

5th National Preparatory Workshop for WRC-23

AI 1.16 & 1.17

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WRC-23 Agenda Item 1.16:

Enabling Ka-band NGSO Earth Station in Motion

WRC-23 Agenda Item 1.16

"... to facilitate the use of the frequency bands

17.7 – 18.6 GHz and 18.8 – 19.3 GHz and 19.7 – 20.2 GHz (space-to-Earth)

27.5 – 29.1 GHz and 29.5 – 30 GHz (Earth-to-space)

by non-GSO FSS ESIM, while ensuring due protection of existing services in those bands..." – Resolution **173 (WRC-19)**

- ▲ Technical and regulatory provisions for the operation of ESIM under this Agenda Item are limited to aeronautical and maritime ESIM

- ▲ Facilitating the implementation of non-GSO ESIM in the Ka-band will:
 - ✓ Support the need for affordable ubiquitous broadband connectivity;
 - ✓ Allow global city-like connectivity with low latency even when on the move; and
 - ✓ Provide a harmonised international framework for the use of ESIM while protecting existing services

Developments of AI1.16 – Methods

Method A	Method B
NOC to RR and suppression of Resolution 173 (WRC-19)	Add a new footnote in RR Article 5 that refers to a new WRC-23 Resolution with technical, operational and regulatory conditions for the operation of non-GSO maritime and aeronautical ESIMs while ensuring protection of allocated services, and consequential suppression of Resolution 173 (WRC-19)

Consistent support from all regional groups, including APG23-4, to develop a regulatory framework for the operation of Non-GSO ESIMs in the Ka-band

Developments of AI1.16 – 1 of 2

- ▲ Last meeting of WP4A (Sep 2022) reviewed contributions on sharing and compatibility studies as well as draft CPM text with a Draft New Resolution, including the relevant annexes
- ▲ Non-GSO ESIM operating in the frequency bands 17.7-18.6, 18.8-19.3, 19.7-20.2 GHz (**RR 5.524**) shall not claim protection from terrestrial services
- ▲ **Protection of terrestrial services in 27.5 – 29.1 / 29.5 – 30.0 GHz**
 - **Same technical conditions as applicable to GSO ESIM can apply (pfd limit on ground for A-ESIM, min. distance from the coast and max EIRP spectral density towards the horizon for M-ESIM)**
 - **GSO and NGSO ESIM have very similar technical and operational characteristics**
- ▲ **Good progress on the development of a methodology for the BR to check compliance with A-ESIM pfd limit on the ground**
 - **Adequate transitional measures to be developed and implemented in case WRC-23 could not finalise the methodology**

Developments of AI1.16 – 2 of 2

- ▲ Protection of EESS(passive) in 18.6-18.8 GHz
 - Support pfd limits
 - Studies in CEPT have shown that no limits are required for LEO systems employing frequency reuse of at least three colours - the channel adjacent to EESS (passive) band would not always be used
- ▲ Decision that the notifying administration of the non-GSO satellite system is the only responsible administration for the operation of ESIM
- ▲ Draft CPM text contains possible approaches to interference management procedures
 - Further discussion on the way that notifying administration is identified by administration victim of unacceptable interference
- ▲ Network Control and Management Centre (NCCMC) functionalities and ESIM operational requirements, including cease emission mechanisms when approaching countries where ESIM operation is not authorised, are included in the draft CPM text



WRC-23 Agenda Item 1.17:

Enabling satellite-to-satellite links in portions of the Ku and Ka frequency bands

WRC-23 Agenda Item 1.17

"to determine and carry out... 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" - **Resolution 773 (WRC-19)**

Frequency bands in consideration under this AI:

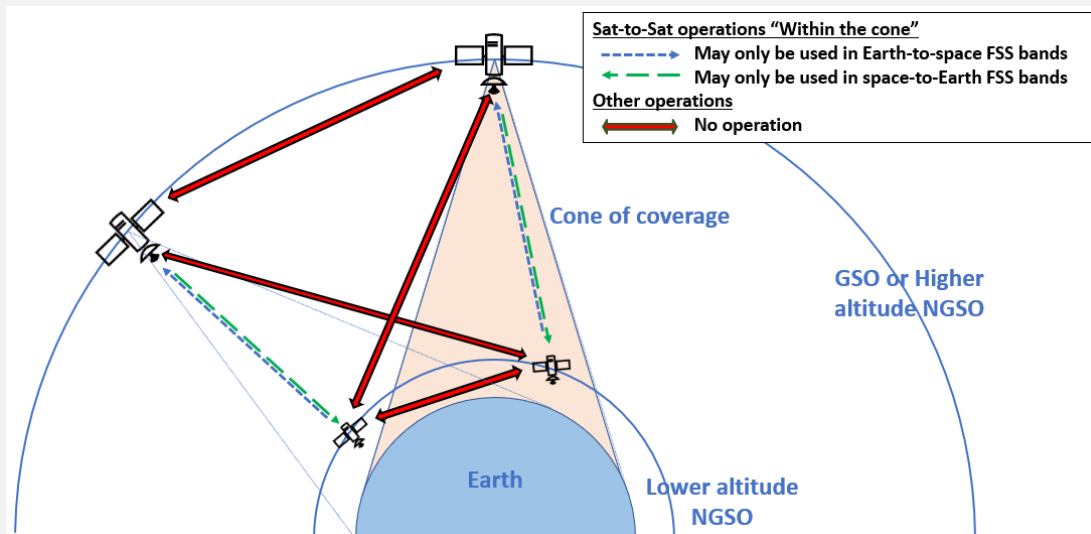
- 11.7 – 12.7 GHz;
- 18.1 – 18.6 GHz;
- 18.8 – 20.2 GHz; and
- 27.5 – 30 GHz

- ▲ Growing interest for utilizing sat-to-sat links for several applications
 - where the space stations have short duration access to their respective earth stations. Examples include Earth observation and space science missions
 - useful also for real or near-real time data applications, such as disaster management

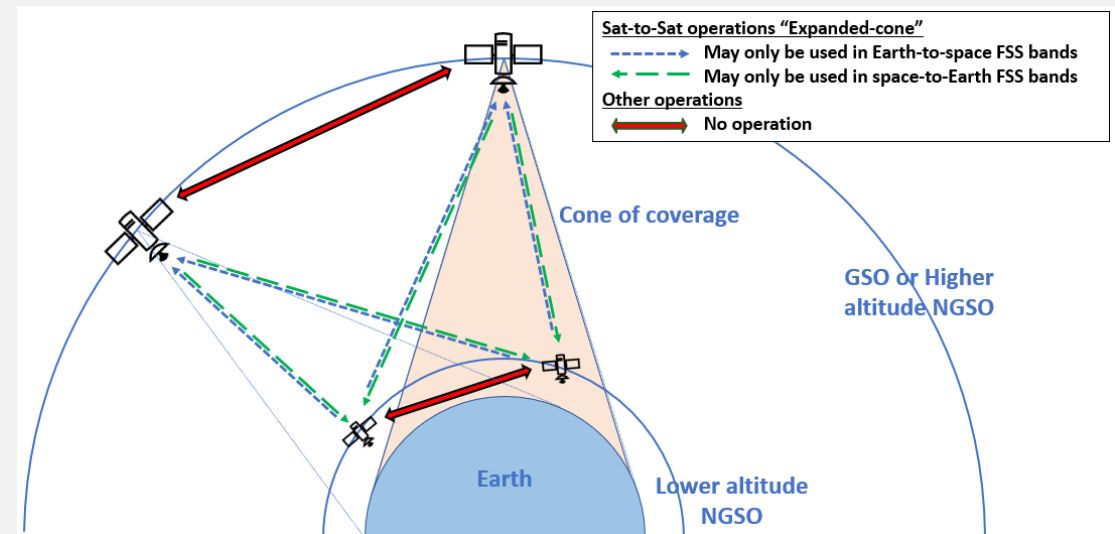
AI1.17 – Concepts of Operations

▲ Two Concepts of Operations

Within the cone



Expanded cone



AI1.17 – Methods

Method	B1	B2	B3	B4	B5	A
Type Service Allocation	FSS (space-to-space)	ISS	FSS (space-to-space)	ISS	Identical to B1 to B4 but w/o F1	NOC
Concept of Operations	Within cone	Within cone	Expanded Cone	Expanded Cone		

Five items were identified for which several options were proposed:

1. Frequency Bands:	F1	F2	F3	F4	F5
	11.7-12.7 GHz	18.1-18.6, 18.8-19.3, 19.7-20.2 GHz	19.3-19.7 GHz	27.5-29.1, 29.5-30 GHz	29.1-29.5 GHz
2. Non-GSO FSS protection:		N1	N2		
		RR No. 9.12	Hard Limit		
3. GSO FSS protection:		G1	G2		
		Within envelope of typical earth station	Hard limit		
4. EESS protection:	EESS1	EESS2			
	Out-of-band pfd limit	No specific mechanism required			
5. NCMC mechanism:	NCMC1		NCMC2		
	Through a monitoring centre		No specific mechanism required		

Developments of AI1.17 – 2 of 5

For protection of non-GSO systems

N1	N2
RR No. 9.21	Hard limits

- For non-GSO to GSO links in the frequency bands 27.5-29.1/29.5-30 GHz, EIRP spectral density limits of [-15/-17.5] dBW/Hz depending on antenna size
- For non-GSO to non-GSO links:
 - Option 1: EIRP spectral density of -20 dBW/Hz or -30 dBW/Hz, depending on the altitude of the non-GSO FSS system that the non-GSO space station communicates with
 - **Option 2: EIRP spectral density should not exceed -20 dBW/Hz**
- Additional points (e.g. minimum separation distance below operational non-GSO systems receiving in 27.5-30GHz, maximum total EIRP of user station) under discussion
- **Support N2 (Option 2 for non-GSO to non-GSO)** subject to further agreement on the limits

Developments of AI1.17 – 3 of 5

For protection of GSO networks

G1	G2
Within envelope of typical earth station	Hard limits

- Difficulty in defining an acceptable value for the hard limit in last WP4A meeting:
 - If limits are too stringent, inter-satellite operation to a GSO service provider is not possible
 - For non-GSO to non-GSO, there are already fixed efd limits (Art 22.2) in part of the band to protect GSO
 - For non-GSO to non-GSO in the rest of the band and for NGSO-to-GSO a possible additional solution is a BR check for compliance of the NGSO user space station operation under the envelope of the service provider earth stations

Developments of AI1.17 – 4 of 5

For protection of EESS

EESS1	EESS2
Out-of-band pfd limit	No specific mechanism required

- ▲ Out of band (18.6-18.8GHz) pfd limits in Annex 3 of the new draft resolution
 - Studies have shown that LEO systems that employ a frequency reuse of at least three colours, the “out-of-band pfd limit” is not required.

Developments of AI1.17 – 5 of 5

For protection of terrestrial services in 27.5-29.5 GHz

Option 1	Option 2
PFD mask based on RR Article 21	PFD mask of A-ESIM operating up to an altitude of 3km as defined in Annex 3 of Res 169 (WRC-19)

- ▲ While protection of terrestrial services is ensured with both masks, proposal is to use the Resolution **169 (WRC-19)** mask (but for ESIM altitudes above 3km) with the atmospheric attenuation taken into account in the BR compliance check
 - Consistent with operation under the envelope of the service provider earth stations

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