



PLENARY MEETING

**Addendum 1 to
Document 4996-E
1 September 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.1

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

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD THA/4996A1/1

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

Alternative 1: -134 dB(W/(m²-1 MHz)) produced up to 30 m above sea level for the protection of the maritime mobile service in the frequency band 4 800-4 990 MHz, and -138 dB(W/(m²-1 MHz)) produced from 30 m up to 19 km above sea level, for the protection of the aeronautical mobile service in the frequency band 4 800-4 950 MHz, at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State.

Alternative 2: -140 dB(W/(m² · 1 MHz)) produced up to 19 km above sea level at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz and -134 dB(W/(m² · 1 MHz)) produced up to 30 m above sea level at 22 km from the coast, defined as the low-water mark, as officially recognized by the coastal State, for the protection of the maritime mobile service in the frequency band 4 800-4 990 MHz.

Alternative 3: -122 dB(W/(m²-1 MHz)), produced up to 19 km above sea level at 82 km from the coast defined as the low-water mark, as officially recognized by the coastal State, for the protection of the aeronautical mobile service in the band 4 800-4 950 MHz.

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

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

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

~~This pfd criterion is subject to review at WRC-23. Resolution 223 (Rev.WRC-1923) applies. This identification shall be effective after WRC-19. (WRC-1923)~~

MOD THA/4996A1/2

RESOLUTION 223 (REV.WRC-1923)

Additional frequency bands identified for International Mobile Telecommunications

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

...

resolves

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

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

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

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

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

invites the ITU Radiocommunication Sector

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

IMT deployment in the frequency band 1 427-1 518 MHz, taking into account the results of these studies;

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

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

~~4~~3 to include the results of the studies mentioned in *invites the ITU Radiocommunication Sector* above in one or more ITU-R Recommendations and Reports, as appropriate~~5~~.

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

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

Reasons:



PLENARY MEETING

**Addendum 4 to
Document **xxxx-E**
xx xx 2023
Original: English**

Japan/ [Thailand]/[[add country names](#)]

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.4

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

Introduction

This document presents the proposal from the Member States cosponsoring this input contribution for WRC-23 agenda item 1.4.

Proposal

The Member States cosponsoring this input contribution support for the use of HIBS in the frequency band 698-960 MHz, or portions thereof, globally including the countries listed in No. **5.313A**, based on Methods A3 in the CPM Report, while ensuring protection of existing primary services, and adjacent bands as appropriate.

ARTICLE 5

Frequency allocations

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

MOD **J/[THA]/xxx**A4/1

460-890 MHz

| Allocation to services | | |
|---|--|--|
| Region 1 | Region 2 | Region 3 |
| 470-694 BROADCASTING 5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.312 | 470-512 BROADCASTING Fixed Mobile 5.292 5.293 5.295 | 470-585 FIXED MOBILE 5.296A BROADCASTING 5.291 5.298 |
| | 512-608 BROADCASTING 5.295 5.297 | |
| | 608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space) | |
| | 614-698 BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309 | 610-890 FIXED MOBILE 5.296A 5.313A 5.317A ADD 5.C14 ADD 5.D14 BROADCASTING |
| | 694-790 MOBILE except aeronautical mobile 5.312A 5.317A ADD 5.C14 BROADCASTING 5.300 5.312 | |
| 790-862 FIXED MOBILE except aeronautical mobile 5.316B 5.317A ADD 5.C14 BROADCASTING 5.312 5.319 | 806-890 FIXED MOBILE 5.317A ADD 5.C14 BROADCASTING | |
| 862-890 FIXED MOBILE except aeronautical mobile 5.317A ADD 5.C14 BROADCASTING 5.322 | | |

| | | |
|-------------|-------------|----------------------------------|
| 5.319 5.323 | 5.317 5.318 | 5.149 5.305 5.306 5.307 5.320 |
|-------------|-------------|----------------------------------|

Reasons: It is proposed that the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in the frequency band 694-960 MHz, or portions thereof, on a global level, including the countries listed in **No. 5.313A**, based on Methods A3 in the CPM Report , while ensuring protection of existing primary services, and adjacent bands as appropriate.

MOD **J[THA]/xxx**A4/2

890-1 300 MHz

| Allocation to services | | |
|---|--|--|
| Region 1 | Region 2 | Region 3 |
| 890-942 FIXED MOBILE except aeronautical mobile 5.317A ADD 5.C14 BROADCASTING 5.322 Radiolocation 5.323 | 890-902 FIXED MOBILE except aeronautical mobile 5.317A ADD 5.C14 Radiolocation 5.318 5.325 | 890-942 FIXED MOBILE 5.317A ADD 5.C14 BROADCASTING Radiolocation 5.327 |
| | 902-928 FIXED Amateur Mobile except aeronautical mobile 5.325A ADD 5.C14 Radiolocation 5.150 5.325 5.326 | |
| | 928-942 FIXED MOBILE except aeronautical mobile 5.317A ADD 5.C14 Radiolocation 5.325 | |
| 942-960 FIXED MOBILE except aeronautical mobile 5.317A ADD 5.C14 BROADCASTING 5.322 5.323 | 942-960 FIXED MOBILE 5.317A ADD 5.C14 | 942-960 FIXED MOBILE 5.317A ADD 5.C14 BROADCASTING 5.320 |

Reasons: It is proposed that the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in the frequency band 694-960 MHz, or portions thereof, on a global level, including the countries listed in **No. 5.313A**, based on Methods A3 in the CPM Report , while ensuring protection of existing primary services, and adjacent bands as appropriate.

ADD **J[THA]/xxx**A4/3

5.C14 The frequency band 698-960 MHz, or portions thereof, in Region 2, the frequency band 694-790 MHz, or portions thereof, in Region 1, and the frequency band 790-960 MHz, or portions thereof, in Regions 1 and 3, are identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the

use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix 4 information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. Resolution [**A14-HIBS 694-960 MHZ**] (**WRC-23**) shall apply. Such use of HIBS in the frequency bands 694-728 MHz and 830-835 MHz is limited to reception by HIBS. (WRC-23)

Reasons: It is proposed that the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in the frequency band 694-960 MHz, or portions thereof, on a global level, including the countries listed in **No. 5.313A**, based on Methods A3 in the CPM Report ,while ensuring protection of existing primary services, and adjacent bands as appropriate.

ADD **J/[THA]/xxxA4/4**

5.D14 The frequency band 698-790 MHz, or portions thereof, in the countries listed in **No. 5.313A**, which are allocated to the mobile service on a primary basis, is identified for use by high-altitude platform stations as International Mobile Telecommunications (IMT) base stations (HIBS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. HIBS shall not claim protection from existing primary services. No. **5.43A** does not apply. The notifying administration of HIBS at the time of submission of the Appendix 4 information shall send an objective, measurable and enforceable commitment undertaking that in case of unacceptable interference is caused shall immediately reduce the interference to the acceptable level or cease the emission. Resolution [**A14-HIBS 694-960 MHZ**] (**WRC-23**) shall apply. Such use of HIBS in the frequency band 698-728 MHz is limited to reception by HIBS. (WRC-23)

Reasons: It is proposed that the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in the frequency band 694-960 MHz, or portions thereof, on a global level, including the countries listed in **No. 5.313A**, based on Methods A3 in the CPM Report ,while ensuring protection of existing primary services, and adjacent bands as appropriate.



PLENARY MEETING

**Addendum 6 to
Document 5519-E
23 August 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.6

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

ADD THA/5519A6/1

DRAFT NEW RESOLUTION [A16] (WRC-23)

**Regulatory provisions for the operation of radiocommunications
on sub-orbital vehicles**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that sub-orbital vehicles operate at higher altitudes than conventional aircraft;
- b) that sub-orbital vehicles operate through the lower levels of the atmosphere, where some may operate in the same airspace as conventional aircraft;
- c) that sub-orbital vehicles may perform various missions such as conducting scientific research or providing transportation;
- d) that stations on board sub-orbital vehicles are expected to provide all or some of the following applications; voice/data communications, navigation, surveillance, and telemetry, tracking and command (TT&C);
- e) that sub-orbital vehicles must be safely integrated into airspace used by conventional aircraft;
- f) that some stations on board sub-orbital vehicles may need to communicate with air traffic management systems and relevant ground control facilities;

~~Approach A supports the *considering* below:~~

- ~~g) that some orbital satellite launch rocket systems or components may be considered as sub-orbital vehicles;~~
- ~~h) that the stations on board orbital satellite launch rocket or deep space launch rocket systems may be operated under the space operation service without having to apply the provisions contained in the present Resolution;~~
- ~~i) that sub-orbital vehicles moving at very high velocity might generate a plasma sheath that may envelop all or most of the vehicle, which could impact communications;~~

~~Approach C supports the following *considering*:~~

- ~~g) that some satellite launch rocket systems or components may be considered as sub-orbital vehicles, operating at times above the atmosphere,~~

~~Approach D supports the following *considering*:~~

- ~~g) that sub-orbital vehicles moving at very high velocity might generate a plasma sheath that may envelop all or most of the vehicle, which could impact communications;~~

noting

- a) that Report ITU-R M.2477 provides information on radiocommunications for sub-orbital vehicles, including a description of the flight trajectory, categories of sub-orbital vehicles, technical studies related to possible avionics systems used by sub-orbital vehicles, and service allocations of those systems;
- b) that the provisions of No. 4.10 may apply to certain operations of sub-orbital vehicles;

- c) that the development of conditions of coexistence between International Civil Aviation Organization (ICAO) standardized aeronautical systems is the responsibility of ICAO;
- d) that ICAO develops, in some cases, Standards and Recommended Practices (SARPs) to address the coexistence between ICAO aeronautical applications,

~~Approach B and Approach C and Approach D support the inclusion of the following *noting*:~~

e) that Report ITU-R M.2477 describes sub-orbital flight as an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur in space without completing a full orbit around the Earth before returning back to the surface of the Earth;

f) that Report ITU-R M.2477 describes a sub-orbital vehicle as a vehicle executing sub-orbital flight,

recognizing

- a) that there is no internationally agreed legal demarcation between the Earth's atmosphere and the space domain, nor between the sovereign airspace and outer space;
- b) that Annex 10 to the Convention on International Civil Aviation contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation;
- c) that, due to the increase of Doppler shift, emissions from stations on board sub-orbital vehicles may impact services operating in the same and adjacent or nearby frequency bands;
- d) that, due to the higher altitude of sub-orbital vehicles compared to conventional aircraft, emissions from stations on board sub-orbital vehicles may have a radiocommunication impact on larger areas involving additional territories and/or on space stations,

~~Approach B, Approach C and Approach D support the following *recognizing*:~~

e) that some space launch systems may have space stations that already operate as part of existing space operation service allocations;

f) that stations on board sub-orbital vehicles may use systems operating under space or terrestrial radiocommunication services;

g) that some sub-orbital vehicles could reach altitudes for a brief period of time in space without sufficient energy to sustain its orbit,

resolves

Approach A:

~~1 — that stations fitted on board a sub-orbital vehicle shall be restricted to operate around the Earth without having the ability or intention to become a station on board a satellite (see No. 1.179);~~

~~2 — that terrestrial stations and earth stations required on board a sub-orbital vehicle to safely accommodate or integrate it into airspace where air traffic services are provided, as decided by the competent aviation authority of the Member State(s)¹;~~

~~2.1 — are allowed to operate in the same service under which these stations are classified when they are used on conventional aircraft;~~

~~¹ Defined accordingly with the Convention on International Civil Aviation and its annexes.~~

- ~~2.2 shall, for the frequency bands identified in the Convention on International Civil Aviation and its annexes that includes SARPs, be operated in accordance with the relevant recognized international aeronautical standards;~~
- ~~2.3 shall not affect the existing and future applications of the same service and/or other radiocommunication services in the same and adjacent frequency bands any more than they would if the same stations were fitted on board a conventional aircraft;~~
- ~~3 that administrations allowing the operation of each station on board sub-orbital vehicles identified in *resolves 2* shall consider coexistence between these terrestrial stations and/or earth stations, and other applications, taking into account *considering c) and d)*;~~
- ~~4 that terrestrial and earth stations on board a sub-orbital vehicle other than those identified in *resolves 2* shall not claim protection from nor create harmful interference to any station operated in the same and adjacent frequency bands unless there is an agreement between the administrations concerned, taking into account *considering c) and d)*;~~

Approach B:

- ~~1 that sub-orbital vehicles may use terrestrial stations (No. 1.62) and earth stations (No. 1.63) during all phases of flight;~~
- ~~2 that terrestrial stations and earth stations on board sub-orbital vehicles referred to in *resolves 1* shall maintain their station class unchanged;~~
- ~~3 that the stations on board sub-orbital vehicles referred to in *resolves 1* shall not cause additional interference to nor claim additional protection from the existing applications of the same service and on other radiocommunication services in the same and adjacent frequency bands;~~

~~**Reasons:** This action will clarify that stations on board sub-orbital vehicles may be terrestrial stations (RR No. 1.62) and earth stations (RR No. 1.63) and can be used in all phases of flight, within their respective service allocations. The stations shall not impose any new constraints on applications of the same service and other radiocommunication services that are allocated on a primary basis.~~

Approach C:

- 1 that, for the purpose of this Resolution, a sub-orbital vehicle is a vehicle expected to reach the upper atmosphere and may reach space in portions of its flight, without completing a full orbit around the Earth;

The view was raised that the texts used in the following resolves are not compatible with the intention of mandatory actions / operation which are covered in any operative / depository part of any resolution, and consequently, the language used therein needs to be revisited and aligned with the intention / and objectives.

- 2 that stations on sub-orbital vehicles may operate in all stages of flight in the aeronautical mobile service (including the aeronautical mobile (R) service), the mobile-satellite service (including the aeronautical mobile-satellite (R) service), or in the radionavigation-satellite service;
- 3 that, when operating in the aeronautical mobile service (including the aeronautical mobile (R) service), stations on sub-orbital vehicles are subject to the same technical and regulatory conditions as aircraft stations operating in the applicable frequency bands and shall cause no more interference than conventional aircraft stations;
- 4 that, when operating in the mobile-satellite service (including the aeronautical mobile satellite (R) service) or in the radionavigation-satellite service, stations on board sub-orbital

vehicles are subject to the same technical and regulatory conditions as earth stations operating in the applicable frequency bands and shall cause no more interference than conventional earth stations,

Reasons: This action clarifies that stations on board sub-orbital vehicles may be terrestrial stations (RR No. 1.62) and earth stations (RR No. 1.63) and can be used in all phases of flight, within certain services specified in the Resolution. The stations shall not impose any new constraints on applications of the same service and other radiocommunication services.

Approach D:

~~1 — that, for the purpose of radiocommunications, a sub-orbital flight is described as an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur beyond the major portion of the Earth's atmosphere without completing a full orbit (see No. 1.184) around the Earth, before returning back to the surface of the Earth, and a sub-orbital vehicle is a vehicle executing a sub-orbital flight;~~

~~2 — that stations on board sub-orbital vehicles should be considered as earth stations or aircraft stations and may operate in the AM(R)S, MSS, RNSS and other potential services, and No. 4.4 shall be applied when stations on board sub-orbital vehicles in some above services operate beyond the major portion of the atmosphere;~~

~~3 — that, when operating in the aeronautical mobile (R) service, stations on sub-orbital vehicles are subject to the same technical and regulatory conditions as aircraft stations operating in the applicable frequency bands and shall cause no more interference than conventional aircraft stations;~~

~~4 — that, when operating in the mobile-satellite service or radionavigation-satellite service, stations on board sub-orbital vehicles are subject to the same technical and regulatory conditions as earth stations operating in the applicable frequency bands and shall cause no more interference than conventional earth stations;~~

~~**Reasons:** This action clarifies that stations onboard sub-orbital vehicles may be terrestrial stations (RR No. 1.62) and earth stations (RR No. 1.63) and the aeronautical mobile (R) service, mobile-satellite service, radionavigation-satellite service can be used. According to existing Radio Regulations, the stations onboard sub-orbital vehicles may have to operate under RR No. 4.4 when in space and relevant sharing and compatibility studies when operation in space have not been carried out at this stage. Moreover, the stations shall not impose any new constraints on applications of the same service and other radiocommunication services.~~

~~**Note—The remaining elements are common to all approaches:**~~

~~*instructs the Secretary-General*~~

~~to bring this Resolution to the attention of ICAO,~~

~~*The view was raised that after and if all problems, difficulties and inconsistencies mentioned above are fully resolved,*~~

~~*invites the International Civil Aviation Organization*~~

~~to take into account this Resolution in the course of developing SARPs for ICAO systems that may be used by sub-orbital vehicles,~~

~~*instructs the Director of the Radiocommunication Bureau*~~

~~to report to future world radiocommunication conferences on any difficulties or inconsistencies encountered in the implementation of this Resolution.~~

Reasons:

SUP THA/5519A6/2

RESOLUTION 772 (WRC-19)

**Consideration of regulatory provisions to facilitate
the introduction of sub-orbital vehicles**

Reasons:



PLENARY MEETING

**Addendum 7 to
Document 5527-E
23 August 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.7

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

ARTICLE 5

Frequency allocations

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

MOD **THA/5527A7/1**

75.2-137.175 MHz

| Allocation to services | | | |
|------------------------|---|----------|-------------|
| | Region 1 | Region 2 | Region 3 |
| 117.975-137 | AERONAUTICAL MOBILE (R) | | |
| | AERONAUTICAL MOBILE-SATELLITE (R) ADD 5.A17 ADD 5.B17 | | |
| | 5.111 | 5.200 | 5.201 5.202 |

Reasons:

ADD **THA/5527A7/2**

5.A17 The use of the frequency band 117.975-137 MHz by the aeronautical mobile-satellite (R) service is subject to coordination under No. **9.11A**. This use is also limited to non-geostationary-satellite systems and internationally standardized aeronautical systems. (WRC-23)

Reasons:

ADD **THA/5527A7/3**

5.B17 In the frequency band 117.975-137 MHz, space stations operating in the aeronautical mobile-satellite (R) service should ensure that the power flux-density of their unwanted emissions in the adjacent band 137-138 MHz does not exceed $-166.6 \text{ dB(W/(m}^2 \cdot 14 \text{ kHz))}$ at the Earth's surface (WRC-23)

Reasons:

APPENDIX 5 (REV.WRC-19)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1 (REV.WRC-19)

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-12)

MOD THA/5527A7/4

1.1 Below 1 GHz*

1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **5.204** and **5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds $-125 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$ at the Earth's surface.

1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

- $-125 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$ for networks for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996;
- $-140 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$ for networks for which complete Appendix **4/S4/3**** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

1.1.3 In the band 137-138 MHz, coordination is also required for a space station on a replacement satellite of a MSS network for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996 and the pfd exceeds $-125 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$ at the Earth's surface for the administrations referred to in § 1.1.1 above.

1.1.4 In the band 117.975-137 MHz, coordination of a space station of the aeronautical mobile-satellite (R) service (space-to-Earth) with respect to the aeronautical mobile (R) service and the aeronautical mobile (OR) service is required only if the pfd produced by the space station exceeds $[-148 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}]$ at the Earth's surface and within [TBD km] from a country's border.

Note: Element from this provision could be used to develop a potential new footnote.

Reasons:

* These provisions apply only to the MSS.

** *Note by the Secretariat:* Edition of 1990, revised in 1994.



PLENARY MEETING

**Addendum 10 to
Document 4992-E
15 June 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.10

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

NOC **THA/4992A10/1**

ARTICLES

Reasons:

NOC **THA/4992A10/2**

APPENDICES

Reasons:

SUP **THA/4992A10/3**

RESOLUTION 430 (WRC-19)

Studies on frequency-related matters, including possible additional allocations, for the possible introduction of new non-safety aeronautical mobile applications

Reasons:



World Radiocommunication Conference (WRC-23)
Dubai, 20 November - 15 December 2023



PLENARY MEETING

**Addendum 11 to
Document 529-E
23 August 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.11

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

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD **THA/5529A11/1**

5.375 The ~~use of the~~ frequency band 1 645.5-1 646.5 MHz is used by the mobile-satellite service (Earth-to-space) and ~~for~~ by inter-satellite links ~~is limited to~~ for distress, urgency and safety communications (see Article 31). Additionally, for the mobile-satellite service, use of this band from earth stations operating in the GMDSS for other than distress purposes is also permitted. (WRC-23)

Reasons:

ARTICLE 19

Identification of stations

Section I – General provisions

MOD **THA/5529A11/2**

19.11 5) All transmissions by satellite emergency position-indicating radiobeacons (EPIRBs) operating in the band 406-406.1 MHz ~~or the band 1 645.5-1 646.5 MHz, or by EPIRBs using digital selective calling techniques,~~ shall carry identification signals. (WRC-23)

Reasons:

APPENDIX 15 (REV.WRC-19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System

MOD **THA/5529A11/3**

TABLE 15-2 (WRC-1923)

Frequencies above 30 MHz (VHF/UHF)

TABLE 15-2 (end) (WRC-1923)

| Frequency (MHz) | Description of usage | Notes |
|------------------|---|--|
| ... | | |
| *1 645.5-1 646.5 | COM D&S-OPS <u>SAT-</u> | Use of the band 1 645.5-1 646.5 MHz (Earth-to-space) is limited to <u>transmission of</u> distress, <u>urgency</u> and safety operations <u>communications, and for non-distress communication purposes, from earth stations operating in the GMDSS</u> (see No. 5.375). (WRC-23) |
| ... | | |

Reasons:

NOC **THA/5598A11/1**

ARTICLES

Reasons:

NOC **THA/5598A11/2**

APPENDICES

Reasons:

SUP **THA/5598A11/3**

RESOLUTION 361 (REV.WRC-19)

**Consideration of possible regulatory actions to support modernization of the
Global Maritime Distress and Safety System and
the implementation of e-navigation**

Reasons: [For issue A, Thailand supports Alternative A1 in the CPM Report. In addition, for issue C, Thailand supports Method C1 \(NOC\) in the CPM Report.](#)



PLENARY MEETING

**Addendum 12 to
Document 5629-E
1 September 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.12

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

Introduction:

Thailand proposes the regulatory methods below that corresponds to CPM Report Method A1 for this agenda item.

Thailand supports possible operational limitations for EESS (active) spaceborne radar sounders in the 40-50 MHz frequency band such as coverage areas, operation time limit as well as establishment of PFD limits to protect in-band and adjacent band incumbent services and not adversely affect those services while also considering the feasibility of spaceborne radar sounders operation.

ARTICLE 5

Frequency allocations

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

MOD THA/5629A12/1

27.5-40.98 MHz

| Allocation to services | | |
|---|---|---|
| Region 1 | Region 2 | Region 3 |
| 39.986-40.02 FIXED MOBILE Space research | | 39.986-40 FIXED MOBILE RADIOLOCATION 5.132A Space research |
| 39.986 40-40.02 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Space research | | 40-40.02 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Space research |
| 40.02-40.98 | FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.150 | |

MOD THA/5629A12/2

40.98-47 MHz

| Allocation to services | | |
|--|---|-----------------|
| Region 1 | Region 2 | Region 3 |
| 40.98-41.015 | FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Space research 5.160 5.161 | |
| 41.015-42 | FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.160 5.161 5.161A | |
| 42-42.5 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 Radiolocation 5.132A 5.160 5.161B | 42-42.5 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.161 | |
| 42.5-44 | FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.160 5.161 5.161A | |
| 44-47 | FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 5.162 5.162A | |

MOD THA/5629A12/3

47-75.2 MHz

| Allocation to services | | |
|--|---|---|
| Region 1 | Region 2 | Region 3 |
| 47-50 BROADCASTING Earth exploration-satellite (active) ADD 5.A112 5.162A 5.163 5.164 5.165 | 47-50 FIXED MOBILE Earth exploration-satellite (active) ADD 5.A112 | 47-50 FIXED MOBILE BROADCASTING Earth exploration-satellite (active) ADD 5.A112 5.162A |

ADD THA/5629A12/4

5.A112-A1 The use of the frequency band 40-50 MHz by the Earth exploration-satellite service (active) shall be in accordance with Resolution [A112-METHOD-A1] (WRC-23).

The provisions of this footnote in no way diminish the obligation of the Earth exploration-satellite service (active) to operate as a secondary service in accordance with Nos. **5.29** and **5.30**. (WRC-23)

ADD THA/5629A12/5

DRAFT NEW RESOLUTION [A112-METHOD-A1] (WRC-23)

Use of the frequency range 40-50 MHz allocated to the Earth exploration-satellite service (active) for spaceborne radar sounders

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that spaceborne active sensors operating in the Earth exploration-satellite service (EESS) (active), described in Recommendation ITU-R RS.2042-1, can provide unique information on the physical properties of the Earth, such as characteristics of polar ice sheets and subterranean fossil aquifers in desertic environments;
- b) that spaceborne active remote sensing requires specific frequency ranges depending on the physical phenomena to be observed;
- c) that worldwide, periodic measurements of subsurface water/ice deposits require the use of spaceborne radar sounder active sensors;
- d) that the measurement of reflectivity from subsurface scattering layers as deep as 10 m to 100 m for shallow aquifers and groundwater conduits, and on the order of 5 km for basal interface topography and ice-sheet thickness, is necessary;
- e) that spaceborne radar sounders operating in the EESS (active) are intended to be operated from polar orbits, only in either uninhabited, sparsely populated or remote areas of the globe, with particular focus on deserts and polar ice fields;

f) that the 40-50 MHz frequency range is preferable to satisfy all operational requirements for such spaceborne radar sounder active sensors,

recognizing

a) that, given the complexity of the EESS (active) instruments implementation in these low frequencies, very few such platforms are expected to be in orbit at the same time; consequently, aggregate interference from multiple spaceborne radar sounders into incumbent services is not anticipated and could be mitigated by coordination between the operators of such instruments;

b) that measurements by these radar sounders are only possible when the total electron content of the ionosphere is near its daily minimum, which normally occurs in a few hours' window centred approximately at 4 a.m. local time;

c) that No. **21.16.8** provides the equation to determine mean pfd values for EESS (active);

Note: *recognizing c)* does not apply to Option 2.

d) that coordination between operators of EESS (active) systems and operators of wind profiler radars in the 40-50 MHz band may be needed on a case-by-case basis to ensure coexistence between the corresponding stations,

resolves

Note: Various options are proposed below. Options 2, 3 and 4 are based on proposals submitted to CPM. Further consideration would be required to assess all four options for the protection of existing services.

Views were expressed that Options 2 and 3 are based on proposals and studies that have not been reviewed and agreed by the ITU-R Study Groups and do not take into account the protection of existing services.

Some administrations expressed their view that none of the four options have reached an agreement in ITU-R. However, the proponents of option 3 stress the fact that the related provisions are based on relevant technical studies and have been designed in such a way to ensure protection of incumbent services.

[Option 1:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that, for the purpose of protecting the in-band and adjacent-band services, the pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed [TBD]/[-156 dB(W/(m² · 4 kHz))] for more than [TBD]/[0.0002%] of time, developed for clear-sky conditions. The limits above take into account the 3 dB aggregate loss due to polarization mismatch for the concerned services;

3 that the spaceborne radar sounder systems in the frequency range 40-50 MHz should only operate in a few hours' window centred approximately at 4 a.m. local time.

End of Option 1

Option 2:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that the following conditions shall apply to stations operating in the EESS (active) in the frequency band 40-50 MHz on a secondary basis:

- 2.1 not claim protection from stations operating in the radiolocation service in the frequency bands 42-42.5 MHz or 46-50 MHz. No. **5.43A** does not apply;
- 2.2 not claim protection from stations operating in the space research service in the frequency bands 40-40.02 MHz or 40.98-41.015 MHz. No. **5.43A** does not apply;
- 2.3 operations are permitted when the subsatellite¹ point is located within any of the following areas:
 - a) the spherical cap formed by latitudes between 72 and 90 degrees North;
 - b) the spherical cap formed by latitudes between 60 and 90 degrees South;
 - c) the quadrangle formed by latitudes between 59 and 72 degrees North and longitudes between 25 and 55 degrees West;

3 that stations in the EESS (active) operating in areas outside of those provided in *resolves 2.3* shall not transmit without prior agreement of directly overlapped and neighbouring administrations.

End of Option 2

Option 3:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that, for the purpose of providing protection to the in-band and adjacent-band services, the mean pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed the following limits, under free-space propagation conditions:

| pfd (dB(W/(m ² · 4 kHz))) | Latitude (degrees) |
|--------------------------------------|---------------------|
| -145 | 0 < Latitude ≤ 64 |
| [between -145 and -138] | Latitude > 64 |
| -138 | Latitude < -64 |

3 that the limits provided in *resolves 2* may be exceeded for no more than 0.05% of the time, while not exceeding the following maximum pfd levels, under free-space propagation conditions:

| pfd (dB(W/(m ² · 4 kHz))) | Latitude (degrees) |
|--------------------------------------|---------------------|
| -136 | 0 < Latitude ≤ 64 |
| [between -136 and -129] | Latitude > 64 |
| [-129] | Latitude < -64 |

4 that, if more than one system is in operation, administrations shall ensure collectively that the limits in *resolves 2* are not exceeded for more than 0.1% of the time and shall have consultations accordingly;

¹ The subsatellite point is defined as the location of the projection of the satellite's nadir-pointing vector onto the Earth's surface.

5 that the spaceborne radar sounder systems in the frequency range 40-50 MHz should only operate in a few hours' window centred approximately at 4 a.m. local time,

invites the ITU Radiocommunication Sector

to regularly review the number and characteristics of spaceborne radar sounders and the application of *resolves 4* by concerned Member States.

End of Option 3

Option 4:

1 that the use of the band 40-50 MHz by EESS (active) is limited to spaceborne radar sounders as described in Recommendation ITU-R RS.2042;

2 that, for the purpose of protecting the in-band and adjacent-band services, the pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed [TBD]/[-156 dB(W/(m² · 4 kHz))] for more than [TBD]/[0.0002%] of time, developed for clear-sky conditions, and the transmit peak power shall not exceed [TBD]/[20 dBW]. The limits above take into account the 3 dB aggregate loss due to polarization mismatch for the concerned services;

3 that the spaceborne radar sounder systems in the frequency range 40-50 MHz should only operate in a few hours' window centred approximately at 4 a.m. local time.

End of Option 4]

Reasons: Options in Method A1 are in square brackets and further consideration is required - noting that at the time of the drafting of this document, more work would be required in the ITU-R to determine the best option or combination of options to ensure protection of incumbent services in-band and in adjacent bands.

SUP **THA/5629A12/6**

RESOLUTION 656 (REV.WRC-19)

**Possible secondary allocation to the Earth exploration-satellite service (active)
for spaceborne radar sounders in the range of frequencies around 45 MHz**

Reasons: This resolution is no longer necessary



PLENARY MEETING

**Addendum 13 to
Document 5630-E
1 September 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.13

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

Introduction:

Thailand proposes the regulatory methods below that corresponds to CPM Report Method B for this agenda item.

ARTICLE 5

Frequency allocations

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

MOD **THA/5630A13/1**

14.5-15.4 GHz

| Allocation to services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 14.8-15.35 | FIXED MOBILE Space research SPACE RESEARCH (space-to-space) Space research (Earth-to-space) (space-to-Earth) 5.339 | |

MOD **THA/5630A13/2**

14.5-15.4 GHz

| Allocation to services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 14.8-15.35 | FIXED MOBILE Space research SPACE RESEARCH (space-to-space) ADD 5.A113 Space research (Earth-to-space) (space-to-Earth) 5.339 | |

SUP THA/5630A13/4

RESOLUTION 661 (WRC-19)

**Examination of a possible upgrade to primary status of the secondary allocation
to the space research service in the frequency band 14.8-15.35 GHz**

Reasons: This resolution is no longer necessary.



PLENARY MEETING

**Addendum 15 to
Document 5530-E
23 August 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.15

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

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD **THA/5530A15/1**

11.7-13.4 GHz

| Allocation to services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 12.75-13.25 | FIXED FIXED-SATELLITE (Earth-to-space) 5.441 ADD 5.A115 MOBILE Space research (deep space) (space-to-Earth) | |

Reasons:

ADD **THA/5530A15/2**

5.A115 The operation of earth stations in motion on board aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be subject to the application of Resolution **[A115]** (**WRC-23**). (WRC-23)

Reasons:

ADD **THA/5530A15/3**

DRAFT NEW RESOLUTION [A115] (WRC-23)

There are several areas on which there are no consensus either on the text or how to proceed with the implementation of this Resolution. Consequently, the text below is not consistent with *resolves* 9 of Resolution **172 (WRC-19)** as shown below.

9 to ensure that the results of ITU-R studies are agreed by Member States taking into account the required consensus on this matter;

Use of the frequency band 12.75-13.25 GHz by earth stations in motion on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that WARC Orb-88 established an Allotment Plan for the use of the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz;
- b) that WRC-07 revised the regulatory regime governing the use of the frequency bands referred to in *considering a)* above;
- c) that the objective of providing broadband mobile satellite communications may also be met by allowing earth stations in motion (ESIMs), on aircraft (A-ESIMs) and vessels (M-ESIMs), to communicate with the geostationary space stations of a fixed-satellite service network in the frequency bands 12.75-13.25 GHz (Earth-to-space) and the associated downlink frequency bands of that satellite, thus for example the frequency bands 10.70-10.95 GHz and 11.20-11.45 GHz of Appendix **30B** may be used;
- d) that the frequency band 12.75-13.25 GHz is currently allocated on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), fixed and mobile services and on a secondary basis to the space research (deep space) (space-to-Earth) service;
- e) that the operation of services to which the frequency band 12.75-13.25 GHz is allocated and those in adjacent bands needs to be protected from A-ESIM and M-ESIM;
- f) that the frequency band 12.75-13.25 GHz (Earth-to-space) is used by the geostationary-satellite orbit (GSO) FSS in accordance with the provisions of Appendix **30B** (No. **5.441**) and that there are many existing GSO FSS satellite networks operating in this frequency band;
- g) that the objective of the procedures in Appendix **30B** is to guarantee, for all countries, equitable access to the GSO in the frequency bands of the FSS covered by this Appendix;
- h) that appropriate regulatory and interference-management mechanisms, including necessary mitigation measures and associated techniques, are required for the operation of A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz (Earth-to-space) to protect other space and terrestrial services in this frequency band as well as services in adjacent frequency bands and without adversely affecting those services and their future development, taking into account the provisions of Appendix **30B** (see also *resolves further* 1 to 5 on responsibilities);
- i) that, in Appendix **30B**, the frequency bands in the space-to-Earth direction corresponding to the frequency band 12.75-13.25 GHz (Earth-to-space) are 10.7-10.95 GHz and 11.2-11.45 GHz, which may be used by A-ESIM and M-ESIM, subject to not claiming protection from other services and applications of the FSS and other radiocommunication services to which the frequency band is allocated;
- j) that there is no publicly available information on coordination agreements reached among administrations regarding GSO FSS satellite networks except whether coordination has been completed, which is provided to, and published by, the Radiocommunication Bureau (BR);
- k) that the operation of A-ESIM and M-ESIM requires the establishment of one or more gateway earth station facilities in one or several countries that are within the service area of the associated satellite network and that are authorized by the administration of the territory where such earth stations are located,

considering further

- a) that A-ESIMs and M-ESIMs operating within the agreed service area of the satellite network with which they communicate may provide service within the territories under the jurisdiction of multiple administrations;

b) that the operation of ESIMs within the territory under the jurisdiction of administrations/countries mentioned in *considering further a)* above is subject to obtaining authorization from those administrations,

recognizing

a) that Article 44 of the ITU Constitution contains the basic principles for the use of the radio-frequency spectrum and the GSO and other satellite orbits, taking into account the needs of developing countries;

b) that administrations intending to authorize A-ESIMs and M-ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures than those contained in this Resolution;

c) that, pursuant to the relevant paragraph in Appendix **30B**, the operation of ESIM in the frequency band 12.75-13.25 GHz could be only within the service area of the Appendix **30B** network for which the explicit agreement of any administration whose territory is partially or wholly included in this service area has been obtained;

c bis) that § 6.16 of Article 6 of Appendix **30B** provides the opportunity to any administration at any time to request that its territory be excluded from the service area of any assignment governed by Appendix **30B**, therefore the service area can change;

d) that the operation of an A-ESIM and M-ESIM pertaining to and communicating with a space station of a given satellite network needs that earth station to be within the coordinated and agreed service area of that satellite under the relevant provisions of Appendix **30B**;

e) that, based on the available information in the Bureau's database in May 2022, there is no contiguous regional or worldwide coordinated and agreed service area for any satellite using the Appendix **30B** frequency band 12.75-13.25 GHz recorded in the Master International Frequency Register (MIFR);

f) that, in order for A-ESIM and M-ESIM to operate in the frequency band 12.75-13.25 GHz (Earth-to-space) of Appendix **30B** in the most efficient and operationally viable manner, having a contiguous regional or worldwide coordinated and agreed service area is an important issue to be taken into account;

g) that the administration authorizing ESIMs on the territory under its jurisdiction has the right to require that the ESIMs referred to above only use those assignments associated with GSO FSS networks which have been successfully coordinated, notified, brought into use and recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**, except those arising from the application of § 6.25 of Appendix **30B**;

h) that Resolution **170 (WRC-19)** provides the procedure to enhance equitable access to frequency bands under Appendix **30B** by developing countries;

i) that the protection of current usage and future development of Appendix **30B** in the frequency band 12.75-13.25 GHz (Earth-to-space) is a fundamental issue without any adverse effect thereto;

j) that the availability of the methodology to examine conformity to the power flux-density (pfd) limit as contained in Annex 2 to this Resolution is a fundamental and crucial element;

k) that there is need to establish regulatory, technical and recording procedures for the usage of these type of ESIMs that may differ from the current FSS Appendix **30B** Plan and List recording procedures;

l) that successful compliance with this Resolution does not oblige any administration to authorize/license A-ESIM and M-ESIM communicating with geostationary space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) to operate within the territory under its jurisdiction (see *resolves* 7);

Option 1

m) that affected administrations retain their right to directly contact the aircraft or vessel on which the ESIM operates;

n) that any administration experiencing unacceptable interference from an ESIM may request the assistance of the administration authorizing the ESIM on the territory under its jurisdiction;

Option 2

Not to add m) and n)

o) that, in accordance with Appendix **30B**, the examination of the Bureau in the frequency band 12.75-13.25 GHz (Earth-to-space) is limited to the test-points on land, it is necessary to perform the examination of A-ESIM and M-ESIM using grid points generated everywhere within the service area of A-ESIM and M-ESIM submitted under Appendix 4 (see Annex 1 to this Resolution),

recognizing further

a) that, under *resolves* 1.1.3 of this Resolution, frequency assignments to ESIMs need to be notified to the BR;

b) that, for the operation of ESIMs, notification of any frequency assignment under Annex 1 of this Resolution shall only be made by one single administration which is the notifying administration of the GSO FSS network with which ESIMs communicate;

c) that an administration authorizing the operation of ESIMs within the territory under its jurisdiction may modify and/or withdraw that authorization at any time;

d) that the three elements consisting of interference management mechanism, switching facility for on/off function and the function of NCMC and their relations with each other and sequence of actions together with estimated time for that action/function are needed for the proper and factual operation of the ESIM;

Option 1 see resolves 1.17, 1.1.8 and 1.19 for Option 2

e) the operation of A-ESIM and M-ESIM shall comply with provision No. **5.340**;

f) when the Appendix **30B** GSO FSS satellite network with which A-ESIM and M-ESIM communicate transmits in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, it shall operate under the levels that were coordinated and included in the List, and these Appendix **30B** satellite transmissions will not change to accommodate A-ESIM and M-ESIM;

g) the operation of A-ESIM and M-ESIM in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, if any, shall not adversely affect the allotments in the Plan or the assignments in the List and not claim protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated,

resolves

1 that, for any A-ESIM and M-ESIM communicating with a GSO FSS space station within the frequency band 12.75-13.25 GHz (Earth-to-space) or parts thereof, the following conditions shall apply:

1.1 with respect to space services in the frequency band 12.75-13.25 GHz and adjacent bands, A-ESIM and M-ESIM shall comply with the following conditions:

1.1.1 the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIM and M-ESIM shall not result in any changes or restrictions to the allotment in the Plan, assignments in the List of Appendix **30B**, and those recorded in the MIFR, including the assignments arising from the implementation of Resolution **170 (WRC-19)**;

1.1.2 with respect to satellite networks or systems of other administrations, the characteristics of A-ESIM and M-ESIM shall remain within the envelope of typical characteristics of notified earth stations associated with the satellite networks with which these earth stations communicate, as published by the Bureau and included in relevant International Frequency Information Circular (BR IFIC), and Annex 1 applies;

1.1.2bis the use of A-ESIM and M-ESIM shall not cause any interference to Appendix **30B** allotments, assignments received by the Bureau under Article 6 either in process or yet to be processed, assignments in the List, assignments notified under Article 8 of that Appendix, and assignments recorded in the MIFR as well as submission under Appendix **30B** beyond that specified in the relevant Annexes to that Appendix;

1.1.3 for the implementation of *resolves* 1.1.1, 1.1.2 and 1.1.2bis above, the notifying administration for the GSO FSS network with which the above-mentioned A-ESIM and M-ESIM communicate shall follow the procedure in Annex 1 of this Resolution, together with the commitment that the operation of ESIM shall be in conformity with the Radio Regulations, including this Resolution;

1.1.4 upon receipt of the notification information referred to in *resolves* 1.1.3 above, the BR shall process the submission in accordance with Annex 1 of this Resolution;

1.1.5 for the protection of non-GSO FSS systems operating in the frequency band 12.75-13.25 GHz, the above-mentioned A-ESIM and M-ESIM communicating with GSO FSS networks referred to above shall comply with the provisions contained in Annex 3 of this Resolution;

1.1.6 the notifying administration of the GSO FSS network with which the above-mentioned earth stations communicate shall ensure that the operation of these A-ESIM and M-ESIM complies with the coordination agreements for the frequency assignments of the earth station of this GSO FSS satellite network of Appendix **30B** obtained under the relevant provisions of that Appendix;

Option 2 (See recognizing further a), b) and c) for Option 1)

~~1.1.7 the operation of A-ESIM and M-ESIM shall comply with provision No. 5.340;~~

~~1.1.8 when the Appendix **30B** GSO FSS satellite network with which A-ESIM and M-ESIM communicate transmits in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, it shall operate under the levels that were coordinated and included in the List, and these Appendix **30B** satellite transmissions will not change to accommodate A-ESIM and M-ESIM;~~

~~1.1.9 the operation of A-ESIM and M-ESIM in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, if any, shall not adversely affect the allotments in the Plan nor the~~

~~assignments in the List and not claim protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated;~~

- 1.2 with respect to the protection of terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations, A-ESIM and M-ESIM shall comply with the following conditions:
 - 1.2.1 transmitting A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz (Earth-to-space) shall not cause unacceptable interference to terrestrial services to which this frequency band is allocated and that operate in accordance with the Radio Regulations, and Annex 2 to this Resolution shall apply;
 - 1.2.2 the receiving part of the above-mentioned ESIM in their associated frequency band shall not claim protection from terrestrial services to which this frequency band is allocated and that operate in accordance with the Radio Regulations;
 - 1.2.3 the requirement to not cause unacceptable interference to terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations shall be respected, irrespective of compliance with Annex 2 (see *resolves 7*);
 - 1.2.4 for the application of Part II of Annex 2 as referred to in *resolves 1.2.1* above, the BR shall examine the characteristics of A-ESIM with respect to the conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2, and publish the results of such examination in the BR IFIC;

Option 1

~~1.2.5 however, the compliance with the technical conditions in Annex 2 does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;~~

~~Option 1 deletes 1.2.6 and 1.2.7~~

Option 2

- 1.2.5 the compliance with the technical conditions in Annex 2 does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;
- 1.2.6 if the BR is unable to examine, in accordance with *resolves 1.2.4* above, the A-ESIM with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2, the notifying administration shall send to BR a commitment that the A-ESIM shall comply with those limits;
- 1.2.7 the BR shall formulate a qualified favourable finding with respect to the limits contained in Part II of Annex 2 if *resolves 1.2.6* is applied successfully, otherwise it shall formulate an unfavourable finding;
- 1.2.7bis that, after the application of *resolves 1.2.6* and *1.2.7* successfully, once the methodology to examine the characteristics of aeronautical GSO ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2 is available, *resolves 1.2.4* shall be applied by the Bureau;

End of Option 2

- 1.2.8 if administrations authorizing A-ESIM agree to pfd levels higher than the limits contained in Part II of Annex 2 within the territory under its jurisdiction, such agreement shall in no way affect other countries that are not party to that agreement;

1.2.9 the notifying administration for the GSO FSS network with which the A-ESIM and M-ESIM will communicate, taking into account the *resolves further* below, shall send to the BR, together with submission of the Appendix 4 information for the above-mentioned earth station, a commitment undertaking that, upon receiving a report of unacceptable interference, it shall immediately take all appropriate measures to eliminate that interference or reduce it to an acceptable level and follow the procedures in *resolves 9*;

1.3 with respect to the aeronautical radionavigation systems operating in the frequency band 13.25-13.4 GHz, A-ESIM and M-ESIM communicating with GSO FSS networks shall not cause unacceptable interference to the aeronautical radionavigation service (ARNS) operating in accordance with the Radio Regulations in the 13.25-13.40 GHz band;

Option 1:

~~2 that, for assignments of Appendix 30B recorded in the List, only frequency assignments entered in the List under § 6.17 can be used as supporting assignments by earth stations on aircraft and vessels communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix 30B, except assignments recorded under § 6.25 of Article 6 of the Appendix;~~

Option 2:

2 that only frequency assignments of Appendix 30B recorded in the List can be used as supporting assignments by A-ESIMs and M-ESIMs communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix 30B;

Option 3:

~~2 that only frequency assignments of Appendix 30B recorded in the List can be used as supporting assignments by A-ESIMs and M-ESIMs communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix 30B provided that assignments recorded under § 6.25 of Article 6 used for A-ESIM and M-ESIM operations shall not cause unacceptable interference or claim protection from those assignments for which agreement was not obtained;~~

3 that operation of A-ESIM and M-ESIM communicating with GSO space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be within the coordinated and notified service area of the GSO FSS network with which the earth stations communicate;

4 that, for the implementation of *resolves 3* above, the notifying administration for the GSO FSS network with which the A-ESIM and M-ESIM communicate shall ensure that necessary arrangements and switching facilities are built into the above-mentioned earth stations to cease emissions once approaching the territory under the jurisdiction of those administrations which either are not within the notified and coordinated service area of the subject space station or have not authorized the operation over their territories;

5 that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network with which A-ESIM and M-ESIM communicate, or on the coordination requirements of that satellite network;

6 that A-ESIM and M-ESIM shall not be used or relied upon for safety-of-life applications;

7 that the operation of A-ESIM and M-ESIM within territorial waters and/or airspace under the jurisdiction of an administration shall be carried out only if a licence according to No. 18.1 of the Radio Regulations/authorization of that administration is obtained;

8 that gateway earth station facilities for A-ESIM and M-ESIM shall be within the service area of the satellite network associated to that gateway;

9 that, in the case unacceptable interference caused by A-ESIM and/or M-ESIM is reported:

Option 1:

~~9.1 only the notifying administration of the GSO FSS network/non-GSO FSS systems with which ESIMs communicate is responsible for resolving the case of unacceptable interference;~~

Option 2:

9.1 the notifying administration of the GSO FSS network/non-GSO FSS systems with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

9.2 the notifying administration of the GSO FSS network with which the ESIMs communicate shall immediately take the required action to eliminate or reduce interference to an acceptable level;

9.3 the affected administration(s) may assist resolving or provide information that would facilitate resolving the case of unacceptable interference;

Option 1:

~~9.4 the administration authorizing the operation of A-ESIM and M-ESIM on territory under its jurisdiction, subject to its explicit agreement, may provide assistance, including information for the resolution of unacceptable interference;~~

Option 2:

9.4 the administration authorizing the operation of A-ESIM and M-ESIM on the territory under its jurisdiction shall, to the extent of its ability, cooperate to assist in the resolution of unacceptable interference, including providing information as necessary;

Option 3:

~~9.4 an administration that the territory of which is situated inside the service area of a satellite and has provided explicit authorization to receive the service/to be served by any type of ESIM has no obligation nor any mandate, whatsoever, to be involved directly or indirectly in detection, identification, reporting, resolution of any interference caused by the operation of the ESIM the operation of which was authorized;~~

9.5 the administration responsible for the aircraft or vessel on which the ESIM operates shall provide a point of contact to assist identifying the notifying administration of the satellite with which the ESIM communicates;

10 that the notifying administration of the GSO FSS satellite network with which the ESIM communicates shall ensure that:

10.1 for the operation of A-ESIM and M-ESIM, techniques are employed to maintain adequate 10 pointing accuracy with the associated GSO/non-GSO FSS satellite;

10.2 all necessary measures shall be taken so that A-ESIM and M-ESIM are subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) in order to comply with the provisions in this Resolution, and are capable of receiving and immediately

acting upon, *inter alia*, “enable transmission” and “disable transmission” commands from the NCMC;

10.3 measures are taken so that the A-ESIM and/or M-ESIM do not transmit on the territory, under the jurisdiction of an administration, including its territorial waters and its national airspace, that is neither in the service area of the GSO satellite network and/or has not authorized its use on its territory;

10.4 a permanent point of contact shall be provided, in the Appendix 4 submission under Annex 1 of this Resolution and published in the special section, by the notifying administration of the GSO FSS network for the purpose of tracing any suspected cases of unacceptable interference from earth stations on aircraft and vessels and to immediately respond to such requests;

Option 1:

~~11 — the implementation of this Resolution remains in abeyance pending an agreement to be universally reached on the issue of the interference management system, monitoring facilities' effectiveness and immediate response of MCNC, cessation of transmission over territories which have not explicitly authorized the functioning and operation of any ESIM over their territories providing satisfactory resolution of the problem, as referred to in *recognizing further d)* above,~~

Option 2:

~~11 — the implementation of this Resolution is conditioned on providing a description to the administrations whose authorization is sought of interference management system(s), monitoring facilities (NCMC), dealing with the cessation of transmission over territories which have not explicitly authorized (see *resolves 7*) the functioning and operation of any ESIM over their territories in order to provide a satisfactory resolution of the problem as referred to in *recognizing further d)* above,~~

~~NOTE: Provided the description mentioned above is properly addressed and concluded, *resolves 11* above may be deleted at WRC-23.~~

resolves further

1 that ESIMs shall not cause unacceptable interference to nor claim protection from other services as referred to in *resolves 1.2.1* and *1.2.2*;

2 that the notifying administration for the ESIMs shall send to the BR, when submitting the relevant Appendix 4 data, a commitment (as stipulated in *resolves 1.2.9*) that, upon receiving a report of unacceptable interference, the notifying administration for the GSO satellite network with which ESIMs communicate shall remove such interference;

3 that the commitment referred to in *resolves further 2* shall be objective, measurable and enforceable;

4 that, in case of continued unacceptable interference despite of the commitment referred to in *resolves further 2*, the assignment causing interference shall be submitted to the Radio Regulations Board for review;

5 that compliance with the provisions contained in Annex 2 does not release the notifying administration of the GSO satellite network with which ESIMs communicate of its obligations mentioned in *resolves further 1* above (see *resolves 1.2.3*);

6 that frequency assignments in the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIM and M-ESIM communicating with geostationary space stations in the FSS shall be notified by the notifying administration of the satellite network with which the ESIM communicates;

7 that the notifying administration of the satellite network shall ensure that ESIMs operate only in the territory under the jurisdiction of an administration from which an authorization has been obtained, taking into account *recognizing further c)* above;

8 that, for the implementation of *resolves further 2* above, the notifying administration of the satellite network with which ESIMs communicate shall ensure that ESIMs are designed and operate so as to cease transmission in the territory of any administration from which authorization has not been obtained;

Option 1

~~8bis — that, for the implementation of *resolves further 7* and *8* above, the system shall employ the minimum capabilities listed in Annex 5;~~

Option 2

~~8bis is not required if Annex 5 is not maintained.~~

9 that, for the implementation of *resolves further 6* above, the notifying administration responsible for the operation of A-ESIM and M-ESIM shall also be responsible for observing and complying with all relevant regulatory and administrative provisions applicable to the operation of the above-mentioned ESIMs as included in this Resolution and those contained in the Radio Regulations;

10 that the authorization for an ESIM to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the satellite network with which the ESIM communicates from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations,

instructs the Director of the Radiocommunication Bureau

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

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution, including whether or not the responsibilities relating to the operation of A-ESIMs and M-ESIMs have been properly addressed;

3 to review, if necessary, once the methodology to examine the characteristics of A-ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2 is available;

Option 1

~~4 — to publish the list of assignments in the Appendix 30B ESIM brought into use with information about its service area and countries authorize such use if any; this information shall be updated regularly;~~

Option 2

4 to publish the list of assignments in the Appendix 30B ESIM brought into use, with information about their service area; this information shall be updated regularly,

Note: It was agreed that the issue of identifying the notifying administration is still ambiguous and requires further discussions before taking the decision regarding this draft new resolution, in order to develop a means for the affected administration to identify the notifying administration of the satellite network space station with which the ESIM communicates.

instructs the Secretary-General

- 1 to bring this Resolution to the attention of the Council with a view to consider if cost recovery should be applied to ESIM;
- 2 to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization and of the Secretary General of the International Civil Aviation Organization.

ANNEX 1 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

PART I

Procedure to be followed by the administrations and the Bureau for submission of the earth stations in motion on aircraft and vessels operating in the frequency band 12.75-13.25 GHz (Earth-to-space) and for the protection of allotments in the Plan, assignments in the Appendix 30B List and those submitted under Articles 6 and 7 of Appendix 30B as well as under Resolution 170 (WRC-19)

Section A – Procedure for entering assignments to earth stations in motion on aircraft and vessels in the Appendix 30B ESIM List¹

1 When an administration, or one acting on behalf of a group of named administrations, intends to use one or more Appendix **30B** assignments already included in the List and MIFR in support of the operation of A-ESIMs and M-ESIMs in the frequency band 12.75-13.25 GHz, it shall send to the Bureau, not earlier than 8 years but preferably not later than 2 years before the operation of A-ESIMs and M-ESIMs, the information specified in Appendix **4**².

An assignment in the Appendix **30B** ESIM List shall lapse if it is not brought into use within 8 years after the date of receipt by the Bureau of the relevant complete information specified above. A proposed assignment not included in the Appendix **30B** ESIM List within 8 years after the date of receipt by the Bureau of the relevant complete information shall also lapse.

1bis If the information received by the Bureau under § 1 is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned.

2 Upon receipt of a complete notice under § 1, the Bureau shall examine it with respect to its conformity with:

- a) the Table of Frequency Allocations and the other provisions³ of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the coordination procedures;

¹ The List of assignments for earth station in motion (ESIM) in the frequency band 12.75-13.25 GHz in Appendix **30B**.

² Submissions may include only the frequency band 12.75-13.0 GHz or 13.0-13.25 GHz.

³ The “other provisions” shall be identified and included in the Rules of Procedure.

- b) Annex 3 to Appendix **30B**;
- c) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the supporting Appendix **30B** assignment(s);
- d) the service area of the supporting Appendix **30B** assignment(s) in respect of explicit agreements of those administrations whose territories are included in the service area⁴;
- e) the frequency band of the supporting Appendix **30B** assignment(s) in the List in the frequency band 12.75-13.25 GHz.

3 When the examination with respect to § 2 leads to an unfavourable finding, the relevant part of the notice shall be returned to the notifying administration with an indication of the appropriate action.

4 When the examination with respect to § 2 leads to a favourable finding, the Bureau shall use the method of Annex 4 to Appendix **30B** to determine administrations whose:

- a) allotments in the Plan; or
- b) assignments which appear in the List; or
- c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article,

are considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s).

5 The Bureau shall publish, in a Special Section of its BR IFIC, the complete information received under § 1, together with the names of the affected administrations, the corresponding allotments in the Plan, assignments in the List and assignments for which the Bureau has previously received complete information in accordance with § 6.1 of Article 6 of Appendix **30B** and which it has examined under § 6.5 of that Article.

5bis The Bureau shall immediately inform the administration proposing the assignment, in the ESIM List drawing its attention to the information contained in the relevant BR IFIC and the requirement to seek and obtain the agreement of those affected administrations.

6 The Bureau shall also inform each administration listed in the Special Section of the BR IFIC published under § 5, drawing its attention to the information it contains.

7 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 5 shall be deemed to have not agreed to the proposed assignment in respect of its allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, according to the case for which absence of reply/comments shall construe their disagreement to the request for coordination. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to thirty days following the date on which the Bureau communicated the result of its action. In respect of its frequency assignments under Article 6 of Appendix **30B** other than those mentioned above, the same course of action outlined in § 6.10 of that Article shall apply.

⁴ The service area may be reduced by excluding certain countries for which explicit agreement was obtained.

8 Unless coordination is no longer required, the administration responsible for the notice published under § 5 shall seek and obtain the explicit agreement of the relevant affected administrations contained in the Special Section published under § 5 in respect of allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, as appropriate. In this specific case of explicit agreement, any request for the assistance of the Bureau shall not change it to implicit/tacit agreement.

9 If agreements have been reached in accordance with §§ 7 and 8 with administrations published under § 5, the administration responsible for the notice published under § 5 may request the Bureau to have the assignment entered into the Appendix **30B** ESIM List, indicating the final characteristics of the notice⁵ together with the names of the administrations with which agreement has been reached.

9bis In submitting such information, noting the requirement of § 1 of Section B, the administration may also request the Bureau to examine the submission in respect of notification under Section B.

9ter If the information received by the Bureau under §§ 9 and *9bis* is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned. The Bureau may also provide additional information in order to assist the notifying administration in complying with requirements under §§ 10, 12 and 13.

10 Upon receipt of a complete notice under § 9, the Bureau shall examine each assignment in the notice with respect to its conformity with:

- a) the Table of Frequency Allocations and the other provisions⁶ of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for obtaining coordination;
- b) Annex 3 to Appendix **30B**;
- c) the service area published under § 5;
- d) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the assignments published under § 5, and
- e) frequency band of the assignments published under § 5.

11 When the examination with respect to § 10 of an assignment received under § 9 leads to an unfavourable finding, the notice shall be returned to the notifying administration with an indication that subsequent resubmission under § 9 will be considered with a new date of receipt.

12 When the examination with respect to § 10 of an assignment received under § 9 leads to a favourable finding, the Bureau shall use the method of Annex 4 to examine if there is any administration and the corresponding:

- a) allotment in the Plan;
- b) assignment which appears in the List at the date of receipt of the examined notice submitted under § 1;

⁵ Submissions may include only the frequency band 12.75-13.0 GHz or 13.0-13.25 GHz.

⁶ The “other provisions” shall be identified and included in the Rules of Procedure.

- c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article at the date of receipt of the examined notice submitted under § 1⁷,

considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s) and whose agreement has not been provided under § 9.

13 The Bureau shall determine if the cumulative interference is caused to an allotment in the Plan or an assignment in the List or an assignment for which the Bureau has received complete information in accordance with Article 6 of Appendix **30B** before the date of receipt of the complete notice under § 9. The cumulative interference shall be calculated based on Appendix 1 to Annex 4 of Appendix **30B**, taking into account assignments in the Appendix **30B** ESIM List together with assignments submitted under § 9. The cumulative interference is considered as being caused when the overall aggregate $(C/I)_{aggregate}$ value is less than that resulting from the supporting Appendix **30B** assignment(s) with a tolerance of 0.25 dB (inclusive of the 0.05 dB computational precision), except for an allotment in the Plan, an assignment stemming from the conversion of an allotment into an assignment without modification, or when the modification is within the envelope characteristics of the initial allotment, as well as assignments relating to application of Article 7 of Appendix **30B** for which the 0.05 dB computational precision is applicable.

14 In the event of a favourable finding under §§ 12 and 13, the Bureau shall enter the proposed assignment in the Appendix **30B** ESIM List and publish in a Special Section of its BR IFIC the characteristics of the assignment received under § 9, together with the names of administrations with which the provisions of this procedure have been successfully applied.

15 When the examination under § 12 or § 13 leads to an unfavourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, or submission in accordance with Resolution **170 (WRC-19)**, the Bureau shall return the notice to the notifying administration. In this case, the notifying administration undertakes not to bring into use the frequency assignments until the finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, or submission in accordance with Resolution **170 (WRC-19)**, is favourable. The Bureau, in returning the notice to the notifying administration, shall indicate that the subsequent resubmission under § 9 will be considered with a new date of receipt.

15bis When the examination under § 12 or § 13 leads to a favourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, but an unfavourable finding with respect to others, and if the notifying administration insists that the proposed assignment be included in the Appendix **30B** ESIM List, the Bureau shall enter the assignment provisionally in the Appendix **30B** ESIM List with an indication of those administrations whose assignments were the basis of the unfavourable finding. To this effect, the notifying administration shall include a signed commitment, indicating that use of an assignment provisionally recorded in the Appendix **30B** ESIM List shall not cause unacceptable interference to, nor claim protection from, those assignments for which agreement still needs to be obtained. The

⁷ Similar course of action as prescribed in footnote 7bis of § 6.21 of Article 6 of Appendix **30B** applies.

entry in the Appendix **30B** ESIM List shall be changed from provisional to definitive only if the Bureau is informed that all required agreements have been obtained.

15ter Should the assignments that were the basis of the unfavourable finding not be brought into use within the period specified in § 6.1 of Article 6 of Appendix **30B** or within the extension period under § 6.31bis Article 6 of Appendix **30B**, then the status of the assignment in the Appendix **30B** ESIM List shall be reviewed accordingly.

16 Should unacceptable interference be caused by an assignment entered in the Appendix **30B** ESIM List under § 15bis to any assignment in the List which was the basis of the disagreement, the notifying administration of the assignment entered in the Appendix **30B** ESIM List under § 15bis shall, upon receipt of advice thereof, immediately eliminate this unacceptable interference.

17 For the examinations referred to in Part I and Part II, the Bureau shall generate a set of uplink grid points everywhere within the service area of the relevant assignments to A-ESIMs and M-ESIMs, assuming that A-ESIMs and M-ESIMs are located at these uplink grid points.

Section B – Procedure for notification and recording in the Master Register of assignments to earth stations in motion on aircraft and vessels dealt with under this Resolution

1 Any assignment in the ESIM List for which the relevant procedure of Section A and Part II of this Annex has been successfully applied shall be notified to the Bureau using the relevant characteristics listed in Appendix **4**, not earlier than three years before the assignments are brought into use.

2 If the first notice referred to in § 1 has not been received by the Bureau within the required period mentioned in § 1 of Section A, the assignments in the Appendix **30B** ESIM List shall be cancelled by the Bureau after having informed the administration at least three months before the expiry of this period.

3 Notices not containing those characteristics specified in Appendix **4** as mandatory or required shall be returned with comments to help the notifying administration to complete and resubmit them, unless the information not provided is immediately forthcoming in response to an inquiry by the Bureau.

4 Complete notices shall be marked by the Bureau with their date of receipt and shall be examined in the date order of their receipt. Following receipt of a complete notice, the Bureau shall, as soon as possible after the date of entry of the corresponding assignment into the Appendix **30B** ESIM List or within not more than two months if the corresponding assignment has already been entered into the Appendix **30B** ESIM List, publish its contents, with any diagrams and maps and the date of receipt, in the BR IFIC, which shall constitute the acknowledgement to the notifying administration of receipt of its notice. When the Bureau is not in a position to comply with the time-limit referred to above, it shall periodically so inform the administrations, giving the reasons thereof.

5 The Bureau shall not postpone the formulation of a finding on a complete notice unless it lacks sufficient data to reach a conclusion thereon.

6 Each notice shall be examined:

6.1 with respect to its conformity with the Table of Frequency Allocations and the other provisions⁸ of these Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for obtaining coordination, which are the subject of the following subparagraph;

6.2 with respect to its conformity with the FSS Plan, the procedures for obtaining coordination and the associated provisions⁹.

7 When the examination with respect to § 6.1 leads to a favourable finding, the assignment shall be examined further with respect to § 6.2; otherwise, the notice shall be returned with an indication of the appropriate action.

8 When the examination with respect to § 6.2 leads to a favourable finding, the ESIM assignment shall be recorded in the Master Register. When the finding is unfavourable, the notice shall be returned to the notifying administration, with an indication of the appropriate action.

9 In every case when a new ESIM assignment is recorded in the Master Register it shall, in accordance with the provisions of this Resolution, include an indication of the finding reflecting the status of the assignment. This information shall also be published in the BR IFIC.

10 A notice of a change in the characteristics of the ESIM assignment already recorded, as specified in Appendix 4, shall be examined by the Bureau under § 6.1 and § 6.2, as appropriate. Any changes to the characteristics of an assignment that has been recorded and confirmed as having been brought into use shall be brought into use within eight years from the date of the notification of the modification. Any changes to the characteristics of an assignment that has been recorded but not yet brought into use shall be brought into use within the period provided for in § 1 of Section A.

11 In applying the provisions of this Section, any resubmitted notice which is received by the Bureau more than six months after the date on which the original notice was returned by the Bureau shall be considered to be a new notice.

12 All frequency assignments notified in advance of their being brought into use shall be entered provisionally in the Master Register. Any frequency assignment provisionally recorded under this provision shall be brought into use no later than the end of the period provided for in § 1 of Section A. Unless the Bureau has been informed by the notifying administration of the bringing into use of the assignment, it shall, no later than 15 days before the end of the regulatory period

⁸ The “other provisions” shall be identified and included in the Rules of Procedure.

⁹ When an administration notifies any assignment with characteristics different from those entered in the Appendix 30B ESIM List through successful application of the relevant procedure of Section A and Part II of this Annex, the Bureau shall undertake calculation to determine if the proposed new characteristics increase the interference level caused to other allotments in the Plan, assignments in the List, an assignment for which the Bureau has received complete information in accordance with § 6.1 of Article 6 of Appendix 30B before the date of receipt of this notification, assignments in the Appendix 30B ESIM List and an assignment for which the Bureau has received complete information in accordance with § 1 of Section A before the date of receipt of this notification. The increase of the interference due to characteristics different from those entered in the Appendix 30B ESIM List will be checked by comparing the *C/I* ratios of these other allotments and assignments, which result from the use of the proposed new characteristics of the subject assignment on the one hand, and those obtained with the characteristics of the subject assignment in the Appendix 30B ESIM List, on the other hand. This *C/I* calculation is performed under the same technical assumptions and conditions.

established under § 1 of Section A, send a reminder requesting confirmation that the assignment has been brought into use within the regulatory period. If the Bureau does not receive that confirmation within 30 days following the period provided under § 1 of Section A, it shall cancel the entry in the Master Register and the corresponding assignment in the Appendix **30B** ESIM List.

13 When the Bureau has received confirmation that the assignment in the Appendix **30B** ESIM List has been brought into use, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC.

14 Wherever the use of a frequency assignment in the Appendix **30B** ESIM List is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When that assignment is brought back into use, the notifying administration shall so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. The date on which the assignment is brought back into use shall be no later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be cancelled from the Master Register and the Appendix **30B** ESIM List.

15 If the supporting Appendix **30B** assignment(s) is cancelled from the List, the corresponding ESIM assignment shall also be cancelled from the Appendix **30B** ESIM List and the Master Register, as appropriate.

PART II

Procedure to be followed by the administrations and the Bureau for examination and protection of one ESIM with respect to the other ESIMs

1 In the publication of the Special Section referred to in § 5 of Section A, the Bureau shall also include the names of the affected administrations, the corresponding assignments in the Appendix **30B** ESIM List and assignments for which the Bureau has previously received complete information in accordance with § 1 of Section A and which it has examined under § 4 of Section A, as appropriate.

2 In determining administrations whose assignments in the Appendix **30B** ESIM List or assignments for which the Bureau has previously received complete information in accordance with § 1 of Section A and which it has examined under § 4 of Section A are considered as being affected, the Bureau shall apply the principle of Annex 4 to Appendix **30B** and the following criteria:

- a) orbital spacing as specified in paragraph 1.2 of Annex 4;
- b) Earth-to-space single-entry carrier-to-interference as specified in paragraph 2.1 of Annex 4 or Earth-to-space single-entry carrier-to-interference (*C/I*) derived from the supporting Appendix **30B** assignment(s), whichever is the lowest;

c) the Earth-to-space pfd as specified in paragraph 2.2 of Annex 4.

3 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 5 of Section A shall be deemed to have agreed to the proposed assignment. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to thirty days following the date on which the Bureau communicated the result of its action.

4 Unless coordination is no longer required, taking into account the final characteristics of the notice in § 9 of Section A, should harmful interference be caused by an assignment included in Appendix **30B** ESIM List to any assignment in Appendix **30B** ESIM List identified in § 1 for which agreement has not been obtained, the notifying administration shall, upon receipt of advice thereof, immediately eliminate this harmful interference.

ANNEX 2 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

Provisions for earth stations on aircraft and vessels to protect terrestrial services in the frequency band 12.75-13.25 GHz

1 The parts below contain provisions to ensure that A-ESIM and M-ESIM do not cause unacceptable interference in neighbouring countries to terrestrial service operations when A-ESIM and M-ESIM operate in frequency bands overlapping with those used at any time by terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and operating in accordance with the Radio Regulations (see also *resolves* 1.2 of this Resolution).

PART I

Earth stations on vessels

2 The notifying administration of the GSO FSS network with which an M-ESIM communicates shall ensure compliance of the M-ESIM operating within the frequency band 12.75-13.25 GHz, or parts thereof, with both of the following conditions for the protection of terrestrial services to which the frequency band is allocated within a coastal State:

2.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which an M-ESIM can operate without the prior agreement of any administration is 133/150 km in the frequency band 12.75-13.25 GHz. Any transmissions from an M-ESIM within the minimum distance shall be subject to the prior agreement of the coastal State concerned.

2.2 The maximum earth station on vessel e.i.r.p. spectral density towards the horizon shall be limited to 12.5 dB(W/MHz). Transmissions from an M-ESIM with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State concerned.

PART II

Earth stations on aircraft

3 The notifying administration of the GSO FSS satellite network with which an A-ESIM communicates shall ensure compliance of the A-ESIM operating within the frequency band 12.75-13.25 GHz, or parts thereof, with all of the following conditions for the protection of terrestrial services to which the frequency band is allocated:

PFD MASK

Option 1

1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single A-ESIM shall not exceed:

$$\begin{aligned} \text{pfd}(\theta) &= -112 && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } \theta \leq 5^\circ \\ \text{pfd}(\theta) &= -117 + \theta && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 5^\circ < \theta \leq 40^\circ \\ \text{pfd}(\theta) &= -77 && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 40^\circ < \theta \leq 90^\circ \end{aligned}$$

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

~~2 When within line of sight of the territory of an administration, maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:~~

~~$$\begin{aligned} \text{pfd}(\theta) &= -123.5 && (\text{dB(W/(m}^2 \cdot \text{MHz}))} && \text{for } \theta \leq 5^\circ \\ \text{pfd}(\theta) &= -128.5 + \theta && (\text{dB(W/(m}^2 \cdot \text{MHz}))} && \text{for } 5^\circ < \theta \leq 40^\circ \\ \text{pfd}(\theta) &= -88.5 && (\text{dB(W/(m}^2 \cdot \text{MHz}))} && \text{for } 40^\circ < \theta \leq 90^\circ \end{aligned}$$~~

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

Option 2

~~1 When within line of sight of the territory of an administration, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:~~

~~$$\begin{aligned} \text{pfd}(\theta) &= -123.5 && (\text{dB(W/(m}^2 \cdot \text{MHz}))} && \text{for } \theta \leq 5^\circ \\ \text{pfd}(\theta) &= -128.5 + \theta && (\text{dB(W/(m}^2 \cdot \text{MHz}))} && \text{for } 5^\circ < \theta \leq 40^\circ \\ \text{pfd}(\theta) &= -88.5 && (\text{dB(W/(m}^2 \cdot \text{MHz}))} && \text{for } 40^\circ < \theta \leq 90^\circ \end{aligned}$$~~

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

~~2 The maximum power in the out of band domain should be attenuated below the maximum output power of the aeronautical ESIM transmitter as described in Recommendation ITU-R SM.1541.~~

ANNEX 3 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

Provisions for earth stations in motion on aircraft and vessels to protect non-GSO FSS in the frequency band 12.75-13.25 GHz

1 In order to protect the non-GSO FSS systems referred to in *resolves* 1.1.5 of this Resolution in the frequency band 12.75-13.25 GHz, ESIMs shall not exceed the following operational limits:

- a) on-axis e.i.r.p. density of 49 dB(W/1 MHz) for an ESIM with an antenna maximum gain lower than 38.5 dBi;
- b) on-axis e.i.r.p. density of 54 dB(W/1 MHz) for an ESIM with an antenna maximum gain equal to or greater than 38.5 dBi but lower than 45 dBi;
- c) on-axis e.i.r.p. density of 57.5 dB(W/1 MHz) for an ESIM with an antenna maximum gain equal to or greater than 45 dBi;
- d) e.i.r.p. density for any off-axis angle ϕ which is 3° or more off the main-lobe axis of an ESIM antenna and outside 3° of the GSO arc:

| <i>Off-axis angle</i> | <i>Maximum e.i.r.p. density</i> |
|-------------------------------------|----------------------------------|
| $3^\circ \leq \phi \leq 31.6^\circ$ | $37 - 25 \log \phi$ dB(W/40 kHz) |
| $31.6^\circ < \phi \leq 180^\circ$ | -0.5 dB(W/40 kHz) |

2 the Radiocommunication Bureau shall not make any examination or finding with respect to compliance with this Annex under either Article 9 or 11.

ANNEX 4 TO DRAFT NEW RESOLUTION [A115] (WRC-23)

NOTE: This methodology has been developed based on the discussions in Working Party 4A regarding the draft new Recommendation ITU-R S.[RES.169_METH] which contains a methodology for assessing compliance of A-ESIM communicating with GSO FSS satellites to meet the obligations to protect terrestrial services in Resolution 169 (WRC-19). Proposals to WRC-23 on agenda item may need to take into account any further progress/updates to this draft new Recommendation when considering a methodology for assessing compliance with Part 2 of Annex 1 of Resolution [A115] (WRC-23) for A-ESIM communicating with GSO FSS satellites. However, it should be emphasized that the discussion in the CG would lead to a satisfactory conclusion on the matter and there is no certainty that the work of the CG will be agreed at WP 4A and SG4. Consequently, actions referred to in CPM should not be based on other actions that may not be conclusive.

Methodology with respect to the examination of compliance of A-ESIM with pfd limits in Part II of Annex 2

1 Overview of the methodology

This methodology determines the off-axis e.i.r.p. spectral density (“ $EIRP_C$ ”) towards the ground for an A-ESIM transmitter communicating with a GSO FSS satellite that would ensure compliance with a set of pre-established pfd limits defined on the Earth’s surface. This methodology may also

be used for guidance by administrations when considering authorizing the operation of ESIMs in their territories.

The methodology then compares the computed $EIRP_C$ with a metric introduced here and named Reference off-axis e.i.r.p. towards the ground (" $EIRP_R$ ") of the A-ESIM. For the emission in each group of a GSO satellite network, $EIRP_R$ will be calculated by using the Appendix 4 data for that network as well as other input parameters that shall be provided by the notifying administration for that network.

Specifically, for an emission of the GSO FSS satellite network associated with an A-ESIM class of station, the $EIRP_R$ is the algebraic summation (in logarithmic terms) of the maximum input power to the antenna flange (item C.8.a.1 of Appendix 4), the peak gain of the A-ESIM antenna (item C.10.d.3 of Appendix 4), the maximum achievable off-axis gain isolation towards the ground of the A-ESIM antenna in the service area of the GSO network under examination and a parameter that would compensate for any difference between the emission bandwidth and the reference bandwidth of the pre-established set of pfd limits.

The operations of A-ESIM shall be evaluated over multiple predefined altitude ranges in order to establish as many $EIRP_C$ levels for comparison with $EIRP_R$.

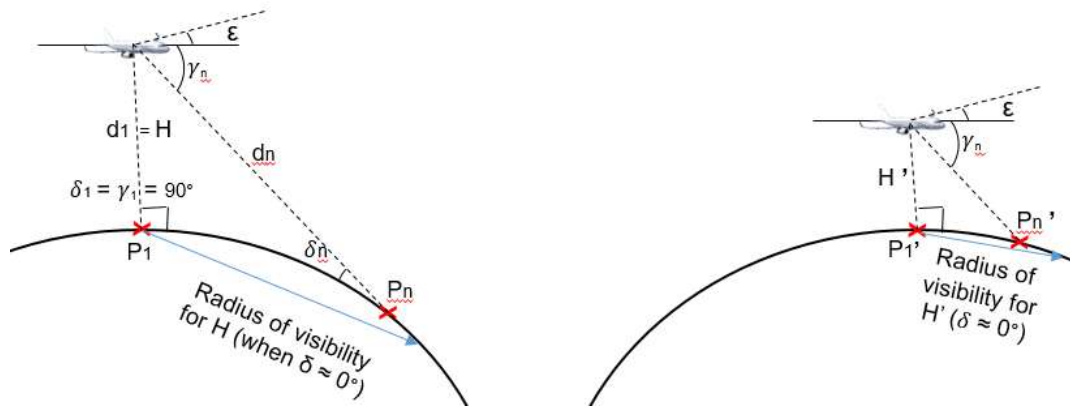
This comparison is at the basis of the methodology and examination that are described more in detail in the following section.

2 Parameters and geometry

Figure A4-1 provides a description of the geometry considered under this methodology. The figure shows an A-ESIM flying at two different altitudes and also some of the parameters used for the calculation. The model is agnostic to GSO ESIM geographical locations on Earth and assumes a spherical Earth model with a fixed radius for the calculation.

FIGURE A4-1

Geometry for the examination of compliance for two different ESIM altitudes



All the parameters required by the Bureau to carry out the examination process are listed and briefly described in Table A4-1. Additional considerations are further elaborated in section 3.

TABLE A4-1

Relevant parameters for pfd compliance examination

| Parameter | Symbol | Type of parameter | Observation |
|---|----------------------|---|---|
| Aeronautical GSO ESIM altitude | H | Established by the methodology as $H_{min} = [0.02]$ km, $H_{max} = [15]$ km, $H_{step} = [1]$ km | The altitudes at which the examination is carried out range from H_{min} to H_{max} at H_{step} intervals |
| Angle of arrival of the incident wave on the Earth's surface | δ | Specified by the pre-established set(s) of pfd limits, variable from 0° to 90° | Pre-established set(s) of pfd should cover incident angles from 0° to 90° |
| Angle below the horizontal plane of the ESIM corresponding to the angle of arrival δ under examination | γ | Calculated from the geometry | This angle is calculated considering the GSO ESIM altitude H_j , examined and angle of arrival δ under examination (see Fig. A.4-1) |
| Distance between the ESIM and the point on the ground under examination | D | Calculated from the geometry | This distance is a function of the A-ESIM altitude and the angles δ and γ |
| Frequency | f | Established by the methodology | To evaluate the propagation loss either at the central frequency or at the upper and lower limits of the frequency range |
| Atmospheric loss | L_{atm} | Calculated and established by the methodology | Based on Recommendation ITU-R P.676 |
| Polarization loss | L_{Pol} | Fixed value | 0 dB proposed as a conservative approach for the polarization loss between the polarization of A-ESIM antenna and the one used by terrestrial services |
| Fuselage attenuation | L_f | Report ITU-R M.2221 or other model supported by ITU-R studies (e.g. Reports and/or Recommendations) | The attenuation depends on the angle (γ) below the horizontal plane of the GSO ESIM. The value(s) could come from ITU-R studies (e.g. Reports and/or Recommendations) based on: measurements simulations |
| A-ESIM antenna peak gain and off-axis gain pattern | $G_{max}, G(\theta)$ | Taken from the Appendix 4 data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the GSO network under examination | The A-ESIM antenna gain is used to compute $EIRP_R$ |
| Emission bandwidth | $BW_{Emission}$ | Taken from the Appendix 4 data (as part of item C.7.a) of the GSO network under examination | These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$ |
| Reference bandwidth | BW_{Ref} | Taken from the set(s) of pre-established pfd limits | |

| Parameter | Symbol | Type of parameter | Observation |
|---|---------------|--|--|
| Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth | $EIRP_C$ | $EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface | For each of the altitudes H_j , the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated with a given altitude H_j ; for each altitude H_j , the lowest $EIRP$ value is the one to be retained and compared with $EIRP_R$ (see section 3) |
| A set of pre-established pfd limits on the Earth's surface | $pfd(\delta)$ | A possible outcome of the studies carried out under WRC-23 AI 1.15 | The pfd limits, expressed in $\text{dB}(\text{W}/\text{m}^2/\text{BW}_{Ref})$, are a function of the angle of arrival δ |

3 Calculation procedure

This section includes a step-to-step description of how the examination methodology would be implemented for a given group associated to the class of earth station for A-ESIM.

START

- i) For the emission of the Group under consideration, compute the reference e.i.r.p. ($EIRP_R$, dB(W)) as:

$$EIRP_R = G_{Max} - G_{Isol_{Max}} + P_{Max} + 10 \log_{10}(BW) \quad (1)$$

where:

G_{Max} is the A-ESIM antenna peak gain in dBi

$G_{Isol_{Max}}$ is the maximum achievable gain isolation of the A-ESIM antenna towards the ground in dB, taking into account the pointing of the A-ESIM towards the GSO satellite within the GSO network service area

P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).

BW in Hz is:

$$BW_{Ref} \quad \text{if} \quad BW_{emission} > BW_{Ref}$$

$$BW_{emission} \quad \text{if} \quad BW_{emission} < BW_{Ref}$$

- ii) For each aircraft altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test the full compliance with the set(s) of pre-established pfd limits. The N angles δ_n must be comprised between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the angles δ_n will correspond to as many N points on the ground.
- iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, compute $EIRP_{C_j}$ using the following algorithm:
- a) Set the altitude of the A-ESIM to H_j .

- b) Compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii) using the following equation:

$$\gamma_{j,n} = \arccos \left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)} \right) \quad (2)$$

where R_e is the mean earth radius.

- c) Compute the distance $D_{j,n}$, in km, for $n = 1, \dots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (3)$$

- d) Compute the fuselage attenuation $L_{f,j,n}$ (dB) applicable to each of the angles $\gamma_{j,n}$ computed in b) above.
- e) Compute the atmospheric loss $L_{atm,j,n}$ (dB) applicable to each of the distances $D_{j,n}$ computed in c) above.
- f) Compute the $EIRP_{C,j,n}$ (dB(W/BW_{Ref})), that is the maximum e.i.r.p. that can be radiated in the pfd mask's reference bandwidth by the A-ESIM towards each of the N points to be compliant with the set(s) of pre-established pfd limits, as per the following equation:

$$EIRP_{C,j,n}(\delta_n, \gamma_n) = pfd(\delta_n) + 10 \log_{10} \left(4\pi (D_{j,n} \cdot 1000)^2 \right) + L_{f,j,n} + L_{atm,j,n} + L_{pol} \quad (4)$$

- g) Compute the minimum $EIRP_{C,j}$ across all values calculated at the previous step, $EIRP_{C,j} = \text{Min}(EIRP_{C,j,n}(\delta_n, \gamma_n))$. The output of this last step is the maximum $EIRP_C$ that can be radiated by the A-ESIM to ensure it complies with the set(s) of pre-established pfd limits with respect to all angles δ_n at the altitude H_j . There will be one $EIRP_{C,j}$ for each of the H_j altitudes considered.
- iv) For the emissions, check whether there is at least one j for which $EIRP_{C,j} > EIRP_R$. If the emission of the Group under examination passes the test above, the result of the Bureau's examination for that Group is **favourable**, otherwise it is **unfavourable**.
- v) The Bureau publishes:
The finding (*favourable* or *unfavourable*) for each Group of emissions of the GSO network examined.

4 Example application of the methodology

Table A4-2 below describes the emissions included in one Group of a fictitious satellite network that are associated to the class of A-ESIM transmitting in the frequency band 12.75-13.25 GHz.

TABLE A4-2

Example A-ESIM emissions in the Group examined

| Emission No. | C7a Designation of emission | C8a2/C8b2 Maximum power density dB(W/Hz) | C8c3 Minimum power density (not used in methodology) dB(W/Hz) | C8e1 C/Nobjective (total – clear sky) (not used in methodology) dB |
|---------------------|--|---|--|---|
| 1 | 6MD7W-- | -70 | -80 | -5.0 |

Table A4-3 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A4-3

Additional assumptions

| Parameter | Notation | Value | Unit |
|------------------------------------|-----------------|----------------------------|-------------|
| Test frequency | F | 13.25 | GHz |
| GSO orbital longitude | GSO_lon | 13.0 | deg |
| GSO service area latitude bounds | - | from 23.55 to 63.55 | deg |
| GSO service area longitude bounds | - | from -9.72 to 30.28 | deg |
| A-ESIM antenna peak gain | G_{max} | 32.7 | dBi |
| Antenna gain pattern | - | APEREC015V01 | |
| \Polarization loss | L_{Pol} | 0.0 | dB |
| Fuselage attenuation model | L_f | See Table A4-4 | |
| Atmospheric loss | L_{atm} | Recommendation ITU-R P.676 | |
| Minimum examination altitude range | H_{min} | 0.02 | km |
| Maximum examination altitude range | H_{max} | 15.0 | km |
| Examination altitude range spacing | H_{step} | 1.0 | km |

TABLE A4-4

Fuselage attenuation model from Report ITU-R M.2221

| | | | |
|--|----|-----|-------------------------------------|
| $L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$ | dB | for | $0^\circ \leq \gamma \leq 10^\circ$ |
| $L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$ | dB | for | $10^\circ < \gamma \leq 34^\circ$ |
| $L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$ | dB | for | $34^\circ < \gamma \leq 50^\circ$ |
| $L_{fuse}(\gamma) = 35$ | dB | for | $50^\circ < \gamma \leq 90^\circ$ |

TABLE A4-5
Tested pfd limits on the ground

The maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single earth station on aircraft shall not exceed:

| | | | |
|-------------------|------------------------------|-----|-----------------------------------|
| -123.5 | dB(W/(m ² · MHz)) | for | $\theta \leq 5^\circ$ |
| -128.5 + θ | dB(W/(m ² · MHz)) | for | $5^\circ < \theta \leq 40^\circ$ |
| -88.5 | dB(W/(m ² · MHz)) | for | $40^\circ < \theta \leq 90^\circ$ |

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

The paragraphs below represent the step-by-step application of the calculation methodology described in section 3.

START


- i) For the emission in Table A4-2, the reference e.i.r.p. ($EIRP_R$, dBW) is computed and the relevant results are included in Table A4-6 below:

TABLE A4-6
Computed values of $EIRP_R$ for the Group under consideration

| Emission | G _{Max} , dBi | G _{Isol_{Max}} , dB | P _{Max} , dB(W/Hz) | BW, MHz | EIRP _R , dBW |
|----------|------------------------|--------------------------------------|-----------------------------|------------|-------------------------|
| 1 | 32.7 | 35.2 | -70 | 6.0 – 12.5 | -12.5 |

- ii) Generate δ_n angles compatible with the pfd limits described in Table A4-5:
 $\delta_n = 0^\circ, 0.01^\circ, 0.02^\circ, \dots, 0.3^\circ, 0.4^\circ, \dots, 12.3^\circ, 12.4^\circ, \dots, 13^\circ, 14^\circ, \dots, 90^\circ$.
- iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, compute $EIRP_{C_j}$. The output of this step is summarized in Table A4-7 below:

TABLE A4-7
Computed $EIRP_{C_j}$ values (see embedded file for full results)

| j | H _j (km) | EIRP _{C_{j,n}} (δ_n, γ_n) dB(W/BW _{Ref}) | | | | EIRP _{C_j} dB(W/BW _{Ref}) |
|-----|------------------------|---|-----------------------|-----|---------------------|---|
| | | $\delta = 0^\circ$ | $\delta = 0.01^\circ$ | ... | $\delta = 90^\circ$ | |
| 1 | 0.02 |  Table A.2.9_1.15.xlsx | | | | -40.62 |
| 2 | 1.00 | | | | | -26.84 |
| 3 | 2.00 | | | | | -20.77 |
| ... | ... | | | | | ... |
| 16 | 15.00 | | | | | -3.27 |

- iv) For the emission, check whether there is at least one altitude for which $EIRP_{C_j} > EIRP_R$. The result of this step is summarized in Table A4-8 below:

TABLE A4-8

Comparison between $EIRP_{C_j}$ and $EIRP_R$

| Emission | $EIRP_R$ dB(W) | Smallest j for which $EIRP_{C_j} > EIRP_R$ | $EIRP_{C_j} > EIRP_R$ |
|----------|-------------------|--|-----------------------|
| 1 | -12.5 | 5 | Yes |

- v) Since the emission among those included in the Group under examination passes the test detailed in iv) above, the results of the Bureau's examination for this Group are *favourable*.
- vi) The Bureau publishes:
The finding (here, favourable) for the Group of the GSO network examined.

~~Annex 5 TO draft new RESOLUTION [A115] (WRC 23)~~

~~Option 1:~~

~~Required ESIM software and hardware capabilities~~

~~In order to enable the ESIM to cease transmission when the conditions described are met, the ESIM network shall be designed with appropriate software or hardware capabilities. The table below describes applicable minimum software and hardware capabilities, with a justification for their requirement.~~

~~Also it is important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.~~

~~For each ESIM, the NCMC will have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and satellite system. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.~~

~~Table A5-1~~

~~Minimum ESIM capabilities and justification~~

| Capability | Justification |
|---|--|
| GNSS (or other geolocation capabilities) | Required to assess ESIM's geographic location so ESIM is aware when entering the administration's territory that has not given authorization and feedback to software to cease transmissions accordingly. |
| Monitor loss of frequency lock | Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band. |
| Monitor loss of LO signal | Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band. |
| Internal power off/on/reset | Required for the ESIM to have the ability to self power down after experiencing a fault condition, then restart or power back on when fault is resolved. |

| Capability | Justification |
|--|--|
| Disable/enable transmission and level adjustment | Required to cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions. |
| Receive and execute commands from NCMC | Required to receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions. |

Furthermore, the ESIM shall have the ability to enter the states described in Table A5-2. These states are required to ensure the ESIM is in the correct radio interface state after some event (such as an initial boot or resuming operations after a fault) and can test system functionality is correct before radiating in order to avoid any transmission errors.

Table A5-2
ESIM states and events¹⁰

| ESIM state | Radio interface state | Corresponding event |
|-----------------------|-----------------------|---|
| Non-valid | Emissions disabled | After power on, until ESIM can receive commands from NCMC and no fault conditions are present After any failure/fault During system checks |
| Initial phase | Emissions disabled | When waiting for a transmission enable or disable command from NCMC |
| Transmission enabled | Carrier off | No carrier transmitted/need for carrier to be transmitted Receive synchronization is lost Pointing threshold is exceeded |
| | Carrier on | During transmission and ESIM is correctly pointed |
| Transmission disabled | Emissions disabled | When commanded by NCMC or ESIM automatically enters based on a "Cease Transmission" condition In locations where transmission is not permitted |

Option 2:

Annex 5 is not needed and these elements can be captured in the ITU-R Reports and/or Recommendations.

Reasons: —

¹⁰ Heavily adapted from EN 303 979.

SUP THA/5530A15/4

RESOLUTION 172 (WRC-19)

Operation of earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space)

Reasons: Thailand supports Method B in the CPM Report which proposes to add a new footnote No. **5.A115** in RR Article **5** and a new WRC Resolution providing the conditions for the operation of ESIM and protection of the services to which the frequency band is allocated, and consequential suppression of Resolution **172 (WRC-19)**.



PLENARY MEETING

**Addendum 16 to
Document 5531-E
23 August 2023
Original: English**

Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.16

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

ARTICLE 5

Frequency allocations

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

MOD THA/5531A16/1

15.4-18.4 GHz

| Allocation to services | | |
|--|---|--|
| Region 1 | Region 2 | Region 3 |
| 17.7-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.517A ADD 5.A116 (Earth-to-space) 5.516 MOBILE | 17.7-17.8 FIXED FIXED-SATELLITE (space-to-Earth) 5.517 5.517A ADD 5.A116 (Earth-to-space) 5.516 BROADCASTING-SATELLITE Mobile 5.515 <hr/> 17.8-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.517A ADD 5.A116 (Earth-to-space) 5.516 MOBILE 5.519 | 17.7-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.517A ADD 5.A116 (Earth-to-space) 5.516 MOBILE |
| 18.1-18.4 | FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A ADD 5.A116 (Earth-to-space) 5.520 MOBILE 5.519 5.521 | |

Reasons:

MOD THA/5531A16/2

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 ADD 5.A116 MOBILE | |
| ... | | |
| 18.8-19.3 | FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A ADD 5.A116 MOBILE | |
| ... | | |
| 19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116 Mobile-satellite (space-to-Earth) | 19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116 MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 5.529 | 19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116 Mobile-satellite (space-to-Earth) |
| 5.524 | | 5.524 |
| 20.1-20.2 | FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A ADD 5.A116 MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 | |

Reasons:

MOD THA/5531A16/3

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 ADD 5.A116 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 ADD 5.A116 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540 | | |
| ... | | |
| 29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116 Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542 | 29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.525 5.526 5.527 5.529 5.540 | 29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116 Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542 |

Reasons:

MOD **THA/5531A16/4**

29.9-34.2 GHz

| Allocation to services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 29.9-30 | FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 ADD 5.A116 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542 | |

Reasons:

ADD **THA/5531A16/5**

5.A116 The operation of earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service in the frequency bands 17.7-18.6 GHz (space-to-Earth), 18.8-19.3 GHz (space-to-Earth) and 19.7-20.2 GHz (space-to-Earth), 27.5-29.1 GHz (Earth-to-space) and 29.5-30 GHz (Earth-to-space) shall be subject to the application of Resolution **[A116]** (**WRC-23**). (WRC-23)

Reasons:

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)

² The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

Footnotes to Tables A, B, C and D

MOD THA/5531A16/6

TABLE A
GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM,
EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-1923)

Option 1:

| Items in Appendix | <i>A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION</i> | Advance publication of a geostationary-satellite network | Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9 | Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9 | Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A) | Notification or coordination of a non-geostationary-satellite network or system | Notification or coordination of an earth station (including notification under Appendices 30A or 30B) | Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5) | Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5) | Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8) | Items in Appendix | Radio astronomy |
|------------------------|---|--|--|--|--|---|---|---|--|---|------------------------|-----------------|
| A.24 | COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION | | | | | | | | | | A.24 | |
| A.24.a | a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution 32 (WRC-19) is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification | | | | | + | | | | | A.24.a | |
| A.25 | <u>COMPLIANCE WITH <i>resolves 1.1.3 OF RESOLUTION 169 (WRC-19)</i></u> | | | | | | | | | | A.25 | |
| A.25.a | <u>a commitment that the ESIM operation would be in conformity with the Radio Regulations and draft new Resolution [A116] (WRC-23)</u> <u>Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23)</u> | | | | | I+ | | | | | A.25.a | |
| A.26 | <u>COMPLIANCE WITH <i>resolves 4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)</i></u> | | | | | | | | | | A.26 | |
| A.26.a | <u>a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the non-GSO FSS network with which ESIMs communicate shall follow the procedures in <i>resolves 6 of draft new Resolution [A116] (WRC-23)</i></u> <u>Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23)</u> | | | | | I+ | | | | | A.26.a | |
| A.27 | <u>COMPLIANCE WITH <i>resolves 1.2.4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)</i></u> | | | | | | | | | | A.27 | |
| A.27.a | <u>a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 to draft new Resolution [A116] (WRC-23)</u> <u>Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23)</u> | | | | | I+ | | | | | A.27.a | |

Option 2:

| Items in Appendix | A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION | Advance publication of a geostationary-satellite network | Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9 | Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section III of Article 9 | Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A) | Notification or coordination of a non-geostationary-satellite network or system | Notification or coordination of an earth station (including notification under Appendices 30A or 30B) | Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5) | Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5) | Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8) | Items in Appendix | Radio astronomy |
|-------------------|--|--|--|---|--|---|---|---|--|---|-------------------|-----------------|
| ... | | | | | | | | | | | | |
| A.20 | COMPLIANCE WITH <i>resolves</i> 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 <i>resolves</i> 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 <i>resolves</i> 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 <i>resolves</i> 7 OF RESOLUTION 169 (WRC-19) | | | | | | | | | | A.22 | |
| A.22.a | a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part II of Annex 3 to Resolution 169 (WRC-19) Required only for the notification of earth stations in motion submitted in accordance with Resolution 169 (WRC-19) | | | | + | | | | | | A.22.a | |
| A.23 | COMPLIANCE WITH RESOLUTION 35 (WRC-19) | | | | | | | | | | A.23 | |
| A.23.a | a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments to the non-geostationary-satellite system | | | | | O | | | | | A.23.a | |
| A.24 | COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION | | | | | | | | | | A.24 | |
| A.24.a | a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution 32 (WRC-19) is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification | | | | | + | | | | | A.24a | |
| A.25 | COMPLIANCE WITH <i>resolves</i> 1.1.1.1 OF RESOLUTION [A116] (WRC-23) | | | | | | | | | | A.25 | |
| A.25.a | a commitment that the ESIM operation would be in conformity with the Radio Regulations and Resolution [A116] (WRC-23) Required only for the notification of earth stations in motion submitted in accordance with Resolution [A116] (WRC-23) | | | | | + | | | | | A.25.a | |
| A.26 | COMPLIANCE WITH <i>resolves</i> 1.1.5 OF RESOLUTION [A116] (WRC-23) | | | | | | | | | | A.26 | |
| A.26.a | a commitment that the ESIM operation would be in conformity with the <i>resolves</i> 1.1.5 of Resolution [A116] (WRC-23) Required only for the notification of earth stations in motion submitted in accordance with Resolution [A116] (WRC-23) | | | | | + | | | | | A.26.a | |

| | | | | | | | | | | | | | | | |
|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|----------------------|------------------------|--|
| A.27 | COMPLIANCE WITH <i>resolves 4 OF RESOLUTION [A116] (WRC-23)</i> | | | | | | | | | | | | A.27 | | |
| A.27.a | a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the GSO FSS network with which ESIMs communicate shall follow the procedures in <i>resolves 5 of Resolution [A116] (WRC-23)</i> Required only for the notification of earth stations in motion submitted in accordance with <i>Resolution [A116] (WRC-23)</i> | | | | | | | | | | | | | A.27.a | |
| A.28 | COMPLIANCE WITH <i>resolves 1.2.2 OF RESOLUTION [A116] (WRC-23)</i> | | | | | | | | | | | | A.28 | | |
| A.28.a | a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part II of Annex 1 to Resolution [A116] (WRC-23) Required only for the notification of earth stations in motion submitted in accordance with <i>Resolution [A116] (WRC-23)</i> | | | | | | | | | | | | | A.28.a | |

Option 3:

| Items in Appendix | A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION | Advance publication of a geostationary-satellite network | Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9 | Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9 | Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A) | Notification or coordination of a non-geostationary-satellite network or system | Notification or coordination of an earth station (including notification under Appendices 30A or 30B) | Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5) | Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5) | Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8) | Items in Appendix | Radio astronomy |
|------------------------|---|--|--|--|--|---|---|---|--|---|------------------------|-----------------|
| A.24 | COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION | | | | | | | | | | A.24 | |
| A.24.a | a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution 32 (WRC-19) is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification | | | | | | | | | | A.24.a | |
| A.25 | COMPLIANCE WITH <i>resolves 1.1.3 OF RESOLUTION 169 (WRC-19)</i> | | | | | | | | | | A.25 | |
| A.25.a | a commitment that the ESIM operation would be in conformity with the Radio Regulations and draft new Resolution [A116] (WRC-23) Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23) | | | | | | | | | | A.25.a | |
| A.26 | COMPLIANCE WITH <i>resolves 4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)</i> | | | | | | | | | | A.26 | |
| A.26.a | a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the non-GSO FSS network with which ESIMs communicate shall follow the procedures in <i>resolves 6 of draft new Resolution [A116] (WRC-23)</i> Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23) | | | | | | | | | | A.26.a | |
| A.27 | COMPLIANCE WITH <i>resolves 1.2.4 OF DRAFT NEW RESOLUTION [A116] (WRC-23)</i> | | | | | | | | | | A.27 | |
| A.27.a | a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 to draft new Resolution [A116] (WRC-23) Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23) | | | | | | | | | | A.27.a | |
| A.28 | COMPLIANCE WITH <i>resolves 1.1.6 OF DRAFT NEW RESOLUTION [A116] (WRC-23)</i> | | | | | | | | | | A.28 | |
| A.28.a | an indication of whether the LEO system with which the ESIMs communicate employs a frequency reuse scheme with at least three colours. Required only for the notification of earth stations in motion submitted in accordance with draft new Resolution [A116] (WRC-23) | | | | | | | | | | A.28.a | |

Reasons:

SUP THA/5531A16/7

RESOLUTION 173 (WRC-19)

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

Reasons:

ADD THA/5531A16/8

DRAFT NEW RESOLUTION [A116] (WRC-23)

There are several areas in which there are no consensus either on the text or how to proceed with the implementation of this Resolution. Consequently, the text below is not consistent with *resolves 5* of Resolution 173 (WRC-19).

Resolves the ITU Radiocommunication Sector to ensure that the results of ITU-R studies are agreed by Member States by consensus

Option 1:

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

Option 2:

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that there is a need for global broadband mobile satellite communications, and that some of this need could be met by allowing earth stations in motion (ESIMs) to communicate with space stations of the non-geostationary-satellite orbit (non-GSO) fixed-satellite service (FSS) operating in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth), and 27.5-29.1 GHz and 29.5-30.0 GHz (Earth-to-space);

b) that the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) are allocated to space services, and the

frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, and 27.5-29.1 GHz are allocated to terrestrial services on a primary basis worldwide; in the countries identified in No. 5.524 of the Radio Regulations, the frequency band 19.7-20.2 GHz is allocated to the fixed and mobile services on a primary basis; and, in the countries identified in No. 5.542 of the Radio Regulations, the frequency band 29.5-30 GHz is allocated to the fixed and mobile services on a secondary basis, and used by a variety of different systems and these existing services and their future development need to be protected, without any additional constraints, from the operation of non-GSO ESIMs;

NOTE: There should be a necessary assurance that these secondary status assignments could continue to render services which were designed for before any allocation be made to ESIM under agenda item 1.16. This assurance does not exist to date.

c) that the frequency band 18.6-18.8 GHz is allocated to the Earth exploration-satellite service (EESS) (passive) and space research service (SRS) (passive) and that these services need to be protected from operation of non-GSO FSS in the space-to-Earth direction;

Option 1:

d) that there is no specific regulatory procedure for the coordination of non-GSO ESIMs relative to terrestrial stations for these services since the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) are not allocated for the operation of non-GSO ESIMs;

Option 2:

No *considering d)* is needed

e) that regulatory procedures and interference-management mechanisms, including necessary mitigation measures, are required for the operation of non-GSO ESIMs to protect other space and terrestrial services allocated in the frequency bands mentioned in *considering a)*,
considering further

Option 1:

a) that administrations intending to authorize non-GSO ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures mutually agreed than those contained in this Resolution as long as the provisions in Annex 1 are unchanged in cross-border applications;

Option 2:

a) that administrations intending to authorize non-GSO ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures than those contained in this Resolution as long as the provisions in Annex 1 are unchanged in cross-border applications;

Option 3:

No *considering further a)* is needed

b) that aeronautical and maritime ESIMs operating within the service area of the non-GSO FSS systems with which they communicate may provide service within the territories under the jurisdiction of multiple administrations;

c) that this Resolution does not establish any technical or regulatory provisions for the operation and use of land ESIMs communicating with non-GSO FSS space stations, and any

authorization of land ESIMs remains strictly a national matter, taking also into account the need to avoid cross-border interference,

recognizing

- a) that the administration authorizing non-GSO ESIMs on the territory under its jurisdiction has the right to require that non-GSO ESIMs referred to above only use those assignments associated with non-GSO FSS systems which have been successfully coordinated, notified, brought into use and recorded in the Master International Frequency Register (MIFR) with a favourable finding under Articles 9 and 11, including Nos. 11.31, 11.32 or 11.32A, where applicable;
- b) that the provisions of No. 22.2 apply to non-GSO FSS satellite systems with which ESIMs operate in the frequency band 17.7-17.8 GHz (space-to-Earth) with respect to GSO FSS and GSO BSS networks;
- c) that, under the provisions of No. 22.2, non-GSO ESIMs in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz shall not claim protection from GSO FSS and GSO BSS networks operating in accordance with these Regulations, and non-GSO ESIMs in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz shall not cause unacceptable interference to GSO FSS and GSO BSS networks operating in accordance with the Radio Regulations, and No. 5.43A does not apply in this case;
- d) that there is no obligation for administration to authorize/license any non-GSO ESIMs to operate within the territory under its jurisdiction;
- e) that, for the implementation of the relevant parts of *resolves* 1.1.2 below that a non-GSO FSS system operating in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) in compliance with the efd limits referred to in Nos. 22.5C, 22.5D and 22.5F is considered as having fulfilled its obligations under No. 22.2 with respect to any geostationary-satellite network;
- f) that, with respect to GSO FSS networks, in the frequency bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) Nos. 9.12A and 9.13 apply, and No. 22.2 does not apply;
- g) that, for the use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-GSO FSS systems, No. 9.12 applies,

Option 1:

- h) that affected administrations retain their right to directly contact the registrar for the aircraft or vessel on which the ESIM operates;
- i) that in case of unacceptable interference, affected administrations may request the administration authorizing the ESIM to operate in the territory under its jurisdiction to provide any information, if available, on a voluntary basis in regard with interference,

It was emphasized that the proponent of this option is urged to provide details on how an affected administration could reach or contact an aircraft or vessel.

It was also emphasized that right of administrations are not issues to be referred to in a recognizing of any Resolution, due to the fact that the Constitution of the ITU clearly defined rights and obligations of Administrations.

Option 2:

Recognizing h) and i) are to be deleted

recognizing further

- a) that frequency assignments to non-GSO ESIMs need to be notified to the Radiocommunication Bureau (BR);
- b) that the notification by different administrations of frequency assignments to be used by the same non-GSO satellite system may create difficulties to identify the responsible administration in case of unacceptable interference;
- c) that, an administration authorizing the operation of ESIMs within the territory under its jurisdiction may modify or withdraw that authorization at any time,

resolves

1 that, for any aeronautical or maritime ESIM communicating with non-GSO FSS space stations in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space), or parts thereof, the following conditions shall apply:

1.1 with respect to space services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz (space-to-Earth), and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space), and in their adjacent bands in the frequency band 18.6-18.8 GHz, non-GSO ESIMs shall comply with the following conditions:

Option 1:

1.1*bis* an administration the territory of which is situated inside the service area of a non-GSO FSS satellite system and has provided explicit authorization to receive the service/to be served by any type of ESIM has no obligation nor any mandate, whatsoever, to be involved directly or indirectly in detection, identification, reporting, resolution of any interference caused by the operation of the ESIM the operation of which was authorized:

Option 2:

No *resolves* 1.1*bis* is needed

- 1.1.1 to prevent potential interference with respect to satellite networks or systems of other administrations non-GSO ESIMs characteristics shall remain within the envelope characteristics of typical earth stations associated with the non-GSO FSS system with which these ESIMs communicate;
- 1.1.1.1 for the implementation of *resolves* 1.1.1 above, the notifying administration for the non-GSO FSS system with which the non-GSO ESIMs communicate shall, in accordance with this Resolution, send to the BR Appendix 4 notification information related to the characteristics of the non-GSO ESIMs intended to communicate with that non-GSO FSS system, together with the commitment that the operation shall be in conformity with the Radio Regulations, including this Resolution;
- 1.1.1.2 upon receipt of the notification information referred to in *resolves* 1.1.1.1 above, the Bureau shall examine it with respect to the provisions referred to in *resolves* 1.1.1 above, including the commitment referred to in *resolves* 1.1.1.1 above, and publish the result of such examination in the International Frequency Information Circular (BR IFIC);

- 1.1.2 the notifying administration of the non-GSO FSS system with which the ESIMs communicate shall ensure that the operation of ESIMs complies with the coordination agreements for the frequency assignments of the typical earth station of this non-GSO FSS system obtained under the provisions of Article 9 of the Radio Regulations, taking into account *recognizing b*);
- 1.1.3 notifying administration of the non-GSO FSS system with which the ESIMs communicate shall ensure that non-GSO ESIMs comply with the epfd limits referred to in Nos. **22.5C**, **22.5D** and **22.5F** for the protection of GSO FSS networks operating in the frequency bands 17.8-18.6 GHz, 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) (*see recognizing g*);
- 1.1.4 non-GSO ESIMs shall not claim protection from BSS feeder-link earth stations operating in accordance with the Radio Regulations in the frequency band 17.7-18.4 GHz;
- 1.1.5 with respect to protection of EESS (passive) operating in the frequency band 18.6-18.8 GHz, any non-GSO FSS systems with an orbital apogee of less than 20 000 km operating in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with which aeronautical and/or maritime ESIMs communicate and for which the complete notification information has been received by the BR after 1 January 2025 shall comply with the provisions indicated in Annex 3 to this Resolution;
- 1.1.5.1 for the implementation of *resolves* 1.1.6 above, the notifying administration for the non-GSO FSS system with which the non-GSO ESIMs communicate shall send to the BR the relevant Appendix 4 notification information including the commitment that the operation shall be in conformity with *resolves* 1.1.6;
- 1.2 with respect to terrestrial services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, 19.7-20.2 GHz, 27.5-29.1 GHz and 29.5-30 GHz, non-GSO ESIMs shall comply with the following conditions:
 - 1.2.1 receiving non-GSO ESIMs in the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (*see No. 5.524*) shall not claim protection from assignments in the terrestrial services to which those frequency bands are allocated and that operate in accordance with the Radio Regulations;
 - 1.2.2 transmitting non-GSO ESIMs in the frequency band 27.5-29.1 GHz shall not cause unacceptable interference to terrestrial services to which the frequency band is allocated and that operate in accordance with the Radio Regulations, and Annex 1 to this Resolution shall apply;
 - 1.2.3 transmitting non-GSO ESIMs in the frequency band 29.5-30.0 GHz shall not adversely affect the operations of terrestrial services to which this frequency band is allocated on secondary basis and that operate in accordance with the Radio Regulations, and limits in Annex 1 to this Resolution shall apply with respect to administrations mentioned in No. **5.542**;

Option 1:

- 1.2.4 the provisions in this Resolution, including Annex 1, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO ESIMs in neighbouring countries in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 above in the frequency band 27.5-29.1 GHz and in the frequency band 29.5-30.0 GHz; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and operating in accordance with the Radio Regulations remains valid (*see resolves* 6);

Option 2:

- 1.2.4 the provisions in this Resolution, including Annex 1, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO ESIMs in neighbouring countries in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 above in the frequency band 27.5-29.1 GHz and in the frequency band 29.5-30.0 GHz as guidance for administrations; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and operating in accordance with the Radio Regulations remains valid (see *resolves* 6);

Option 3:

- 1.2.4 the provisions in this Resolution, including Annex 1, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO ESIMs in neighbouring countries in accordance with the provisions included in *resolves* 1.2.2 and 1.2.3 above in the frequency band 27.5-29.1 GHz and in the frequency band 29.5-30.0 GHz with respect to administrations mentioned in No. **5.542**; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and operating in accordance with the Radio Regulations remains valid (see *resolves* 6);

NOTE: START of a section that was not discussed in detail at CPM23-2

Scenario 1 (Applies if the relevant methodology is included in Annex 2)

- 1.2.5 the Bureau shall examine, in accordance with the provisions included in *resolves* [1.2.2](#) and [1.2.3](#) ~~above~~ and with the methodology in Annex 2, the characteristics of aeronautical non-GSO ESIMs with respect to the conformity with the power flux-density (pfd) limits on the Earth's surface specified in Part 2 of Annex 1 [to this Resolution](#) and publish the results of such examination in the BR IFIC;
- [1.2.5.1](#) [however, the compliance with the technical conditions in Annex 1, does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;](#)

Scenario 2 (Applies if the relevant methodology is not included in Annex 2 by the end of WRC-23)

- 1.2.5 the Bureau shall examine, in accordance with the provisions included in *resolves* [1.2.2](#) and [1.2.3](#) ~~above~~, the characteristics of aeronautical non-GSO ESIMs with respect to the conformity with the power flux-density (pfd) limits on the Earth's surface specified in Part 2 of Annex 1, and publish the results of such examination in the BR IFIC;
- 1.2.6 if the BR is unable to examine, in accordance with *resolves* [1.2.45](#) ~~above~~, non-GSO aeronautical ESIMs with respect to conformity with the pfd limits specified in Part 2 of Annex 1, ~~the Bureau shall request~~ the notifying administration ~~to~~ [shall](#) send to [the](#) BR a commitment to ensure that the aeronautical non-GSO ESIMs comply with those limits;
- 1.2.7 the BR shall formulate a qualified favourable finding under No. **11.31** with respect to the pfd limits contained in Part 2 of Annex 1, otherwise the BR shall formulate an unfavourable finding;
- 1.2.8 ~~after the successful application of resolves 1.2.4,~~ once the methodology to examine the characteristics of aeronautical non-GSO ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 is available, *resolves* [1.2.54](#) shall be applied by the Bureau;

- 1.2.8 after the successful application of *resolves* 1.2.46 and 1.2.7, once the methodology to examine the characteristics of aeronautical non-GSO ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part 2 of Annex 1 is available, *resolves* 1.2.5 shall be applied by the Bureau;

NOTE: END of a section that was not discussed in detail at CPM23-2

- 1.3 that, in the case unacceptable interference caused by A-ESIM and/or M-ESIM is reported:

Option 1:

- 1.3.1 only the notifying administration of the non-GSO FSS system with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

Option 2:

- 1.3.1 the notifying administration of the non-GSO FSS system with which ESIMs communicate is responsible for resolving the case of unacceptable interference;
- 1.3.2 the notifying administration of the non-GSO FSS system with which the ESIMs communicate shall immediately take the required action to eliminate or reduce interference to an acceptable level;
- 1.3.3 the affected administration(s) may assist resolving or provide information that would facilitate resolving the case of unacceptable interference;

Option 1:

- 1.3.4 the administration authorizing the operation of A-ESIM and M-ESIM on territory under its jurisdiction, subject to its explicit agreement, may provide assistance, including information for the resolution of unacceptable interference;

Option 2:

- 1.3.4 the administration authorizing the operation of A-ESIM and M-ESIM on the territory under its jurisdiction shall, to the extent of its ability, cooperate to assist in the resolution of unacceptable interference, including providing information as necessary;
- 1.3.5 the administration responsible for the aircraft or vessel on which the ESIM operates shall provide a point of contact to assist identifying the notifying administration of the satellite with which the ESIM communicates;

- 1.4 that the notifying administration of non-GSO FSS satellite system with which ESIMs communicate shall ensure that:

- 1.4.1 for the operation of A-ESIM and M-ESIM, techniques are employed to maintain adequate antenna pointing accuracy with the associated non-GSO FSS satellite;
- 1.4.2 all necessary measures shall be taken so that earth stations on aircraft and vessels are subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) in order to comply with the provisions in this Resolution, and are capable of receiving and immediately acting upon inter alia “enable transmission” and “disable transmission” commands from the NCMC (see Annex 4);
- 1.4.3 measures are taken so that the A-ESIM and/or M-ESIM do not transmit on the territory under the jurisdiction of an administration, including its territorial waters and its national airspace, that has not authorized its use;
- 1.4.4 the notifying administration of the non-GSO FSS system with which ESIMs communicate shall provide a permanent point of contact in the Appendix 4 submission

and this shall be published in the relative special section of the BR IFIC for the purpose of tracing any suspected cases of unacceptable interference from A-ESIMs or M-ESIMs and for the purpose of immediately responding to the relevant requests;

NOTE: START of a section that was not discussed in detail at CPM23-2

2 that non-GSO ESIMs shall not be used or relied upon for safety-of-life applications;

~~3 that the operation of non-GSO ESIMs within the territory, including territorial waters and airspace, of an administration shall be carried out only if a licence according to No. 18.1 of that administration is obtained, authorized by that administration;~~

43 that the operation of non-GSO ESIMs within the territory, including territorial waters and airspace, under the jurisdiction of any administration shall be carried out only if an authorization or a licence according to No. 18.1 of from that administration is obtained;

45 that the notifying administrations of those non-GSO FSS systems with which non-GSO ESIMs in the frequency bands ~~as detailed in considering a)~~ above are intended to operate shall submit a commitment to the Bureau to immediately act~~take the required action~~ to eliminate or reduce the interference to an acceptable level upon receiving a report of unacceptable interference (see *resolves* 56);

NOTE: END of a section that was not discussed in detail at CPM23-2

Option 1:

5 in case there is more than one administration involved in the notification of frequency assignments of the same non-GSO satellite system with which ESIMs communicate, those administrations shall nominate one administration as the notifying administration responsible to act on their behalf to be responsible to eliminate any unacceptable interference cases and inform the Bureau accordingly;

Option 2:

No *resolves* 5 is needed

NOTE: START of a section that was not discussed in detail at CPM23-2

Option 1

~~86~~ that the application of this Resolution does not provide regulatory status to non-GSO ESIMs different from that derived from the non-GSO FSS satellite system with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing b)* ~~above~~),

Option 2

~~86~~ that the application of this Resolution does not provide regulatory status to non-GSO ESIMs different from that derived from the non-GSO FSS satellite system with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing b)* ~~above~~);₅

7 that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the non-GSO FSS satellite system with which non-GSO ESIMs communicate or on the coordination requirements of that satellite system;

NOTE: END of a section that was not discussed in detail at CPM23-2

Option 1:

8 the implementation of this Resolution remains in abeyance pending an agreement to be universally reached on the issue of the interference management system, monitoring facilities' effectiveness and immediate response of MCNC, cessation of transmission over territories which have not explicitly authorized the functioning and operation of any ESIM over their territories providing satisfactory resolution of the problem, as referred to in *recognizing further d)* above,

Option 2:

8 the implementation of this Resolution is conditioned on providing a description to the administrations whose authorization is sought of interference management system(s), monitoring facilities (NMC), dealing with the cessation of transmission over territories which have not authorized (*see resolves 3*) the functioning and operation of any ESIM over their territories in order to provide a satisfactory resolution of the problem as referred to in *recognizing further d)* above,

NOTE: Provided the description mentioned above is properly addressed and concluded, *resolves 9* above may be deleted at WRC-23

resolves further

1 that ESIMs shall not cause unacceptable interference to nor claim protection from other services as referred to *recognizing c)* and *d)* and in *resolves 1.1.1.1, 1.1.6.1, 1.2.1 and 1.2.4;*

2 that the notifying administration for the ESIMs shall send to the BR, when submitting the relevant Appendix 4 data a commitment (as stipulated in *resolves 5*) that, upon receiving a report of unacceptable interference, the notifying administration for the non-GSO system with which ESIMs communicate shall remove such interference;

3 that the commitment referred to in *resolves further 2* shall be objective, measurable and enforceable;

4 that, in case of continued unacceptable interference despite of the commitment referred to in *resolves further 2*, the assignment causing interference shall be submitted to the Radio Regulation Board for review;

5 that compliance with the provisions contained in Annex 1 does not release the notifying administration of the non-GSO satellite system with which ESIMs communicate of its obligations mentioned in *resolves further 1* above.

NOTE: START of a section that was not discussed in detail at CPM23-2

~~16~~ that frequency assignments to ~~non-GSO~~ ESIMs shall be notified by the notifying administration of the non-GSO satellite system in the FSS with which ESIMs communicate;

Option 1

~~27~~ that the notifying administration of the satellite system shall ensure that non-GSO ESIMs operate only in the territory under the jurisdiction of ~~any~~ administration/~~country~~ from which an authorization has been obtained, taking into account *recognizing further d)* above;

Option 2

~~2~~ that the notifying administration of the satellite system shall ensure that non-GSO ESIMs operate only in the territory under the jurisdiction of any administration/country from which an authorization has been obtained, taking into account *recognizing further d)* above;

~~38~~ that, for the implementation of *resolves further 2* above, the notifying administration of the satellite system in the FSS with which non-GSO ESIMs communicate shall ensure that ESIMs

~~are~~shall be designed and operate so as to cease transmission over the territory of any administration/country from which authorization has not been obtained;

Option 1

~~93bis~~ ~~that, for the implementation of resolves further 2 and 3 above, the system shall employ the minimum software and hardware capabilities listed in Annex 4;~~

[Editor's note: Such hardware and software requirements are not appropriate in a resolution and would be better kept in a report or recommendation if required.]

Option 2 (if Annex 4 is maintained)

~~93bis~~ that, for the implementation of resolves further 2 above, the system shall employ the minimum software and hardware capabilities listed in Annex 4;

104 that, for the implementation of *resolves further 1* ~~above~~, the notifying administration responsible for the operation of aeronautical and maritime non-GSO ESIMs shall also be responsible for observing and complying with all relevant regulatory and administrative provisions applicable to the operation of the ~~above-mentioned~~ ESIMs as included in this Resolution and those contained in the Radio Regulations;

Option 1

~~511~~ that the authorization to non-GSO ESIMs to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the non-GSO satellite system with which the non-GSO ESIMs communicate from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations;

Option 2

~~5~~ ~~that the authorization to non-GSO ESIMs to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the satellite system with which non-GSO ESIMs communicate from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations;~~

Option 1

126 that, should an administration authorizing aeronautical non-GSO ESIMs agree to pfd levels higher than the limits contained in Part 2 of Annex 1 to this Resolution within the territory under its jurisdiction, such agreement shall not affect other countries that are not party to that agreement,

Option 2

126 that, should an administration authorizing aeronautical and/or maritime non-GSO ESIMs agree to ~~pfd levels higher than the less stringent~~ limits than those contained ~~in Part 2 of~~ Annex 1 within the territory under its jurisdiction, such agreement shall not affect other countries that are not party to that agreement,

instructs the Director of the Radiocommunication Bureau

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

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution, including whether or not the

responsibilities relating to the operation of aeronautical and maritime non-GSO ESIMs have been properly addressed;

3 ~~_____~~ not to examine, under No. 11.31, the conformity of non-GSO FSS systems with the provisions of *resolves* 1.1.5 of this Resolution,

Option 1

~~3 _____ to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of Recommendation ITU-R S.1503 for verifying that the non-GSO FSS systems under this Resolution comply with the epfd limits specified in Article 22;~~

Option 2

~~34 _____ to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of Recommendation ITU-R S.1503 for verifying that the non-GSO FSS systems under this Resolution comply with the epfd limits specified in Article 22;~~

Option 1:

5 _____ to publish the list of non-GSO satellite systems with which ESIM communicate brought into use with information about its service area and countries authorize such use if any; this information shall be updated regularly,

Option 2:

5 _____ to publish the list of non-GSO satellite systems with which ESIM communicate brought into use with information about its service area; this information shall be updated regularly,

Note: It was agreed that the issue of identifying the notifying administration is still ambiguous and requires further discussions before taking the decision regarding this draft new resolution, in order to develop a means for the affected administration to identify the notifying administration of the satellite network space station with which the ESIM communicates.

invites administrations

~~to collaborate for the implementation of this Resolution, in particular for resolving interference, if any;~~

to take into consideration the relevant recommendations to employ Annex 4 procedures when licensing/authorizing the operation of earth stations in motion in their territories,

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization and of the Secretary General of the International Civil Aviation Organization.

NOTE: END of a section that was not discussed in detail at CPM23-2

ANNEX 1 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

NOTE: Annex 1 was not discussed in detail at CPM23-2

Provisions for maritime and aeronautical non-GSO ESIMs to protect terrestrial services operating in the frequency band 27.5-29.1 GHz and for the frequency band 29.5-30.0 GHz with respect to/on the territories of/in relation to administrations mentioned in No. 5.542 (see No. 5.542)/as a guidance for administrations when considering to authorize the A-ESIM and M-ESIM in their territories

Option 1:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. ~~The provisions could also be used as a guidance for the operation of the non-GSO ESIMs in 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services.~~

Option 2:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. The provisions ~~could below~~ also ~~be used as a guidance~~ apply for the operation of the non-GSO ESIMs in the frequency band 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services with respect to administrations mentioned in No. 5.542.

Option 3:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and ~~that operating~~ operate in accordance with the Radio Regulations. The provisions ~~in the parts below could also be used as a guidance for the operation of the non-GSO ESIMs~~ also apply in the frequency band 29.5-30 GHz with respect to administrations mentioned in ~~in order not to adversely impact the secondary allocated terrestrial services~~ No. 5.542 of the Radio Regulations.

Option 4:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency bands 27.5-29.1 GHz and 29.5-30 GHz ~~are~~ is allocated and operating in accordance with the Radio Regulations. ~~The provisions could also be used as a guidance for the operation of the non-GSO ESIMs in 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services.~~

Option 5:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. The provisions below also apply ~~could also be used as a guidance~~ for the operation of the non-GSO ESIMs in the frequency band 29.5-30 GHz with respect to administrations mentioned in No. 5.542 (see resolves 1.2.4) ~~in order not to adversely impact the secondary allocated terrestrial services.~~

Option 6:

The parts below contain provisions to ensure that maritime and aeronautical non-GSO ESIMs do not cause unacceptable interference in neighbouring countries to terrestrial service operations when non-GSO ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations and for the frequency band 29.5-30.0 GHz on the territories of administrations mentioned in No. 5.542. ~~The provisions could also be used as a guidance for the operation of the non-GSO ESIMs in 29.5-30 GHz in order not to adversely impact the secondary allocated terrestrial services.~~

Option 7:

~~The provisions below could be applied for guidance to administrations to ensure aeronautical and maritime non-GSO ESIMs do not cause unacceptable interference to terrestrial services to which the frequency band 29.5-30.0 GHz is allocated and that operate in accordance with the Radio Regulations (see No. 5.542—Additional allocation to the fixed and mobile services on a secondary basis in some countries).~~

Option 1:

The provisions below ~~also~~ apply in the frequency band 29.5-30.0 GHz ~~on the territories of~~ with respect to administrations mentioned in No. 5.542.

Option 2:

~~The provisions below also apply in the frequency band 29.5-30.0 GHz on the territories of administrations mentioned in No. 5.542.~~

Part 1: Maritime non-GSO ESIMs

Option 1:

1 The notifying administration of the non-GSO FSS satellite system with which maritime ESIMs communicates shall ensure compliance of the maritime ESIMs operating within the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, or parts thereof, with both of the following conditions for the protection of terrestrial services to which the frequency bands s are ~~is~~ allocated within a coastal State:

Option 2:

1 The notifying administration of the non-GSO FSS satellite system with which maritime ESIMs communicates shall ensure compliance of the maritime ESIMs ~~operating within the~~

~~frequency band 27.5-29.1 GHz, or parts thereof,~~ with both of the following conditions for the protection of terrestrial services to which the frequency band is allocated within a coastal State:

Option 1:

1.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which maritime ESIMs can operate without ~~the prior agreement of any administration~~ is 70 km ~~within the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz~~. Any transmissions from maritime ESIMs within the minimum distance shall be subject to the prior agreement of the coastal State(s) concerned.

Option 2:

1.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which maritime ESIMs can operate without the prior agreement of any administration is 70 km ~~within the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz~~. Any transmissions from maritime ESIMs within the minimum distance shall be subject to the prior agreement of the coastal State(s) concerned.

Option 1:

1.2 The maximum maritime ESIMs e.i.r.p. spectral density towards the territory of any coastal State ~~will~~ shall be limited to ~~12.98/24.44~~ dBW in a reference bandwidth of ~~1/14~~ MHz. Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State(s) concerned.

Option 2:

1.2 The maximum maritime ESIMs e.i.r.p. spectral density towards the territory of any coastal State shall ~~will~~ be limited to ~~12.98/24.44~~ dBW in a reference bandwidth of ~~1/14~~ MHz. Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State(s) concerned.

Option 3:

1.2 The maximum maritime ESIMs e.i.r.p. spectral density towards the territory of any coastal State ~~will~~ shall be limited to [12.98/24.44] dBW in a reference bandwidth of [1/14] MHz. Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State(s) concerned.

Part 2: Aeronautical non-GSO ESIMs

Option 1:

2 The notifying administration of the non-GSO FSS satellite system with which aeronautical ESIMs communicate shall ensure compliance of the aeronautical ESIMs ~~operating within the frequency bands 27.5-29.1 GHz, or parts thereof,~~ with all of the following conditions for the protection of the terrestrial services to which the frequency band is allocated:

Option 2:

2 The notifying administration of the non-GSO FSS satellite system with which aeronautical ESIMs communicate shall ensure compliance of the aeronautical ESIMs operating within the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, ~~or parts thereof,~~ with all of the following conditions for the protection of the terrestrial services to which the frequency bands are ~~is~~ allocated:

2.1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

Option 1:

| | | |
|---|---|---|
| $\text{pfd}(\theta) = -124.7$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot [14] \text{ MHz})))$ | for $0^\circ \leq \theta \leq 0.01^\circ$ |
| $\text{pfd}(\theta) = -120.9 + 1.9 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 14 \text{ MHz})))$ | for $0.01^\circ < \theta \leq 0.3^\circ$ |
| $\text{pfd}(\theta) = -116.2 + 11 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 14 \text{ MHz})))$ | for $0.3^\circ < \theta \leq 1^\circ$ |
| $\text{pfd}(\theta) = -116.2 + 18 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 14 \text{ MHz})))$ | for $1^\circ < \theta \leq 2^\circ$ |
| $\text{pfd}(\theta) = -117.9 + 23.7 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 14 \text{ MHz})))$ | for $2^\circ < \theta \leq 8^\circ$ |
| $\text{pfd}(\theta) = -96.5$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 14 \text{ MHz})))$ | for $8^\circ < \theta \leq 90.0^\circ$ |

Option 2:

| | | |
|---|--|---|
| $\text{pfd}(\theta) = -136.2$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot [1] \text{ MHz})))$ | for $0^\circ \leq \theta \leq 0.01^\circ$ |
| $\text{pfd}(\theta) = -132.4 + 1.9 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $0.01^\circ < \theta \leq 0.3^\circ$ |
| $\text{pfd}(\theta) = -127.7 + 11 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $0.3^\circ < \theta \leq 1^\circ$ |
| $\text{pfd}(\theta) = -127.7 + 18 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $1^\circ < \theta \leq 2^\circ$ |
| $\text{pfd}(\theta) = -129.4 + 23.7 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $2^\circ < \theta \leq 8^\circ$ |
| $\text{pfd}(\theta) = -108$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $8^\circ < \theta \leq 90.0^\circ$ |

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

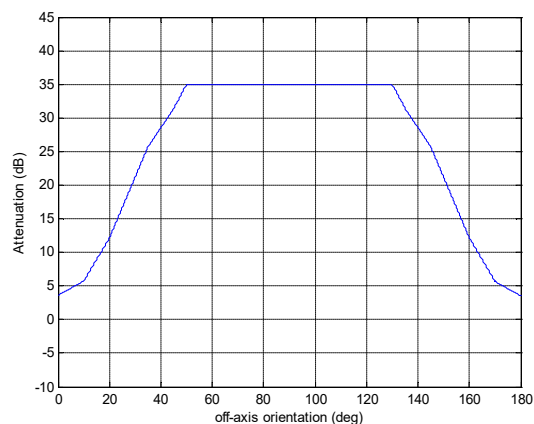
2.2 When within line-of-sight of the territory of an administration, and up to an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIMs shall not exceed:

| | | |
|--|--|---|
| $\text{pfd}(\theta) = -136.2$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $0^\circ \leq \theta \leq 0.01^\circ$ |
| $\text{pfd}(\theta) = -132.4 + 1.9 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $0.01^\circ < \theta \leq 0.3^\circ$ |
| $\text{pfd}(\theta) = -127.7 + 11 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $0.3^\circ < \theta \leq 1^\circ$ |
| $\text{pfd}(\theta) = -127.7 + 18 \cdot \log\theta$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $1^\circ < \theta \leq 12.4^\circ$ |
| $\text{pfd}(\theta) = -108$ | $(\text{dB}(\text{W}/(\text{m}^2 \cdot 1 \text{ MHz})))$ | for $12.4^\circ < \theta \leq 90^\circ$ |

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

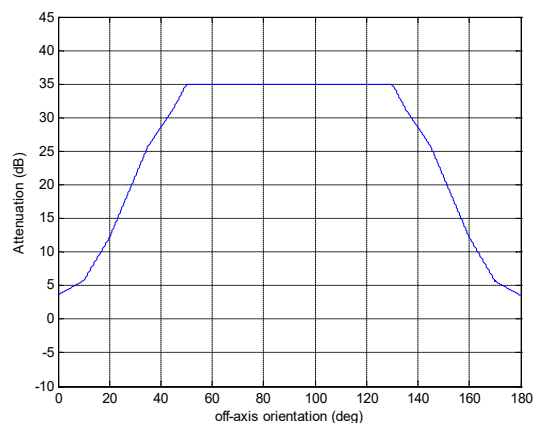
Option 1:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained ~~using free-space propagation and~~ attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the [frequency](#) bands 27.5-29.1 GHz and 29.5-30 GHz, the following figure shall be used for the calculation of attenuation due to the aircraft fuselage in these bands.



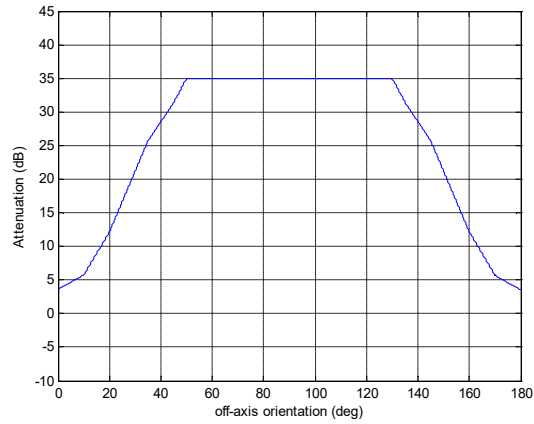
Option 2:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using ~~free space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the bands 27.5-29.1 GHz and 29.5-30 GHz,~~ the following figure shall be used for the calculation of attenuation due to the aircraft fuselage ~~in these bands, unless there is an available ITU-R Recommendation to perform this calculation in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz.~~



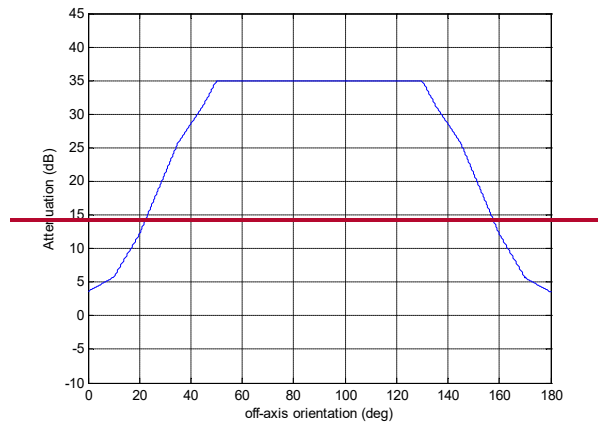
Option 3:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation incorporated by reference in the Radio Regulations to calculate attenuation due to the aircraft fuselage in the bands 27.5-29.1 GHz and 29.5-30 GHz, the following figure shall be used for the calculation of attenuation due to the aircraft fuselage in these bands.



Option 4:

~~2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the bands 27.5-29.1 GHz and 29.5-30 GHz, the following figure shall be used for the calculation of attenuation due to the aircraft fuselage in these bands.~~

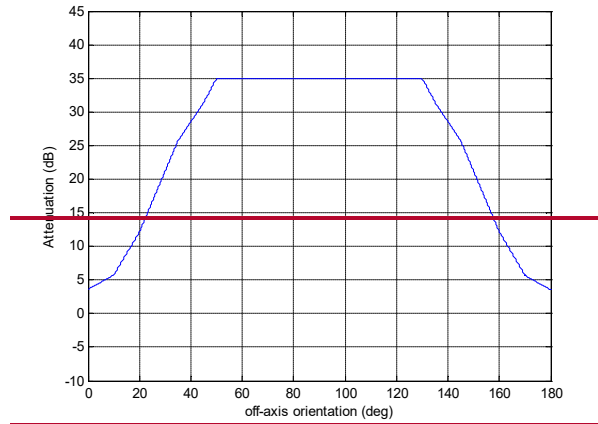


Option 5:

2.3 The pfd levels provided in §§ 2.1 and 2.2 above relate to the pfd and angles of arrival that shall be obtained using free-space propagation and attenuation due to the aircraft fuselage. Unless there is an available ITU-R Recommendation to calculate attenuation due to the aircraft fuselage in the [frequency](#) bands 27.5-29.1 GHz and 29.5-30 GHz, the [formulas in the table below](#) ~~following figure~~ shall be used for the calculation of attenuation due to the aircraft fuselage in these [frequency](#) bands.

Fuselage attenuation model from Report ITU-R M.2221

| | | | |
|--|-----------|------------|--|
| $L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$ | <u>dB</u> | <u>for</u> | <u>$0^\circ < \gamma < 10^\circ$</u> |
| $L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$ | <u>dB</u> | <u>for</u> | <u>$10^\circ < \gamma < 34^\circ$</u> |
| $L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$ | <u>dB</u> | <u>for</u> | <u>$34^\circ < \gamma < 50^\circ$</u> |
| $L_{fuse}(\gamma) = 35$ | <u>dB</u> | <u>for</u> | <u>$50^\circ < \gamma < 90^\circ$</u> |



Option 1:

2.4 ~~An a~~Aeronautical ESIMs operating in the [frequency band](#) 27.5-29.1 GHz ~~band~~, or ~~portions~~~~parts~~ thereof, within the territory of an administration that has authorized fixed-service and/or mobile-service operation in the same frequency bands shall not transmit in these frequency bands without prior agreement of that administration (see also *resolves 3/[recognizing j](#)*) of this Resolution).

Option 2:

2.4 An aeronautical ESIM operating in the [frequency bands](#) 27.5-29.1 GHz [and 29.5-30 GHz](#) ~~band~~, or portions thereof, within the territory of an administration that has authorized fixed-service and/or mobile-service operation in the same frequency bands shall not transmit in these frequency bands without prior agreement of that administration (~~see also *resolves 3 of this Resolution*~~).

Option 1:

2.5 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the aeronautical ESIM transmitter as described in Recommendation ITU-R SM.1541.

Option 2:

~~2.5 Higher pfd levels than those provided in §§ 2.1 and 2.2 above produced by aeronautical non-GSO ESIMs on the surface of the Earth within an administration shall be subject to the prior agreement of that administration.~~

NOTE: Annex 2 was not discussed in detail at CPM23-2.

ANNEX 2 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

**Methodology with respect to the examination referred to in Scenario 1
*resolves 1.2.5***

NOTE: This methodology has been developed based on the discussions in Working Party 4A regarding draft new Recommendation ITU-R S.[RES.169_METH] which contains a methodology for assessing compliance of A-ESIM communicating with GSO FSS satellites to meet the obligations to protect terrestrial services in Resolution 169 (WRC-19). Proposals to WRC-23 on agenda item 1.16 including Doc. CPM23-2/175 may need to take into account any further

progress/updates to this draft new Recommendation when considering a methodology for assessing compliance with Part 2 of Annex 1 of Resolution [A116] for A-ESIM communicating with non-GSO FSS satellites.

However, it should be emphasized that the discussion in the CG would lead to a satisfactory conclusion on the matter and there is no certainty that the work of the CG will be agreed at WP 4A and SG4. Consequently, decisions of the CPM on this matter should not be based on other actions by SG4 or RA-23 that may not be conclusive.

Option 1 for the methodology:

1 Overview of the methodology

Option 1:

Aeronautical earth station in motion (A-ESIM) can operate over time at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable off-axis e.i.r.p. spectral density (“ $EIRP_C$ ”) for an A-ESIM transmitter communicating with a non-GSO FSS satellite that would ensure compliance with a set of pre-established power flux-density (pfd) limits defined on the Earth’s surface. This methodology derives the $EIRP_C$ considering the relevant loss and attenuation in the geometry considered, among other things.

Option 2:

An aeronautical earth station in motion (A-ESIM) can operate over time at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable off-axis e.i.r.p. spectral density (“ $EIRP_C$ ”) for an A-ESIM transmitter communicating with a non-GSO FSS space station that ensures compliance with a set of the defined pfd limits on the Earth’s surface in Annex 1 to this Resolution. This methodology derives the $EIRP_C$ considering the relevant loss and attenuation in the geometry considered, among other things.

The methodology then compares the computed $EIRP_C$ with the reference off-axis e.i.r.p. towards the ground (“ $EIRP_R$ ”) of the A-ESIMs. For each emission in each group of a non-GSO FSS satellite system, $EIRP_R$ can be calculated by using the Appendix 4 data for that system as well as other input parameters that shall be provided by the notifying administration for that system.

Specifically, for each emission in the non-GSO FSS satellite system associated with a to-be-defined non-GSO A-ESIM class of station, the $EIRP_R$ is the algebraic summation (in logarithmic terms) of the maximum input power to the antenna (item C.8.a.1 of Appendix 4), the peak gain of the A-ESIM antenna (item C.10.d.3 of Appendix 4), the maximum achievable off-axis gain isolation towards the ground of the A-ESIM antenna and a parameter that would compensate for any difference between the emission bandwidth and the reference bandwidth of the pre-established set of pfd limits.

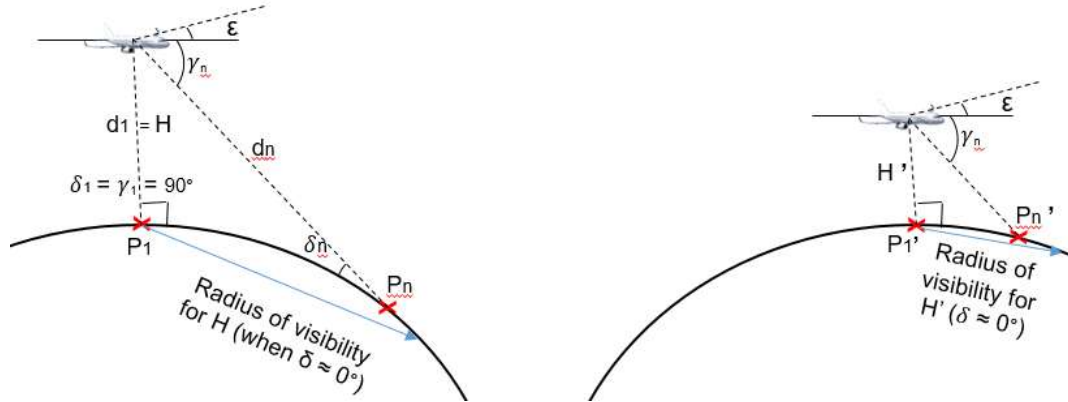
The operations of A-ESIMs shall be evaluated over multiple predefined altitude ranges in order to establish as many $EIRP_C$ levels for comparison with $EIRP_R$. This comparison is at the basis of the methodology and examination that are described more in detail in the following section. An examination by the Bureau shall apply this methodology for each altitude range, to determine whether the A-ESIM operating under a given non-GSO satellite system complies with the defined pfd limits on the Earth’s surface in Annex 1 to this Resolution to ensure the protection of terrestrial services.

2 Parameters and geometry

Figure A2-1 provides a description of the geometry considered under this methodology. The figure shows A-ESIMs flying at two different altitudes and also some of the parameters used for the calculation. The model is agnostic to non-GSO ESIM geographical locations on Earth and assumes a spherical Earth model with a fixed radius for the calculation.

FIGURE A2-1

Geometry for the examination of compliance for two different ESIMs altitudes



The notifying administration for the non-GSO FSS system with which the A-ESIM communicates shall send to the Bureau the relevant characteristics of the A-ESIM intended to communicate with that non-GSO FSS network under *resolves* 1.1.3 above. All the parameters required by the Bureau to carry out the examination process are listed and briefly described in Table A2-1. Additional considerations are further elaborated in section 3.

Option 1:

TABLE A2-1

Relevant parameters for pfd limits compliance examination

| Parameter | Symbol | Type of parameter | Observation |
|--|----------|--|--|
| Aeronautical non-GSO ESIM altitude | H | Established by the methodology as: $H_{min} = 0.01$ km, $H_{max} = [13/15]$ km, $H_{step} = 1$ km | The altitudes at which the examination is carried out range from H_{min} to H_{max} at H_{step} intervals. |
| Angle of arrival of the incident wave on the Earth's surface | δ | Specified by the pre-established set(s) of pfd limits, variable from 0° to 90° | Pre-established set(s) of pfd limits should cover incident angles from 0° to 90° |

| Parameter | Symbol | Type of parameter | Observation |
|--|----------------------|--|--|
| Angle below the horizontal plane of the ESIMs corresponding to the angle of arrival δ under examination | γ | Calculated from the geometry | This angle is calculated considering the non-GSO ESIMs altitude H_j examined and angle of arrival δ under examination (see Fig. A.2.1) |
| Distance between the ESIMs and the point on the ground under examination | D | Calculated from the geometry | This distance is a function of the A-ESIMs altitude and the angles δ and γ |
| Frequency | f | Taken from the Appendix 4 data | To evaluate the propagation loss or at the lower limits of the frequency range |
| Atmospheric loss | L_{atm} | Calculated and established by the methodology | Based on Recommendation ITU-R P.676 |
| Fuselage attenuation | L_f | See § 2.3 in Annex 1 | The attenuation depends on the angle (γ) below the horizontal plane of the non-GSO ESIMs. |
| A-ESIM antenna peak gain and off-axis gain pattern | $G_{max}, G(\theta)$ | Taken from the Appendix 4 data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the non-GSO system under examination | The A-ESIM antenna gain is used to compute $EIRP_R$ |
| Emission bandwidth | $BW_{Emission}$ | Taken from the Appendix 4 data (as part of item C.7.a) of the non-GSO system under examination | These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$ |
| Reference bandwidth | BW_{Ref} | Taken from the set(s) of pre-established pfd limits | |
| Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth | $EIRP_C$ | $EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface | For each of the altitudes H_j , the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated to a given altitude H_j ; for each altitude H_j , the lowest e.i.r.p. value is the one to be retained and compared with $EIRP_R$ (see section 3) |
| A set of pre-established pfd limits on the Earth's surface | $PF D(\delta)$ | Taken from Annex 1 to this Resolution | The pfd limits, expressed in $\text{dB}(\text{W}/\text{m}^2/\text{BW}_{ref})$, are a function of the angle of arrival δ |

Option 2:

TABLE A2-1
Relevant parameters for pfd compliance examination

| Parameter | Symbol | Type of parameter | Observation |
|---|----------------------|--|--|
| Aeronautical non-GSO ESIM altitude | H | Established by the methodology as: $H_{min} = 0.01$ km, $H_{max} = 15.01$ km | The altitudes at which the examination is carried out range from H_{min} to H_{max} at the following altitudes: H_{min} , 1.01 km, 2.01 km, 3.00 km, 3.01 km, 4.01 km... H_{max} . |
| Angle of arrival of the incident wave on the Earth's surface | δ | Specified by the pre-established set(s) of pfd limits, variable from 0° to 90° | Pre-established set(s) of pfd should cover incident angles from 0° to 90° |
| Angle below the horizontal plane of the ESIM corresponding to the angle of arrival δ under examination | γ | Calculated from the geometry | This angle is calculated considering the non-GSO A-ESIM's altitude H_j examined and angle of arrival δ under examination (see Fig. A.2.1) |
| Distance between the ESIM and the point on the ground under examination | D | Calculated from the geometry | This distance is a function of the A-ESIMs altitude and the angles δ and γ |
| Frequency | f | Provided by the Appendix 4 data | To evaluate the propagation loss either at the centre frequency or at the upper and lower limits of the frequency range |
| Atmospheric loss | L_{atm} | Calculated and established by the methodology | Based on Recommendation ITU-R P.676 |
| Fuselage attenuation | L_f | Report ITU-R M.2221-0 or other ITU-R Reports or Recommendations | The attenuation depends on the angle (γ) below the horizontal plane of the non-GSO A-ESIM. The value(s) could come from ITU-R Reports and/or Recommendations, such as Report ITU-R M.2221. Note, the model contained in Report ITU-R M.2221-0 might require updating and/or clarifications. |
| A-ESIM antenna peak gain and off-axis gain pattern | $G_{max}, G(\theta)$ | Taken from the Appendix 4 data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the non-GSO system under examination | The A-ESIM antenna gain is used to compute $EIRP_R$ |
| Emission bandwidth | $BW_{Emission}$ | Taken from the Appendix 4 data (as part of item C.7.a) of the non-GSO system under examination | These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$ |
| Reference bandwidth | BW_{Ref} | Taken from the set(s) of pre-established pfd limits | |

| Parameter | Symbol | Type of parameter | Observation |
|---|----------|--|--|
| Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth | $EIRP_C$ | $EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface | For each of the altitudes H_j , the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated to a given altitude H_j ; for each altitude H_j , the lowest e.i.r.p. value is the one to be retained and compared with $EIRP_R$ (see section 3) |

3 Calculation procedure

This section includes a step-to-step description of how the examination methodology would be implemented for a given group associated to the class of earth station for non-GSO A-ESIMs in a non-GSO satellite system.

START

Calculate $EIRP_R$

- i) For each of the emissions included in the Group under consideration, compute the Reference EIRP ($EIRP_R$, dB(W)) as:

$$EIRP_R = G_{Max} - G_{Isol_{Max}} + P_{Max} + 10 \log_{10}(BW) \quad (1)$$

where:

G_{Max} is the A-ESIM antenna peak gain in dBi

$G_{Isol_{Max}}$ is the maximum achievable gain isolation of the A-ESIM antenna towards the ground in dB when operating in the examined non-GSO system

P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).

BW in Hz is:

$$\begin{aligned} BW_{Ref} & \quad \text{if } BW_{emission} > BW_{Ref} \\ BW_{emission} & \quad \text{if } BW_{emission} < BW_{Ref} \end{aligned}$$

Calculate $EIRP_C$

- ii) For each aircraft altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test the full compliance with the set(s) of pre-established pfd limits. The N angles δ_n shall be comprised between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the angles δ_n will correspond to as many N points on the ground.

- iii) For each altitude $H_j = H_{min}, \dots, H_{max}$, compute $EIRP_{C_j}$ using the following algorithm:

- a) Set the altitude of the A_ESIM to H_j
b) Compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii) using the following equation:

$$\gamma_{j,n} = \arccos \left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)} \right) \quad (2)$$

where R_e is the mean Earth radius.

- c) Compute the distance $D_{j,n}$, in km, for $n = 1, \dots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (3)$$

- d) Compute the fuselage attenuation $L_{f,j,n}$ (dB) applicable to each of the N points on the ground as a function of the angles $\gamma_{j,n}$ computed in b) above
- e) Compute the atmospheric loss $L_{atm,j,n}$ (dB) applicable to each of the distances $D_{j,n}$ computed in c) above
- f) Compute the $EIRP_{C,j,n}$ (dB(W/BW_{Ref})), that is the maximum e.i.r.p. that can be radiated in the pfd mask's reference bandwidth by the A-ESIM towards each of the N points to be compliant with the set(s) of pre-established pfd limits, as per the following equation:

$$EIRP_{C,j,n}(\delta_n, \gamma_n) = pfd(\delta_n) + 10 \log_{10} \left(4\pi (D_{j,n} \cdot 1000)^2 \right) + L_{f,j,n} + L_{atm,j,n} \quad (4)$$

- g) Compute the minimum $EIRP_{C,j}$ across all values calculated at the previous step, $EIRP_{C,j} = \text{Min}(EIRP_{C,j,n}(\delta_n, \gamma_n))$. The output of this last step is the maximum $EIRP_C$ that can be radiated by the A-ESIM to ensure it complies with the set(s) of pre-established pfd limits with respect to all angles δ_n at the altitude H_j . There will be one $EIRP_{C,j}$ for each of the H_j altitudes considered.

The output of step iii) is summarized in Table A2-2 below:

TABLE A2-2
Computed $EIRP_{C,j}$ values

| j | H _j (km) | EIRP _{C,j,n} (δ _n , γ _n) dB(W/BW _{Ref}) | | | | EIRP _{C,j} dB(W/BW _{Ref}) |
|------------------|------------------------|--|-----------|-----|---------|---|
| | | δ = 0° | δ = 0.01° | ... | δ = 90° | |
| 1 | H _{min} | xxx | xxx | xxx | xxx | XXX |
| 2 | | yyy | yyy | yyy | yyy | YYY |
| ... | ... | ... | ... | ... | ... | ... |
| j _{max} | H _{max} | zzz | zzz | zzz | zzz | ZZZ |

Compare $EIRP_C$ and $EIRP_R$, and produce an examination finding

- iv) For each of the emissions, check whether $EIRP_{C,j} > EIRP_R$. The results of this check are illustrated in Table A2-3 below.

TABLE A2-3

Comparison between $EIRP_{C_j}$ and $EIRP_R$

| Group ID | Emission No. | $EIRP_R$ dB(W) | Is there at least one altitude H_j for which $EIRP_{C_j} > EIRP_R$? | Smallest H_j for which $EIRP_{C_j} > EIRP_R$ (km) |
|----------|--------------|-------------------|--|--|
| X | 1 | XXX | Yes/No | AAA |
| Y | 2 | YYY | Yes/No | BBB |
| ... | ... | ... | ... | ... |
| Z | N | ZZZ | Yes/No | CCC |

- v) For the emissions included in the Group under examination which pass the test detailed in iv) above, the results of the Bureau’s examination for that Group is **favourable** (after removing emissions that have failed the examination), otherwise it is **unfavourable**.
- vi) The Bureau shall publish:
 - the finding (favourable or unfavourable) for each Group of the non-GSO system examined;
 - Table A2-3, that is the output of step iii) of the algorithm.

Note: As part of standard procedure, the Bureau would publish the emissions with unfavourable findings in BR IFIC Part III-S, which concerns frequency assignments that are returned to the responsible administration.

Option 2 for the methodology:

1 Examination methodology

1.1 Introduction

An A-ESIM can operate at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable off-axis e.i.r.p. spectral density (“ $EIRP_C$ ”) for an A-ESIM transmitter communicating with a non-GSO FSS satellite and still ensure compliance with the pfd limits included in Part 2 of Annex 1 of this Resolution to protect terrestrial services, for a defined set of altitude ranges. The methodology derives the $EIRP_C$ taking into account the relevant loss and attenuation in the geometry considered.

The methodology then compares the computed $EIRP_C$ with the Reference A-ESIM off-axis e.i.r.p. towards the ground (“ $EIRP_R$ ”) under which the A-ESIM operates. The $EIRP_R$ of the non-GSO satellite system is calculated from the data included in the Appendix 4 Notification information of non-GSO satellite system with which the ESIM communicates and on the ESIM characteristics, as applicable. For the emission in each group of a non-GSO satellite system, $EIRP_R$ can be calculated by using the Appendix 4 data for that system as well as other input parameters that shall be provided by the notifying administration for that system.

The operations of A-ESIM may be evaluated over a number of predefined altitude ranges in order to establish a number of $EIRP_C$ levels. Each altitude range would have its own $EIRP_C$ such that, all other assumptions being equal, higher altitude A-ESIM operation would allow for a higher $EIRP_C$, since the distance between the A-ESIM and the chosen location on the ground is larger and so are the applicable losses and attenuations.

An examination by the Bureau would apply this methodology for each altitude range, to determine whether the A-ESIM operating under a given non-GSO satellite system would comply with the pfd limits included in Part 2 of Annex 1 of this Resolution to protect terrestrial services.

1.2 Input parameters

Considering a hypothetical non-GSO satellite system, Table 1 below describes the emissions that are examined and that are included in one Group associated to the “UO” class of e/s transmitting in the 27.5-29.5 GHz band. Tables 2 and 3 provide additional parameters.

TABLE 1
Example of a Group of applicable A-ESIM emissions
(with reference to relevant RR Appendix 4 data fields)

| Emission No. | C.7.a Designation of emission | $BW_{emission}$ MHz | C.8.c.3 minimum power density dB(W/Hz) | C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz) |
|--------------|-------------------------------------|------------------------|--|--|
| 1 | 6M00G7W-- | 6.0 | -69.7 | -66.0 |
| 2 | 6M00G7W-- | 6.0 | -64.7 | -61.0 |
| 3 | 6M00G7W-- | 6.0 | -59.7 | -56.0 |

TABLE 2
Additional example assumptions

| ID | Parameter | Notation | Value | Unit |
|----|---------------------------------|------------|---|------|
| 1 | Frequency assignment | f | 29.5 | GHz |
| 2 | Reference bandwidth of pfd mask | BW_{Ref} | 14.0 | MHz |
| 3 | A-ESIM antenna peak gain | G_{max} | 37.5 | dBi |
| 4 | A-ESIM antenna gain pattern | - | As per Rec. ITU-R S.580 (see C.10.d.5.a.1) | |

TABLE 3
Additional assumptions defined in the methodology

| ID | Parameter | Notation | Value | Unit |
|-----------------|--|------------|--|------|
| 9 ²⁾ | Atmospheric attenuation | L_{atm} | Computed with Rec. ITU-R P.676 | dB |
| 10 | Angle of arrival of the incident wave on the Earth's surface | δ | Specified by the pre-established sets of pfd limits, variable from 0° to 90° | deg |
| 11 | Minimum examination altitude | H_{min} | 0.01 | km |
| 12 | Maximum examination altitude | H_{max} | 15 | km |
| 13 | Examination altitude spacing | H_{step} | 1.0 | km |
| 14 | Fuselage attenuation | L_f | See Table 4 | dB |

FIGURE 1
Geometry for the examination of compliance for two different ESIM altitudes

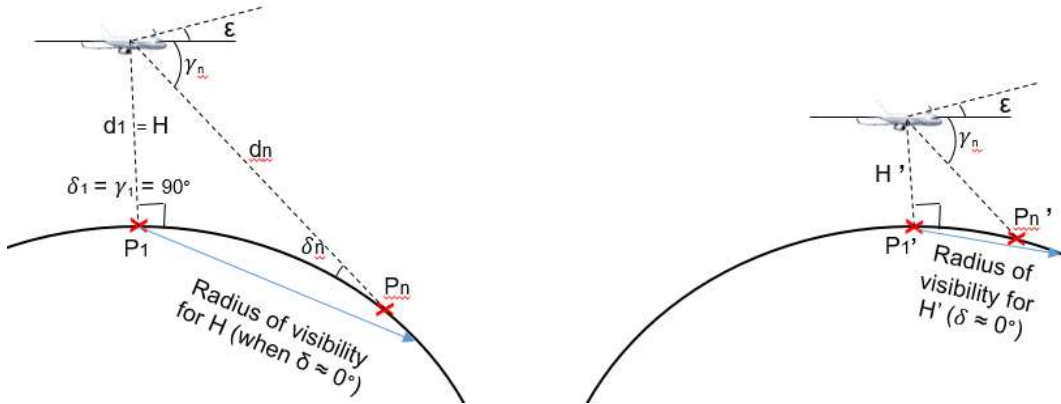


FIGURE 2
A-ESIM main beam gain points at satellite

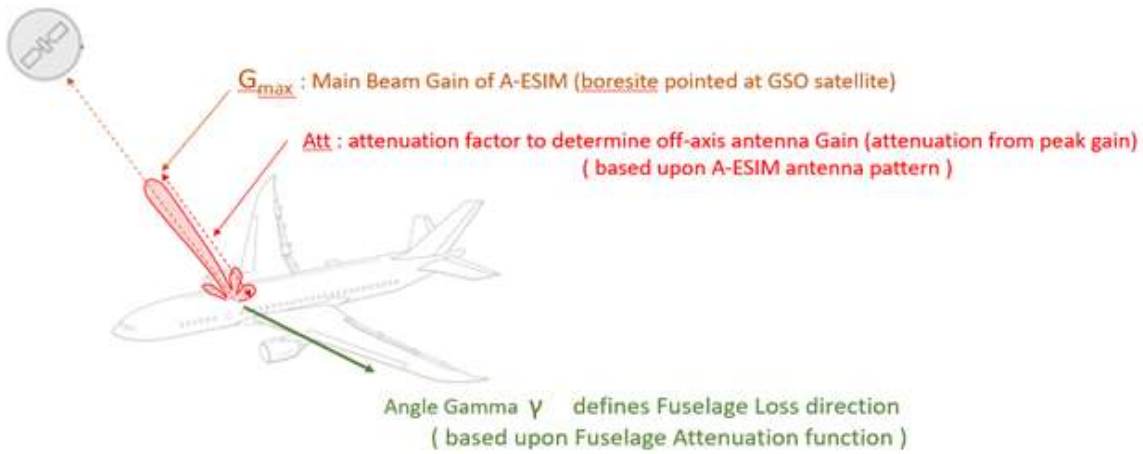


TABLE 4

Fuselage attenuation model

| | | | |
|--|----|-----|-------------------------------------|
| $L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$ | dB | for | $0^\circ \leq \gamma \leq 10^\circ$ |
| $L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$ | dB | for | $10^\circ < \gamma \leq 34^\circ$ |
| $L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$ | dB | for | $34^\circ < \gamma \leq 50^\circ$ |
| $L_{fuse}(\gamma) = 35$ | dB | for | $50^\circ < \gamma \leq 90^\circ$ |

Note: This example fuselage attenuation model from on Report ITU-R M.2221-0. [Additional models are being developed in WP 4A.]

TABLE 5A

Required conformance pfd mask for altitudes up to 3 km

| | | |
|--|----------------------------------|---|
| $pfd(\delta) = -136.2$ | (dB(W/(m ² · 1 MHz))) | for $0^\circ \leq \delta \leq 0.01^\circ$ |
| $pfd(\delta) = -132.4 + 1.9 \cdot \log \delta$ | (dB(W/(m ² · 1 MHz))) | for $0.01^\circ < \delta \leq 0.3^\circ$ |
| $pfd(\delta) = -127.7 + 11 \cdot \log \delta$ | (dB(W/(m ² · 1 MHz))) | for $0.3^\circ < \delta \leq 1^\circ$ |
| $pfd(\delta) = -127.7 + 18 \cdot \log \delta$ | (dB(W/(m ² · 1 MHz))) | for $1^\circ < \delta \leq 12.4^\circ$ |
| $pfd(\delta) = -108$ | (dB(W/(m ² · 1 MHz))) | for $12.4^\circ < \delta \leq 90^\circ$ |

TABLE 5B

Required conformance pfd mask for altitudes above 3 km

| | | |
|---|-----------------------------------|---|
| $pfd(\delta) = -124.7$ | (dB(W/(m ² · 14 MHz))) | for $0^\circ \leq \delta \leq 0.01^\circ$ |
| $pfd(\delta) = -120.9 + 1.9 \cdot \log \delta$ | (dB(W/(m ² · 14 MHz))) | for $0.01^\circ < \delta \leq 0.3^\circ$ |
| $pfd(\delta) = -116.2 + 11 \cdot \log \delta$ | (dB(W/(m ² · 14 MHz))) | for $0.3^\circ < \delta \leq 1^\circ$ |
| $pfd(\delta) = -116.2 + 18 \cdot \log \delta$ | (dB(W/(m ² · 14 MHz))) | for $1^\circ < \delta \leq 2^\circ$ |
| $pfd(\delta) = -117.9 + 23.7 \cdot \log \delta$ | (dB(W/(m ² · 14 MHz))) | for $2^\circ < \delta \leq 8^\circ$ |
| $pfd(\delta) = -96.5$ | (dB(W/(m ² · 14 MHz))) | for $8^\circ < \delta \leq 90.0^\circ$ |

1.3 Step-by-step algorithm

This section includes a step-by-step description of how the examination methodology would be implemented.

START

- i) For each aircraft altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test the full compliance with the applicable set of pfd limits. The N angles δ_n must be comprised between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the angles δ_n will correspond to as many N points on the ground.
- ii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, compute $EIRP_{C_j}$ and $EIRP_{R_j}$ using the following algorithm:
 - a) set the altitude of the A-ESIM to H_j
 - b) compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii. using the following equation:

$$\gamma_{j,n} = \arccos \left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)} \right) \quad (1)$$

where R_e is the mean earth radius.

- c) Compute the distance $D_{j,n}$, in km, for $n = 1, \dots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (2)$$

- d) Compute the fuselage attenuation $L_{f,j,n}$ (dB) with $i = 1, \dots, N$ applicable to each of the of the angles $\gamma_{j,n}$ computed in *b*) above
- e) Compute the gaseous absorption $L_{atm,j,n}$ (dB) with $i = 1, \dots, N$ applicable to each of the distances $D_{j,n}$ computed in *c*) above, using the applicable sections of Recommendation ITU-R P.676
- f) Compute the maximum $EIRP_{C,j,n}$ (dB(W/ BW_{Ref})) that is the maximum e.i.r.p. that can be radiated by the A-ESIM at altitude H_j towards each of the angles $\gamma_{j,n}$ and still be compliant with the pfd limits indicated in Table 5, as per the following equation:

$$EIRP_{C,j,n}(\delta_n, \gamma_n) = pfd(\delta_n) + 10 \log_{10} \left(4\pi (D_{j,n} \cdot 1000)^2 \right) + L_{f,j,n} + L_{atm,j,n} \quad (3)$$

- g) Compute the minimum $EIRP_{C,j}$ across all values calculated at the previous step, $EIRP_{C,j} = \text{Min}(EIRP_{C,j,n}(\delta_n, \gamma_n))$. The output of this step is the maximum $EIRP_{C,j}$ that can be safely radiated by the A-ESIM to ensure it complies with the pfd limits indicated in Table 5A or 5B, as applicable, with respect to all angles δ_n at the altitude H_j . There will be one $EIRP_{C,j}$ for each of the H_j altitudes considered.
- h) For each emission included in the Group under consideration, compute the reference e.i.r.p. ($EIRP_{R,j,n}$ (dBW)) as:

$$EIRP_{R,j,n} = P_{Max} + Gtx(\gamma_{j,n} + \varepsilon) + 10 \log_{10}(BW) \quad (4)$$

where:

- P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).
- $Gtx(\gamma_{j,n} + \varepsilon)$ is the transmit antenna gain with the separation angle from the peak direction consisting of each the angle $\gamma_{j,n}$ and the elevation angle ε .
- ε is the A-ESIM elevation angle towards the satellite.

BW in Hz is:

$$\begin{aligned} BW_{Ref} & \quad \text{if } BW_{emission} > BW_{Ref} \\ BW_{emission} & \quad \text{if } BW_{emission} < BW_{Ref} \end{aligned}$$

- i) Compute the $EIRP_{R,j}$ across all values calculated at the previous step, $EIRP_{R,j} = \text{Max}(EIRP_{R,j,n}(\delta_n, \gamma_n))$. Note that the $EIRP_{R,j}$ is calculated for each emission.

The output of steps *g*) and *i*) is summarized in Table 7 below:

TABLE 7
Computed $EIRP_{C,j}$ and $EIRP_{R,j}$ values

| H_j (km) | $EIRP_{C,j}$ dB(W/ BW_{Ref}) | $EIRP_{R,j}$ dB(W/ BW_{Ref}) |
|---------------|------------------------------------|------------------------------------|
| 0.01 | TBD | TBD |
| 1.0 | TBD | TBD |
| 2.0 | TBD | TBD |
| 3.0 | TBD | TBD |

| H_j (km) | $EIRP_{C_j}$ dB(W/ BW_{Ref}) | $EIRP_{R_j}$ dB(W/ BW_{Ref}) |
|---------------|------------------------------------|------------------------------------|
| 4.0 | TBD | TBD |
| 5.0 | TBD | TBD |
| 6.0 | TBD | TBD |
| 7.0 | TBD | TBD |
| 8.0 | TBD | TBD |
| 9.0 | TBD | TBD |
| 10.0 | TBD | TBD |
| 11.0 | TBD | TBD |
| 12.0 | TBD | TBD |
| 13.0 | TBD | TBD |
| 14.0 | TBD | TBD |
| 15.0 | TBD | TBD |

Note: This methodology computes the e.i.r.p. backwards, upwards from the ground, starting with the power flux-density (pfd, either the one specified in Table 5A or 5B, depending on the altitude H_j , as applicable) and:

- converting it to an effective received power at the ground;
- translating back to the aircraft location based upon the slant distance and subtracting propagation losses based upon distance;
- computing and subtracting atmospheric losses based upon distance;
- computing and subtracting fuselage attenuation losses based upon the angle below the aircraft local horizon.

All to allow the A-ESIM operator to operate in compliance with an effective on-axis boresight isotropic radiated power (e.i.r.p.) that would ensure it complies with the pfd mask at the airborne A-ESIM altitude and location considered.

- iv) For each of the groups, check whether there is at least one j) for which $EIRP_{C_j} > EIRP_j$. The results of this check are illustrated in Table 8 below.

TABLE 8
Comparison between $EIRP_{C_j}$ and $EIRP_{R_j}$

| Group No. | C.7.a Designation of emission | Lowest altitude H_j (km) for which $EIRP_{C_j} > EIRP_{R_j}$ |
|-----------|-------------------------------------|--|
| 1 | 6M00G7W-- | TBD |
| 2 | 6M00G7W-- | TBD |
| 3 | 6M00G7W-- | TBD |

For the emissions included in the Group under examination which pass the test detailed in iv) above, the results of the Bureau’s examination for that Group is *favourable*, after removing emissions that have failed the examination, otherwise it is *unfavourable*.

- v) The Bureau should publish:
- a) The finding (favourable or unfavourable) for the examined Group of the non-GSO system examined; and
 - b) the information included in Table 8, along with the comment: The operation of A-ESIM with the Emission **XXX** (Emission Code) under examination shall be possible below the altitude of **YYY** km (minimum altitude for favourable finding of that emission) referred to in Table 8 only if the appropriate mitigation techniques are used to ensure that the power flux-density produced on Earth's surface respect the limits indicated in Part 2 of Annex 1 of this Resolution on territories where those limits apply.

Note: As part of standard procedure, the Bureau would publish the emissions with unfavourable finding in BR IFIC Part III-S, which concerns frequency assignments that are returned to the responsible administration.

END

Option 1:

2 Example application of the methodology

Table A2-4 below describes the emissions included in one group of a fictitious satellite system that are associated to the class of earth station indicating the non-GSO aeronautical ESIM (A-ESIM) transmitting in the frequency band 27.5-29.1 GHz. Three different types of emissions are included in the group to cover different performance objectives of the communication link.

Option 1:

TABLE A2-4

Example A-ESIM emissions in the group examined

| Emission No. | C.7.a Designation of emission | C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz) | C.8.c.3 Minimum power density dB(W/Hz) | C.8.e.1 C/N objective (total – clear sky) dB |
|---------------------|--|--|--|--|
| 1 | 6MD7W-- | -56.0 | -69.7 | -5.0 |
| 2 | 6MD7W-- | -51.0 | -64.7 | 0.0 |
| 3 | 6MD7W-- | -42.0 | -55.7 | 9.0 |

Table A2-5 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A2-5

Additional assumptions

| Parameter | Notation | Value | Unit |
|------------------------------------|------------|------------------|------|
| Test frequency | f | 29.5 | GHz |
| A-ESIMs antenna peak gain | G_{max} | 37.5 | dBi |
| Antenna gain pattern | - | APEREC015V01 | |
| Polarization loss | L_{Pol} | 0.0 | dB |
| Fuselage attenuation model | L_f | See Table A2-6 | |
| Atmospheric loss | L_{atm} | Rec. ITU-R P.676 | |
| Minimum examination altitude range | H_{min} | 0.02 | km |
| Maximum examination altitude range | H_{max} | 15.0 | km |
| Examination altitude range spacing | H_{step} | 1.0 | km |

Option 2:

TABLE A2-4

Example A-ESIMs emissions in the Group ID No. 1

| Emission No. | C.7.a Designation of emission | C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz) | C.8.c.3 Minimum power density dB(W/Hz) | C.8.e.1 C/N objective (total – clear sky) dB |
|--------------|-------------------------------------|---|---|---|
| 1 | 6MD7W-- | -56.0 | -69.7 | -5.0 |
| 2 | 6MD7W-- | -51.0 | -64.7 | 0.0 |
| 3 | 6MD7W-- | -46.0 | -59.7 | 5.0 |

Table A2-5 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A2-5

Additional assumptions

| Parameter | Notation | Value | Unit |
|------------------------------------|-----------|--|------|
| Test frequency | f | 30.0 | GHz |
| A-ESIMs antenna peak gain | G_{max} | 37.5 | dBi |
| Antenna gain pattern | - | Rec. ITU-R S.580 | |
| Polarization loss | L_{Pol} | 0.0 | dB |
| Fuselage attenuation model | FA | See Table A2-6 | |
| Atmospheric attenuation | L_{atm} | Section 2.21.2 of Rec. ITU-R P.676 | |
| Reference atmosphere | - | “Winter high latitude” from Rec. ITU-R P.835.6 | |
| Minimum examination altitude range | H_{min} | 0.02 | km |
| Maximum examination altitude range | H_{max} | 15.0 | km |

| Parameter | Notation | Value | Unit |
|---|------------|-------|------|
| Examination altitude range spacing | H_{step} | 1.0 | km |
| Altitude of the interfered with terrestrial station | H_T | 0.01 | km |

TABLE A2-6

Fuselage attenuation model from Report ITU-R M.2221

| | | | |
|--|----|-----|-------------------------------------|
| $L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$ | dB | for | $0^\circ \leq \gamma \leq 10^\circ$ |
| $L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$ | dB | for | $10^\circ < \gamma \leq 34^\circ$ |
| $L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$ | dB | for | $34^\circ < \gamma \leq 50^\circ$ |
| $L_{fuse}(\gamma) = 35$ | dB | for | $50^\circ < \gamma \leq 90^\circ$ |

TABLE A2-7

Tested pfd limits on the ground

| | | | |
|---|-----------------------------------|-----|---------------------------------------|
| $\text{pfd}(\theta) = -124.7$ | (dB(W/(m ² · 14 MHz))) | for | $0^\circ \leq \theta \leq 0.01^\circ$ |
| $\text{pfd}(\theta) = -120.9 + 1.9 \cdot \log\theta$ | (dB(W/(m ² · 14 MHz))) | for | $0.01^\circ < \theta \leq 0.3^\circ$ |
| $\text{pfd}(\theta) = -116.2 + 11 \cdot \log\theta$ | (dB(W/(m ² · 14 MHz))) | for | $0.3^\circ < \theta \leq 1^\circ$ |
| $\text{pfd}(\theta) = -116.2 + 18 \cdot \log\theta$ | (dB(W/(m ² · 14 MHz))) | for | $1^\circ < \theta \leq 2^\circ$ |
| $\text{pfd}(\theta) = -117.9 + 23.7 \cdot \log\theta$ | (dB(W/(m ² · 14 MHz))) | for | $2^\circ < \theta \leq 8^\circ$ |
| $\text{pfd}(\theta) = -96.5$ | (dB(W/(m ² · 14 MHz))) | for | $8^\circ < \theta \leq 90.0^\circ$ |

The paragraphs below represent the step-by-step application of the calculation methodology described in section 3.

START

- i) For each of the emissions listed in Table A2-4, the reference e.i.r.p. ($EIRP_R$, dBW) is computed and the relevant results are included in Table A2-8 below:

Option 1:

TABLE A2-8

Computed values of $EIRP_R$ for the group under consideration


| Emission No. | G_{Max} (dBi) | $G_{isol,Max}$ (dB) | P_{Max} (dB(W/Hz)) | BW , MHz | $EIRP_R$ (dBW) |
|--------------|--------------------|------------------------|-------------------------|------------|-------------------|
| 1 | 37.5 | 42.4 | -56.0 | 6.0 | 6.89 |
| 2 | | | -51.0 | | 11.89 |
| 3 | | | -42.0 | | 20.89 |

- ii) Generate δ_n angles compatible with the pfd limits described in Table A2-7:

$$\delta_n = 0^\circ, 0.01^\circ, 0.02^\circ, \dots, 0.3^\circ, 0.4^\circ, \dots, 12.3^\circ, 12.4^\circ, \dots, 13^\circ, 14^\circ, \dots, 90^\circ.$$

- iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, compute $EIRP_{C_j}$. The output of this step is summarized in Table A2-9 below:

TABLE A2-9
Computed $EIRP_{C_j}$ values
(see embedded file for full results)

| j | H_j (km) | $EIRP_{C_{j,n}}(\delta_n, \gamma_n)$ dB(W/ BW_{Ref}) | | | | $EIRP_{C_j}$ dB(W/ BW_{Ref}) |
|-----|---------------|--|-----------------------|-----|---------------------|------------------------------------|
| | | $\delta = 0^\circ$ | $\delta = 0.01^\circ$ | ... | $\delta = 90^\circ$ | |
| 1 | 0.02 |  Table A.2.9_full.xlsx (see Annex to this contribution) | | | | -40.6 |
| 2 | 1.00 | | | | | -6.04 |
| 3 | 2.00 | | | | | 0.38 |
| ... | ... | | | | | ... |
| 16 | 15.00 | | | | | 17.45 |

- iv) For each of the emissions, check whether there is at least one altitude for which $EIRP_{C_j} > EIRP_R$. The result of this step is summarized in Table A2-10 below.

TABLE A2-10
Comparison between $EIRP_{C_j}$ and $EIRP_R$

| Emission No. | $EIRP_R$ dB(W) | smallest j for which $EIRP_{C_j} > EIRP_R$ | $EIRP_{C_j} > EIRP_R$ |
|--------------|-------------------|---|-----------------------|
| 1 | 6.89 | 6 | Yes |
| 2 | 11.89 | 9 | Yes |
| 3 | 20.89 | None | No |

- v) Since there is at least one emission among those included in the Group under examination which passes the test detailed in iv) above, the results of the Bureau's examination for this Group is ***favourable***.
- vi) The Bureau publishes:
The ***favourable*** finding for the Group of the non-GSO system examined.


Option 2:

TABLE A2-8
Computed values of $EIRP_R$ for the group under consideration

| Emission No. | G_{Max} (dBi) | $G_{isol_{Max}}$ (dB) | P_{Max} (dB(W/Hz)) | BW , MHz | $EIRP_R$ (dBW) |
|--------------|--------------------|--------------------------|-------------------------|------------|-------------------|
| 1 | 37.5 | 42.4 | -56.0 | 6.0 | 6.89 |
| 2 | | | -51.0 | | 11.89 |
| 3 | | | -46.0 | | 16.89 |

- i) Generate δ_n angles compatible with the pfd limits described in Table A2-7:
 $\delta_n = 0^\circ, 0.01^\circ, 0.02^\circ, \dots, 0.3^\circ, 0.4^\circ, \dots, 12.3^\circ, 12.4^\circ, \dots, 13^\circ, 14^\circ, \dots, 90^\circ$.
- ii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, compute $EIRP_{C_j}$. The output of this step is summarized in Table A2-9 below:

TABLE A2-9
Computed $EIRP_{C_j}$ values
(see embedded file for full results)

| j | H_j (km) | $EIRP_{C_{j,n}}(\delta_n, \gamma_n)$ dB(W/BW _{Ref}) | | | | $EIRP_{C_j}$ dB(W/BW _{Ref}) |
|-----|---------------|--|-----------------------|-----|---------------------|--|
| | | $\delta = 0^\circ$ | $\delta = 0.01^\circ$ | ... | $\delta = 90^\circ$ | |
| 1 | 0.02 |  Table A.2.9_full.xlsx | | | | -40.6 |
| 2 | 1.00 | | | | | -6.04 |
| 3 | 2.00 | | | | | 0.38 |
| ... | ... | | | | | ... |
| 16 | 15.00 | | | | | 17.45 |

- iii) For each of the emissions, check whether there is at least one j for which $EIRP_{C_j} > EIRP_R$. The result of this step is summarized in Table A2-10 below.

TABLE A2-10
Comparison between $EIRP_{C_j}$ and $EIRP_R$

| Group ID | Emission No. | $EIRP_R$ dB(W) | Is there at least one altitude H_j for which $EIRP_{C_j} > EIRP_R$? | Smallest H_j for which $EIRP_{C_j} > EIRP_R$ (km) |
|----------|--------------|-------------------|--|--|
| 1 | 1 | 6.89 | Yes | 5.0 |
| 1 | 2 | 11.89 | Yes | 8.0 |
| 1 | 3 | 16.89 | Yes | 14.0 |

- iv) Since there is at least one emission among those included in the Group under examination which passes the test detailed in iv) above, the results of the Bureau's examination for this Group is *favourable*.
- v) The Bureau shall publish:
 - the *favourable* finding for the Group ID No. 1 of the non-GSO system examined
 - Table A2-10, published for information only.

END

Option 2: suppress section 2

Option 1:

ATTACHMENT TO ANNEX 2 OF DRAFT NEW
RESOLUTION [A116] (WRC-23)

An example of a satellite filing Group is provided below to facilitate the understanding of the methodology.

| | | | | | |
|---|---------------------------------|--------------------------------------|-------------------------------|---|--------------------------------------|
| SECTION SPECIALE / SPECIAL SECTION / SECCIÓN ESPECIAL / 特殊 / СПЕЦИАЛЬНАЯ СЕКЦИЯ / القسم الخاص | | CR/C/5111 | | | |
| A | A1a Sat Network TELESTAR-LEO | A1f1 Notif adm CAN | A1f3 Inter. sat. org. [] | BR1 Date of receipt 17.09.2019 | BR20/BR21 BR I/FIC no./part 2911/ |
| BR6a/BR6b | id. no. 119520219 | BR3a/BR3b Provision reference 9.6 | C | BR2 Adm. serial no. [] | KU11 R |
| A15a EPFD compliance [] A18a Aircraft earth station commitment [] | | | | | |
| B1a/BR17 Beam designation KU11 | | B1b Steerable Y | B2 Emi/Rcp R | B3a1 Max. co-polar gain 29 | |
| B2bis.a Transmit only when visible from notified service area [] B2bis.b Min. Elev. Angle [] | | | | | |
| B3c1 Co-polar antenna pattern | | | | | |
| Co-polar ref. pattern REC-1528 | | Coef. A | Coef. B | Co-polar rad. diag. [] | |
| List of orbital planes 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 | | | | | |
| B4a3a1 | Angle alpha 0 | B4a3a2 | Angle beta 0 | BR7a/BR7b Group id. 119740373 | |
| A2b Period of valid. 50 | | A3a Op. agency 003 | A3b Adm. resp. B | BR1 Date of receipt 17.09.2019 | C2c RR No. 4.4 [] |
| BR62 Expiry date for bringing into use 17.09.2026 | | | | | |
| BR74 Special Section CR/C/5111 | | | | | |
| C4a | Class of station EC | C3a Assigned freq. band [] | C5a Noise temperature 730 | B4b5 Peak of pfd [] | |
| C4b | Nature of service CP | C6a Polarization type N | C6b Polarization angle [] | C11a3 Service area diagram [] | |
| C11a1 | Service area no. [] | C11a2 | Service area XAA | C9c1 Type of multiple access 1 | |
| C9c2 Spectrum mask diagram [] | | C11b Affected region [] | | A5/A6 Coordinations/Agreements 9.12 | |
| C2a1 Assigned frequency | | | | | |
| 27.55 GHz | | 27.75 GHz | 27.95 GHz | 28.15 GHz | 28.35 GHz |
| 27.65 GHz | | 27.85 GHz | 28.05 GHz | 28.25 GHz | 28.45 GHz |
| 28.55 GHz | | 28.55 GHz | | | |
| C7a | | | | | |
| Design of emission | | C8a1/C8b1 Max. peak pwr | C8a2/C8b2 Max. pwr dens. | C8c1 Min. peak pwr | C8c2 Min. pwr dens. |
| 1 100MD7M-- | | 16 | -64 | 5 | -75 |
| 2 10M0D7M-- | | 6 | -64 | -5 | -75 |
| 3 1M00D7M-- | | -4 | -64 | -15 | -75 |
| C7b | | | | | |
| C10a1 C10a2 C10a3 C10a4 | | C10d7 | | C8g1 C8g2 C8g3 | |
| Geographical coord. | | Cts. / Nat. | | Max. aggr. pwr. | |
| Type | | Cty | | Ant diameter | |
| T | | 1 TC CP | | Transp. bandwidth = Aggr. bandwidth | |
| C10b1 | | C10b2 | | C10d5a Co-polar antenna pattern | |
| Assoc. earth station id. | | Type | | C10d7 | |
| REC-580-6 | | REC-580-6 | | C10d5a | |
| Co-polar ref. pattern | | Coef. A | | Coef. B | |
| [] | | [] | | [] | |
| Co-polar rad. diag. | | Coef. C | | Coef. D | |
| [] | | [] | | [] | |
| Findings | | 2D Date of protection 17.09.2019 | | 13B1 Prov. 13B2 Remarks 13B3 Date of Review | |
| 13C Remarks | | [] | | | |

Option 2: suppression of Attachment to Annex 2

ANNEX 3 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

Provisions for non-GSO FSS systems¹ transmitting to aeronautical and/or maritime ESIMs operating in or over an ocean in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with respect to EESS (passive) operating in the frequency band 18.6-18.8 GHz (in accordance with *resolves* 1.1.6)

Option 1:

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with an aeronautical or maritime ESIM shall not exceed a pfd produced at the surface of the oceans across the 200 MHz of the frequency band 18.6-18.8 GHz, of $-123 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$. This value can be exceeded provided that the non-GSO fixed-satellite system does not exceed a pfd across the 200 MHz of the frequency band 18.6-18.8 GHz of $-137 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$ averaged over an area of 10 000 000 km² at the surface of the oceans.

Option 2:

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz over oceans with aeronautical or maritime ESIM shall not exceed the following pfd values produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band:

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

Option 3:

Any non-GSO fixed satellite space station operating in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with (i) an orbit apogee less than 20 000 km (ii) communicating with an aeronautical or maritime ESIM over the ocean, and (iii) for which complete notification information has been received by the Radiocommunication Bureau after 1 January 2025, shall not exceed an unwanted emission power flux-density produced at the surface of the ocean in the 18.6-18.8 GHz band, based on the following piecewise equation:

$$\text{for } N \geq 10: \quad pfd = \min(-77 - 10 * \log(S), -110) \quad \text{dB(W/(m}^2 \cdot 200 \text{ MHz))}$$

$$\text{for } N < 10: \quad pfd = \min(-67 - 10 * \log(S) - 10 * \log(N), -110) \quad \text{dB(W/(m}^2 \cdot 200 \text{ MHz))}$$

where S is the non-GSO fixed satellite space station 3 dB beam footprint area on the ground expressed in km² and N is the maximum number of co-frequency beams

¹ These provisions do not apply to non-GSO systems using orbits with an apogee less than 2 000 km that employ a frequency reuse factor of at least three.

generated by the non-GSO fixed satellite system within a 10 000 000 km² square on the Earth.

NOTE: Annex 4 was not discussed in detail at CPM23-2

Option 1:

ANNEX 4 TO DRAFT NEW RESOLUTION [A116] (WRC-23)

Required/Recommended ESIM ~~software and hardware capabilities~~

ESIM shall be designed with the following minimum capabilities:~~In order to enable the ESIM to cease transmission when the conditions described are met, the ESIM network shall be designed with appropriate software or hardware capabilities. The table below describes applicable minimum software and hardware capabilities, with a justification for their requirement.~~

In order to enable the ESIM to cease transmission when the conditions described are met, it is recommended the ESIM network ~~shall~~ be designed with appropriate ~~software or hardware~~ capabilities. ~~The table below~~Table A5.1 describes applicable ~~minimum software and hardware~~ capabilities, with a justification for their requirement.

Option 1:

~~Also, it~~ is also important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.

Option 2:

~~Also, it is important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.~~

Option 1:

For each ESIM, the NCMC ~~will~~should have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and non-GSO satellite system with which the non-GSO ESIM communicates. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.

Option 2:

~~For each ESIM, the NCMC will have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and satellite system. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.~~

Option 1:

TABLE A4-1
Minimum ESIM capabilities and justification

| Capability | Justification |
|--|---|
| GNSS (or other geolocation capabilities) | Required <u>To</u> assess the ESIM's geographic location so the ESIM is aware when entering an administration's territory that has not given authorization and feedback to software to cease transmissions accordingly. |
| Monitor loss of frequency lock | Required <u>To</u> anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band. |
| Monitor loss of LO signal | Required <u>To</u> anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band. |
| Internal power off/on/reset | Required <u>For</u> the ESIM to have the ability to self-power down after experiencing a fault condition, then restart or power back on when fault is resolved. |
| Disable/enable transmission and level adjustment | Required <u>To</u> cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions. |
| Receive and execute commands from NCMC | Required <u>To</u> receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions. |

Option 2:

TABLE A4-1
Minimum ESIM capabilities and justification

| Capability | Justification |
|--|--|
| GNSS (or other geolocation capabilities) | Required to assess the ESIM's geographic location so the ESIM is aware when entering an administration's territory that has not given authorization and feedback to software to cease transmissions accordingly. |
| Monitor loss of frequency lock | Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band. |
| Monitor loss of LO signal | Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band. |
| <u>Monitor and control of the transmission frequency</u> | <u>Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.</u> |
| Internal power off/on/reset | Required for the ESIM to have the ability to self-power down after experiencing a fault condition, then restart or power back on when fault is resolved. |
| Disable/enable transmission and level adjustment | Required to cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions. |
| Receive and execute commands from NCMC | Required to receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions. |

Option 1:

Furthermore, it is recommended the ESIM ~~shall~~ have the ability to enter the states described in Table A4-2. These states ~~are required to~~ ensure the ESIM is in the correct radio-interface state after some event (such as an initial boot or resuming operations after a fault) and can test system functionality is correct before radiating to avoid any transmission errors.

Option 2:

~~Furthermore, the ESIM shall have the ability to enter the states described in Table A4-2. These states are required to ensure the ESIM is in the correct radio interface state after some event (such as an initial boot or resuming operations after a fault) and can test system functionality is correct before radiating to avoid any transmission errors.~~

Option 1:

TABLE A4-2

ESIM states and events¹

| ESIM state | Radio-interface state | Corresponding event |
|-----------------------|-----------------------|---|
| Non-valid | Emissions disabled | After power-on, until ESIM can receive commands from NCMC and no-fault conditions are present After any failure/fault During system checks |
| Initial phase | Emissions disabled | When waiting for a transmission enable or disable command from NCMC |
| Transmission enabled | Carrier-off | No carrier transmitted/need for carrier to be transmitted Receive synchronization is lost Pointing threshold is exceeded |
| | Carrier-on | During transmission and ESIM is correctly pointed |
| Transmission disabled | Emissions disabled | When commanded by NCMC or ESIM automatically enters based on a “Cease Transmission” condition In locations where transmission is not permitted |

Option 2: Suppression of Table A4-2

Reasons: Thailand supports Method B in the CPM Report which proposes to add a new footnote No. 5.A116 in RR Article 5 and a new WRC Resolution providing the conditions for the operation of ESIM and protection of the services to which the frequency bands are allocated, and consequential suppression of Resolution 173 (WRC-19).

¹—Heavily adapted from EN 303-979.



PLENARY MEETING

**Addendum 17 to
Document 5538-E
24 August 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/5538A17/1**

11.7-13.4 GHz

| Allocation to services | | |
|---|---|--|
| Region 1 | Region 2 | Region 3 |
| 11.7-12.5 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492 5.487 5.487A | 11.7-12.1 FIXED 5.486 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488 Mobile except aeronautical mobile 5.485 | 11.7-12.2 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492 5.487 5.487A |
| | 12.1-12.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488 5.485 5.489 | |
| | 12.2-12.7 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492 | |
| 12.5-12.75 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B (Earth-to-space) 5.494 5.495 5.496 | 5.487A 5.488 5.490 12.7-12.75 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE except aeronautical mobile | 12.2-12.5 FIXED FIXED-SATELLITE (space-to-Earth) 5.484B MOBILE except aeronautical mobile BROADCASTING 5.487 5.484A 12.5-12.75 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B MOBILE except aeronautical mobile BROADCASTING-SATELLITE 5.493 |

Reasons: — Thailand is of the view that No change to 11.7-12.7 GHz is in line with Method B of the CPM Report.

NOC **THA/5538A17/2**

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)

Reasons: Thailand is of the view that No change to 11.7-12.7 GHz is in line with Method B of the CPM Report.

MOD THA/5538A17/3

15.4-18.4 GHz

| Allocation to services | | |
|------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| 18.1-18.4 | FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.517A (Earth-to-space) 5.520 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117 MOBILE 5.519 5.521 | |

Reasons: Thailand supports Alternative FSS.

MOD THA/5538A17/4

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 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117 MOBILE | |
| ... | | |
| 18.8-19.3 | FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117 MOBILE | |
| 19.3-19.7 | FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.517A 5.523B 5.523C 5.523D 5.523E Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117 MOBILE | |

| | | |
|--|---|--|
| <p>19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE-ADD 5.A117 Mobile-satellite (space-to-Earth) 5.524</p> | <p>19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE-ADD 5.A117 MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 5.529</p> | <p>19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE-ADD 5.A117 Mobile-satellite (space-to-Earth) 5.524</p> |
| <p>20.1-20.2</p> | <p>FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE-ADD 5.A117 MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528</p> | |

Reasons: Thailand supports Alternative FSS.

MOD **THA/5538A17/5**

24.75-29.9 GHz

| Allocation to services | | |
|-------------------------|---|----------|
| Region 1 | Region 2 | Region 3 |
| <p>27.5-28.5</p> | <p>FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.539 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE-ADD 5.A117 MOBILE 5.538 5.540</p> | |
| <p>28.5-29.1</p> | <p>FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.523A 5.539 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE-ADD 5.A117 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540</p> | |

| | | |
|---|---|---|
| <p>29.1-29.5</p> <p>FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.517A 5.523C 5.523E 5.535A 5.539 5.541A Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117</p> <p>MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540</p> | | |
| <p>29.5-29.9</p> <p>FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117</p> <p>Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542</p> | <p>29.5-29.9</p> <p>FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117</p> <p>MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.525 5.526 5.527 5.529 5.540</p> | <p>29.5-29.9</p> <p>FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117</p> <p>Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542</p> |

Reasons: ~~Thailand supports Alternative FSS.~~

ADD **THA/5538A17/6**

5.A117

Alternative non-GSO FSS hard limit

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

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

End of alternative non-GSO FSS hard limit

Alternative non-GSO FSS coordination

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

Option 4: For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the ~~Alternative FSS:~~ fixed-satellite service (space-to-

space) ~~Alternative ISS: inter-satellite service~~ Resolution [A117-B](WRC-23) shall apply.
No. 4.10 does not apply (WRC-23)

End of alternative non-GSO FSS coordination

Reasons:

MOD THA/5538A17/7

29.9-34.2 GHz

| Allocation to services | | |
|------------------------|--|----------|
| Region 1 | Region 2 | Region 3 |
| 29.9-30 | FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 Alternative FSS: (space-to-space) ADD 5.A117 Alternative ISS: INTER-SATELLITE ADD 5.A117 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542 | |

~~Reasons: Thailand supports Alternative FSS.~~

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

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

MOD THA/5538A17/8

TABLE 21-4 (Rev.WRC-1923)

| Frequency band | Service* | Limit in dB(W/m ²) for angles of arrival (δ) above the horizontal plane | | | Reference bandwidth |
|-------------------------------|--|---|--|---|---------------------|
| | | 0°-5° | 5°-25° | 25°-90° | |
| ... | | | | | |
| 17.7-19.3 GHz ^{7, 8} | Fixed-satellite (space-to-Earth) Alternative FSS: Fixed-satellite (space-to-space) Alternative ISS: Inter-satellite Meteorological-satellite (space-to-Earth) | 0°-5° -115 ^{14, 15} or -115 - X ¹³ | 5°-25° -115 + 0.5(δ - 5) ^{14, 15} or -115 - X + ((10 + X)/20)(δ - 5) ¹³ | 25°-90° -105 ^{14, 15} or -105 ¹³ | 1 MHz |
| | | 0°-3° | 3°-12° | 12°-25° | 1 MHz |

| | | | | | | |
|-------------------------------|---|--------------------|------------------------------------|--------------------------------------|--------------------|-------|
| 17.7-19.3 GHz ^{7, 8} | Fixed-satellite (space-to-Earth) Alternative FSS: Fixed-satellite (space-to-space) Alternative ISS: Inter-satellite | -120 ¹⁶ | -120 + (8/9) (δ - 3) ¹⁶ | -112 + (7/13) (δ - 12) ¹⁶ | -105 ¹⁶ | |
| 19.3-19.7 GHz | Fixed-satellite (space-to-Earth) Alternative FSS: Fixed-satellite (space-to-space) Alternative ISS: Inter-satellite | 0°-3° | 3°-12° | 12°-25° | -105 ¹⁶ | 1 MHz |
| | | -120 ¹⁶ | -120 + (8/9) (δ - 3) ¹⁶ | -112 + (7/13) (δ - 12) ¹⁶ | | |

TABLE 21-4 (continued) (Rev.WRC-1923)

| Frequency band | Service* | Limit in dB(W/m ²) for angles of arrival (δ) above the horizontal plane | | | Reference bandwidth |
|---|---|---|---------------------------------|--------------------|---------------------|
| | | 0°-5° | 5°-25° | 25°-90° | |
| 19.3-19.7 GHz 21.4-22 GHz (Regions 1 and 3) 22.55-23.55 GHz 24.45-24.75 GHz 25.25-27.5 GHz 27.500-27.501 GHz | Fixed-satellite (space-to-Earth) Broadcasting-satellite Earth exploration-satellite (space-to-Earth) Inter-satellite Space research (space-to-Earth) | -115 ¹⁵ | -115 + 0.5(δ - 5) ¹⁵ | -105 ¹⁵ | 1 MHz |
| <i>Alternative 1 for the pfd mask for the protection of fixed and mobile stations</i> | | | | | |
| <u>27.5-29.5 GHz</u> | Alternative FSS: Fixed-satellite (space-to-space) (non-geostationary satellite orbit) Alternative ISS: Inter-satellite (non-geostationary satellite orbit) | <u>-115</u> | <u>-115 + 0.5(δ - 5)</u> | <u>-105</u> | <u>1 MHz</u> |
| <i>Alternative 2 for the pfd mask for the protection of fixed and mobile stations</i> | | | | | |
| <u>27.5-29.5 GHz</u> | Alternative FSS: Fixed-satellite (space-to-space) (non-geostationary satellite orbit) Alternative ISS: Inter-satellite (non-geostationary satellite orbit) | <u>TBD</u> | <u>TBD</u> | <u>TBD</u> | <u>1 MHz</u> |
| ... | | | | | |

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.

Reasons:

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

² The Radiocommunication Bureau shall develop and keep up-to-date forms of notice to meet fully the statutory provisions of this Appendix and related decisions of future conferences. Additional information on the items listed in this Annex together with an explanation of the symbols is to be found in the Preface to the BR IFIC (Space Services). (WRC-12)

MOD THA/5538A17/9

TABLE A
GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM,
EARTH STATION OR RADIO ASTRONOMY STATION (Rev.WRC-1923)

| Items in Appendix | <i>A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION</i> | 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 <i>resolves</i> 1.5 of Resolution 156 (WRC-15) that the administration responsible for the use of the assignment shall implement <i>resolves</i> 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 <i>resolves</i> 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 <i>resolves</i> 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 <i>resolves</i> 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 <i>resolves</i> 7 OF RESOLUTION 169 (WRC-19) | | | | | | | | | | A.22 | |
| A.22.a | a commitment that aeronautical ESIMs would be in conformity with the pfd limits on the Earth's surface specified in Part II of Annex 3 to Resolution 169 (WRC-19) Required only for the notification of earth stations in motion submitted in accordance with Resolution 169 (WRC-19) | | | | + | | | | | | A.22.a | |
| A.23 | COMPLIANCE WITH RESOLUTION 35 (WRC-19) | | | | | | | | | | A.23 | |
| A.23.a | a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments to the non-geostationary-satellite system | | | | | O | | | | | A.23.a | |
| A.24 | COMPLIANCE WITH NOTIFICATION OF A NON-GSO SHORT DURATION MISSION | | | | | | | | | | A.24 | |
| A.24.a | a commitment by the administration that, in the case that unacceptable interference caused by a non-GSO satellite network or system identified as short-duration mission in accordance with Resolution 32 (WRC-19) is not resolved, the administration shall undertake steps to eliminate the interference or reduce it to an acceptable level Required only for notification | | | | | + | | | | | A.24.a | |
| A.25 | COMPLIANCE WITH RESOLUTION JA117-B1 (WRC-23) | | | | | | | | | | A.25 | |
| A.25.a | a commitment from the notifying administration of a non-GSO space station receiving in the frequency bands 27.5-28.6 GHz and 29.5-30.0 GHz that the equivalent power flux-density produced at any point in the geostationary-satellite orbit by emissions from all combined operations of space-to-space and Earth-to-space links shall not exceed the limits given in Table 22-2 | | | + | | + | | | | | A.25.a | |

| Items in Appendix | A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION | Advance publication of a geostationary-satellite network | Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9 | Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9 | Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A) | Notification or coordination of a non-geostationary-satellite network or system | Notification or coordination of an earth station (including notification under Appendices 30A or 30B) | Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5) | Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5) | Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8) | Items in Appendix | Radio astronomy |
|--------------------------|---|--|--|--|--|---|---|---|--|---|-------------------|-----------------|
| A.25.b | a commitment from the notifying administration that, upon receiving a report of unacceptable interference, from its non-GSO space station transmitting in frequency bands (27.5-30 GHz) the notifying administration will follow the procedures in <i>resolves further 2</i> of Resolution [A117-B] (WRC-23) Required only for the notification of non-GSO space stations submitted in accordance with Resolution [A117-B] (WRC-23) | | | | | + | | | | A.25.b | | |
| A.25.c.1 | Exclusion zone angle (degrees), the minimum angle to the geostationary-satellite orbit at the non-geostationary space station transmitting space station at which it will operate defined at the non-geostationary transmitting space station | | | + | | + | | | | A25c1 | | |
| A.25.c.2 | Mask pattern defined in terms of the e.i.r.p. in a 40 kHz bandwidth as a function of the off-axis angle between the non-geostationary transmitting space station boresight line and the line from the non-geostationary transmitting space station to a point on the geostationary-satellite orbit | | | + | | + | | | | A25c2 | | |
| A.25.d | COMPLIANCE WITH <i>resolves 3.3</i> OF RESOLUTION [A117-B] (WRC-23) | | | | | | | | | A25.d | | |
| A.25.d.1 | a commitment by the notifying administration for a non-GSO FSS system with an orbital apogee of less than 20 000 km communicating with lower orbiting non-GSO space stations in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz that the pfd shall be in conformity with the pfd limits on the Earth's surface specified in Annex 3 to Resolution [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 | | |

Reasons:

Reasons:

ADD THA/5538A17/11

DRAFT NEW RESOLUTION [A117-B] (WRC-23)

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

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that there is a need for non-geostationary-satellite orbit (non-GSO) space stations to be able to relay data to the Earth, and that part of this need could be met by allowing such non-GSO space stations to communicate with ~~[Alternative FSS: fixed-satellite service (FSS)]~~ ~~[Alternative ISS: inter-satellite service (ISS)]~~ space stations operating in the geostationary-satellite orbit (GSO) and in the non-GSO in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof;
- b) that the administration responsible for the notification of non-GSO space stations communicating with GSO or non-GSO space stations in the ~~[Alternative FSS: FSS]~~ ~~[Alternative ISS: ISS]~~ at higher altitude does not need to be the same administration that has already notified assignments in the ~~[Alternative FSS: FSS]~~ ~~[Alternative ISS: ISS]~~;
- c) that imposing the hard limits necessary to protect other services would provide regulatory certainty for both notifying administrations of non-GSO space stations communicating with ~~[Alternative FSS: FSS]~~ ~~[Alternative ISS: ISS]~~ space stations and potentially impacted services;
- d) that there is growing interest for utilizing satellite-to-satellite links for a variety of applications;
- e) that the ITU Radiocommunication Sector (ITU-R) has carried out sharing and compatibility studies between incumbent services in the frequency bands 18.1-18.6 GHz, 18.8-20.2 and 27.5-30 GHz and adjacent bands and satellite-to-satellite transmissions in the ~~[Alternative FSS: FSS]~~ ~~[Alternative ISS: ISS]~~;
- f) that these studies were based on certain principles, including the limitation of the use of frequency bands in a specific direction in accordance with the existing FSS allocations in these frequency bands, the use of power control and antenna-steering capabilities and compliance with applicable efd and off-axis e.i.r.p. limits to protect incumbent services;
- g) that the frequency bands 18.1-18.6 GHz (space-to-Earth), 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) are also allocated to terrestrial and space services used by a variety of different systems, and these existing services and their future development need to be protected, without the imposition of undue constraints, from the operation of satellite-to-satellite links,

recognizing

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

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

resolves

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

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

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

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

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

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

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

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

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

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

2.3bis 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 $-148 \text{ dB(W/(m}^2 \cdot \text{MHz))}$;

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 $-148 \text{ dB(W/(m}^2 \cdot \text{MHz))}$. 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 $\text{dB(W/(m}^2 \cdot \text{MHz))}$;

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 $\text{dB(W/(m}^2 \cdot \text{MHz))}$. This limit may be exceeded at the site of a non-GSO mobile satellite gateway station of any country whose administration has so agreed as long as these limits are unchanged in cross-border applications;

End of Alternative non-GSO FSS Hard limits

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

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

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

7 *Option 1:* that the implementation of this Resolution is conditioned on the development of the description of interference management system(s), monitoring facilities (NCCM), 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 (NMC) or equivalent facility and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NMC or equivalent facility;
- c) a permanent point of contact is provided for the purpose of tracing any cases of unacceptable interference from non-GSO transmitting space stations in these frequency bands in the ~~Alternative FSS~~-FSS (space-to-space) ~~Alternative ISS~~-ISS service and to immediately respond to requests from the focal point;

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

instructs the Director of the Radiocommunication Bureau

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

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

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

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

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

ANNEX 1 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Determination of the off-nadir angle

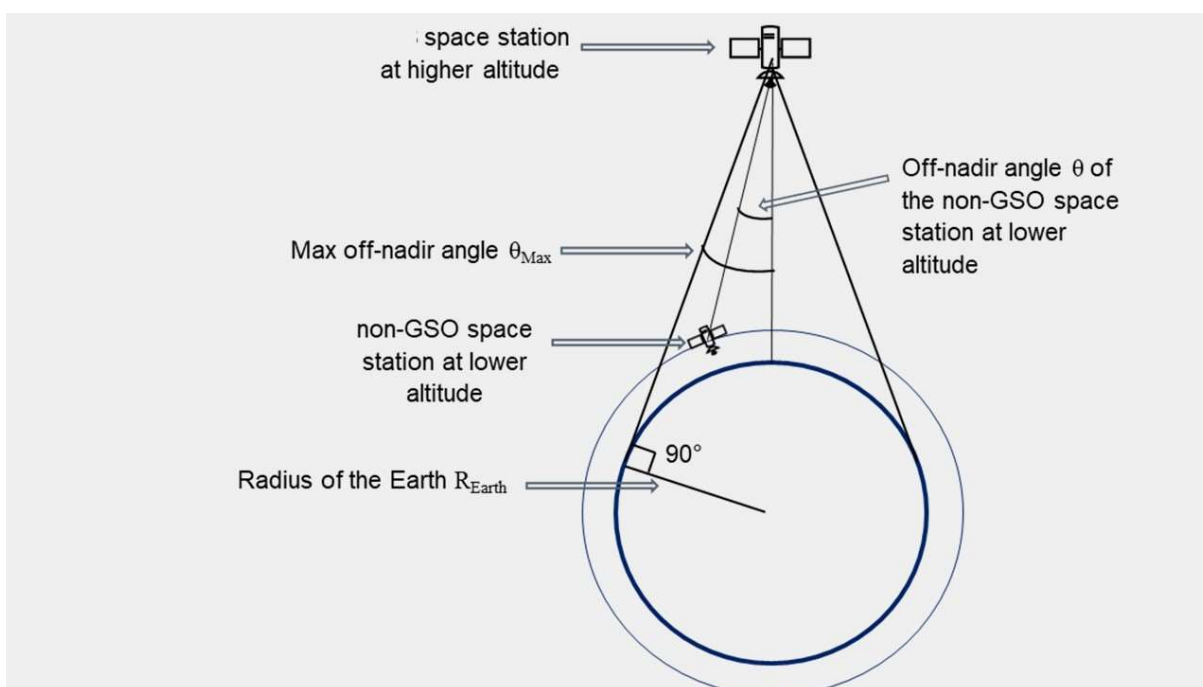
1 A non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall only communicate with a non-GSO space station when the off-nadir angle between this non-GSO space station and the non-GSO space station with which it communicates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

$$\theta_{Max} = \sin^{-1} \left(\frac{R_{Earth}}{R_{Earth} + Alt_{Higher}} \right)$$

where

$$R_{Earth} = 6\,378 \text{ km}$$

Alt_{Higher} = altitude of the non-GSO space station at higher orbital altitude in km.



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

Alternative GSO “expanded cone”

if the altitude of the non-GSO space station is less than 2 000 km:

$$\theta_{Max} = \sin^{-1} \left(\frac{R_{Earth} + Alt_{non-GSO}}{R_{Earth} + Alt_{GSO}} \right)$$

if the altitude of the non-GSO space station is greater than or equal to 2 000 km:
End of Alternative GSO “expanded cone”

$$\theta_{Max} = \sin^{-1} \left(\frac{R_{Earth}}{R_{Earth} + Alt_{GSO}} \right)$$

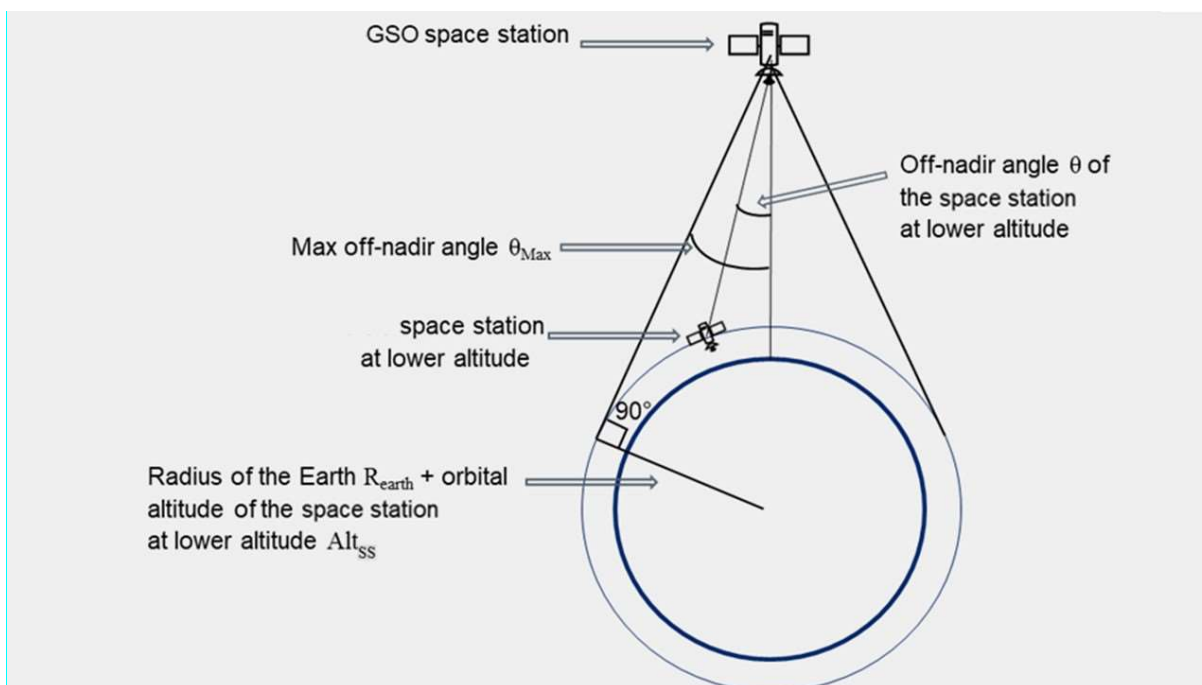
where:

$R_{Earth} = 6\,378$ km

$Alt_{GSO} =$ altitude of the GSO space station in km.

Alternative GSO “expanded cone”

$Alt_{non-GSO} =$ altitude of the non-GSO space station in km.



3 If the altitude of the non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz is less than 2 000 km, the angle between the vector from this space station to the centre of the Earth and the vector between this space station and the GSO space station, shall be at least 90°.

End of Alternative GSO “expanded cone”

43 In case the notified service area of the Alternative GSO “within the cone”: GSO or non-GSO network/system at higher orbital altitude is not global, the maximum off-nadir angle θ_{Max} will vary at each azimuth according to the notified service area and there will be a specific maximum off-nadir angle associated to each azimuth based on the position in space of the FSS network/system at higher orbital altitude and the geographic coordinates (latitude, longitude) of the border of the notified service area at each azimuth, which are extracted from the Graphical Interference Management System (GIMS) database container that was submitted to the BR when notifying a specific non-global service area.

$$\theta_{Max} = \cos^{-1} \left(\frac{\left(R_{Earth} + Alt_{Higher} \right)^2 + dist^2 - R_{Earth}^2}{2 \times \left(R_{Earth} + Alt_{Higher} \right) \times dist} \right)$$

with:

$$dist = \sqrt{(X_E - X_S)^2 + (Y_E - Y_S)^2 + (Z_E - Z_S)^2}$$

$$X_E = R_{Earth} \times \cos(lat_{sab}(\varphi)) \times \cos(lon_{sab}(\varphi))$$

$$Y_E = R_{Earth} \times \cos(lat_{sab}(\varphi)) \times \sin(lon_{sab}(\varphi))$$

$$Z_E = R_{Earth} \times \sin(lat_{sab}(\varphi))$$

$$X_S = \left(R_{Earth} + Alt_{Higher} \right) \times \cos(lat_{SS}) \times \cos(lon_{SS})$$

$$Y_S = \left(R_{Earth} + Alt_{Higher} \right) \times \cos(lat_{SS}) \times \sin(lon_{SS})$$

$$Z_S = \left(R_{Earth} + Alt_{SS} \right) \times \sin(lat_{Higher})$$

where:

$lat_{sab}(\varphi)$ = latitude of the service area border for the azimuth φ

$lon_{sab}(\varphi)$ = longitude of the service area border for the azimuth φ

lat_{SS} = latitude of the sub-satellite point of the GSO/non-GSO space station

lon_{SS} = longitude of the sub-satellite point of the GSO/non-GSO space station.

REASONS: THAILAND SUPPORTS ALTERNATIVE GSO "WITHIN THE CONE"

ANNEX 2 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

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

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

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

Option 1

$$pfd(\theta) = -115 \quad (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} \quad \text{for} \quad 0^\circ \leq \theta \leq 5^\circ$$

$$pfd(\theta) = -115 + 0.5(\theta - 5) \quad (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} \quad \text{for} \quad 5^\circ \leq \theta \leq 25^\circ$$

$$pfd(\theta) = -105 \quad (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} \quad \text{for} \quad 25^\circ < \theta \leq 90^\circ$$

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

End of Option 1

Option 2-1

$$\begin{aligned} \text{pfd}(\theta) &= -136.2 && (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} && \text{for } 0^\circ \leq \theta \leq 0.01^\circ \\ \text{pfd}(\theta) &= -132.4 + 1.9 \cdot \log\theta && (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} && \text{for } 0.01^\circ < \theta \leq 0.3^\circ \\ \text{pfd}(\theta) &= -127.7 + 11 \cdot \log\theta && (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} && \text{for } 0.3^\circ < \theta \leq 1^\circ \\ \text{pfd}(\theta) &= -127.7 + 18 \cdot \log\theta && (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} && \text{for } 1^\circ < \theta \leq 2^\circ \\ \text{pfd}(\theta) &= -129.4 + 23.7 \cdot \log\theta && (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} && \text{for } 2^\circ < \theta \leq 8^\circ \\ \text{pfd}(\theta) &= -108 && (\text{dB(W/(m}^2 \cdot 1 \text{ MHz)))} && \text{for } 8^\circ < \theta \leq 90.0^\circ \end{aligned}$$

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

End of Option 2-1

Option 2-2

$$\begin{aligned} \text{pfd}(\delta) &= -124.7 && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 0^\circ \leq \delta \leq 0.01^\circ \\ \text{pfd}(\delta) &= -120.9 + 1.9 \cdot \log \delta && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 0.01^\circ < \delta \leq 0.3^\circ \\ \text{pfd}(\delta) &= -116.2 + 11 \cdot \log \delta && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 0.3^\circ < \delta \leq 1^\circ \\ \text{pfd}(\delta) &= -116.2 + 18 \cdot \log \delta && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 1^\circ < \delta \leq 2^\circ \\ \text{pfd}(\delta) &= -117.9 + 23.7 \cdot \log \delta && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 2^\circ < \delta \leq 8^\circ \\ \text{pfd}(\delta) &= -96.5 && (\text{dB(W/(m}^2 \cdot 14 \text{ MHz)))} && \text{for } 8^\circ < \delta \leq 90^\circ \end{aligned}$$

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 1d*), PSD is the power spectral density in the reference bandwidth associated with the pfd limit, and compute the off-axis gain pattern $G_{tx}(\varphi)$, with φ being the off-axis angle in the direction of the terrestrial receiver. Assume the Earth is a sphere whose radius, R_e , is 6 378 km.
- 2) Compute the angle, as seen from the non-GSO system transmitting in frequency range 27.5-29.5 GHz (the user space station), between the centre of the Earth and the GSO network or non-GSO systems receiving in the frequency range 27.5-29.5 GHz (the service provider space station) assuming that the user is at the edge of the cone of coverage with the formula:

$$\delta = \arcsin\left(\frac{R_e}{R_e + a}\right)$$

- 3) Sweep angle of arrival to the terrestrial station, θ from 0 to 90 degrees in 0.1-degree increments.
- 4) Compute satellite angle $\gamma = \arcsin\left(\frac{\sin(90+\theta)}{R_e+a} * R_e\right)$.
- 5) Compute off-axis angle $\phi = 180 - \delta - \gamma$.
- 6) Compute the gain G_{tx} in dBi towards the Earth point for each of the angles from step 5, using the user space station transmit antenna pattern.
- 7) Compute slant range $d = (R_e + a) \frac{\sin(90-\gamma-\theta)}{\sin(90+\theta)}$.
- 8) Compute the atmospheric attenuation A_{atm} in dB, for the corresponding angle of arrival, θ , using Recommendation ITU-R P.676-13 with the mean global standard atmosphere from Recommendation ITU-R P.835-6.
- 9) Compute the $PF D$ on the ground as:

$$PF D = PSD + G_{tx}(\theta) - A_{atm}(\theta) - 10 \times \log_{10}(4\pi d^2)$$

ANNEX 3 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

Provisions for non-GSO space stations¹ 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 1a*), 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 $-118 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$.

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 1a*), 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 $-110 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$.

[End of Option 1]

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

[Option 2]

Non-GSO fixed-satellite space stations operating with an orbit apogee less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space

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

station as described in *resolves 1a*), 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 |
| $450 \leq$ altitude < 600 | 61 |
| $600 \leq$ altitude < 750 | 58 |
| $750 \leq$ altitude < 900 | 55 |
| altitude \geq 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 |
| $450 \leq$ altitude < 600 | 58 |
| $600 \leq$ altitude < 750 | 55 |
| $750 \leq$ altitude < 900 | 53 |
| altitude \geq 1 290 | N/A |

End of Option 1

Option 2:

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

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

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

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

End of Option 2

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

End of Alternative non-GSO FSS hard limits

ANNEX 5 TO DRAFT NEW RESOLUTION [A117-B] (WRC-23)

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

- 1) In the frequency band 27.5-30 GHz, when a non-GSO system as identified in *resolves further 1b)* identifies an associated GSO network as described in *resolves further 1b)* 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 1d*), 1e), 2 and 3.

2bis) 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 1c*) identifies a non-GSO system as described in *resolves further 1c*) 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 1d*), 1e), 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 1c*) shall not exceed a pfd of (-163/-165) dBW/m² in any 40 kHz band. A computation methodology is provided in Appendix 3 to this Annex.

APPENDIX 1

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

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

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

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

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

$$\Delta FSL = 20 \log_{10} \left(\frac{GSO_{alt}}{GSO_{alt} - NGSO_{alt}} \right)$$

where $NGSO_{alt}$ is the altitude of the transmitting non-GSO system space stations, and $GSO_{alt} = 35\,786$ km. It should be noted that if several altitudes are included in the notification, each altitude shall be tested.

Step 5: Compute the reduced e.i.r.p. spectral density as $EIRPSD_{reduced} = EIRPSD - \Delta FSL$.

Step 6: For all beams in the non-GSO system notification with a class of station ES/XY, the e.i.r.p. spectral density mask is given in Appendix 4 data item A.25.c.2.

Step 7: For all emissions in the GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0 and 80°, with a step of 1°, and reduce it by ΔFSL . The e.i.r.p. spectral density mask computation should assume that the maximum gain is for an off-axis angle of 0°.

Step 8: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5 if, for all beams:

- the maximum value of the e.i.r.p. spectral density mask from step 6 does not exceed the $EIRPSD_{reduced}$ quantity, computed at the same altitude,
- the e.i.r.p. spectral density mask of the transmitting non-GSO space station from step 6 is less than the reduced e.i.r.p. spectral density mask, compared in one hertz, from step 7 for all angles for at least one emission in the GSO network notification.

Otherwise, the assignments shall receive an unfavourable finding.

APPENDIX 2

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

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

Step 2: For each of the receiving non-GSO systems, as listed in *resolves further 1c*).

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

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

$$\Delta FSL = 20 \log_{10} \left(\frac{GSO_{alt}}{GSO_{alt} - NGSO_{alt}} \right)$$

where $NGSO_{alt}$ is the altitude of the transmitting non-GSO system space stations, and $GSO_{alt} = 35\,786$ km. It should be noted that if several altitudes are included in the notification, each altitude shall be tested.

Step 5: Compute the reduced e.i.r.p. spectral density as $EIRPSD_{reduced} = EIRPSD - \Delta FSL$.

Step 6: For all beams in the non-GSO system notification with a class station ES/XY, the e.i.r.p. spectral density mask is given in Appendix 4 data item A.25.c.2.

Step 7: For all emissions in the receiving non-GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0 and 80°, with a step of 1°, and reduce it by ΔFSL . The e.i.r.p. spectral density mask computation should assume that the maximum gain is for an off-axis angle of 0°.

Step 8: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5 if, for all beams:

- the maximum value of the mask from step 6 does not exceed the $EIRPSD_{reduced}$ quantity, computed at the same altitude,
- the e.i.r.p. spectral density mask of the transmitting non-GSO space station from step 6 is less than the reduced e.i.r.p. spectral density mask from step 7 for all angles.

Otherwise, the assignments shall receive an unfavourable finding.

APPENDIX 3

To check the compliance of the non-GSO emissions with the pfd limit given in Annex 5, § 5), the following procedure shall be followed.

Step 1: Select the corresponding value to the GSO arc avoidance angle in the e.i.r.p. mask as given in Appendix 4 data item A.25.c.2, and denote it as $eirp_{\alpha}$. If the mask is non-monotonic, select the largest value in the e.i.r.p. mask considering all angles greater than or equal to the GSO arc avoidance angle as given in Appendix 4 data item A.25.c.1.

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

$$PFD = eirp_{\alpha} - 10 \log \left(4\pi((35\,786 - alt) \times 1\,000)^2 \right)$$

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

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

Reasons:

SUP THA/5538A17/12

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).



PLENARY MEETING

**Addendum 7 to
Document 5014(Add.22)-
E
23 August 2023
Original: English**

Singapore (Republic of)/Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 7(E)

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

7(E) Topic E - RR Appendix **30B** improved procedures for new Member States

APPENDIX 30B (REV.WRC-19)

**Provisions and associated Plan for the fixed-satellite service
in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz,
10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz**

MOD SNG/THA/5014A22A7/1

ARTICLE 6 (REV.WRC-1923)

**Procedures for the conversion of an allotment into an assignment, for
the introduction of an additional system or for the modification of
an assignment in the List^{1, 2, 2bis, 2ter} (WRC-1923)**

Reasons:

MOD SNG/THA/5014A22A7/2

ARTICLE 7 (REV.WRC-1523)

**Procedure for the addition of a new allotment to the Plan
for a new Member State of the Union^{XX2} (WRC-23)**

Reasons:

NOC SNG/THA/5014A22A7/3

7.1 The administration of a country** which has joined the Union as a Member State and does not have a national allotment in the Plan or an assignment stemming from the conversion of an allotment shall obtain a national allotment by the following procedure. (WRC-15)

Reasons:

NOC SNG/THA/5014A22A7/4

7.2 The administration shall submit its request for an allotment to the Bureau, with the following information:

- a) the geographical coordinates of not more than 20 test points for determining the minimal ellipse to cover its national territory;
- b) the height above sea level of each of its test points;
- c) any special requirement which is to be taken into account to the extent practicable.

Reasons:

^{2ter} [In respect of proposed allotments by new Member States of the Union under Article 7 of this Appendix, special provisions as outlined in that Article apply. \(WRC-23\)](#)

^{XX2} [See also Resolution \[NEW-MEMBER-STATE-AP30B\] \(WRC-23\). \(WRC-23\)](#)

⁹ (SUP - WRC-15)

NOC SNG/THA/5014A22A7/5

7.3 Upon receipt of the complete information (mentioned in § 7.2 above), the Bureau shall expeditiously and ahead of submissions for which the examination under § 6.5 has not yet started, identify appropriate technical characteristics and associated orbital locations for a prospective national allotment. The Bureau shall send this information to the requesting administration.

Reasons:

NOC SNG/THA/5014A22A7/6

7.4 Upon receipt of the Bureau's response under § 7.3, the requesting administration shall, within thirty days, indicate which of the proposed orbital locations with the associated technical parameters as identified by the Bureau it has selected. During this period, the requesting administration may at any time seek the assistance of the Bureau.

Reasons:

MOD SNG/THA/5014A22A7/7

7.4bis If a selection for an allotment under § 7.4 has not been received by the Bureau within the specified time-limit [referred to in § 7.4 above](#), the Bureau ~~will~~[shall](#) resume examination of submissions under § 6.5, or subsequent submission under Article 7, as appropriate, and inform the requesting administration that its request will be processed under § 7.5 when the Bureau is informed about the selected orbit location.

Reasons:

MOD SNG/THA/5014A22A7/8

7.5 Upon receipt of a request under § 7.4, the Bureau shall process the request ahead of submissions for which the examination under § 6.5 has not yet started and, using [Annexes 3 and 4](#) [Appendices 1 and 2 of Attachment 1 to Resolution 170 \(WRC-19\)](#), examine it with respect to its conformity with:

- a) the Table of Frequency Allocations and the other provisions¹⁰ of the Radio Regulations, except those provisions relating to conformity with the fixed-satellite service Plan which are the subject of the following subparagraph;
- b) allotments in the Plan;
- c) assignments which appear in the List;
- d) assignments for which the Bureau has previously received complete information and which have been examined, or are at the stage of examination under § 6.5.

Reasons:

NOC SNG/THA/5014A22A7/9

7.6 When the examination under § 7.5 leads to a favorable finding, the Bureau shall enter the national allotment of the new Member State of the Union in the Plan and publish the characteristics of the allotment concerned and the result of its examination in a Special Section of the BR IFIC with the updated reference situation.

Reasons:

MOD SNG/THA/5014A22A7/10

7.7 In the event that the Bureau's findings under § 7.5 are unfavourable, the proposed allotment of the Member State shall be treated as a submission under § 6.1 and shall be treated by the Bureau ahead of any other submissions received under Article 6, except for submissions which were already under examination under § 6.5 by the Bureau at the time of completion of the examination of the request of the new Member State under § 7.5. During the Article 6 procedure for the proposed allotment of the new Member State of the Union, the additional provisions contained in §§ 8 and 9 of Attachment 1 to Resolution 170 (WRC-19) shall apply and the associated technical criteria specified in Appendices 1 and 2 to that Attachment shall be used during technical examinations at the various stages of Article 6.

Reasons:

MOD SNG/THA/5014A22A7/11

RESOLUTION 170 (REV.WRC-1923)

**Additional measures for satellite networks in the fixed-satellite service
in frequency bands subject to Appendix 30B for the enhancement
of equitable access to these frequency bands**

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

...

ATTACHMENT 1 TO
RESOLUTION 170 (REV.WRC-1923)

...

APPENDIX 2 TO ATTACHMENT 1 TO
RESOLUTION 170 ([REV.WRC-1923](#))

Protection criteria for a new incoming network

| Incoming network | Allotments or assignments to be protected | Protection criteria |
|---|---|---|
| Assignment applying the special procedure or allotment proposed under Article 7 of Appendix 30B | Allotment in the Plan | Annex 4 of Appendix 30B |
| | Assignment converted from allotment without modification | Annex 4 of Appendix 30B |
| | Assignment converted from allotment with modification within the envelope of the allotment | Annex 4 of Appendix 30B |
| | Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure applied | Annex 4 of Appendix 30B |
| | Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure NOT applied | New criteria specified in this Resolution |
| | Former existing system | Annex 4 of Appendix 30B |
| | Additional system for which the special procedure applied | Annex 4 of Appendix 30B |
| | Additional system with frequency assignments recorded in the List until 22 November 2019 with service area limited to national territories for which the special procedure NOT applied | Annex 4 of Appendix 30B |
| | Additional system with frequency assignments submitted under item 6.1 of Appendix 30B with service area limited to national territories for which the special procedure NOT applied | New criteria specified in this Resolution |
| | Additional system with frequency assignments with service area beyond national territories for which the special procedure NOT applied | New criteria specified in this Resolution |
| | Request under Article 7 but transferred to Article 6 | Annex 4 of Appendix 30B |
| New allotment through the application of § 6.35 | Annex 4 of Appendix 30B | |
| Conversion of allotment or new additional system for which the special procedure NOT applied | All | Annex 4 of Appendix 30B |

Reasons:

Singapore (Republic of) and Thailand support grant to new ITU Member States with the same privileges as those granted by WRC-19 to administrations having no assignments in the RR Appendix 30B List or under coordination. Therefore, Singapore and Thailand support Method E2 in the CPM Report.



PLENARY MEETING

**Addendum 8 to
Document 5520(Add.22)-
E
23 August 2023
Original: English**

Singapore (Republic of)/Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 7(F)

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

7(F) Topic F - Excluding uplink service area in RR Appendix **30A** for Regions 1 and 3 and RR Appendix **30B**

Agenda item 7(F)

NOC SNG/THA/5520A22A8/1

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List¹ for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz² and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

MOD SNG/THA/5520A22A8/2

ARTICLE 4 (REV.WRC-1923)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

4.1 Provisions applicable to Regions 1 and 3

ADD SNG/THA/5520A22A8/3

4.1.10e An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-23)

4.1 Provisions applicable to Regions 1 and 3

ADD SNG/THA/5520A22A8/4

4.1.20bis When an administration or a group of named administrations plans to implement a satellite network with a service area limited to its territory or their territories, as appropriate, and with characteristics in compliance with §§ 3.2, 3.4 and 3.5 of Annex 3 of this Appendix, including the co- and cross-polar off-axis e.i.r.p. characteristics specified by curves A' and B' of Figure A respectively, any other notifying administration of a satellite network having relative satellite

antenna gain derived from the minimum ellipse^{ZZ} required to cover the service area of equal to or less than -20 dB over the territory/territories of the former administration(s) and being identified as affected by the Bureau shall not claim protection from uplink interference emanating from the territory of the former administration(s). § 4.1.20 does not apply. (WRC-23)

NOC SNG/THA/5520A22A8/5

APPENDIX 30B (REV.WRC-19)

**Provisions and associated Plan for the fixed-satellite service
in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz,
10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz**

MOD SNG/THA/5520A22A8/6

ARTICLE 6 (REV.WRC-19²³)

**Procedures for the conversion of an allotment into an assignment, for
the introduction of an additional system or for the modification of
an assignment in the List^{1, 2, 2bis}** (WRC-19)

^{ZZ} The minimum ellipse is determined by the set of test points contained in the satellite network, including the associated relevant Regions 1 and 3 List of additional uses, using the relevant BR software application. (WRC-23)

¹ If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 6.7 and/or 6.23 and the corresponding entries in the List under § 6.23 and/or 6.25, as appropriate, and reinstate any allotments back into the Plan after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. See also Resolution **905 (WRC-07)***.

* *Note by the Secretariat:* This Resolution was abrogated by WRC-12.

² Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

^{2bis} Resolution **170 (WRC-19)** applies. (WRC-19)

MOD SNG/THA/5520A22A8/7

6.16 An administration may at any time during or after the above-mentioned four-month period inform the Bureau about its objection to being included in the service area of any assignment, even if this assignment has been entered in the List. The Bureau shall then inform the administration responsible for the assignment and exclude the territory and test points **MOD 6bis** that are within the territory of the objecting administration from the service area. The Bureau shall update the reference situation without reviewing the previous examinations. (WRC-1923)

ADD SNG/THA/5520A22A8/8

6.29bis When an administration or a group of named administrations plans to implement a satellite network with a service area limited to its territory or their territories, as appropriate, and with uplink characteristics in compliance with §§ 1.2, 1.3 and 1.6 of Annex 1 of this Appendix, including those of Table 1 of § 1.6.4, any other notifying administration of a satellite network having relative satellite antenna gain derived from the minimum ellipse^{ZZ} required to cover the service area of equal to or less than -20 dB over the territory/territories of the former administration(s) and being identified as affected by the Bureau shall not claim protection from uplink interference emanating from the territory of the former administration(s). § 6.29 does not apply. (WRC-23)

Reasons:

Singapore (Republic of) and Thailand support Method F3 in the CPM report to exclude uplink service area in RR Appendix 30A for Regions 1 and 3 and RR Appendix 30B.

^{6bis} The administration responsible for the assignment may request to relocate the **downlink** test points from the excluded territory to a new location within the remaining part of its service area. **Uplink test points relocation shall not cause more interference.** (WRC-1923)

^{ZZ} The minimum ellipse is determined by the set of both uplink and downlink test points contained in the satellite network using the relevant BR software application. (WRC-23)



PLENARY MEETING

**Addendum 10 to
Document 5523(Add.22)-
E
23 August 2023
Original: English**

Singapore (Republic of)/Thailand

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 7(H)

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

7(H) Topic H - Enhanced protection of RR Appendices **30/30A** in Regions 1 and 3 and RR Appendix **30B**

Agenda item 7(H)

NOC SNG/THA/5523A22A10/1

APPENDIX 30 (REV.WRC-19)*

**Provisions for all services and associated Plans and List¹ for
the broadcasting-satellite service in the frequency bands
11.7-12.2 GHz (in Region 3), 11.7-12.5 GHz (in Region 1)
and 12.2-12.7 GHz (in Region 2) (WRC-03)**

MOD SNG/THA/5523A22A10/3

ARTICLE 4 (REV.WRC-19-23)

**Procedures for modifications to the Region 2 Plan or
for additional uses in Regions 1 and 3³**

MOD SNG/THA/5523A22A10/7

4.1.10d If no decision is communicated to the Bureau within 30 days after the date of dispatch of the reminder under § 4.1.10b and the identification is of:

- an assignment in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~ no objection to the proposed assignment and an agreement under § 4.1.13bis is considered as concluded between the administration of the affected assignment in the Regions 1 and 3 Plan and the notifying administration of the proposed assignment; or
- an assignment not in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-1523)

ADD SNG/THA/5523A22A10/8

4.1.13bis When an agreement under this provision is concluded with an administration of the affected assignment in the Regions 1 and 3 Plan, the notifying administration of the proposed assignment shall commit to respect a power flux-density limit shown in Annex 1 at any point within the territory, situated inside the –3 dB contour of the associated beam area, of this administration whose assignment was the basis of the disagreement at the date on which the frequency assignment in the Regions 1 and 3 Plan is to be brought into use as communicated under § 5.1.10bis or within twelve months of the date of dispatch of the telefax sent under § 5.1.10bis, whichever comes later. (WRC-23)

³ The provisions of Resolution 49 (Rev.WRC-15) apply. (WRC-15)

ADD SNG/THA/5523A22A10/9

4.1.13*ter* Upon the conclusion of agreements under § 4.1.13*bis*, when entering the assignment in the List, the Bureau shall indicate those administrations whose assignments in the Regions 1 and 3 Plan were the basis of the agreement. (WRC-23)

ADD SNG/THA/5523A22A10/4

4.1.30 When an assignment is entered in the List referred to in § 4.1.13*ter*, that assignment shall not be taken into account in updating the reference situation of those assignments in the Regions 1 and 3 Plan with which an agreement under § 4.1.13*bis* was concluded. (WRC-23)

ADD SNG/THA/5523A22A10/5

4.1.31 If the Bureau is informed that a commitment under § 4.1.13*bis* is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 4.1.13*bis*. (WRC-23)

ADD SNG/THA/5523A22A10/6

4.1.32 If, in spite of the application of § 4.1.31, conditions specified in § 4.1.13*bis* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

MOD SNG/THA/5523A22A10/10

ARTICLE 5 (REV.WRC-1923)

**Notification, examination and recording in the Master International
Frequency Register of frequency assignments to space stations
in the broadcasting-satellite service¹⁸ (WRC-07)**

Reasons:

¹⁸ If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.6 and the corresponding entries in the Master Register under § 5.2.2, 5.2.2.1, 5.2.2.2 or 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. See also Resolution **905 (WRC-07)***. (WRC-07)

* *Note by the Secretariat:* This Resolution was abrogated by WRC-12.

ADD SNG/THA/5523A22A10/11

5.1.6bis Upon receipt of a complete notice, the Bureau shall immediately send a telefax to administrations which applied § 4.1.13bis with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 5.1.1 of this notice and the date on which the frequency assignment, subject of § 4.1.13bis agreement, is planned to be brought into use. (WRC-23)

NOC SNG/THA/5523A22A10/12

APPENDIX 30A (REV.WRC-19)*

Provisions and associated Plans and List¹ for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz² and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2 (WRC-03)

ARTICLE 4 (REV.WRC-19)

Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3

MOD SNG/THA/5523A22A10/16

4.1.10d If no decision is communicated to the Bureau within 30 days after the date of dispatch of the reminder under § 4.1.10b and the identification is of:

- an assignment in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~no objection to the proposed assignment and an agreement under § 4.1.13bis is considered as concluded between the administration of the affected assignment in the Regions 1 and 3 Plan and the notifying administration of the proposed assignment; or
- an assignment not in the Regions 1 and 3 Plan, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-1523)

ADD SNG/THA/5523A22A10/18

4.1.13bis When an agreement under this provision is concluded with the administration of an affected assignment in the Regions 1 and 3 Plan, the notifying administration shall commit to

respect a power flux-density of $-197.0 - GR_x^{zz}$ dB(W/(m² · Hz)) arriving at the receiving space station of this administration whose assignment was the basis of the disagreement at the date on which the frequency assignment in the Regions 1 and 3 Plan is to be brought into use communicated under § 5.1.10*bis* or within twelve months of the date of dispatch of the telefax sent under § 5.1.10*bis*, whichever comes later. (WRC-23)

ADD SNG/THA/5523A22A10/17

4.1.13*ter* Upon the conclusion of agreements under § 4.1.13*bis*, when entering the assignment in the List, the Bureau shall indicate those administrations whose assignments in the Regions 1 and 3 Plan were the basis of the agreement. (WRC-23)

ADD SNG/THA/5523A22A10/15

4.1.30 When an assignment is entered in the List referred to in § 4.1.13*ter*, that assignment shall not be taken into account in updating the reference situation of those assignments in the Regions 1 and 3 Plan with which an agreement under § 4.1.13*bis* was concluded. (WRC-23)

ADD SNG/THA/5523A22A10/14

4.1.31 If the Bureau is informed that a commitment under § 4.1.13*bis* is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 4.1.13*bis*. (WRC-23)

ADD SNG/THA/5523A22A10/13

4.1.32 If, in spite of the application of § 4.1.31, conditions specified in § 4.1.13*bis* are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

^{zz} GR_x is the relative receive antenna gain of the space station of the national allotment of the administration with which an agreement under § 4.1.13*bis* was concluded in the direction of the location of the feeder-link earth station of the notifying administration. (WRC-23)

MOD SNG/THA/5523A22A10/19

ARTICLE 5 (REV.WRC-19-23)

Coordination, notification, examination and recording in the Master International Frequency Register of frequency assignments to feeder-link transmitting earth stations and receiving space stations in the fixed-satellite service^{21, 22} (WRC-19)

Reasons:

ADD SNG/THA/5523A22A10/20

5.1.10*bis* Upon receipt of a complete notice, the Bureau shall immediately send a telefax to administrations which applied § 4.1.13*bis* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 5.1.1 of this notice and the date on which the frequency assignment, subject of § 4.1.13*bis* agreement, is planned to be brought into use. (WRC-23)

NOC SNG/THA/5523A22A10/21

APPENDIX 30B (REV.WRC-19)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

²¹ Notification of assignments to transmitting feeder-link earth stations included in the Region 2 feeder-link Plan after 2 June 2000, or included in the feeder-link List, following successful application of Article 4, shall be effected applying the provisions of Article **11** following completion of the procedure of Article **9**. (WRC-03)

²² If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 5.1.10 and the corresponding entries in the Master Register under § 5.2.2, § 5.2.2.1, § 5.2.2.2 or § 5.2.6, as appropriate, and the corresponding entries included in the Plan on and after 3 June 2000 or in the List, as appropriate, after informing the administration concerned. The Bureau shall inform all administrations of such action. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. (WRC-19)

MOD SNG/THA/5523A22A10/22

ARTICLE 6 (REV.WRC-1923)

Procedures for the conversion of an allotment into an assignment, for the introduction of an additional system or for the modification of an assignment in the List^{1, 2, 2bis} (WRC-19)

ADD SNG/THA/5523A22A10/23

6.4bis When the examination of each assignment in a notice received under § 6.1, to convert an allotment into an assignment, with respect to § 6.3 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations for which § 6.15^{quat} was applied with regard to this notice. This telefax shall inform these administrations of the reception under § 6.1 of this notice. (WRC-23)

MOD SNG/THA/5523A22A10/26

6.15 If no decision is communicated to the Bureau within thirty days after the date of dispatch of the reminder under § 6.14 and the identification is of:

- a)* an allotment in the Plan, it shall be deemed that the administration which has not given a decision has ~~agreed~~ no objection to the proposed assignment until this administration plans to bring into use its allotment in the Plan and an agreement under § 6.15^{quat} is considered as concluded between the administration of the affected allotment in the Plan and the notifying administration of the proposed assignment; or
- b)* an assignment, it shall be deemed that the administration which has not given a decision has agreed to the proposed assignment. (WRC-23)

¹ If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication specified in § 6.7 and/or 6.23 and the corresponding entries in the List under § 6.23 and/or 6.25, as appropriate, and reinstate any allotments back into the Plan after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482, unless the payment has already been received. See also Resolution **905 (WRC-07)***.

* *Note by the Secretariat:* This Resolution was abrogated by WRC-12.

² Resolution **49 (Rev.WRC-15)** applies. (WRC-15)

2bis Resolution **170 (WRC-19)** applies. (WRC-19)

ADD SNG/THA/5523A22A10/24

6.15quin Upon conclusion of agreements under § 6.15quat, when entering the assignment in the List, the Bureau shall indicate those administrations whose allotments were the basis of the agreement. (WRC-23)

Reasons:

ADD SNG/THA/5523A22A10/25

6.15quat When an agreement under this provision is concluded with the administration of an affected allotment in the Plan, the notifying administration of the proposed assignment shall commit to respect the power flux-density limits shown in Section 2.2 of Annex 4 of Appendix **30B** (Rev.WRC-19) at any point within the territory, situated inside the -3 dB contour of the associated beam area, of the administration whose allotment was the basis of the disagreement at the date on which the frequency assignment, stemming from the conversion of an affected allotment, is to be brought into use as communicated under § 8.10bis or within twelve months of the date of dispatch of the telefax sent under § 8.10bis, whichever comes later. (WRC-23)

ADD SNG/THA/5523A22A10/27

6.27bis When an assignment is entered in the List referred to in § 6.15quin, that assignment shall not be taken into account in updating the reference situation of those allotments with which an agreement under § 6.15quat was concluded. (WRC-23)

ADD SNG/THA/5523A22A10/29

6.29bis If the Bureau is informed that obligations under § 6.15quat is not respected by an assignment in the List, the Bureau shall immediately consult with the administration responsible for this assignment, requesting immediate respect of the conditions specified in § 6.15quat. (WRC-23)

ADD SNG/THA/5523A22A10/28

6.29ter If, in spite of the application of § 6.29bis, conditions specified in § 6.15quat are still not respected by an assignment in the List, the Bureau shall immediately inform the Radio Regulations Board. (WRC-23)

ARTICLE 8 (WRC-15)

**Procedure for notification and recording in the Master Register
of assignments in the planned bands for the
fixed-satellite service^{11, 12} (WRC-19)**

ADD SNG/THA/5523A22A10/30

8.10*bis* When the examination with respect to § 8.9 leads to a favourable finding, the Bureau shall immediately send a telefax to administrations which applied § 6.15*quat* with regard to this notice, if any. This telefax shall inform the concerned administrations of the notification under § 8.1 of this notice and the date on which the frequency assignment stemming from the conversion of an allotment, subject of § 6.15*quin* agreement, into an assignment, is planned to be brought into use. (WRC-23)

Reasons:

On the issue of the implicit agreement, Singapore (Republic of) and Thailand support to use a new mechanism to replace the implicit agreement whereby the administration of the additional use/system is allowed to operate (with commitment to respect certain conditions) until the bringing into use of the national assignment/allotment of the other administration. Therefore, Singapore (Republic of) and Thailand support Method H1C in the CPM Report.

On the issue of the AP30/30A EPM degradation tolerance, Singapore (Republic of) and Thailand support Method H2A in the CPM Report which proposes no change to the Radio Regulations.



PLENARY MEETING

**Document CPM23-
2/4849-E
25 August 2023
Original: English**

China (People's Republic of)/Thailand

PROPOSED MODIFICATIONS OF THE DRAFT CPM REPORT TO WRC-23

MOD CHN/THA/4849/1

Agenda item 7
(WP 4A / -)

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

Resolution 86 (Rev.WRC-07) – Implementation of Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference

Reasons:

MOD CHN/THA/4849/2

4/7/10 Topic J – Modifications to Resolution 76 (Rev.WRC-15)

Reasons:

4/7/10.4 Methods to satisfy Topic J

MOD CHN/THA/4849/3

4/7/10.4.2 Method J2: Modify Resolution 76 (Rev.WRC-15) to introduce the concept of “consultation process/meetings”

This method proposes to incorporate the concept of consultation meetings between administrations operating or planning to operate non-GSO FSS systems. Such meetings would provide a forum for them to discuss and agree cooperatively on sharing the aggregate efd in a manner to achieve the level of protection for GSO satellite networks. Details of the meeting, including decisions, would be sent to the BR.

This method is not meant to address any of the technical aspects relating to the calculation of the aggregate efd nor the reduction of such aggregate efd when exceeding the level prescribed in the RR.

Reasons:

MOD CHN/THA/4849/4

4/7/10.5 Regulatory and procedural considerations

Reasons:

MOD CHN/THA/4849/5

4/7/10.5.2 For Method J2: Modify Resolution 76 (Rev.WRC-15) to introduce the concept of “consultation process/meetings”

Note: This draft modification is presented to stimulate discussions as other modifications not identified in this document may still be required.

MOD

RESOLUTION 76 (REV.WRC-~~15~~23)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

The World Radiocommunication Conference (~~Geneva, 2015~~[Dubai, 2023](#)),

considering

- a) that WRC-97 adopted, in Article 22, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary fixed-satellite service (non-GSO FSS) systems in order to protect GSO FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;
- b) that WRC-2000 revised Article 22 to ensure the limits contained therein provide adequate protection to GSO systems without placing undue constraints on any of the systems and services sharing these frequency bands;
- c) that WRC-2000 decided that a combination of single-entry validation, single-entry operational and, for certain antenna sizes, single-entry additional operational epfd limits, contained in Article 22, along with the aggregate limits in Tables 1A to 1D as contained in Annex 1 to this Resolution, which apply to non-GSO FSS systems, protects GSO networks in these frequency bands;
- d) that these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D, assuming a maximum effective number of non-GSO FSS systems of 3.5;
- e) that the effective number of non-GSO FSS systems is not the same as the actual number of systems since each operational system may cause an epfd curve which is well below, at least in certain portions of the cumulative distribution curve, the curve of the epfd limits;
- e*f*) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these frequency bands into GSO FSS systems should not exceed the aggregate epfd levels in Tables 1A to 1D;
- g) that, to achieve the objective in *considering f*), administrations operating or planning to operate non-GSO FSS systems will need to agree cooperatively through consultation meetings on sharing the aggregate epfd in a manner to achieve the level of protection for GSO satellite networks;
- h) that administrations planning to operate non-GSO FSS systems may also participate in such meetings, but their system would only be considered once it becomes operational;
- f*i*) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in the frequency bands in question are to mutually coordinate the use of frequencies in these frequency bands under the provisions of No. 9.12;
- g*i*) that the orbital characteristics of such systems are likely to be inhomogeneous;

~~h~~k) that, as a result of this likely inhomogeneity, the aggregate efd levels from multiple non-GSO FSS systems will not be directly related to the actual number of systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small;

~~i~~l) that the possible misapplication of single-entry limits should be avoided,

recognizing

a) that non-GSO FSS systems ~~may are likely to~~ need to implement interference mitigation techniques to mutually share frequencies;

b) that coordination amongst systems will prevent simultaneous transmissions from several such systems into the main beam of a GSO earth station;~~that, on account of the use of such interference mitigation techniques, it is likely that the number of non-GSO systems will remain small, as will the aggregate interference caused by non-GSO FSS systems into GSO systems;~~

c) that, notwithstanding *considering d), e) and ef) and recognizing b)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables 1A to 1D;

d) that administrations operating or planning to operate GSO systems may wish to ensure that the aggregate efd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables 1A to 1D,

noting

Recommendation ITU-R S.1588 “Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network”,

resolves

1 that administrations operating or planning to operate non-GSO FSS systems, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, shall take all possible steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels given in Tables 1A to 1D to be exceeded (see No. **22.5K**);

2 that, in the event that the aggregate interference levels in Tables 1A to 1D are exceeded, administrations operating or planning to operate non-GSO FSS systems in these frequency bands shall take all necessary measures expeditiously to reduce the aggregate efd levels to those given in Tables 1A to 1D, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**);

3 that administrations, in carrying out their obligations under *resolves 1 and 2* above, shall take into account all the non-GSO FSS systems operating or planning to operate in the frequency bands covered in Tables 1A to 1D that have met all the criteria listed in Annex 2 of this Resolution with the relevant information provided to the consultation meetings referred to in *considering g)*;

4 that administrations, in developing agreements to carry out their obligations under *resolves 1 and 2* above, shall establish mechanisms to ensure that the operators and administrations associated with all the non-GSO FSS systems operating or planning to operate are given full visibility of the process in the frequency bands covered in Tables 1A to 1D;

5 that those participating in this process of epfd calculation should hold consultation meetings on a regular basis (e.g. yearly);

6 that the administrations participating in the consultation meeting shall designate one administration to:

- i) communicate to the Bureau the results of any aggregate sharing determinations made in application of *resolves* 2 above, without regard to whether such determinations result in any modifications to the published characteristics of their respective systems or networks;
- ii) provide a draft record of each consultation meeting; and
- iii) provide the Radiocommunication Bureau (BR) with the approved record as per Annex 1,

invites the ITU Radiocommunication Sector

~~1~~ to continue its studies and to develop, as appropriate, a suitable methodology for calculating the aggregate epfd produced by all non-GSO FSS systems operating or planning to operate co-frequency in the frequency bands referred to in *considering a*) above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels given in Tables 1A to 1D;

~~2~~ to continue its studies and to develop a Recommendation on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a*) above, in order to assist administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate epfd levels produced by their systems into GSO networks, and to provide guidance to GSO network designers on the maximum epfd levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;

~~3~~ to develop a Recommendation containing procedures to be used among administrations in order to ensure that the aggregate epfd limits given in Tables 1A to 1D are not exceeded by operators of non-GSO FSS systems;

~~4~~ to attempt to develop measurement techniques to identify the interference levels from non-GSO systems in excess of the aggregate limits given in Tables 1A to 1D, and to confirm compliance with these limits,

~~instructs the Director of the Radiocommunication Bureau~~

~~1~~ to assist in the development of the methodology referred to in *invites the ITU Radiocommunication Sector 1* above;

~~2~~ to report to a future competent conference on the results of studies in *invites the ITU Radiocommunication Sector 1* and *3* above.

instructs the Radiocommunication Bureau

1 to participate in consultation meetings mentioned under *resolves* 6 and to observe carefully the results of the epfd calculation mentioned in *resolves* 5;

2 to publish in the International Frequency Information Circular (BR IFIC) the information referred to in *resolves* 6 and *instructs the Radiocommunication Bureau 1*;

3 to develop aggregate epfd calculation tools based on relevant ITU-R Recommendations,

invites administrations

- 1 to address non-GSO FSS intersystem matters, as required, as early as possible;
- 2 to provide to the Bureau, and to all participants in the consultation meetings, access to appropriate software to calculate the epfd level mentioned under *resolves 1*, until such time as the Bureau has access to appropriate software mentioned under *instructs the Radiocommunication Bureau 3*.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-~~15~~23)

...

ANNEX 2 TO RESOLUTION 76 (REV.WRC-23)

Results of the aggregate epfd calculation

- Summary record of the meeting;
- detailed description of methodology used to calculate the aggregate interference;
- all input materials submitted to the meeting; and
- studies conducted prior to or at the meeting as well as any other materials deemed necessary for demonstrating compliance with Tables 1A to 1D.

ANNEX 3 TO RESOLUTION 76 (REV.WRC-23)

List of criteria for the application of *resolves 3*

1 Submission of appropriate coordination and/or notification information for non-GSO FSS systems.

2 Entry into satellite manufacturing or procurement agreement, and entry into satellite launch agreement.

The non-geostationary FSS system operator should possess:

- i) evidence of a binding agreement for the manufacture or procurement of its satellites;
and
- ii) evidence of a binding agreement to launch its satellites.

The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision, and the launch agreement should identify the launch date, launch site and launch service provider. The notifying administration is responsible for authenticating the evidence of an agreement.

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

Reasons:

China (People's Republic of) and Thailand support Method J2, Option 2 in the CPM Report. Thailand is of the view that the coordination process can be held without waiting for the completion of the relevant ITU-R Recommendation and the process should incorporate future satellite systems.



World Radiocommunication Conference (WRC-23)
Dubai, 20 November - 15 December 2023



PLENARY MEETING

**Addendum 23 to
Document 5642-E
2 September 2023
Original: English**

Thailand (Kingdom of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 8

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

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD **THA/5642A23/1**

5.429 *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Benin, Brunei Darussalam, Cambodia, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Egypt, the United Arab Emirates, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, New Zealand, Oman, Uganda, Pakistan, Qatar, [Thailand](#), the Syrian Arab Republic, the Dem. Rep. of the Congo, the Dem. People's Rep. of Korea, Sudan and Yemen, the frequency band 3 300-3 400 MHz is also allocated to the fixed and mobile services on a primary basis. New Zealand and the countries bordering the Mediterranean shall not claim protection for their fixed and mobile services from the radiolocation service. (WRC-1923)

Reasons:



PLENARY MEETING

Thailand (Kingdom of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 10

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

View(s)

Thailand supports an agenda item for WRC-27 towards sharing and compatibility studies for possible identification of terrestrial component of IMT in the following frequency bands:

- portion(s) of the frequency range 7.125-8.5 GHz;
- 14.8-15.35 GHz.

Thailand is of the view that the studies must ensure the protection of services to which the frequency bands are allocated on a primary basis, without imposing additional regulatory or technical constraints on those services in the same frequency bands and adjacent frequency bands.

Proposal(s)

MOD **THA/xxx/1**

RESOLUTION 812 ([REV. WRC-1923](#))

Preliminary agenda for the 2027 World Radiocommunication Conference*

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

...

1.x _____ to consider [new Mobile Service allocation and] IMT identification in portion(s) of the frequency bands 7.125-8.5 GHz and 14.8-15.35 GHz, in accordance with Resolution [IMT 7.125-15.35 GHz] (WRC-23);

Reasons:

ADD **THA/xxx/2**

DRAFT NEW RESOLUTION [IMT 7.125-15.35 GHz] (WRC-23)

Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications (IMT) identification in portion(s) of the frequency bands 7.125-8.5 GHz and 14.8-15.35 GHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that International Mobile Telecommunications (IMT) is intended to provide telecommunication services on a worldwide scale, regardless of location and type of networks or terminals;
- b) that IMT systems are now being evolved to provide diverse usage scenarios¹, and applications;
- c) the development of enhanced and evolved IMT and its future development is to continue improving quality of life for all and to expand its goals towards societal, environmental, cultural and economic sustainability;
- d) that some of the frequency bands below 7 125 MHz and between 24.25 and 86 GHz have been studied and identified for IMT in the ITU Radio Regulations globally, regionally and/or nationally;

¹ Immersive Communication, HRLLC (Hyper Reliable and Low-Latency Communication), Massive Communication, Ubiquitous Connectivity, Integrated Artificial Intelligence (AI) and Communication, and Integrated Sensing and Communication

- e) the identification of spectrum for IMT - in the Radio Regulations provides the information not only for the harmonized use of radio spectrum but also for the proper use of radio spectrum for IMT, which enables IMT to achieve sharing and compatibility with other applications and services in the same and/or adjacent frequency bands;
- f) that while the frequency bands are identified for IMT, some countries have not been used or not be planned for use by IMT due to different spectrum usage for other applications and services;
- g) that continuation of studies regarding additional identification for IMT spectrum is needed in order to provide proper conditions for a use of IMT, which provide sharing and compatibility with other incumbent applications, and then to give flexibility for administrations to select the frequency bands among those identified bands for IMT;
- h) that at previous WRCs, frequency ranges other than those mentioned in considering d) were not thoroughly studied;
- i) that it may be required to study additional spectrum requirements to meet the gigabit-per-second user data rate, high quality of user experience (QoE) and user demands in dense urban areas and/or in peak times;
- j) that the ITU Radiocommunication Sector has been working on standardization for IMT for 2030 and beyond;
- k) that adequate and timely availability of spectrum and supporting regulatory provisions is essential to support the future development of IMT and to realize the objectives in Recommendation ITU-R M.[FRAMEWORK FOR 2030 AND BEYOND];
- l) that harmonized worldwide frequency bands and harmonized frequency arrangements for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale;
- m) that IMT has effectively shared the limited spectrum resource with other services and applications through the provisions in the Radio Regulations,

noting

- a) that Resolution ITU-R 65 addresses the principles for the process of development of IMT for 2030 and beyond;
- b) that IMT encompasses IMT-2000, IMT-Advanced, IMT-2020 [and IMT-2030] collectively, as described in Resolution ITU-R 56;
- c) that Question ITU-R 229/5 seeks to address the further development of IMT;
- d) that Question ITU-R 262/5 addresses the study of usage of IMT systems for specific applications;
- e) Recommendation ITU-R M.[IMT.FRAMEWORK FOR 2030 AND BEYOND], on the framework and objectives of the future development of IMT for 2020 and beyond;
- f) that Report ITU-R M.2516 addresses future technology trends of terrestrial IMT systems;
- g) Report ITU-R M.2376, on technical feasibility of IMT in bands above 6 GHz;
- h) that RR No. **5.340** lists the frequency bands where all emissions are prohibited,

recognizing

- a) that there is a lead time between the allocation of frequency bands by world radiocommunication conferences and the deployment of systems in those bands, and that timely

availability of wide and contiguous blocks of spectrum is therefore important to support the development of IMT;

b) that in order to ensure the future development of IMT it is important to ensure the timely identification of additional spectrum;

c) the developments in new spectrum sharing techniques including use of Artificial Intelligence, Machine Learning, Integrated Access & Backhaul, Dynamic Spectrum Access, etc.;

d) that various frequency bands in the range 7.125-15.35 GHz are being used extensively by incumbent services, including satellite based services;

e) that any identification of frequency bands for IMT should not establish priority in the Radio Regulations and do not preclude the use of the frequency bands by any application of the services to which it is allocated, including the evolving needs of these services and applications;

f) that no additional regulatory or technical constraints should be imposed to any applications of the services to which it is currently allocated on a primary basis;

g) that the preamble of the Radio Regulations provides objectives including:

to facilitate the efficient and effective operation of all radiocommunication services; and

to provide for and, where necessary, regulate new applications of radiocommunication technology,

resolves to invite ITU Radiocommunication Sector

1 to conduct and complete in time for WRC-27 the sharing and compatibility studies for the use of the terrestrial component of IMT in portion(s) of the frequency bands 7.125-8.5 GHz and 14.8-15.35 GHz with a view to ensuring the protection of services to which the frequency bands are allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and on services in adjacent bands, for the frequency bands, taking into account:

- technical and operational characteristics of IMT systems that would operate in these specific frequency bands;

- protection of co-primary services in the same frequency bands and in adjacent frequency bands for ensuring their service continuation and future deployment;

- [IMT spectrum demand of [evolving] IMT usage applications;]

resolves

1 to invite the first session of the Conference Preparatory Meeting for WRC-27 to define the date by which technical and operational characteristics needed for sharing and compatibility studies are to be available to ensure that studies referred to in *resolves to invite the ITU Radiocommunication Sector* can be completed in time for consideration at WRC-27;

2 to invite WRC-27 to consider, based on the results of the above studies, additional Mobile Service allocations on a primary basis and identification of frequency bands for the terrestrial component of IMT,

encourages Member States, Sector Members, Academia, and Associates

to participate in the studies by submitting contributions to ITU-R.

Template for the submission of proposals for WRC-27 agenda item

Subject: Proposal for a new WRC-27 agenda item to consider identification of specific frequency bands within Mobile Service allocation in the frequency range 7.125-15.35 GHz for International Mobile Telecommunications (IMT)

Origin: Thailand (Kingdom of)

Proposal:

To consider identification of specific frequency bands within Mobile Service allocation in the frequency range 7.125-15.35 GHz for International Mobile Telecommunications (IMT), in accordance with Resolution [IMT 7.125-15.35 GHz] (WRC-23);

Background/reason:

Since ITU initiated the studies on IMT in 1985, IMT has evolved not only for providing the international mobile telecommunications but also for supporting the development of various industry sectors. Furthermore, IMT will be an important enabler of achieving the UN Sustainable Development Goals (SDGs) and societal, economic, environmental, and cultural development.

IMT will continue to improve the efficient use of spectrum, and benefits from new spectrum to satisfy the demands for increasing capacity and new applications and to provide for new capabilities. Taking into account differences in the demands, deployments and timings of mobile data growth in different countries, multiple frequency ranges from low band to high band would be needed to meet the capacity and coverage requirements of IMT systems. In particular, mid bands mainly covering frequency ranges 4-15 GHz provides a balance between wide area coverage and capacity.

The evolution of IMT has been facilitated through the identification of the frequency bands for IMT in the ITU Radio Regulations (RRs). In the early stage of the identification of IMT spectrum, global harmonized use of IMT was the main purpose. However, it is now well recognized that the identification of IMT spectrum is also associated with the information on proper conditions regarding how IMT could share the frequency bands with other incumbent services through the provisions in the RRs. These provisions in the RRs give flexibility for Members to use the identified IMT frequency bands in accordance with their own national spectrum policies.

Considering the enlargement of usage scenario of IMT, the development of technology which also enables the sharing of the frequency bands with other incumbent services and IMT identification for the proper use of IMT, ITU (collectively of Members) should continue exploring new identification of IMT spectrum in order not only to keep providing a way of efficient use of spectrum but also to assist Members to use/select those identified frequency bands for IMT according to their own national spectrum policies.

Therefore, it would be useful to study some specific frequency bands for IMT from the frequency ranges 7.125-15.35 GHz to provide broadband capacity together with a certain level of coverage. For this study, it is essential to keep in mind that there were some reasons why some of these frequency ranges were not considered for IMT at the past WRCs, such as heavy use of spectrum by the incumbent services and requirements of their protection and their future development.

There is a significant gap of time between the identification of frequency bands for IMT in the RRs and the implementation and deployment of IMT systems in those bands. Therefore, timely identification of IMT spectrum in the RRs is important to support the development of IMT,

while considering the need to protect existing services and to allow for their continued development.

Radiocommunication Services concerned:

Within 7.125 - 15.35 GHz:

- portion(s) of the frequency range 7.125-8.5 GHz;
- 14.8-15.35 GHz.

Indication of possible difficulties:

The proposed frequency bands are widely used for other services on a co-primary basis.

Previous/ongoing studies on the issue:

The following studies have been initiated and are now ongoing in ITU-R Working Party 5D:

- Report ITU-R M.2516,
- Draft new Recommendation ITU-R M.[IMT.FRAMEWORK FOR 2030 AND BEYOND]

| | |
|---|---|
| <i>Studies to be carried out by:</i> | <i>with participation of:</i> |
| ITU-R SG 5/WP 5D | Administrations and Sector members of the ITU-R |

ITU-R Study Groups concerned:

SG5/WP5A, 5B, 5C, SG4/WP4A, SG7/WP7B

ITU resource implications, including financial implications (refer to CV 126):

This proposed agenda item will be studied within the normal ITU-R procedures and planned budget. As the responsible group on IMT matters, ITU-R WP 5D usually has meetings three times a year, each of which lasts around 10 days.

| | |
|---|--------------------------------------|
| <i>Common regional proposal:</i> | <i>Multicountry Proposal:</i> |
| | <i>Number of countries:</i> |

Remarks



PLENARY MEETING

Thailand (Kingdom of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 10

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

View(s)

Thailand supports the study on frequency-related matters for the terrestrial component of IMT identification in the frequency band 6 425-7 025 MHz in Region 3 with a view to considering the potential IMT identification while ensuring the protection of existing services in the same frequency band and in adjacent frequency bands.

Proposal(s)

MOD **THA/xxx/1**

RESOLUTION 812 ([REV. WRC-1923](#))

Preliminary a **Agenda for the 2027 World Radiocommunication Conference***

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

...

1.x to consider identification for IMT in the 6 425-7 025 MHz frequency range in Region 3 in accordance with Resolution [XXX] (WRC-23);

Reasons:

ADD **THA/xxx/2**

DRAFT NEW RESOLUTION [XXX] (WRC-23)

Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications (IMT) identification in the frequency band 6 425-7 025 MHz in Region 3

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT) is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that IMT systems have contributed to global economic and social development;
- c)* that IMT systems are now being evolved to provide diverse usage scenarios such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications, and applications including fixed broadband;
- d)* the development of future IMT is to continue improving quality of life for all and to expand its goals towards societal, environmental, cultural and economic sustainability;
- e)* that, compared with lower and higher frequency bands, the mid-band spectrum can provide better balance for the meeting needs for both coverage and capacity;
- f)* that adequate and timely availability of spectrum and corresponding regulatory provisions are essential to support the future development of IMT;
- g)* that global/regional harmonized frequency bands and harmonized frequency arrangements for IMT are highly desirable in order to achieve roaming and the benefits of economies of scale;

- h) that identification of additional frequency bands for IMT may change the sharing situation regarding applications of all services to which the frequency band is already allocated, and may require additional regulatory actions;
- i) the need to protect existing services and to allow for their continued development when considering frequency bands for possible additional allocations to any service;
- j) there is a great potential for continued exploitation of some of the frequency bands already identified for IMT in other regions or countries through ITU-R studies.

noting

- a) that Resolution ITU-R 65 addresses the principles for the process of development of IMT for 2020 and beyond;
- b) that IMT encompasses IMT-2000, IMT-Advanced and IMT-2020 collectively, as described in Resolution ITU-R 56;
- c) that Question ITU-R 77-8/5 considers the needs of developing countries in the development and implementation of IMT;
- d) that Question ITU-R 229/5 seeks to address the further development of IMT;
- e) that Question ITU-R 262/5 addresses the study of usage of IMT systems for specific applications;
- f) that Report ITU-R M. 2516/0 addresses future technology trends of terrestrial IMT systems;

recognizing

- a) that there is a lead time between the allocation of frequency bands by world radiocommunication conferences and the deployment of systems in those bands, and that timely availability of wide and contiguous blocks of spectrum is therefore important to support the development of IMT;
- b) that in order to ensure the future development of IMT it is important to ensure the timely identification of additional spectrum;
- c) that any identification of frequency bands for IMT should take into account the use of the frequency bands by other services and the evolving needs of these services;

resolves to invite the ITU Radiocommunication Sector

1 to conduct and complete in time for WRC-27 the sharing and compatibility studies for the use of the terrestrial component of IMT in the 6 425-7 025 MHz frequency range in Region 3 with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and on services in adjacent frequency bands, taking into account:

- technical and operational characteristics of terrestrial IMT systems that would operate within this specific frequency band;
- protection of co-primary services in the same frequency band and in adjacent frequency bands for ensuring their service continuation and future services;
- [IMT spectrum demand of [evolving] IMT usage applications];

resolves

1 to invite the first session of the Conference Preparatory Meeting for WRC-27 to define the date by which technical and operational characteristics needed for sharing and compatibility studies are to be available to ensure that studies referred to in *resolves to invite the ITU Radiocommunication Sector* can be completed in time for consideration at WRC-27;

2 to invite WRC-27 to consider, based on the results of the above studies, possible identification of the frequency band for the terrestrial component of IMT

invites administrations

to participate actively in these studies by submitting contributions to the ITU Radiocommunication Sector.

Template for the submission of proposals for WRC-27 agenda item

Subject: Proposal for a new WRC-27 agenda item to consider identification of the frequency bands 6 425-7 025 MHz in Region 3 for the terrestrial component of International Mobile Telecommunications (IMT).

Origin: Thailand (Kingdom of)

Proposal:

To consider identification of the frequency bands 6 425-7 025 MHz in Region 3 for terrestrial component of International Mobile Telecommunications (IMT), in accordance with Resolution [xxx] (WRC-23);

Background/reason:

Since the introduction of IMT-2000 systems in around 2000, IMT systems have evolved around every 10 years, which are also known as IMT-Advanced and IMT-2020. IMT systems have been widely deployed around the world, which fill the digital gap and contribute to the overall society economic. The spectrum harmonization by identification of specific frequency bands for use by IMT through WRC procedure provides the firm foundation for the success of IMT development.

In ITU-R, several studies relevant to IMT evolution have been undertaken, including future technology trends, framework and overall objectives of the future development of IMT. The spectrum for future IMT should cover various frequency ranges to support different applications and usage scenarios, and full access to the low, middle and high spectrum would be essential. Among all the frequency ranges, the middle frequency band, which could provide a very good balance between coverage and capacity, is essential to fulfill the objectives of IMT to provide high data rate communications at anytime and anywhere.

The adequate mid-band spectrum for IMT is important for APT countries to support further development of digital economy. During the last study cycle, APT Members submitted the joint contribution to WRC-19 (WRC-19/C110) to support a new WRC-23 agenda item to consider identification of IMT in the frequency band 5 925-7 125 MHz, which contribute to the establishment of WRC-23 agenda item 1.2, which considers the possible identification of the frequency bands 3 600-3 800 MHz and 3 300-3 400 MHz (Region 2), 3 300-3 400 MHz (amend footnote in Region 1), 7 025-7 125 MHz (globally), 6 425-7 025 MHz (Region 1), and 10.0-10.5 GHz (Region 2) for IMT. While 3 GHz band or portions thereof is widely adopted for IMT deployment, the frequency band 6 425-7 125 MHz is another potential band which also enables a good balance between capacity and coverage.

Global/regional IMT spectrum harmonization is essential for IMT industry's economies of scale and device roaming. Since the frequency band 6 425-7 025 MHz in WRC-23 agenda item 1.2 is mainly considered by Region 1, there is a great potential for continued exploitation of this band through ITU-R studies for other Regions.

The identification under the WRC framework is the most effective way to protect the incumbent services. This Administration proposes the studies on a new agenda item to consider identification of frequency bands 6 425-7 025 MHz in Region 3 for the terrestrial component of IMT.

Radiocommunication Services concerned:

6 425-6 700 MHz: fixed service, fixed-satellite service (Earth-to-space), mobile service

6 700-7 025 MHz: fixed service, fixed-satellite service (Earth-to-space), fixed-satellite service (space-to-Earth), mobile service

Indication of possible difficulties:

The proposed bands are widely used for terrestrial and space services on a co-primary basis. The coexistence of IMT and incumbent services needs to be considered.

Previous/ongoing studies on the issue:

The following studies have been conducted in ITU-R Working Party 5D:

- new Report ITU-R M. 2516/0 and
 - Working document on sharing and compatibility studies of IMT systems in the frequency bands 6 425-7 025 and 7 025-7 125 MHz
-

Studies to be carried out by:

ITU-R SG 5/WP 5D

with participation of:

Administrations and Sector members of the ITU-R

ITU-R Study Groups concerned:

SG4 and other groups

ITU resource implications, including financial implications (refer to CV 126):

This proposed agenda item will be studied within the normal ITU-R procedures and planned budget. As the responsible group on IMT matters, ITU-R WP 5D usually has meetings three times a year which last around 10 days each.

Common regional proposal:

Multicountry Proposal:

Number of countries:

Remarks