



PLENARY MEETING

**Addendum 17 to
Document 6218-E
9 October 2023
Original: English**

African Common Proposals

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;

Introduction

ATU proposes Method B for this agenda item that proposes a Resolution to address 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. This method also supports no change (NOC) for the frequency band 11.7-12.7 GHz. Within Method B there are several options that should be considered within each of the alternatives pertaining to some of the regulatory mechanisms to ensure the protection of incumbent services. ATU position is as follows:

1. On the Type of Allocation, ATU supports the ISS alternative, which would also include exclusion of the use of the KU-band for the inter satellite link.
2. On the concept of operation, ATU supports the within the cone concept of operation.
3. On sharing mechanisms with non-GSO FSS systems, ATU supports Alternative non-GSO FSS Hard Limit.
4. On the protection mechanisms for Incumbent services, ATU supports the following:
 - a. Annex 2: Option 2-2 is supported.
 - b. Annex 3: Option 1 is supported.
 - c. Annex 4: Option 2 is supported.

Acknowledge that EIRP limits vary with altitude to ensure the protection of incumbent networks from potential hardware damage, therefore, propose adding additional invites ITU-R to review the EIRP limits to ensure the hardware damage protection for non-GSO FSS systems from non-GSO ISS systems planning to operate in altitudes above or equal to 900 Km and below 1290 Km

d. Annex 5: Option B is supported.

5. ATU supports 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.

6. ATU supports development of an acceptable power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station for space-to-space links in the frequency band 19.3-19.7 GHz.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

NOC AFCP/6218A17/1

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

NOC AFCP/6218A17/2

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)

MOD AFCP/6218A17/3

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 <u>INTER-SATELLITE ADD 5.A117</u> MOBILE 5.519 5.521	

Reasons: ATU supports ISS Allocation

MOD AFCP/6218A17/4

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 <u>INTER-SATELLITE ADD 5.A117</u> MOBILE	
...		
18.8-19.3	FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.517A 5.523A <u>INTER-SATELLITE ADD 5.A117</u> MOBILE	
19.3-19.7	FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.517A 5.523B 5.523C 5.523D 5.523E <u>INTER-SATELLITE ADD 5.A117</u> MOBILE	
19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A <u>INTER-SATELLITE ADD 5.A117</u> Mobile-satellite (space-to-Earth) 5.524	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A <u>INTER-SATELLITE ADD 5.A117</u> 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 <u>INTER-SATELLITE ADD 5.A117</u> Mobile-satellite (space-to-Earth) 5.524
20.1-20.2	FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A <u>INTER-SATELLITE ADD 5.A117</u> MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528	

Reasons: ATU supports ISS Allocation

MOD AFCP/6218A17/5

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 <u>INTER-SATELLITE ADD 5.A117</u> 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 <u>INTER-SATELLITE ADD 5.A117</u> MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
29.1-29.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.517A 5.523C 5.523E 5.535A 5.539 5.541A <u>INTER-SATELLITE ADD 5.A117</u> 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 <u>INTER-SATELLITE ADD 5.A117</u> 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 <u>INTER-SATELLITE ADD 5.A117</u> 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 <u>INTER-SATELLITE ADD 5.A117</u> Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542

Reasons: ATU supports ISS Allocation

ADD AFCP/6218A17/6

5.A117

For use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, by space stations in the inter-satellite service, Resolution [AFCP-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)

Reasons: ATU is in support of applying hard limits and not in favour of coordination while using the satellite-to-satellite links, there is currently no coordination procedure for Inter-Satellite links.

MOD AFCP/6218A17/7

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 <u>INTER-SATELLITE ADD 5.A117</u> MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542				

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

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

MOD AFCP/6218A17/8

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°		
...					
17.7-19.3 GHz ^{7, 8}	Fixed-satellite (space-to-Earth) <u>Inter-satellite</u> Meteorological-satellite (space-to-Earth)	0°-5°	5°-25°		1 MHz
		-115 ^{14, 15} or -115 - X ¹³	-115 + 0.5(δ - 5) ^{14, 15} or -115 - X + ((10 + X)/20)(δ - 5) ¹³		
17.7-19.3 GHz ^{7, 8}	Fixed-satellite (space-to-Earth) <u>Inter-satellite</u>	0°-3°	3°-12°	12°-25°	1 MHz
		-120 ¹⁶	-120 + (8/9)(δ - 3) ¹⁶	-112 + (7/13)(δ - 12) ¹⁶	
19.3-19.7 GHz	Fixed-satellite (space-to-Earth) <u>Inter-satellite</u>	0°-3°	3°-12°	12°-25°	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°		

19.3-19.7 GHz 21.4-22 GHz (Regions 1 and 3) 22.55-23.55 GHz 24.45-24.75 GHz 25.25-27.5 GHz 27.500- 27.501 GHz	Fixed-satellite (space-to-Earth) Broadcasting-satellite Earth exploration- satellite (space-to-Earth) Inter-satellite Space research (space-to-Earth)	-115^{15}	$-115 + 0.5(\delta - 5)^{15}$	-105^{15}	1 MHz
<i>Alternative 1 for the pfd mask for the protection of fixed and mobile stations</i>					
<u>27.5-29.5 GHz</u>	<u>Inter-satellite (non-geostationary satellite orbit)</u>	<u>-115</u>	<u>$-115 + 0.5(\delta - 5)$</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>	<u>Inter-satellite (non-geostationary satellite orbit)</u>	<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.

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 AFCP/6218A17/9

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 [AFCP-A117-B] (WRC-23)										A.25	
A.25.a	a commitment from the notifying administration of a non-GSO space station receiving in the frequency bands 27.5-28.6 GHz and 29.5-30.0 GHz that the equivalent power flux-density produced at any point in the geostationary-satellite orbit by emissions from all combined operations of space-to-space and Earth-to-space links shall not exceed the limits given in Table 22-2			+		+				A.25.a		

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK OR SYSTEM, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.25.b	<p><u>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 [AFCP-A117-B] (WRC-23)</u></p> <p><u>Required only for the notification of non-GSO space stations submitted in accordance with Resolution [AFCP-A117-B] (WRC-23)</u></p>					+				A.25.b		
A.25.c.1	<p><u>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</u></p>			+		+				A25c1		
A.25.c.2	<p><u>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</u></p>			+		+				A25c2		
A.25.d	<p><u>COMPLIANCE WITH <i>resolves 3.3</i> OF RESOLUTION [AFCP-A117-B] (WRC-23)</u></p>									A25.d		
A.25.d.1	<p><u>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)</u></p> <p><u>Required only for the notification of non-GSO space stations submitted in accordance with Resolution [A117-B] (WRC-23)</u></p>					+				A.25.d.1		

MOD AFCP/6218A17/10

TABLE C

CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY ASSIGNMENTS
FOR A SATELLITE ANTENNA BEAM OR AN EARTH STATION OR
RADIO ASTRONOMY ANTENNA (Rev.WRC-1923)

Items in Appendix	C- CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY ASSIGNMENTS FOR A SATELLITE ANTENNA BEAM OR AN EARTH STATION OR RADIO ASTRONOMY ANTENNA	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network or system subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network or system not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network or system	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
...	...											
C.11	SERVICE AREA (S) <i>For all space applications except active or passive sensors</i>										C.11	
C.11.a	the service area or areas of the satellite beam on the Earth, when the associated transmitting or receiving stations are earth stations For a space station submitted in accordance with Appendix 30, 30A or 30B, the service area identified by a set of a maximum of 100 test points and by a service area contour on the surface of the Earth or defined by a minimum elevation angle <i>Note</i> – When an assignment converted from an allotment is reinstated in the Appendix 30B Plan, the notifying administration may choose a maximum of 20 test points within its national territory for the reinstated allotment			X	X	X		X	X	X	C.11.a	
<u>C.11.a.1</u>	<u>for the case of satellite-to-satellite links in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz frequency bands, service area is described by sub-satellite points on the Earth of the transmitting space station in 27.5-30 GHz or receiving space station in 18.1-18.6 GHz, 18.8-20.2 GHz</u> <u>Required for space stations in the ISS transmitting in the bands 18.1-18.6 GHz and 18.8-20.2 GHz</u>			+		+					<u>C.11.a.1</u>	
...	...											

Reasons : ATU is in support of option 2 which gives more clear view about the bands being used and which is transiting or receiving beams.

ADD AFCP/6218A17/11

DRAFT NEW RESOLUTION [AFCP-A117-B]

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 [inter-satellite service (ISS) space stations operating in the geostationary-satellite orbit (GSO) and in the non-GSO in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof;
- b) that the administration responsible for the notification of non-GSO space stations communicating with GSO or non-GSO space stations in the ISS at higher altitude does not need to be the same administration that has already notified assignments in the ISS;
- c) that imposing the hard limits necessary to protect other services would provide regulatory certainty for both notifying administrations of non-GSO space stations communicating with ISS space stations and potentially impacted services;
- d) that there is growing interest for utilizing satellite-to-satellite links for a variety of applications;
- e) that the ITU Radiocommunication Sector (ITU-R) has carried out sharing and compatibility studies between incumbent services in the frequency bands 18.1-18.6 GHz, 18.8-20.2 and 27.5-30 GHz and adjacent bands and satellite-to-satellite transmissions in the ISS;
- f) that these studies were based on certain principles, including the limitation of the use of frequency bands in 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

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 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

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;

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;

3.4 for space-to-space links in the frequency band 19.3-19.7 GHz, or parts thereof, a GSO or non-GSO space station communicating with a non-GSO space station shall not produce a power flux-density on the surface of the Earth towards a non-GSO mobile satellite gateway station that exceeds TBD dB(W/(m² · MHz));

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 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,

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 (advance publication) 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 (advance publication) information containing the characteristics of the non-GSO space station/stations and the associated name of the notified non-GSO FSS system(s) with which it intends to communicate;

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

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

- a) the notifying administration for that non-GSO space station shall cooperate with an investigation on the matter and provide, to the extent of its ability, any required information on the operation of the transmitting space station and a point of contact to provide such information;
- b) the notifying administration for that non-GSO space station and the notifying administration of the GSO or non-GSO space station receiving these space-to-space transmissions shall, jointly or individually, as the case may be, upon receipt of a report of unacceptable interference, take the required action to eliminate or reduce interference to an acceptable level;
- c) in case of continued unacceptable interference despite of the firm commitment to remove that, the assignment causing interference shall be submitted to the Radio Regulations Board for review;

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

- a) the non-GSO space stations transmitting in these frequency bands employed techniques to maintain pointing accuracy with the associated receiving space station and avoid tracking inadvertently adjacent GSO space stations of any other notifying administration or space stations in a non-GSO system of any other notifying administration;
- b) all necessary measures are taken so that non-GSO transmitting space stations in these frequency bands are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC or equivalent facility;
- c) a permanent point of contact is provided for the purpose of tracing any cases of unacceptable interference from non-GSO transmitting space stations in these frequency bands in the 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,

invites ITU-R

to review the EIRP limits to ensure the hardware damage protection for non-GSO FSS systems from non-GSO ISS systems planning to operate in altitudes above or equal to 900 Km and below 1290 Km,

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

Determination of the off-nadir angle

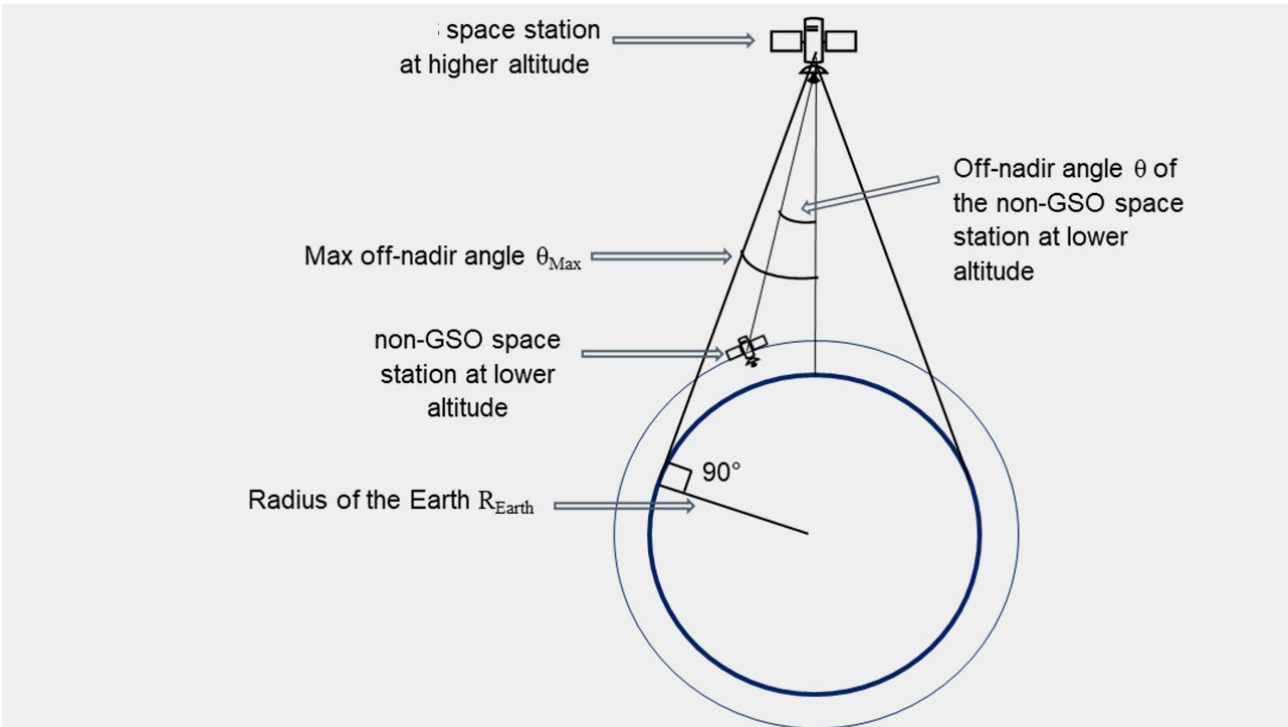
1 A non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall only communicate with a non-GSO space station when the off-nadir angle between this non-GSO space station and the non-GSO space station with which it communicates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

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

where

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

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



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

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

where:

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

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

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

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

with:

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

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

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

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

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

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

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

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.

ANNEX 2 TO DRAFT NEW RESOLUTION [AFCP-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:

$$pfd(\delta) = -124.7 \quad (\text{dB(W/(m}^2 \cdot 14 \text{ MHz))) for } 0^\circ \leq \delta \leq 0.01^\circ$$

$$pfd(\delta) = -120.9 + 1.9 \cdot \log \delta \quad (\text{dB(W/(m}^2 \cdot 14 \text{ MHz))) for } 0.01^\circ < \delta \leq 0.3^\circ$$

$$pfd(\delta) = -116.2 + 11 \cdot \log \delta \quad (\text{dB(W/(m}^2 \cdot 14 \text{ MHz))) for } 0.3^\circ < \delta \leq 1^\circ$$

$$pfd(\delta) = -116.2 + 18 \cdot \log \delta \quad (\text{dB(W/(m}^2 \cdot 14 \text{ MHz))) for } 1^\circ < \delta \leq 2^\circ$$

$$pfd(\delta) = -117.9 + 23.7 \cdot \log \delta \quad (\text{dB(W/(m}^2 \cdot 14 \text{ MHz))) for } 2^\circ < \delta \leq 8^\circ$$

$$pfd(\delta) = -96.5 \quad (\text{dB(W/(m}^2 \cdot 14 \text{ MHz))) for } 8^\circ < \delta \leq 90^\circ$$

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

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 $\gamma = \arcsin\left(\frac{\sin(90+\theta) * R_e}{R_e + a}\right)$.
- 5) Compute off-axis angle $\varphi = 180 - \delta - \gamma$.
- 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 PFD on the ground as:

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

ANNEX 3 TO DRAFT NEW RESOLUTION [AFCP-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

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 $-118 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$.

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.

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 $-110 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$.

ANNEX 4 TO DRAFT NEW RESOLUTION [AFCP-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: -17.5 dBW/Hz ;
 - for non-GSO space station transmit on-axis antenna gains less than 40.6 dBi: $-17.5 - (40.6 - X) \text{ dBW/Hz}$;
- 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 $-70/-62 \text{ dBW/Hz}$ 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.
- 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
$450 \leq \text{altitude} < 600$	61
$600 \leq \text{altitude} < 750$	58
$750 \leq \text{altitude} < 900$	55
$900 \leq \text{altitude} < 1\ 290$	TBD
altitude $\geq 1\ 290$	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 -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
$450 \leq \text{altitude} < 600$	58
$600 \leq \text{altitude} < 750$	55
$750 \leq \text{altitude} < 900$	53
$900 \leq \text{altitude} < 1\ 290$	TBD
altitude $\geq 1\ 290$	N/A

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.

ANNEX 5 TO DRAFT NEW RESOLUTION [AFCP-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)* 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 agenda item A.25.c.2, and denote it as $eirp_{\alpha}$. If the mask is non-monotonic, select the largest value in the e.i.r.p. mask considering all angles greater than or equal to the GSO arc avoidance angle as given in Appendix 4 agenda item A.25.c.1.

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

$$PFD = eirp_{\alpha} - 10 \log \left(4\pi((35\,786 - alt) \times 1\,000)^2 \right)$$

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

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

SUP AFCP/6218A17/12

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**