSS coordination*: addressing the sharing with non-GSO FSS through coordination under RR No. **9.12** with space-to-space emissions.

*• Alternative non-GSO FSS Hard limit*: addressing the sharing with non-GSO FSS through a Hard Limit with space-to-space emissions.

Some CITEL Administrations support a hard limit to address sharing with non-GSO FSS systems given the need to protect incumbent systems and the potential added complexity of coordinating incumbent systems with satellite-to-satellite operations.

Some CITEL Administrations further propose no change (NOC) to the Radio Regulations for the frequency band 11.7-12.7 GHz due to lack of sufficient ITU‑R studies necessary to demonstrate the requisite protection of incumbent services in order to support satellite-to-satellite link operations in this frequency range.

Finally, as a consequence of the proposals described above, some CITEL Administrations propose suppression of Resolution **773 (WRC‑19)**.

Proposals

ARTICLE 5

Frequency allocations

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

NOC IAP/44A17/1

11.7-13.4 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 11.7-12.5FIXEDMOBILE except aeronautical mobileBROADCASTINGBROADCASTING-SATELLITE5.492 | 11.7-12.1FIXED 5.486FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.488 Mobile except aeronautical mobile5.485 | 11.7-12.2FIXEDMOBILE except aeronautical mobileBROADCASTINGBROADCASTING-SATELLITE5.492 |
| 12.1-12.2FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488  |
| 5.485 5.489 | 5.487 5.487A |
| 12.2-12.7FIXEDMOBILE except aeronauticalmobileBROADCASTINGBROADCASTING-SATELLITE5.492 | 12.2-12.5FIXEDFIXED-SATELLITE(space-to-Earth) 5.484BMOBILE except aeronauticalmobileBROADCASTING |
| 5.487 5.487A | 5.487 5.484A |
| 12.5-12.75FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B(Earth-to-space)5.494 5.495 5.496 | 5.487A 5.488 5.490  | 12.5-12.75FIXEDFIXED-SATELLITE(space-to-Earth) 5.484A 5.484BMOBILE except aeronauticalmobileBROADCASTING-SATELLITE 5.493 |
| 12.7-12.75FIXEDFIXED-SATELLITE(Earth-to-space) MOBILE except aeronauticalmobile |
| 12.75-13.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.441 MOBILE Space research (deep space) (space-to-Earth) |
| 13.25-13.4 EARTH EXPLORATION-SATELLITE (active) AERONAUTICAL RADIONAVIGATION 5.497 SPACE RESEARCH (active) 5.498A 5.499 |

**Reasons:** Limited ITU-R studies were done in accordance with Resolution **773 (WRC-19)** supporting only satellite-to-satellite link operations in the downlink direction in the frequency range 11.7-12.7 GHz with no corresponding uplink direction spectrum. Hence NOC is proposed for this frequency band.

MOD IAP/44A17/2#1893

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 INTER-SATELLITE ADD 5.A117 MOBILE 5.519 5.521 |

**Reasons:** Include footnote in RR Article **5** recognizing satellite-to-satellite operations as part of the inter-satellite service in the indicated frequency bands.

ADD IAP/44A17/3#1896

5.A117 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 inter-satellite service Resolution **[IAP-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)

**Reasons:** New footnote recognizing satellite-to-satellite operations in the inter-satellite service with provisions for operation specified in a new WRC‑23 Resolution. Such use would not fall under the safety service provisions of RR No. **4.10**.

MOD IAP/44A17/4#1894

18.4-22 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 18.4-18.6 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A  INTER-SATELLITE ADD 5.A117 MOBILE |
| … |
| 18.8-19.3 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A  INTER-SATELLITE ADD 5.A117 MOBILE |
| 19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.517A 5.523B5.523C 5.523D 5.523E  INTER-SATELLITE ADD 5.A117 ADD 5.523XMOBILE |
| 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.516B 5.527A INTER-SATELLITE ADD 5.A117Mobile-satellite (space-to-Earth) | 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.516B 5.527A INTER-SATELLITE ADD 5.A117MOBILE-SATELLITE(space-to-Earth) | 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.516B 5.527A INTER-SATELLITE ADD 5.A117Mobile-satellite (space-to-Earth) |
| 5.524 | 5.524 5.525 5.526 5.527 5.528 5.529 | 5.524 |
| 20.1-20.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A  INTER-SATELLITE ADD 5.A117 MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 |

**Reasons:** Include footnote RR No. **5.A117** in Article **5** recognizing satellite-to-satellite operations as part of the inter-satellite service in the indicated frequency bands. Include a footnote RR No. **5.523X** in Article **5** specifying a power flux-density limit to protect feeder links for non-geostationary-satellite systems in the mobile-satellite service.

ADD IAP/44A17/5

5.523X In order to protect feeder links of non-geostationary networks in the mobile-satellite service in the band 19.3-19.7 GHz, the power flux-density values produced at the surface of the Earth for all angles of arrival by a space station in the inter-satellite service operating in this band in accordance with Resolution **[IAP-A117-B] (WRC-23)** shall not exceed −140 dB(W/m2) in any 1 MHz within 150 km of any of the above feeder link earth stations recorded in the Master International Frequency Register.     (WRC‑23)

**Reasons:** New footnote specifying a power flux-density limit to protect feeder links for non-geostationary-satellite systems in the mobile-satellite service. Note that date priority is set automatically by the date of notification as reflected in RR No. **8.3**.

MOD IAP/44A17/6#1895

24.75-29.9 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 27.5-28.5 FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.539 INTER-SATELLITE ADD 5.A117 MOBILE 5.538 5.540 |
| 28.5-29.1 FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.523A 5.539 INTER-SATELLITE ADD 5.A117  MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540 |
| **29.1-29.5** FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.517A 5.523C 5.523E 5.535A 5.539 5.541A  INTER-SATELLITE ADD 5.A117 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540 |
| 29.5-29.9FIXED-SATELLITE(Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 INTER-SATELLITE ADD 5.A117Earth exploration-satellite(Earth-to-space) 5.541Mobile-satellite (Earth-to-space) | 29.5-29.9FIXED-SATELLITE(Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 INTER-SATELLITE ADD 5.A117MOBILE-SATELLITE(Earth-to-space)Earth exploration-satellite(Earth-to-space) 5.541 | 29.5-29.9FIXED-SATELLITE(Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 INTER-SATELLITE ADD 5.A117Earth exploration-satellite(Earth-to-space) 5.541Mobile-satellite (Earth-to-space)  |
| 5.540 5.542 | 5.525 5.526 5.527 5.529 5.540  | 5.540 5.542 |

**Reasons:** Include footnote in RR Article **5** recognizing satellite-to-satellite operations as part of the inter-satellite service in the indicated frequency bands.

MOD IAP/44A17/7#1897

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 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 |

**Reasons:** Include footnote in RR Article **5** recognizing satellite-to-satellite operations as part of the inter-satellite service in the indicated frequency bands.

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section V − Limits of power flux-density from space stations

MOD IAP/44A17/8#1898

TABLE **21-4**     (Rev.WRC‑23)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency band | Service\* | Limit in dB(W/m2) for anglesof arrival (δ) above the horizontal plane | Reference bandwidth |
| 0°-5° | 5°-25° | 25°-90° |
| ... |
| 17.7-19.3 GHz 7, 8 | Fixed-satellite(space-to-Earth)Inter-satelliteMeteorological-satellite(space-to-Earth) | **0°-5°** | **5°-25°** | **25°-90°** | 1 MHz |
| −115 14, 15or−115 − *X* 13 | −115 + 0.5(δ − 5) 14, 15or−115 − *X* + ((10 + *X* )/20)(δ − 5) 13 | −105 14, 15or−105 13 |
| 17.7-19.3 GHz 7, 8 | Fixed-satellite(space-to-Earth)Inter-satellite | **0°-3°** | **3°-12°** | **12°-25°** | −105 16 | 1 MHz |
| −120 16 | −120 + (8/9)(δ − 3) 16 | −112 +(7/13)(δ − 12) 16 |
| 19.3-19.7 GHz | Fixed-satellite(space-to-Earth)Inter-satellite | **0°-3°** | **3°-12°** | **12°-25°** | −105 16 | 1 MHz |
| −120 16 | −120 + (8/9)(δ − 3) 16 | −112 +(7/13)(δ − 12) 16 |

TABLE **21-4**  (*continued*)     (Rev.WRC‑23)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency band | Service\* | Limit in dB(W/m2) for anglesof 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 GHz24.45-24.75 GHz25.25-27.5 GHz27.500-27.501 GHz | Fixed-satellite(space-to-Earth)Broadcasting-satelliteEarth exploration-satellite (space-to-Earth)Inter-satelliteSpace research(space-to-Earth) | −115 15 | −115 + 0.5(δ − 5) 15 | −105 15 | 1 MHz |
| 27.5-29.5 GHz | Inter-satellite(non-geostationary satellite orbit) | −115 | −115 + 0.5(δ – 5) | −105 | 1 MHz |
| … |

**Reasons:** Include inter-satellite service in RR Article **21**, Table **21-4** to ensure that pfd limits to protect terrestrial services that apply to FSS (space-to-Earth) also apply to ISS. Studies within Working Party (WP) 4A have shown the pfd limits in the bands above and below the frequency band 27.5-29.5 GHz would also protect terrestrial services in this band. A more stringent mask is not required nor is it justified.

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[[3]](#footnote-4)2    (Rev.WRC‑12)

Footnotes to Tables A, B, C and D

MOD IAP/44A17/9#1899

**TABLE A**

GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM,
EARTH STATION OR RADIO ASTRONOMY STATION     (Rev.WRC‑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 levelRequired only for notification |  |  |  |  | **+** |  |  |  |  | A.24.a |  |
| **A.25** | **COMPLIANCE WITH RESOLUTION** **[IAP-A117-B] (WRC-23)** |  | **A.25** |  |
| A.25.a | a commitment from the notifying administration of a non-GSO ISS 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 inter-satellite and Earth-to-space links shall not exceed the limits given in Table **22‑2** |  |  | **+** |  | **+** |  |  |  |  | A.25.a |  |
| A.25.b.1 | 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 **[IAP-A117-B] (WRC‑23)**Required only for non-GSO space stations submitted in accordance with Resolution **[IAP-A117-B] (WRC‑23)** |  |  | **+** |  | **+** |  |  |  |  | A.25.b.1 |  |
| A.25.b.2 | a commitment of compliance with per-satellite power flux-density level in the frequency band 19.3-19.7 GHz, as defined in No. **5.523X**Required only for the notification of space stations submitted in accordance with Resolution **[IAP‑A117-B] (WRC‑23)** |  |  | **+** |  | **+** |  |  |  |  | A.25.b.2 |  |
| 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 |  |  | **+** |  | **+** |  |  |  |  | A.25.c.1 |  |
| 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, and as a function of the latitude at nadir of the non-geostationary transmitting space station |  |  | **+** |  | **+** |  |  |  |  | A.25.c.2 |  |
| A.25.d | COMPLIANCE WITH *resolves* 3.3 OF RESOLUTION **[IAP-A117-B] (WRC‑23)** |  |  |  |  |  |  |  |  |  | A.25.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 **[IAP-A117-B] (WRC‑23)**Required only for the notification of non-GSO space stations submitted in accordance with Resolution **[IAP-A117-B] (WRC-23)** |  |  |  |  | **+** |  |  |  |  | A.25.d.1 |  |

MOD IAP/44A17/10#1900

**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‑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 stationsFor 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 | areas of the satellite beam on the Earth, when the associated transmitting [or receiving] stations are space stationsRequired for space stations in the ISS transmitting in the bands 18.1-18.6 GHz and 18.8-20.2 GHz |  |  | **+** |  | **+** |  |  |  |  | C.11.a.1 |  |
| … | … |  |  |  |  |  |  |  |  |  |  |  |

**Reasons:** Include new RR Appendix **4** data elements that are needed as a result of Resolution **[IAP-A117-B] (WRC-23)**.

ADD IAP/44A17/11#1901

draft new RESOLUTION [IAP-A117-B] (WRC‑23)

Use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz by the inter-satellite service

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 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 ISS at higher altitude does not need to be the same administration that has already notified assignments in the ISS;

*c)* that imposing hard limits necessary to protect other services would provide regulatory certainty for both notifying administrations of non-GSO space stations communicating with 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 GHz and 27.5-30 GHz and adjacent bands and satellite-to-satellite transmissions in the ISS;

*f)* that these studies were based on certain principles including the limitation of the use of frequency bands in 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, pfd 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 additional constraints, from the operation of the ISS,

recognizing

that any course of action taken under this Resolution with respect to the satellite-to-satellite links in the ISS has no impact on the coordination requirements with other services which are otherwise subject to coordination, regardless of date of receipt,

resolves

1 that, for a non-GSO space station subject to this Resolution communicating with a GSO or non-GSO space station using the ISS 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 ISS space station transmitting in the frequency bands 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 inter-satellite links when its apogee altitude[[4]](#footnote-5)1 is lower than the minimum operational altitude[[5]](#footnote-6)2 of the GSO or non-GSO space station it communicates with and when the off-nadir angle between this GSO or non-GSO 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 or non-GSO 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 inter-satellite 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 satellite-to-satellite links in the ISS 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 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 a non-GSO ISS space station transmitting satellite-to-satellite links in the frequency band 27.5-30 GHz, the following conditions shall apply:

2.1 this non-GSO ISS 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 ISS 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 it communicates with;

2.3 this non-GSO ISS space stationshall meet the limits given in Table **21-4** for protection of terrestrial services in the frequency band 27.5-29.5 GHz and shall not cause unacceptable interference to or otherwise impose constraints on the operation or the development of terrestrial services;

2.4 this non-GSO space station shall not cause unacceptable interference to or otherwise impose constraints on the operation or the development of non-GSO FSS systems and shall comply with the provisions contained in Annex 4 to this Resolution;

2.5 when transmitting in the frequency band 29.1-29.5 GHz, shall limit communicationsto GSO FSS space stations, and shall not cause unacceptable interference to or otherwise impose constraints on the operation or development of FSS feeder links to non-GSO mobile-satellite service systems operating in the band 29.1-29.5 GHz; the conditions in Annex 4 b) shall apply;

2.6 the emissions of this non-GSO ISS space station shall comply with the provisions contained in Annex 5 to this Resolution for protection of GSO space stations;

3 that space station transmitting 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 ISS 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 that, 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 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;

4 that non-GSO ISS 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 meteorological-satellite service networks as well as terrestrial services operating in conformity with the Radio Regulations;

5 that space stations receiving satellite-to-satellite transmissions in the frequency band 27.5-30 GHz from non-GSO space stations shall not claim protection for inter-satellite links from FSS and MSS networks and systems as well as terrestrial services operating in conformity with the Radio Regulations;

6that assignments to the ISS in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz bands shall not cause unacceptable interference to nor claim protection from GSO FSS services operating in the frequency band allocated to FSS,

resolves further

1 that, subject to this Resolution:

*a)* the notifying administration of the non-GSO system choosing to operate inter-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 inter-satellite and associated earth station transmissions shall not exceed the limits given in Table **22‑2**;

*b)* the notifying administration of the non-GSO ISS 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** advance publication information containing the characteristics of the non-GSO ISS space station/stations and the associated name of the GSO FSS network that has the recorded assignments with which the non-GSO ISS space station/stations intend to communicate;

*c)* the notifying administration of the non-GSO ISS 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, 18.8-20.2 GHz) shall send to the BR the relevant Appendix **4** advance publication information containing the characteristics of the non-GSO ISS space station/stations and the associated name of the notified non-GSO FSS system(s) with which it intends to communicate;

*d)* that the notifying administration for the non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz shall provide to the BR, when submitting Appendix **4** data, a 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 ISS space station transmitting in the frequency band 27.5-30 GHz or parts thereof:

*a)* the notifying administration for that non-GSO ISS 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 ISS space station and the notifying administration of the GSO or non-GSO space station receiving these satellite to satellite transmissions shall, jointly or individually, as the case may be, upon receipt of a report of unacceptable interference, take a 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 Regulation Board for review;

3 that the notifying administration for the GSO or non-GSO FSS receiving inter-satellite transmissions in the frequency band 27.5-30 GHz shall ensure that:

*a)* the non-GSO ISS 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 station of any other notifying administration or space station in a non-GSO system of any other notifying administration;

*b)* all necessary measures are taken so that a non-GSO ISS space stations transmitting 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 ISS space stations transmitting in these frequency bands 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*1b*)* or 1c*)*, 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 ISS 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 Annex 2 of this Resolution when assessing compliance with the pfd limits in Table **21-4**;

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 [IAP-A117-B] (WRC-23)

Determination of the off-nadir angle

1 a non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz, 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:

 

where:

 *REarth* = 6 378 km

 *AltHigher* = altitude of the non-GSO space station at higher orbital altitude in km.



2 a non-GSO ISS 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:

 

where:

 *REarth*= 6 378 km

 *AltGSO* = altitude of the GSO space station in km;

3 in case the notified service area of the 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:

 

with:

 

 

 

 

 

 

 

where:

 *latsab*(φ) = latitude of the service area border for the azimuth φ

 *lonsab*(φ) = longitude of the service area border for the azimuth φ

 *latSS* = latitude of the sub-satellite point of the GSO/non-GSO space station

 *lonSS* = longitude of the sub-satellite point of the GSO/non-GSO space station.

ANNEX 2 TO draft new RESOLUTION [IAP-A117-B] (WRC‑23)

Provisions for non-GSO ISS space stations transmitting in the frequency band 27.5-29.5 GHz to protect terrestrial services in the frequency band 27.5‑29.5 GHz

To check the compliance of the non-GSO ISS emissions with the pfd mask described in in Table **21-4**, the following procedures shall be followed.

1) Parameter *a* is the orbital altitude (km) of the non-GSO ISS system identified in *resolves further* 1b*)* or in *resolves further* 1c*)*, *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, *Re*, is 6 378 km.

2) Compute the angle, as seen from the non-GSO ISS 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:

 

3) Sweep angle of arrival to the terrestrial station, θ from 0 to 90 degrees in 0.1 degree increments.

4) Compute satellite angle .

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 .

8) Compute the atmospheric attenuation *Aatm* 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:

 

ANNEX 3 TO draft new RESOLUTION [IAP-A117-B] (WRC‑23)

Provisions for non-GSO space stations[[6]](#footnote-7)3 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

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 ISS space station as described in *resolves* 1 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 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)).

The Radiocommunication Bureau shall not examine, under No. **11.31**, the conformity of non-GSO FSS systems with the provisions of this Annex.

ANNEX 4 TO draft new RESOLUTION [IAP-A117-B](WRC‑23)

Provisions for non-GSO inter-satellite links in the frequency band 27.5-30.0 GHz to protect non-GSO space stations

The following conditions for non-GSO ISS 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 ISS 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: −17.5 dBW/Hz;

– for non-GSO space station transmit on-axis antenna gains less than 40.6 dBi: −17.5 − (40.6 – X) dBW/Hz;

 where X is the on-axis gain of the non-GSO space station antenna in dBi.

*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 −67odBW/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.

*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 1350 km.

*d)* 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 ≥ 1 350 | N/A |

*e)* 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 −28 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 < 375 | 61 |
| 375≤ altitude < 450 | 60 |
| 450 ≤ altitude < 600 | 58 |
| 600 ≤ altitude < 750 | 55 |
| 750 ≤ altitude < 900 | 53 |
| altitude ≥ 1 290/1 350 | N/A |

*f)* 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(j) dBi for angles between 3.5 degrees and 8.5 degrees, −44.82 + 5.95(j) for angles between 8.5 and 9.5 degrees, and 43-32 log(j) for angles between 9.5 and 20 degrees.

ANNEX 5 TO draft new RESOLUTION [IAP-A117-B] (WRC‑23)

Provisions for non-GSO inter-satellite links in the frequency band 27.5‑30.0 GHz bands 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)*, 2 and 3.

3) 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.

4) 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 inter-satellite links, the BR shall perform the examination in Appendix 2 to this Annex.

5) 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)*, 2 and 3.

6) 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 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:

 

 where *NGSOalt* is the altitude of the transmitting non-GSO system space stations, and *GSOalt* = 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 *EIRPSDreduced* = *EIRPSD* − Δ*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** A.25.y.

Step 7: For all emissions in the GSO network notification, compute e.i.r.p. spectral density mask for all off axis 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 *EIRPSDreduced* 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 1c).*

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:

 

 where *NGSOalt* is the altitude of the transmitting non-GSO system space stations, and *GSOalt* = 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 *EIRPSDreduced* = *EIRPSD* − Δ*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** A.25.y.

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 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 *EIRPSDreduced* 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, *6)*, the following procedure shall be followed.

Step 1: For each of the latitudes in the e.i.r.p. spectral density mask given in Appendix **4** A.25.c.2, elect the corresponding value to the GSO arc avoidance, and denote it as *eirpα*. 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** A.25.c.1.

Step 2a: compute the slant distance to the GSO arc as



where *alt* is the altitude of the transmitting non-GSO space station, in kilometres***,*** and latitude is at nadir of the non-GSO space station.

Step 2b: Compute the PFD on the GSO arc using:



Step 3: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5, 6) if all pfd values calculated in Step 3 are below the threshold given in Annex 5, 6).

**Reasons:** Same methodology adopted to the new latitude dependency of the user mask (see AP**4**).

SUP IAP/44A17/12#1890

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

**Reasons:** Adoption by WRC-23 of the aforementioned proposals satisfies the agenda item and therefore Resolution **773 (WRC-19)** is no longer needed.

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1. 1 A single unit cubesat has the dimensions of 10 × 10 × 10 centimetres and typical mass less than 2 kilograms. [↑](#footnote-ref-2)
2. 2 The cone of coverage is 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 the notified service area of the individual service provider space station. [↑](#footnote-ref-3)
3. 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) [↑](#footnote-ref-4)
4. 1 See item A.4.b.4.d of Appendix **4**. [↑](#footnote-ref-5)
5. 2 See item A.4.b.4.f of Appendix **4**. [↑](#footnote-ref-6)
6. 3 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. [↑](#footnote-ref-7)