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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 149-E** |
|  | **30 October 2023** |
|  | **Original: English** |
|  |
| Thailand |
| 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;

ARTICLE 5

Frequency allocations

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

NOC THA/149A17/1#1891

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 |

NOC THA/149A17/2#1892

5.487 In the band 11.7-12.5 GHz in Regions 1 and 3, the fixed, fixed-satellite, mobile, except aeronautical mobile, and broadcasting services, in accordance with their respective allocations, shall not cause harmful interference to, or claim protection from, broadcasting-satellite stations operating in accordance with the Regions 1 and 3 Plan in Appendix 30.     (WRC-03)

MOD THA/149A17/3#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(space-to-space) ADD 5.A117 MOBILE 5.519 5.521 |

MOD THA/149A17/4#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 (space-to-space) ADD 5.A117 MOBILE |
| **…** |
| 18.8-19.3 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A (space-to-space) 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 (space-to-space) ADD 5.A117MOBILE |
| 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.516B 5.527A (space-to-space) ADD 5.A117Mobile-satellite (space-to-Earth) | 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.516B 5.527A (space-to-space) ADD 5.A117MOBILE-SATELLITE(space-to-Earth) | 19.7-20.1FIXED-SATELLITE(space-to-Earth) 5.484A 5.484B 5.516B 5.527A (space-to-space) 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 (space-to-space) ADD 5.A117 MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 |

MOD THA/149A17/5#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 (space-to-space) 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(space-to-space) 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 (space-to-space) 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 (space-to-space) ADD 5.A117 Earth 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 (space-to-space) ADD 5.A117 MOBILE-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 (space-to-space) ADD 5.A117 Earth 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 |

ADD THA/149A17/6#1896

5.A117

***Alternative non-GSO FSS hard limit***

 *Option 1:* For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the fixed-satellite service (space-to-space), Resolution **[A117‑B] (WRC‑23)** shall apply. Such use is not subject to coordination under No. **9.11A**. No.4.10 does not apply.     (WRC‑23)

 *Option 2*: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the fixed-satellite service (space-to-space), Resolution **[A117‑B](WRC‑23)** shall apply. Such use is limited to space research, space operation and/or Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space and is not subject to coordination under No. **9.11A**. No.4.10 does not apply.     (WRC‑23)

***End of alternative non-GSO FSS hard limit***

*Alternative non-GSO FSS coordination*

 *Option 3*: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the fixed-satellite service (space-to-space), Resolution **[A117‑B](WRC‑23)** shall apply. Such use is limited to space research, space operation and/or Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space. No. 4.10 does not apply.     (WRC‑23)

 *Option 4*: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the fixed-satellite service (space-to-space), Resolution **[A117‑B](WRC‑23)** shall apply. No.4.10 does not apply     (WRC‑23)

***End of alternative non-GSO FSS coordination***

MOD THA/149A17/7#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 (space-to-space) ADD 5.A117  MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542 |

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

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

MOD THA/149A17/8#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)Fixed-satellite(space-to-space)Meteorological-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)Fixed-satellite(space-to-space) | **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)Fixed-satellite(space-to-space) | **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 |
| *Alternative 1 for the pfd mask for the protection of fixed and mobile stations* |
| 27.5-29.5 GHz | Fixed-satellite (space-to-space)(non-geostationary satellite orbit) | −115 | −115 + 0.5(δ – 5) | −105 | 1 MHz |
| *Alternative 2 for the pfd mask for the protection of fixed and mobile stations* |
| 27.5-29.5 GHz | Fixed-satellite (space-to-space)(non-geostationary satellite orbit) | TBD | TBD | TBD | 1 MHz |
| ... |

*Note: Some administrations are of the view that the pfd mask to protect terrestrial services from emissions from space stations should only be included in Annex 2 of the Resolution along with the methodology for compliance in the frequency band 27.5-29.5 GHz.*

APPENDIX 4 (REV.WRC‑19)

Consolidated list and tables of characteristics for use in the
application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations
or radio astronomy stations2    (Rev.WRC‑12)

Footnotes to Tables A, B, C and D

MOD THA/149A17/9#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** **[A117-B] (WRC-23)** |  | **A.25** |  |
| A.25.a | a commitment from the notifying administration of a non-GSO space station receiving in the frequency bands 27.5-28.6 GHz and 29.5-30.0 GHz that the equivalent power flux-density produced at any point in the geostationary-satellite orbit by emissions from all combined operations of space-to-space and Earth-to-space links shall not exceed the limits given in Table **22‑2** |  |  | **+** |  | **+** |  |  |  |  | A.25.a |  |
| A.25.b | a commitment from the notifying administration that, upon receiving a report of unacceptable interference, from its non-GSO space station transmitting in frequency bands (27.5-30 GHz) the notifying administration will follow the procedures in *resolves further* 2 of Resolution **[A117‑B] (WRC‑23)**Required only for the notification of non-GSO space stations submitted in accordance with Resolution **[A117‑B] (WRC‑23)** |  |  |  |  | **+** |  |  |  |  | A.25.b |  |
| A.25.c.1 | Exclusion zone angle (degrees), the minimum angle to the geostationary-satellite orbit at the non-geostationary space station transmitting space station at which it will operate defined at the non-geostationary transmitting space station |  |  | **+** |  | **+** |  |  |  |  | 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 |  |  | **+** |  | **+** |  |  |  |  | A.25.c.2 |  |
| A.25.d | COMPLIANCE WITH *resolves* 3.3 OF RESOLUTION **[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 **[A117‑B] (WRC‑23)**Required only for the notification of non-GSO space stations submitted in accordance with Resolution **[A117‑B] (WRC-23)** |  |  |  |  | **+** |  |  |  |  | A.25.d.1 |  |

MOD THA/149A17/10#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 | Option 1:areas of the satellite beam on the Earth, when the associated transmitting [or receiving] stations are space stationsOption 2: for the case of satellite-to-satellite links in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, service area is described by sub-satellite points on the Earth of the transmitting space station in 27.5-30 GHz or receiving space station in 18.1-18.6 GHz, 18.8-20.2 GHz Required for space stations in the FSS (space-to-space) transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz |  |  | **+** |  | **+** |  |  |  |  | C.11.a.1 |  |
| … | … |  |  |  |  |  |  |  |  |  |  |  |

ADD THA/149A17/11#1901

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

Use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz for satellite-to-satellite transmissions

The World Radiocommunication Conference (Dubai, 2023),

considering

*a)* that there is a need for non-geostationary-satellite orbit (non-GSO) space stations to be able to relay data to the Earth, and that part of this need could be met by allowing such non-GSO space stations to communicate with fixed-satellite service (FSS) 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 FSS at higher altitude does not need to be the same administration that has already notified assignments in the FSS;

*c)* that imposing the hard limits necessary to protect other services would provide regulatory certainty for both notifying administrations of non-GSO space stations communicating with FSS space stations and potentially impacted services;

*d)* that there is growing interest for utilizing satellite-to-satellite links for a variety of applications;

*e)* that the ITU Radiocommunication Sector (ITU‑R) has carried out sharing and compatibility studies between incumbent services in the frequency bands 18.1-18.6 GHz, 18.8-20.2 and 27.5-30 GHz and adjacent bands and satellite-to-satellite transmissions in the FSS;

*f)* that these studies were based on certain principles, including the limitation of the use of frequency bands in a specific direction in accordance with the existing FSS allocations in these frequency bands, the use of power control and antenna-steering capabilities and compliance with applicable epfd and off-axis e.i.r.p. limits to protect incumbent services;

*g)* that the frequency bands 18.1-18.6 GHz (space-to-Earth), 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) are also allocated to terrestrial and space services used by a variety of different systems, and these existing services and their future development need to be protected, without the imposition of undue constraints, from the operation of satellite-to-satellite links,

recognizing

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

*b)* that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network or the non-GSO FSS system with which non-GSO space stations communicate or on the coordination requirements of that satellite network,

resolves

1 that, for a non-GSO space station subject to this Resolution communicating with a GSO or non-GSO FSS space station within the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, the following conditions shall apply:

1.1 the non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall only operate space-to-space links when its apogee altitude is lower than the minimum operational altitude of the GSO or non-GSO FSS space station it communicates with and when the off-nadir angle between this GSO or non-GSO FSS space station and the non-GSO space station it communicates with is less than or equal to θ*Max* (as defined in Annex 1 to this Resolution);

1.2 the GSO/non-GSO FSS space station receiving in the frequency band 27.5-30 GHz and transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall only operate space-to-space links when its minimum operational altitude is higher than the apogee altitude of the non-GSO space station with which it communicates;

1.3 that the use of space-to-space links by GSO or non-GSO space stations transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz and receiving in the frequency band 27.5-30 GHz is limited to those with recorded assignments in the relevant FSS (space-to-Earth) and (Earth-to-space) allocations in these bands;

2 that for a non-GSO space station transmitting in the space-to-space direction in the frequency band 27.5-30 GHz, the following conditions shall apply:

2.1 this non-GSO space station shall only transmit when within the cone whose apex is the GSO or non-GSO receiving space station and whose angle is θ*Max* (as defined in Annex 1 to this Resolution);

2.2 the emissions of this non-GSO space station shall remain within the envelope of the notified/recorded characteristics of the associated transmitting FSS earth stations of the GSO FSS network or non-GSO FSS system;

2.3 (*Option 1*): this non-GSO space stationshall comply with the provisions contained in Annex 2 to this Resolution for protection of terrestrial services in the frequency band 27.5-29.5 GHz;

 (*Option 2*): this non-GSO space stationshall not cause unacceptable interference to terrestrial services in the frequency band 27.5-29.5 GHz, and Annex 2 to this Resolution shall apply;

 (*Option 3*): this non-GSO space stationshall not cause unacceptable interference to the terrestrial services in the frequency band 27.5-29.5 GHz, and Annex 2 to this Resolution shall apply, and in the frequency band 29.5-30 GHz, with respect to the terrestrial service on the territory of administrations listed in footnote No. **5.542**, Annex 2 shall also apply;

2.3*bis* the requirement to not cause unacceptable interference to terrestrial services shall not release the notifying administration of its obligation as contained in *resolves* 2.3 above;

2.4 *(Option 1):* this non-GSO space station shall comply with the provisions contained in Annex 4 to this Resolution;

 *(Option 2)*: this non-GSO shall not cause unacceptable interference to or otherwise impose constraints on the operation or the development of non-GSO FSS systems, and protect non-GSO FSS space stations by complying with the provisions contained in Annex 4 to this Resolution;

2.5 *Option 1:* the emissions of this non-GSO space station shall not produce a power flux-density at any point in the GSO arc greater than the power flux-density produced by earth stations associated with satellite network/system with which they communicate;

 *Option 2*: the emissions of this non-GSO space station shall comply with the provisions contained in Annex 5 to this Resolution for protection of GSO space stations;

 *Option 3*: shall not produce a power flux-density at any point in the GSO arc greater than the power flux-density produced by earth stations associated with the satellite network/system with which they communicate as determined in Annex 5 to this Resolution;

3 that for a space station transmitting in the space-to-space direction in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz or parts thereof, the following conditions shall apply:

3.1 this non-GSO or GSO space station shall only transmit when the non-GSO receiving space station is within the cone whose apex is the GSO or non-GSO transmitting space station and whose angle is θ*Max* (as defined in Annex 1 to this Resolution);

3.2 the transmissions shall remain within the envelope of the notified/recorded characteristics of transmitting GSO FSS or non-GSO FSS towards its associated FSS earth stations;

3.3 with respect to the Earth exploration-satellite service (EESS) (passive) operating in the frequency band 18.6-18.8 GHz, any non-GSO FSS system with an orbital apogee of less than 20 000 km communicating with lower orbiting non-GSO space stations in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz and for which the complete notification information has been received by the Radiocommunication Bureau (BR) after 1 January 2025 shall comply with the provisions indicated in Annex 3 to this Resolution;

*Alternative non-GSO FSS hard limits*

3.4 for space-to-space links in the frequency band 19.3-19.7 GHz, or parts thereof,

 *Option 1:* a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station that exceeds −148 dB(W/(m2 · MHz));

 *Option 2:* a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station site that exceeds −148 dB(W/(m2 · MHz)). This limit may be exceeded at the site of a non-GSO mobile satellite gateway station of any country whose administration has so agreed as long as these limits are unchanged in cross-border applications;

 *Option 3:* a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station that exceeds TBD dB(W/(m2 · MHz));

 *Option 4:* a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station site that exceeds TBD dB(W/(m2 · MHz)). This limit may be exceeded at the site of a non-GSO mobile satellite gateway station of any country whose administration has so agreed as long as these limits are unchanged in cross-border applications;

*End of Alternative non-GSO FSS Hard limits*

4 that non-GSO space stations receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall not claim protection from FSS, mobile-satellite service (MSS) networks and systems and MetSat as well as terrestrial services operating in conformity with the Radio Regulations;

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

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

7 *Option 1*: that the implementation of this Resolution is conditioned on the development of the description of interference management system(s), monitoring facilities (NCMC), dealing with the cessation of transmission in order to provide a satisfactory resolution of the problem,

 *Option 2*: this option proposes that this *resolves*7 is not required,

resolves further

1 that, subject to this Resolution:

*a)* the notifying administration of the non-GSO system choosing to operate satellite-to-satellite links and receiving in the frequency bands 27.5-28.6 GHz and 29.5-30.0 GHz shall indicate to the BR the commitment that the equivalent power flux-density produced at any point in the geostationary-satellite orbit by emissions from all combined operations of space-to-space and associated earth station transmissions shall not exceed the limits given in Table **22‑2**;

*b)* the notifying administration of the non-GSO space station/stations transmitting in the frequency band 27.5-30 GHz towards a GSO network and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall send to the BR the relevant Appendix 4 ([*alternative non-GSO FSS hard limit:* advance publication][*alternative non-GSO FSS coordination:* coordination]) information containing the characteristics of the non-GSO space station/stations and the associated name of the notified GSO FSS network with which it intends to communicate;

*c)* the notifying administration of the non-GSO space station/stations transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz towards a non-GSO system and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall send to the BR the relevant Appendix 4 ([*alternative non-GSO FSS hard limit:* advance publication][*alternative non-GSO FSS coordination:* coordination]) information containing the characteristics of the non-GSO space station/stations and the associated name of the notified non-GSO FSS system(s) with which it intends to communicate;

*d)* the notifying administration for the non-GSO space station transmitting in the space-to-space direction in the frequency band 27.5-30 GHz shall provide to the BR, when submitting Appendix 4 data, an objective, measurable and enforceable commitment that, upon receiving a report of unacceptable interference, the notifying administration will follow the procedures in *resolves further* 2;

2 that, in case of unacceptable interference caused by a non-GSO space station transmitting in the frequency band 27.5-30 GHz or parts thereof:

*a)* the notifying administration for that non-GSO space station shall cooperate with an investigation on the matter and provide, to the extent of its ability, any required information on the operation of the transmitting space station and a point of contact to provide such information;

*b)* the notifying administration for that non-GSO space station and the notifying administration of the GSO or non-GSO space station receiving these space-to-space transmissions shall, jointly or individually, as the case may be, upon receipt of a report of unacceptable interference, take the required action to eliminate or reduce interference to an acceptable level;

*c)* in case of continued unacceptable interference despite of the firm commitment to remove that, the assignment causing interference shall be submitted to the Radio Regulations Board for review;

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

*a)* the non-GSO space stations transmitting in these frequency bands employed techniques to maintain pointing accuracy with the associated receiving space station and avoid tracking inadvertently adjacent GSO space stations of any other notifying administration or space stations in a non-GSO system of any other notifying administration;

*b)* all necessary measures are taken so that non-GSO transmitting space stations in these frequency bands are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC or equivalent facility;

*c)* a permanent point of contact is provided for the purpose of tracing any cases of unacceptable interference from non-GSO transmitting space stations in these frequency bands in the FSS (space-to-space) service and to immediately respond to requests from the focal point;

4 that, upon examination of the information submitted by the notifying administration under *resolves further*1*b)* or 1*c)*, if no recorded frequency assignments with typical earth stations for the relevant frequency bands can be identified for the GSO FSS network or non-GSO FSS system with which the notifying administration’s non-GSO space station intends to communicate, the BR shall return the information to the notifying administration with an unfavourable finding,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolution of interference, if and when required;

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution;

3 to use the methodology given in the Appendix to Annex 2 of this Resolution when assessing compliance with the pfd limits in Annex 2;

4 to use the methodology given in Appendixes 1 to 3 to Annex 5 of this Resolution when assessing compliance with Annex 5;

5 not to examine, under No. **11.31**, the conformity of non-GSO FSS systems with the provisions of *resolves*5 of this Resolution.

ANNEX 1 TO draft new RESOLUTION [A117-B] (WRC-23)

Determination of the off-nadir angle

1 A non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall only communicate with a non-GSO space station when the off-nadir angle between this non-GSO space station and the non-GSO space station with which it communicates is equal to or smaller than:

 

where

 *REarth* = 6 378 km

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



2 A non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall only communicate with a GSO space station when the off-nadir angle between this GSO space station and the non-GSO space station with which it communicates is equal to or smaller than:

 

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 [A117-B] (WRC‑23)

Provisions for non-GSO space stations transmitting in the frequency
bands 27.5-29.1 GHz and 29.1-29.5 GHz to protect terrestrial
services in the frequency band 27.5-29.5 GHz

*Note: Some administrations are of the view that the pfd mask to protect terrestrial services from emissions from space stations should be included in Article****21*** *for compliance in the frequency band 27.5-29.5 GHz.*

The maximum pfd produced at the surface of the Earth by emissions from a non-GSO space station transmitting in the frequency band 27.5-29.5 GHz shall not exceed:

Option 1

 pfd(θ) = −115 (dB(W/(m2 ⋅ 1 MHz))) for 0° ≤ θ ≤ 5°

 pfd(θ) = −115 + 0.5(θ − 5) (dB(W/(m2 ⋅ 1 MHz))) for 5° ≤ θ ≤ 25°

 pfd(θ) = −105 (dB(W/(m2 ⋅ 1 MHz))) for 25° < θ ≤ 90°

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

End of Option 1

Option 2-1

 pfd(θ) = −136.2 (dB(W/(m2 ⋅ 1 MHz))) for 0° ≤ θ ≤ 0.01°

 pfd(θ) = −132.4 + 1.9 ∙ logθ (dB(W/(m2 ⋅ 1 MHz))) for 0.01° < θ ≤ 0.3°

 pfd(θ) = −127.7 + 11 ∙ logθ (dB(W/(m2 ⋅ 1 MHz))) for 0.3° < θ ≤ 1°

 pfd(θ) = −127.7 + 18 ∙ logθ (dB(W/(m2 ⋅ 1 MHz))) for 1° < θ ≤ 2°

 pfd(θ) = −129.4 + 23.7 ∙ logθ (dB(W/(m2 ⋅ 1 MHz))) for 2° < θ ≤ 8°

 pfd(θ) = −108 (dB(W/(m2 ⋅ 1 MHz))) for 8° < θ ≤ 90.0°

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

End of Option 2-1

Option 2-2

 pfd(δ) = −124.7 (dB(W/(m2 ⸱ 14 MHz))) for 0° ≤ δ ≤ 0.01°

 pfd(δ) = −120.9 + 1.9 ∙ log δ (dB(W/(m2 ⸱ 14 MHz))) for 0.01° < δ ≤ 0.3°

 pfd(δ) = −116.2 + 11 ∙ log δ (dB(W/(m2 ⸱ 14 MHz))) for 0.3° < δ ≤ 1°

 pfd(δ) = −116.2 + 18 ∙ log δ (dB(W/(m2 ⸱ 14 MHz))) for 1° < δ ≤ 2°

 pfd(δ) = −117.9 + 23.7 ∙ log δ (dB(W/(m2 ⸱ 14 MHz))) for 2° < δ ≤ 8°

 pfd(δ) = −96.5 (dB(W/(m2 ⸱ 14 MHz))) for 8° < δ ≤ 90°

where δ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

End of Option 2-2

APPENDIX

To check the compliance of the non-GSO emissions with the pfd mask described in Annex 2, the following procedures shall be followed:

1) Parameter*a* is the orbital altitude (km) of the non-GSO system identified in *resolves further* 1c*)* or in *resolves further* 1*d)*, *PSD* is the power spectral density in the reference bandwidth associated with the pfd limit, and compute the off-axis gain pattern *Gtx*(φ), with φ being the off-axis angle in the direction of the terrestrial receiver. Assume the Earth is a sphere whose radius, *Re*, is 6 378 km.

2) Compute the angle, as seen from the non-GSO system transmitting in frequency range 27.5-29.5 GHz (the user space station), between the centre of the Earth and the GSO network or non-GSO systems receiving in the frequency range 27.5-29.5 GHz (the service provider space station) assuming that the user is at the edge of the cone of coverage with the formula:

 

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 [A117-B] (WRC‑23)

Provisions for non-GSO space stations[[1]](#footnote-1)1 links in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz towards non-GSO space stations with
respect to EESS (passive) in the frequency band 18.6-18.8 GHz

*[Option 1]*

Non-GSO space stations operating with an orbit apogee of more than 2 000 km and less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space station as described in *resolves* 1*a)*, shall not exceed a power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band of −118 dB(W/(m² · 200 MHz)).

Non-GSO space stations operating with an orbit apogee less than 2 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space station as described in *resolves* 1*a)*, shall not exceed a power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band, of −110 dB(W/(m² · 200 MHz)).

*[End of Option 1]*

Note: The pfd limits of unwanted emissions in Option 2 come from the studies done for AI 1.16.

*[Option 2]*

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space station as described in *resolves* 1*a)*, shall not exceed the following power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band,

 −123 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes greater than 2 000 km;

 −117 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes between 1 000 km and 2 000 km;

 −104 dB(W/(m² · 200 MHz)) for non-GSO FSS space stations operating at orbital altitudes below 1 000 km.

[End of Option 2]

Alternative non-GSO FSS hard limits

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

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

The following conditions for non-GSO space stations transmitting in the frequency band 27.5-30.0 GHz to protect non-GSO space stations shall apply:

*a)* The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a GSO FSS network shall not exceed the following on-axis e.i.r.p. spectral density limits:

– for non-GSO space station transmit on-axis antenna gains greater than 40.6 dBi: −15/−16.1/−17.5 dBW/Hz;

– for non-GSO space station transmit on-axis antenna gains less than 40.6 dBi: −15/−16.1/−17.5 − (40.6 – X) dBW/Hz;

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

Note: Further consideration of the reference bandwidth in the above provision a) may be considered.

*b)* To protect FSS feeder links to non-GSO mobile-satellite service systems the following conditions for non-GSO space stations and systems transmitting in the frequency band 29.1-29.5 GHz shall apply:

– emissions from any non-GSO space station communicating with a GSO network shall not exceed a maximum power spectral density of −70/−62 dBW/Hz at the input of the antenna of the non-GSO space station;

– any non-GSO space station communicating with a GSO network shall have a minimum antenna diameter of 0.3 m whose gain shall not exceed the gain envelope in the most recent version of Recommendation ITU‑R S.580;

– non-GSO space stations communicating with a GSO network shall only operate in orbits with inclination between 80 and 100 degrees;

– non-GSO systems communicating with a GSO network shall not contain more than 100 satellites.

Option 1:

*c)* Non-GSO space stations transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz shall not operate at orbital altitudes greater than or equal to 900 km and less than 1 290 km.

*c bis)* The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude higher than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of −20 dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

|  |  |
| --- | --- |
| Transmitting non-GSO space station operational altitude (km) | Maximum total e.i.r.p. (dBW) |
| altitude < 450 | 63 |
| 450 ≤ altitude < 600 | 61 |
| 600 ≤ altitude < 750 | 58 |
| 750 ≤ altitude < 900 | 55 |
| altitude ≥ 1 290 | N/A |

*c ter)* The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of (−26/−28/−30) dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

|  |  |
| --- | --- |
| Transmitting non-GSO space station operational altitude (km) | Maximum total e.i.r.p. (dBW) |
| altitude < 450 | 60 |
| 450 ≤ altitude < 600 | 58 |
| 600 ≤ altitude < 750 | 55 |
| 750 ≤ altitude < 900 | 53 |
| altitude ≥ 1 290 | N/A |

*End of Option 1*

Option 2:

*c)* The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude higher than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of −20 dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

|  |  |
| --- | --- |
| Transmitting non-GSO space station operational altitude (km) | Maximum total e.i.r.p. (dBW) |
| altitude < 450 | 63 |
| 450 ≤ altitude < 600 | 61 |
| 600 ≤ altitude < 750 | 58 |
| 750 ≤ altitude < 900 | 55 |
| 900 ≤ altitude < 1 290 | TBD |
| altitude ≥ 1 290 | N/A |

*c bis)* The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of (−26/−28/−30) dBW/Hz and the total e.i.r.p. from any non-GSO space station shall not exceed:

|  |  |
| --- | --- |
| Transmitting non-GSO space station operational altitude (km) | Maximum total e.i.r.p. (dBW) |
| altitude < 450 | 60 |
| 450 ≤ altitude < 600 | 58 |
| 600 ≤ altitude < 750 | 55 |
| 750 ≤ altitude < 900 | 53 |
| 900 ≤ altitude < 1 290 | TBD |
| altitude ≥ 1 290 | N/A |

End of Option 2

*d)* For off-axis angles greater than 3.5 degrees, the off-axis e.i.r.p. emissions of a non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5‑30 GHz to communicate with a non-GSO ISS system with a minimum operational altitude higher than 2 000 km shall not exceed the envelope generated by the combination of an input power spectral density at the antenna flange of −62 dBW/Hz coupled with the off-axis gain derived from 29 − 25 log() dBi for angles between 3.5 degrees and 20 degrees.

End of Alternative non-GSO FSS hard limits

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

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

1) In the frequency band 27.5-30 GHz, when a non-GSO system as identified in *resolves further*1*b)* identifies an associated GSO network as described in *resolves further*1*b)* to operate inter-satellite links, the BR shall perform the examination in Appendix 1 to this Annex.

2) The notifying administration of the GSO network identified in 1) above shall respect all coordination agreements that have already been recorded, noting the provisions from *resolves further*1*d)*, 1*e)*, 2 and 3.

2*bis*) *Option A*: The notifying administration of the GSO network identified in 2) is urged to provide, upon any request from the notifying administration of a GSO network involved in the coordination agreements referred above, additional information on how the relevant coordination agreements will be respected. Efforts should be made to provide this information as soon as practicable.

 *Option B*: The notifying administration of the GSO network identified in 2) above shall provide, upon any request from the notifying administration of a GSO network involved in the coordination agreements referred above, additional information on how the relevant coordination agreements will be respected with regard to protection from inter-satellite links. This information shall be provided within 90 days after the reception of the request.

3) In the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, when a non-GSO system as identified in *resolves further*1*c)* identifies a non-GSO system as described in *resolves further*1*c)* to operate space-to-space links, the BR shall perform the examination in Appendix 2 to this Annex.

4) The notifying administration of the receiving non-GSO network identified in 3) above shall respect all coordination agreements that have already been recorded, noting the provisions from *resolves further*1*d)*, 1*e)*, 2 and 3.

5) In the frequency bands 27.5-28.6 GHz and 29.5-30 GHz, the pfd produced at any point in the geostationary-satellite orbit by a non-GSO space station as mentioned in *resolves further*1*c)* shall not exceed a pfd of (−163/−165) dBW/m² in any 40 kHz band. A computation methodology is provided in Appendix 3 to this Annex.

APPENDIX 1

The aim of this Appendix is to provide a method to be used by the BR to assess whether the emissions from a non-GSO space station operating inter-satellite links with a GSO space station are within the envelope of the typical earth stations of the GSO network.

Step 1: For each group of the transmitting non-GSO notification.

Step 2: For each of the receiving GSO networks, as listed in *resolves further 1b)*.

Step 3: For each beam in the Earth-to-space direction of the receiving GSO network notification, compute the maximum e.i.r.p. produced in one hertz (*EIRPSD*).

Step 4: Compute the reduction in free space loss at the altitude of the user using:

 

 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 data item A.25.c.2.

Step 7: For all emissions in the GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0 and 80°, with a Step of 1°, and reduce it by ∆*FSL*. 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*1*c).*

Step 3: For each beam in the Earth-to-space direction of the receiving non-GSO system notification, compute the maximum e.i.r.p. produced in one hertz (*EIRPSD*).

Step 4: Compute the reduction in free space loss at the altitude of the user using:

 

 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 data item A.25.c.2.

Step 7: For all emissions in the receiving non-GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0 and 80°, with a Step of 1°, and reduce it by ∆*FSL*. 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, § 5), the following procedure shall be followed.

Step 1: Select the corresponding value to the GSO arc avoidance angle in the e.i.r.p. mask as given in Appendix **4** data item A.25.c.2, 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 data item A.25.c.1.

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



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

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

SUP THA/149A17/12#1902

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:** Thailand supports Method B in the CPM Report which proposes no change (NOC) for the frequency band 11.7-12.7 GHz and additions of a new footnote No. **5.A117** in RR Article **5** and a new WRC Resolution providing the regulatory mechanisms to operate the satellite-to-satellite links in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or portions thereof, in order to protect the services to which the frequency bands are allocated, and consequential suppression of Resolution **773 (WRC-19)**.

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1. 1 These provisions do not apply to non-GSO systems using orbits with an apogee less than 2 000 km that employ frequency reuse schemes of at least three colours. [↑](#footnote-ref-1)