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| **World Radiocommunication Conference (WRC-19)Sharm el-Sheikh, Egypt, 28 October – 22 November 2019** |  |
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| PLENARY MEETING | **Addendum 6 toDocument 28-E** |
|  | **27 September 2019** |
|  | **Original: Chinese** |
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| China (People's Republic of) |
| Proposals for the work of the conference |
|  |
| Agenda item 1.6 |

1.6 to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate 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 accordance with Resolution **159 (WRC-15)**;

Introduction

Resolution **159 (WRC-15)** discusses the development of new technologies in the fixed-satellite service (FSS) in 50/40 GHz frequency bands, that would allow for the provision of high-capacity and low-cost communications in all parts of the world, especially in remote and isolated areas. This Resolution considers that satellite constellations in both geostationary-satellite orbits (GSO) and non-geostationary-satellite orbits (non-GSO) would allow for the implementation of these new technologies in the FSS bands and that the Radio Regulations should enable the introduction of such technologies to ensure efficient use of the radio spectrum.

Resolution **159 (WRC-15)** resolves to invite the ITU-R to conduct and complete in time for WRC‑19 studies on the regulatory provisions to enable the operation of non-GSO FSS satellite systems in the abovementioned frequency bands, including sharing studies with GSO (FSS, BSS, MSS), EESS and RAS.

To satisfy this agenda item, China supports the following approaches:

1) To modify, as appropriate, Article **22** of the Radio Regulations to ensure compatibility of non-GSO FSS operations with GSO networks;

2) Both the single-entry and the aggregate interference from non-GSO systems to the GSO systems should be considered;

3) To modify, as appropriate, Article **9** of the Radio Regulations and develop a new resolution to establish mechanisms of coordination procedures between non-GSO systems operating in 50/40 GHz;

4) To protect the EESS systems in the adjacent bands, modifications to Resolution **750 (Rev.WRC-15)** should encompass both the non-GSO and GSO systems.

Proposals

ARTICLE 5

Frequency allocations

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

MOD CHN/28A6/1#50006

5.338AIn the frequency bands 1 350-1 400 MHz, 1 427-1 452 MHz, 22.55-23.55 GHz, 30-31.3 GHz, 49.7-50.2 GHz, 50.4-50.9 GHz, 51.4-52.6 GHz, 81-86 GHz and 92-94 GHz, Resolution **750 (Rev.WRC-19)** applies.     (WRC-19)

**Reasons:** Consequential change.

MOD CHN/28A6/2#49996

34.2-40 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 37.5-38 FIXED FIXED-SATELLITE (space-to-Earth) ADD 5.A16 MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth) Earth exploration-satellite (space-to-Earth) 5.547 |
| 38-39.5 FIXED FIXED-SATELLITE (space-to-Earth) ADD 5.A16 MOBILE Earth exploration-satellite (space-to-Earth) 5.547 |
| 39.5-40 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B ADD 5.A16 MOBILE MOBILE-SATELLITE (space-to-Earth) Earth exploration-satellite (space-to-Earth) 5.547 ADD 5.B16 |

**Reasons:** To have provisions for coordination among non-GSO satellite services.

ADD CHN/28A6/3#50000

5.A16The use of 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) by a non‑geostationary-satellite system in the fixed-satellite service for which complete coordination information is received by the Bureau after 1 January 2020, is subject to the application of the provisions of No. **9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service, but not with non-geostationary systems in other services. Non-GSO systems in the fixed-satellite service in these frequency bands shall operate in accordance with draft new Resolution **[CHN/A16] (WRC‑19)**. No.**22.2** shall continue to apply.     (WRC‑19)

**Reasons:** To stress coordination among non-GSO FSS systems in the 50/40 GHz bands and to state that the draft new Resolution **[CHN/A16] (WRC-19)** shall apply to regulate the protection of GSO networks from the interference caused by non-GSO systems operating in the same band.

ADD CHN/28A6/4#50004

5.B16The use of the frequency bands 39.5-40 and 40-40.5 GHz by the mobile-satellite service (space-to-Earth) and non‑geostationary-satellite systems in the fixed-satellite service (space-to-Earth) for which complete coordination information is received by the Bureau after 1 January 2020 is subject to coordination under No. **9.11A**.     (WRC‑19)

**Reasons:** To address coordination between non-GSO FSS and MSS systems in the 50/40 GHz bands.

MOD CHN/28A6/5#49997

40-47.5 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 40-40.5 EARTH EXPLORATION-SATELLITE (Earth-to-space) FIXED FIXED-SATELLITE (space-to-Earth) 5.516B ADD 5.A16 MOBILE MOBILE-SATELLITE (space-to-Earth)  SPACE RESEARCH (Earth-to-space) Earth exploration-satellite (space-to-Earth) ADD 5.B16 |
| 40.5-41FIXEDFIXED-SATELLITE (space-to-Earth) ADD 5.A16BROADCASTINGBROADCASTING-SATELLITEMobile5.547 | 40.5-41FIXEDFIXED-SATELLITE (space-to-Earth) 5.516B ADD 5.A16BROADCASTINGBROADCASTING-SATELLITEMobileMobile-satellite (space-to-Earth)5.547 | 40.5-41FIXEDFIXED-SATELLITE (space-to-Earth) ADD 5.A16BROADCASTINGBROADCASTING-SATELLITEMobile5.547 |
| 41-42.5 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B ADD 5.A16 BROADCASTING BROADCASTING-SATELLITE Mobile 5.547 5.551F 5.551H 5.551I |
| ... |
| 47.2-47.5 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 ADD 5.A16 MOBILE 5.552A |

**Reasons:** To have provisions for coordination among non-GSO satellite services.

MOD CHN/28A6/6#49998

47.5-51.4 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 47.5-47.9FIXEDFIXED-SATELLITE(Earth-to-space) 5.552 ADD 5.A16 (space-to-Earth) 5.516B 5.554A MOBILE | 47.5-47.9 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 ADD 5.A16 MOBILE |
| 47.9-48.2 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 ADD 5.A16 MOBILE 5.552A |
| 48.2-48.54FIXEDFIXED-SATELLITE(Earth-to-space) 5.552 ADD 5.A16(space-to-Earth) 5.516B5.554A 5.555BMOBILE | 48.2-50.2 FIXED FIXED-SATELLITE (Earth-to-space) 5.516B MOD 5.338A 5.552 ADD 5.A16 MOBILE |
| 48.54-49.44FIXEDFIXED-SATELLITE(Earth-to-space) 5.552 ADD 5.A16MOBILE5.149 5.340 5.555 |  |
| 49.44-50.2FIXEDFIXED-SATELLITE(Earth-to-space) MOD 5.338A 5.552 ADD 5.A16(space-to-Earth) 5.516B5.554A 5.555BMOBILE |  5.149 5.340 5.555 |
| ... |
| 50.4-51.4 FIXED FIXED-SATELLITE (Earth-to-space) MOD 5.338A ADD 5.A16 MOBILE Mobile-satellite (Earth-to-space) |

**Reasons:** To insert provisions for coordination among non-GSO satellite services.

ARTICLE 9

Procedure for effecting coordination with or obtaining agreement of other administrations1, 2, 3, 4, 5, 6, 7, 8, 9    (WRC‑15)

Section II − Procedure for effecting coordination12, 13

Sub-Section IIA − Requirement and request for coordination

MOD CHN/28A6/7#50009

9.35 *a)* examine that information with respect to its conformity with No. 11.31MOD 19;     (WRC‑19)

**Reasons:** Consequential change.

MOD CHN/28A6/8#50010

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19 9.35.1The Bureau shall include the detailed results of its examination under No. 11.31 of compliance with the limits in Tables **22‑1** to **22‑3** or the applicable single-entry limits in No. **22.5L** of Article **22** in the publication under No. **9.38**.     (WRC‑19)

**Reasons:** To address the publication of the Bureau’s examination of the non-GSO single entry limits.

ARTICLE 22

Space services1

ADD CHN/28A6/9#50007

22.5L9) A non-geostationary system in the fixed-satellite servicein 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) shall not exceed:

– a single entry of 3% of the time allowance for the *C*/*N* value specified in the short-term performance objective associated with the shortest percentage of time (lowest *C*/*N*) for each GSO reference link; and

– a 3%reduction in time-averaged[[1]](#footnote-1)27 spectral efficiency as associated with the long-term performance objective for each GSO reference link using adaptive coding and modulation. The procedures and methodologies specified in draft new Resolution **[CHN/A16] (WRC‑19)** shall be used for the calculations. The epfd levels from the non-GSO FSS system should be derived using the latest version of Recommendation ITU‑R S.1503.     (WRC‑19)

**Reasons:** Based on ITU-R studies, the detailed technical regulatory provisions added above will introduce technical regulatory provisions into the Radio Regulations that will enable the introduction of non-GSO satellite systems that will protect GSO networks and provide for maximum spectral efficiency for simultaneous operations of non-GSO systems and GSO networks in the 50/40 GHz bands. The term “reserve capacity” is not clear, so the term “spectral efficiency” is more appropriate.

ADD CHN/28A6/10#50008

22.5M 10) Administrations operating or planning to operate non-geostationary-satellite systems in the fixed-satellite service 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 shall ensure that the aggregate interference to GSO FSS, MSS and BSS networks does not exceed 10% of the short- and long-term performance objectives by applying the provisions of draft new Resolution **[CHN/A16] (WRC-19)**.     (WRC‑19)

**Reasons:** Based on ITU-R studies, the detailed technical regulatory provisions added above will introduce technical regulatory provisions into the Radio Regulations that will enable the introduction of non-GSO satellite systems that will protect GSO networks and provide for maximum spectral efficiency for simultaneous operations of non-GSO systems and GSO networks in the 50/40 GHz bands.

SUP CHN/28A6/11

RESOLUTION 159 (WRC‑15)

Studies of technical, operational issues and regulatory provisions for non-geostationary fixed-satellite services satellite systems 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)

**Reasons:** No longer needed since it has been satisfied by methods specified in the WRC-19 new resolution.

MOD CHN/28A6/12#50013

RESOLUTION 750 (Rev.WRC‑19)

Compatibility between the Earth exploration-satellite service (passive) and relevant active services

…

TABLE 1-1

| EESS (passive) band | Activeservice band | Active service | Limits of unwanted emission power fromactive service stations in a specified bandwidthwithin the EESS (passive) band1 |
| --- | --- | --- | --- |
| 1 400-1 427 MHz | 1 427-1 452 MHz | Mobile | −72 dBW in the 27 MHz of the EESS (passive) band for IMT base stations−62 dBW in the 27 MHz of the EESS (passive) band for IMT mobile stations2, 3 |
| 23.6-24.0 GHz | 22.55-23.55 GHz | Inter-satellite | −36 dBW in any 200 MHz of the EESS (passive) band for non-geostationary (non-GSO) inter-satellite service (ISS) systems for which complete advance publication information is received by the Bureau before 1 January 2020, and −46 dBW in any 200 MHz of the EESS (passive) band for non-GSO ISS systems for which complete advance publication information is received by the Bureau on or after 1 January 2020 |
| 31.3-31.5 GHz | 31-31.3 GHz | Fixed(excluding HAPS) | For stations brought into use after 1 January 2012: −38 dBW in any 100 MHz of the EESS (passive) band. This limit does not apply to stations that have been authorized prior to 1 January 2012 |
| 50.2-50.4 GHz | 49.7-50.2 GHz | Fixed-satellite(E‑to‑s)4 | For GSO stations brought into use after the date of entry into force of the Final Acts of WRC‑07 and for which complete notification information is received prior to 1 January 2020:−10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi−20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBiFor GSO stations for which complete notification information is received by the Bureau after 1 January 2020:−35 dBW in any 200 MHz of the EESS (passive) band for earth stations with elevation angles less than 80° and having an antenna gain greater than or equal to 57 dBi−52 dBW in any 200 MHz of the EESS (passive) band for earth stations with elevation angles greater than or equal to 80° and having an antenna gain greater than or equal to 57 dBi−55 dBW in any 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBiFor non-GSO stations brought into use after the date of entry into force of the Final Acts of WRC‑07 and before 1 January 2020:−10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi−20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBiFor non-GSO stations brought into use after 1 January 2020:−45 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi−55 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi |
| 50.2-50.4 GHz | 50.4-50.9 GHz | Fixed-satellite(E‑to‑s)4 | For GSO stations brought into use after the date of entry into force of the Final Acts of WRC‑07 and for which complete notification information is received prior to 1 January 2020:−10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi−20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBiFor GSO stations for which complete notification information is received by the Bureau after 1 January 2020:−35 dBW in any 200 MHz of the EESS (passive) band for earth stations with elevation angles less than 80°and having an antenna gain greater than or equal to 57 dBi−52 dBW in any 200 MHz of the EESS (passive) band for earth stations with elevation angles greater than or equal to 80°and having an antenna gain greater than or equal to 57 dBi−55 dBW in any 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBiFor non-GSO stations brought into use after the date of entry into force of the Final Acts of WRC‑07 and before 1 January 2020:−10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi−20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBiFor non-GSO stations brought into use after 1 January 2020:−45 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi−55 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi |
| 52.6-54.25 GHz | 51.4-52.6 GHz | Fixed | For stations brought into use after the date of entry into force of the Final Acts of WRC‑07:−33 dBW in any 100 MHz of the EESS (passive) band |

NOTE - See sub-section 3/1.6/3.3 of the CPM Report on the study of non-GSO and EESS (passive).

**Reasons:** Studies have shown that, in order for the aggregate interference from both GSO and non-GSO FSS earth stations emission to meet the protection criteria of EESS systems, modifications to the unwanted emission limits for both GSO and non-GSO FSS systems are needed.

ADD CHN/28A6/13#50011

draft new RESOLUTION [CHN/A16] (WRC‑19)

Protection of geostationary FSS, BSS and MSS networks from unacceptable interference from non-GSO FSS systems in the frequency bands of 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),

considering

*a)* that the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz are allocated, on a primary basis, to the fixed-satellite service (FSS) in all Regions;

*b)* that the frequency bands 40.5-41 GHz and 41-42.5 GHz are allocated, on a primary basis, to the broadcasting-satellite service (BSS) in all regions;

*c)* that the frequency bands 39.5-40 GHz and 40-40.5 GHz are allocated, on a primary basis, to the mobile-satellite service (MSS) in all regions;

*d)* that Article **22** of the Radio Regulations contains regulatory and technical provisions on sharing between GSO and non-GSO FSS systems in frequency bands referred to in *considering* *a)*;

*e)* that, in accordance with No. **22.2**, non-geostationary-satellite orbit (non-GSO) systems shall not cause unacceptable interference to geostationary-satellite orbit (GSO) FSS and broadcasting-satellite service (BSS) networks and, unless otherwise specified in the Radio Regulations, shall not claim protection from GSO FSS and BSS satellite networks;

*f)* that non-GSO FSS systems would benefit from increased certainty that would result from the quantification of technical regulatory measures required for protection of GSO satellite networks operating in the bands referred to in *considering* *a)*, *b)* and *c)* above;

*g)* that GSO FSS, MSS, and BSS networks could be protected without placing undue constraints on non-GSO FSS systems in the bands referred to in *considering a)*, *b)* and *c)* above;

*h)* that for the bands in *considering* *a)*, WRC‑19 modified Article **22** to limit single-entry and aggregate permissible time allowance for degradation in terms of *C*/*N* by non-GSO FSS systems to GSO satellite networks, based on sharing methodology provided in Annex 2 to this Resolutionand the reference links given in Annex 1 to this Resolution;

*i)* that the operating parameters and orbital characteristics of non-GSO FSS systems are usually inhomogeneous;

*j)* that, as a result of this inhomogeneity, the time allowance for the *C*/*N* value specified in the short-term performance objective associated with the shortest percentage of time (lowest *C*/*N*) or decrease of the long-term throughput (spectral efficiency) caused to reference GSO FSS links by non-GSO FSS systems is likely to vary between such systems;

*k)* that the aggregate interference limit level of non-GSO FSS is directly related to the actual number of the single-entry non-GSO systems sharing the same frequency band;

*l)* that to protect GSO FSS, MSS, and BSS networks in the frequency bands listed in *considering* *a)* from unacceptable interference, the aggregate interference caused by all co-frequency non-GSO FSS systems shall not exceed the maximum aggregate interference specified in No. **22.5M** of the Radio Regulations;

*m)* that to achieve the level of protection of GSO reference links given in Annex 1 to this Resolution, administrations operating or planning to operate non-GSO FSS systems will need to reach agreement through consultation meetings;

*n)* that the aggregate level of the time allowance for the *C*/*N* value specified in the short-term performance objective associated with the shortest percentage of time (lowest *C*/*N*) of GSO reference link is likely to be the summation of single-entry levels caused by non-GSO FSS systems,

recognizing

*a)* that non-GSO FSS systems may need to implement interference mitigation techniques, such as orbital avoidance angles, earth station site diversity, and GSO arc avoidance, to facilitate sharing of frequencies among non-GSO FSS systems and to protect GSO networks;

*b)* that administrations operating or planning to operate non-GSO FSS systems will need to agree cooperatively through consultation meetings to share the aggregate interference impact allowance for all non-GSO FSS systems operating in the frequency bands listed in *considering* *a)* in a manner that achieves the level of protection for GSO FSS, MSS and BSS networks that is stated in No. **22.5M** of the Radio Regulations;

*c)* that, taking into account the single-entry allowance in No. **22.5L**,the aggregate impact of all non-GSO FSS systems can be calculated, without the need for specialized software tools, based on the results of the single-entry impact for each system;

*d)*that administrations operating non-GSO FSS systems in the frequency bands listed in *considering* *a)* need to set up “urgency level” consultation meetings to cooperate and reach an agreement whenever the aggregate interference level is higher than the aggregate impact allowance of the operational non-GSO FSS systems;

*e)* that representatives of administrations operating or planning to operate GSO FSS, MSS and BSS networks are encouraged to be involved in decisions made pursuant to *recognizing* *b)*;

*f)* that 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), signals experience high levels of attenuation due to atmospheric effects such as rain, clouds and gaseous absorption;

*g)* that given these expected high levels of attenuation, it is desirable for GSO networks and non-GSO FSS systems to implement fading restraining measures such as automatic level control, power control and adaptive coding and modulation,

noting

*a)* Annex 2 to this Resolutioncontains the methodology for calculating the single-entry and aggregate limits to protect the GSO networks;

*b)* that Recommendation ITU‑R S.1503 provides guidance on how to calculate the epfd levels from a non-GSO system into GSO earth stations and satellites;

*c)* Annex 1 to this Resolutioncontains GSO satellite system characteristics to be considered in non-GSO/GSO frequency sharing analyses 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 administrations operating or planning to operate non‑GSO FSS systems in the frequency bands referred to in *considering a)* above, shall take all necessary steps, including, if necessary, the appropriate modifications to their systems or networks, to ensure that the aggregate interference caused by such systems to GSO FSS, MSS and BSS satellite networks does not exceed the aggregate protection limits determined pursuant to No. **22.5M** of the Radio Regulations;

2 that to fulfil the obligations in *resolves*1 above, administrations operating or planning to operate non-GSO FSS systems should cooperate through regular consultation meetings referred to in *recognizing* *b)* to ensure that operations of all non-GSO networks do not exceed the aggregate level of protection for geostationary satellite networks;

3 that to fulfil the obligations of *resolves*2above*,* administrations shall take into account the GSO satellite characteristics listed in GSO reference links in Annex 1 to this Resolution when applying the methodology contained in Annex 2 to this Resolution and calculating the aggregate impact to GSO networks by means of the validation software;

4 that administrations operating or planning to operate non-GSO FSS systems (including representatives of administrations operating GSO FSS, MSS and BSS networks) participating in a consultation meeting are allowed to use their own software in conjunction with any software tools used by the Radiocommunication Bureau for the calculation and verification of the aggregate limits given in Annex 2 to this Resolution, subject to the agreement of the consultation meeting;

5 that administrations, in carrying out their obligations under *resolves*1 above, shall take into account only those non-GSO FSS systems with frequency assignments in the frequency bands referred to in *considering a)* above that have met the criteria listed in Annex 2 to this Resolution through appropriate information provided in the course of consultation discussions referred to in *resolves*2;

6 that administrations, in developing agreements to carry out their obligations under *resolves*1 above, should establish mechanisms to ensure that all potential FSS system and network notifying administrations and operators are given full visibility of and the opportunity to participate in the process;

7 that participation in the consultation process by administrations operating or planning to operate non-GSO FSS systems that are subject to this Resolution is required, and that failure by a responsible administration to participate in the consultation process does not relieve that administration of obligations under *resolves*1 above, nor does it remove their systems from consideration in any aggregate calculations by the consultation group;

8 that each administration, in the absence of an agreement reached at consultation meetings referred to in *resolves* 2, shall ensure that each of its non-GSO FSS systems subject to this Resolution are operated in accordance with reduced single-entry interference impact allowances, calculated by the apportionment of the aggregate allowance commensurate to the number of simultaneously operating non-GSO systems, so as to ensure that the aggregate allowance in No. **22.5M** is not exceeded in operation;

9 that, in the practical implementation of *resolves* 7above, if the consultation discussions show that there would be an exceedance of the aggregate allowance from non-GSO FSS systems in operation, every operational non-GSO FSS system shall work together to reduce aggregate interference, not limit to reduce its emissions or by means of appropriate modifications to the operation of their systems;

10 that the administrations participating in the consultation discussion referred to in *resolves*2 shall designate one focal point to be responsible for communicating to the Bureau, such as shown in Annex 1 the results of the aggregate non-GSO system operational calculation and sharing determinations made in application of *resolves*1, 7, and 8 above, regardless whether such determinations would result in any modifications to the published characteristics of their respective systems, providing a draft record of each consultation meeting, and posting it when approved,

invites the Radiocommunication Bureau

to participate in the consultation meetings referred to in *resolves* 2 as an observer and to provide advice as necessary with respect to the results of the aggregate interference impact calculation performed according to *resolves*1,

instructs the Radiocommunication Bureau

1 to publish in the International Frequency Information Circular (BR IFIC) the information referred to in *resolves*6;

2 to exclude the aggregate calculations given in No. **22.5M** as part of a satellite network examination under No. **11.31**,

urges administrations

to provide the Radiocommunication Bureau and all participants of the consultation meetings with the methodology, assumptions and inputs used in conjunction with *resolves* 3.

ANNEX 1 TO draft new RESOLUTION [CHN/A16] (WRC-19)

List of geostationary network characteristics and format of the result of the aggregate calculation to be provided to the Bureau for
publication as information

# I GSO network characteristics to be used in the calculation of aggregate emissions from non-GSO FSS systems

## I-1 GSO network characteristics and reference links

For the generic GSO satellite system characteristics for evaluation of compliance with single-entry requirements for non-GSO systems, the data in Table 1 and 2 are to be regarded as a generic range of representative technical characteristics of GSO network deployment that are independent of any specific geographic location, to be used only for establishing the interference impact of a non-GSO system into GSO satellite networks and not as a basis for coordination between satellite networks.

Table 1

Generic link parameters of GSO links to be used in examination of the downlink (space-Earth) impact from a non-GSO network

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | Generic link parameters = service |  |  |
|  | Link type | User #1 | User #2 | User #3 | User #4 | Gateway #1 |  |
| 1.1 | Frequency band (GHz) | 40 | 40 | 40 | 40 | 40 |  |
| 1.2 | e.i.r.p. density (dBW/MHz) | 38 | 38 | 38 | 38 | 38 |  |
| 1.3 | Equivalent antenna diameter (m) | .45 | 0.78 | 2.4 | 0.3 | 7.5/13 |  |
| 1.4 | Bandwidth (MHz) | 1 | 1 | 1 | 1 | 1 |  |
| 1.4 | ES antenna gain sidelobe characteristics | S.580 | S.580 | S.580 | S.580 | S.580 |  |
| 1.5 | ES antenna efficiency | 0.48 | 0.48 | 0.53 | 0.49 (for receiving only) | 0.55 |  |
| 1.6 | Additional link losses (dB) | 1 | 1 | 1 | 1 | 1 |  |
| 1.7 | Additional link margin (dB) | 3 | 3 | 3 | 3 | 3 |  |
|  |  |
| 2 | Generic link parameters – parametric analysis | Parametric cases for evaluation |  |
| 2.1 | e.i.r.p. density variation | ±3 dB from value in 1.2 |  |
| 2.2 | Elevation angle (deg) | TDB | TDB | TDB |  |
| Additional link margin (dB) | TDB | TDB | TDB |  |
| Latitude (deg) | TDB | TDB | TDB |  |
| 2.3 | 0.01% rain rate (mm/hr) | TBD |  |
| 2.4 | Height of ES (m) | 0, 500, 1 000 |  |
| 2.5 | ES noise temperature (K) | 392K, 20 degree of antenna elevation angle231K, 40 degree of antenna elevation angle110K, 60 degree of antenna elevation angle |  |
| 2.6 | Threshold *C*/*N* (dB) | 3.5, 5, 7.5, 9, 10 |  |
|  |  |
|  |  |
| 3 | Example implementation – link calculation | First case parametric taken for examples | Equations to calculate downlink availability |
| 3,1 | ES peak gain (dBi) | TBD | TBD |  |
|  | *Interim step: calculate the latitude corresponding with the elevation, ε* |  |  |  |  |  |
|  |
| 3.2 | Path length (km) | TBD | TBD |  |
| 3.3 | Path loss (dB) | TBD | TBD |  |
| 3.4 | Unfaded wanted single strength (dBW/MHz) | TBD | TBD |  |
| 3.5 | Noise plus margin (dBW/MHz) | TBD | TBD |  |
|  |
| 4 | Validation checks |  |
| 4.1 | Margin for rain fade (dB) | TBD | TBD |  |
| 4.2 | *PFDval* (dB(W/(m2 · MHz))) | TBD | TBD |  |
| 4.3 | Delta from Article **21** | TBD | TBD |  |

Table 2

Generic link parameters of GSO links to be used in examination of the uplink (Earth-space) impact from a non-GSO network

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | Generic link parameters = service |  |  |
|  | Link type | Link #1 | Link #2 | Link #3 | Link #4 |  |
| 1.1 | Frequency band (GHz) | 49 | 49 | 49 | 49 |  |
| 1.2 | ES EIRP density (dBW/Hz) | −5 | −10 | −15 | −25 |  |
| 1.3 | Spot beam size (deg) | TBD | TBD | TBD | TBD |  |
| 1.4 | Recommendation ITU-R S.672 sidelobe level (dB) | −25 | −25 | −25 | −25 |  |
| 1.5 | ES antenna efficiency | 0.48 | 0.47 | 0.47 | 0.42 |  |
| 1.6 | Additional link losses (dB) | 1 | 1 | 1 | 1 |  |
| 1.7 | Additional link margin (dB) | 3 | 3 | 3 | 3 |  |
|  |  |
| 2 | Generic link parameters -parametric analysis | Parametric cases for evaluation |  |
| 2.1 | e.i.r.p. density variation | ±3 dB from value in 1.2 |  |
| 2.2 | Elevation angle (deg) | TBD | TBD | TBD |  |
| Additional link margin (dB) | TBD | TBD | TBD |  |
| Latitude (deg) | TBD | TBD | TBD |  |
| 2.3 | 0.01% rain rate (mm/hr) | TBD |  |
| 2.4 | Height of ES (m) | 0, 500, 1 000 |  |
| 2.5 | Satellite noise temperature (K) | 500 |  |
| 2.6 | Threshold *C*/*N* (dB) | 3.5, 5, 7.5, 9, 10 |  |
|  |  |
|  |  |
| 3 | Example implementation – link calculation | First case parametric cases taken for examples | Equations to calculate uplink availability |
| 3.1 | ES peak gain (dBi) | TBD | TBD |  |
|  | *Interim step: calculate the latitude corresponding with the elevation, ε* |  |  |  |
|  |
| 3.2 | Path length (km) | TBD | TBD |  |
| 3.3 | Path loss (dB) | TBD | TBD |  |
| 3.4 | Unfaded wanted single strength (dBW/MHz) | TBD | TBD |  |
| 3.5 | Noise plus margin (dBW/MHz) | TBD | TBD |  |
|  |
| 4 | Validation checks |  |
| 4.1 | Margin for rain fade (dB) | TBD | TBD |  |
| Note：The above *C*/*N* values represent thresholds for:• 3.5 dB for links using QPSK FEC1/2 coding • 5 dB for links using 8PSK FEC1/2 coding• 7.5dB for links using 8PSK FEC3/4 coding• 9 dB for links using 8PSK FEC7/8 coding• 10 dB for links using 16APSK FEC3/4 coding |

## I-2 Non-GSO satellite system constellation parameters

For each non‑GSO satellite system, the following parameters should be provided to the Bureau for publication in the aggregate calculation:

– notifying administration;

– number of space stations used in aggregate calculations;

– single-entry contribution to the aggregate of each non-GSO FSS system.

# II Results of the aggregate epfd calculation

ANNEX 2 TO draft new RESOLUTION [CHN/A16] (WRC-19)

Description of parameters and procedures for the evaluation of interference from a non-GSO system into GSO links

This Annex provides the process to validate compliance with the single-entry permissible interference of a non-GSO system into GSO networks using the generic link parameters in Annex 1 of this Resolution and the interference impact using the latest version of Recommendation ITU‑R S.1503. The procedure to determine the compliance with the single-entry permissible interference relies on the following principles.

*Principle 1:* Since in these bands the fading attenuation varies significantly during a year, and in order to meet the short-term performance of a link, the margin allocated to the fading alone tends to be very large. Additionally, non-GSO FSS systems might need to implement interference mitigation techniques, such as orbital avoidance angles, earth station site diversity and GSO arc avoidance, to facilitate sharing of frequencies and to protect GSO networks. The probability of network outage caused by either interference or fading would be a very small percentage of a year. Therefore, simultaneous occurrence of interference and fading event would not be statistically significant. The interference allowances can be determined by assuming that the aggregate time-varying nature of interference by itself (without simultaneous fading degradation) can use 10% of the time allowances for the BER (or *C*/*N* value) specified in the short-term performance objectives of the desired network. The single-entry interference impact should not exceed 3% of this time allowance.

*Principle 2:* The GSO network design should allocate 10% allowance to the aggregate non-time-varying long-term interference from non-GSO networks in addition to its thermal noise when calculating its total system noise power. The single-entry interference should not exceed 3% of the total system noise power.

*Principle 3*: One of the time-varying sources of link performance degradation is due to link fading (from rain, clouds, gas and scintillation attenuation) as well as the characteristics of the link. The total *C*/*N* with fading in the reference bandwidth for a given carrier is:

  (3)

where:

 Ccs is wanted signal power (dBW) under clear-sky conditions,

 *A* is the time-varying attenuation (dB) due to fading,

 *NT* is the total system noise, which includes the system thermo noise and non-time-varying long-term interference.

The formula (60) in the Recommendation ITU‑R P.618‑13 provides a method to estimate the total attenuation due to fading with a fixed probability *p* and it is reproduced below:

  (4)

If the short-term performance objective for a link is *C*/*N* ≥ (*C*/*N*)*threshold*for more than *ap*% of the time of a year, then the allowable time for *C*/*N <*(*C*/*N*)*threshold* should be less than (100 − *ap*)% of a year. Since *Principle 1* allocates 90% time allowance to fading, the probability for fading attenuation we need to calculate is 0.9\*(100 − *ap*)%, where (*C*/*N*)*cs* − (*C*/*N*)*threshold* *= AT*(0.9\*(100 − *ap*)%)*.* Therefore, *Ccs* can be obtained by:

  (5)

For example, If the short-term performance objective of a link is *C*/*N ≥* (*C*/*N*)*threshold* for more than 99.99% of a year, it means that *C*/*N* can only be below (*C*/*N*)*threshold*for less than 0.01% of a year. *AT*(0.009%) for attenuation at 0.009% probability needs to be calculated using formula (4).

*Principle 4*: When determining *Ccs*, the single-entry permissible level of interference mask of the non-GSO system can be calculated using Methodology B in Recommendation ITU‑R S.1323. Therefore:

  (6)

where:

 *I*(*t*)*:* interference threshold (dBW)

 *t:* time percentage

 *p:* time percentage for *C*/*N* is below (*C*/*N*)*threshold*

 *Ibit-sync  =* 10lg[(10^(*zt + zs*)/10) − 1) *NT*]

 *IBER =* 10lg[(10^(*zt/*10) − 1) *NT*]

 *Ilong-term  =* 10lg[(3/100) *NT*]*,* per *principle 2*

 *zt =* (*C*/*N*)*cs −* (*C*/*N*)*threshold*

Using formula (5), *zt* = *AT*(0.9\**p*)

 *zs =* (*C*/*N*)*threshold −* (*C*/*N*)*bit-sync*

(*C*/*N*)*bit-sync* is the minimum *C*/*N* to maintain the carrier bit sync. If nothing is given it can be assumed to be 0.9 dB below (*C*/*N*)*threshold*

 *Y* is the time percentage of a year defined for long-term performance. Normally *y* = 10%*.*

*Principle 5*: Single-entry EPFD is calculated using a method described in the most recent version of Recommendation ITU‑R S.1503. The probability distribution function (pdf) of the single entry interference power can be calculated based on the pdf of epfd:

 ** (7)

Then the cumulative distribution function (cdf) of the single-entry interference can be calculated. The cdf statistics are validated against the *I*(*t*) mask from equation (6) to ensure that for any percentage time period the single-entry interference from the non-GSO network does not exceed the limits as defined in equation (6).

**Reasons:** The advantage of this proposed method is that all calculations are straight forward and as defined in the existing ITU-R Recommendations. It removes the guesswork and ambiguity in the single entry interference validation process. It also avoids the complexity to calculate the convolutions of multiple probability distribution functions.

ANNEX 3 TO draft new RESOLUTION [CHN/A16] (WRC-19)

List of criteria for the application of *resolves* 4

1 Submission of coordination or notification information.

2 Already at the satellite manufacturing or procurement agreement negotiation stage, and the satellite launch agreement signed.

The non-GSO FSS system operator should possess:

i) clear evidence of a binding agreement for the manufacture or procurement of its satellites, and

ii) clear 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 specify the launch date, launch site and the launch service provider. The notifying administration is responsible for authenticating the evidence of agreements.

The information required under this criterion may be submitted in the form of a written commitment by the responsible administration.

**Reasons:** It is not appropriate to use the evidence of guaranteed funding arrangements in place of the implementation of the project, because this evidence is not sufficient to prove that funds will actually be used for building the non-GSO FSS system.

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1. 27 The term “time-averaged” means averaged over a period of a year, in accordance with Recommendation ITU-R P.618. [↑](#footnote-ref-1)