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Session 8:
WRC-27 agenda items 1.18 resolves 1 and 1.19

Bruno Espinosa, WP 7C Chair

1.18 to consider, based on the results of ITU Radiocommunication Sector studies, possible regulatory measures regarding the protection of the Earth exploration-satellite service (passive) and the radio astronomy service in certain frequency bands above 76 GHz from unwanted emissions of active services, in accordance with Resolution **712 (WRC-23)**;

RESOLUTION 712 (WRC-23)

Studies on compatibility between the Earth exploration-satellite service (passive), the radio astronomy service in certain bands above 76 GHz, and active services in adjacent and nearby frequency bands

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 compatibility studies between the EESS (passive) and the corresponding active services in adjacent frequency bands as listed in Table 1 below:

EESS (passive) frequency bands to be studied and corresponding active services to be included

EESS (passive) frequency band	Active service frequency band	Active service
86-92 GHz	81-86 GHz	Fixed-satellite service (FSS) (Earth-to-space), mobile service (MS)
	92-94 GHz	MS, radiolocation service (RLS)
114.25-116 GHz	111.8-114.25 GHz	Fixed service (FS), MS
164-167 GHz	158.5-164 GHz	FS, FSS (space-to-Earth), MS, mobile-satellite service (MSS) (space-to-Earth)
	167-174.5 GHz	FS, FSS (space-to-Earth), inter-satellite service (ISS), MS
200-209 GHz	191.8-200 GHz	FS, ISS, MS, MSS, radionavigation service (RNS), radionavigation-satellite service (RNSS)
	209-217 GHz	FS, FSS (Earth-to-space), MS

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1 to determine, based on the results of studies, any required regulatory measures regarding the protection of the EESS (passive) in the frequency bands listed in Table 1 above from unwanted emissions of active services and update Resolution **750 (Rev.WRC-19)** accordingly;

AI 1.18 resolves 1: Background

- Bands : 86-92 GHz, 114.25-116 GHz, 164-167 GHz, and 200-209 GHz: covered by RR No. 5.340, have significant importance for the scientific monitoring of the Earth, passive sensors already operational.
  - 86-92 GHz, 164-167 GHz, and 200-209 GHz bands are critical for the passive remote sensing of several atmospheric, cloud and precipitation parameters;
  - 114.25-116 GHz band is important for temperature sounding in the atmosphere
- EESS (passive) characteristics: Recommendation ITU-R RS.1861-1.
- EESS (passive) protection criteria: Recommendation ITU-R RS.2017.
- Resolution **750 (Rev. WRC-19)**: Compatibility between the Earth exploration-satellite service (passive) and relevant active services

Frequency band(s) (GHz)	Reference bandwidth (MHz)	Maximum interference level (dBW)	Percentage of area or time permissible interference level may be exceeded(1) (%)	Scan mode (N, C, L)(2)
86-92	100	−169	0.01	N, C
114.25-116	10	−189	1	L
115.25-122.25	200/10(3)	−166/−189(3)	0.01/1(3)	N, L
164-167	200/10(3)	−163/−189(3)	0.01/1(3)	N, C, L
200-209	3	−194	1	L

TABLE 1

EESS (passive) frequency band	Active service frequency band	Active service	Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) frequency band[1]
1 400	1 427		−72 dBW in the 27 MHz of the EESS (passive) band for IMT base stations

TABLE 2

EESS (passive) frequency band	Active service frequency band	Active service	Recommended maximum level of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) frequency band[1]

AI 1.18 resolves 1: 86-92 GHz

EESS (passive) frequency band	Active service frequency band	Active satellite service (space-to-Earth)
86-92 GHz	81-86 GHz[2]	Fixed-satellite service (FSS), (Earth-to-space), mobile service (MS)
	92-94 GHz	MS, radiolocation service (RLS)

- FS in 81-86 GHz: out of scope of Resolution **712** (already included in Resolution **750**).
- FSS (E-s) in 81-86 GHz:
  - Characteristics provided by WP 4A (Systems A, B, C, D)
  - Preliminary studies performed with assumptions on unwanted emission levels
  - Further consideration required
- MS in 81-86 GHz
  - Exchange between WP 7C and WP 5B on AMS characteristics
  - Current research, but no characteristics available for LMS
- MS in 92-94 GHz
  - RSTT characteristics in Report ITU-R M.2500
- RLS in 92-94 GHz
  - Characteristics in Recommendation ITU-R M.2162
  - Studies between FOD and EESS (passive) performed by WP 5B, in cooperation with WP 7C: **Draft New Report M.[FOD_EESS_SHARE]**.

AI 1.18 resolves 1: 114.25-116 GHz

EESS (passive) frequency band	Active service frequency band	Active satellite service (space-to-Earth)
114.25-116 GHz	111.8-114.25 GHz	Fixed service (FS), MS

- FS in 111.8-114.25 GHz
  - Studies performed by WP 5C, in cooperation with WP 7C**: Draft new Report ITU-R F.[EESS-PROTECTION]**.
  - Potential unwanted emission limits for the protection of EESS (passive) in 114.25-116 GHz.
- MS in 111.8-114.25 GHz
  - Current research, but no characteristics available for LMS

AI 1.18 resolves 1: 164-167 GHz

EESS (passive) frequency band	Active service frequency band	Active satellite service (space-to-Earth)
164-167 GHz	158.5-164 GHz	FS, FSS (space-to-Earth), MS, mobile-satellite service (MSS) (space-to-Earth)
	167-174.5 GHz	FS, FSS (space-to-Earth), inter-satellite service (ISS), MS

- FS in 158.5-164 GHz and 167-174.5 GHz
  - Studies performed by WP 5C, in cooperation with WP 7C: **Draft new Report ITU-R F.[EESS-PROTECTION]**.
  - Potential unwanted emission limits for the protection of EESS (passive) in 164-167 GHz GHz.
- MS in 158.5-164 GHz and 167-174.5 GHz
  - Current research, but no characteristics available for LMS
- FSS (s-E) in 158.5-164 GHz and 167-174.5 GHz :
  - Characteristics provided by WP 4A (System B)
  - Studies to be performed
- MSS (s-E) in 158.5-164 GHz
  - No information available
- ISS in 167-174.5 GHz
  - No characteristics provided by WP 4A, but frequency assignments recorded in MIFR.
  - To be analysed.

AI 1.18 resolves 1: 200-209 GHz

EESS (passive) frequency band	Active service frequency band	Active satellite service (space-to-Earth)
200-209 GHz	191.8-200 GHz	FS, ISS, MS, MSS, radionavigation service (RNS), radionavigation-satellite service (RNSS)
	209-217 GHz	FS, FSS (Earth-to-space), MS

- FS in 191.8-200 GHz and 209-217 GHz
  - Characteristics provided by WP 5C.
  - Studies to be performed.
- MS in in 191.8-200 GHz and 209-217 GHz
  - Current research, but no characteristics available for LMS
- FSS (E-s) in 209-217 GHz :
  - No characteristics provided by WP 4A, but frequency assignments recorded in MIFR.
  - To be analysed.
- RNS and RNSS in 191.8-200 GHz
  - No information available, no assignments in MIFR
- ISS in 191.8-200 GHz
  - No characteristics provided by WP 4A, but frequency assignments recorded in MIFR.
  - To be analysed.
- MSS in 191.8-200 GHz
  - No information available.

AI 1.18 resolves 1: Issues to be addressed

- Further develop initiated studies (FSS (E-s) in 81-86 GHz)
- Develop compatibility studies when characteristics are available (AMS in 81-86 GHz, RSTT in 92-94 GHz, FSS (s-E) in 158.5-164 GHz and 167-174.5 GHz, FS in 209-217 GHz)
- Assess information provided from MIFR assignments (ISS in 167-174.5 GHz and 191.8-200 GHz, FSS (E-s) in 209-217 GHz)
- **What to do for services when no characteristics are available?**
    - LMS in 81-86 GHz, 111.8-114.25 GHz, 158.5-164 GHz, 167-174.5 GHz, 191.8-200 GHz and 209-217 GHz
    - MSS (s-E) in 158.5-164 GHz and MSS in 191.8-200 GHz
    - RNS and RNSS in 191.8-200 GHz
- **How to handle aggregate interference from various services?** Band-by-band apportionment to be further discussed.
- Develop further the CPM Text in cooperation with WP 7D
    - **Assess study results for potential update of Resolution 750** (WRC-19) including for the completed studies (FS in 111.8-114.25 GHz, 158.5-164 GHz and 167-174.5 GHz, FOD in 92-94 GHz).

1.19 to consider possible primary allocations in all Regions to the Earth exploration-satellite service (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz, in accordance with Resolution **674 (WRC-23)**,

RESOLUTION 674 (WRC-23)

Studies on possible allocations to the Earth exploration-satellite service (passive) in the bands 4 200-4 400 MHz and 8 400-8 500 MHz

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sharing and compatibility studies to determine the possibility of a future allocation to the EESS (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz,

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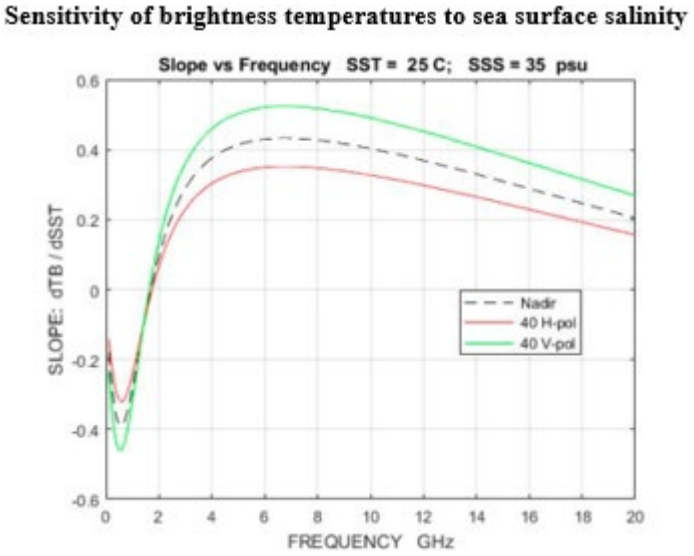
to examine the results of these studies with a view to considering a new primary allocation in all Regions to the EESS (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz, without protection from existing services in these frequency bands and in adjacent bands.

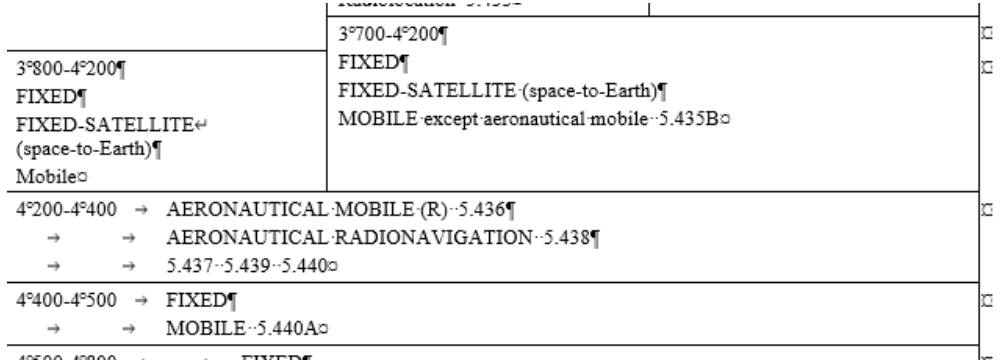
AI 1.19: Background

- Measurements of Sea Surface Temperature (SST): Bands : predominant measurement technique to assess the occurrence and trajectory of hurricanes/cyclones/storms. Key factor for numerical weather prediction model.
- Currently performed in the 6 425-7 250 MHz range, RR No. 5.458 (not an allocation).
- AI 1.19 is looking for complementary EESS (passive) allocations in order to ensure continuity of SST measurements.
- EESS (passive) characteristics in 4200-4400 MHz and 8400-8500 MHz: derived from those EESS (passive) in the 6-7 GHz range in Recommendation ITU-R RS.1861-1.
- EESS (passive) protection criteria: Recommendation ITU-R RS.2017.\



- **5.437:** Passive sensing in the Earth exploration-satellite and space research services may be authorized in the frequency band 4 200-4 400 MHz on a secondary basis. (WRC-15)

AI 1.19 studies: 4200-4400 MHz



		3°700-4°200¶ FIXED¶ FIXED-SATELLITE·(space-to-Earth)¶ MOBILE·except·aeronautical·mobile··5.435B¤
3°800-4°200¶ FIXED¶ FIXED-SATELLITE↵ (space-to-Earth)¶ Mobile¤		
4°200-4°400 →	AERONAUTICAL·MOBILE·(R)··5.436¶ AERONAUTICAL·RADIONAVIGATION··5.438¶ 5.437··5.439··5.440¤	
4°400-4°500 →	FIXED¶ MOBILE··5.440A¤	

- In band studies under development:
  - AM(R)S (WAIC): risks of interference from WAIC into EESS (passive) in some areas.
  - ARNS (Radio altimeters): risks of interference from altimeters into EESS (passive) in some areas
- Adjacent band studies under development
  - FSS (s-E) in 3700-4200 MHz: no interference from FSS. To be confirmed.
  - LMS in 3800-4200 MHz: potential compatibility with mitigation. To be confirmed.
  - LMS in 4400-4800 MHz: diverging conclusions. To be further discussed.
- No studies currently available on the interference into EESS (passive) in 4200-4400 MHz from FS in adjacent bands and from AMS and MMS in 4400-4800 MHz.
- Overlap between AI 1.19 and AI 1.7: interference from IMT in 4400-4800 MHz into EESS (passive) in 4200-4400 MHz
  - 1 study: possible compatibility subject to assumptions on IMT unwanted emission levels. To be further discussed.
  - Cooperation between WP 7C and WP 5D.

AI 1.19 studies: 8400-8500 MHz

8 215-8 400	EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.463 5.462A
8 400-8 500	FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth) 5.465 5.466
8 500-8 550	RADIOLOCATION 5.468 5.469

- In band studies under development:
  - FS: different results subject to assumptions on FS deployment.
  - SRS (s-E): no interference expected into EESS (passive).
  - MS: no study currently available.
- Adjacent band studies under development
  - EESS (s-E) in 8215-8400 MHz: no interference expected into EESS (passive)
  - FSS (E-s) in 7900-8400 MHz: risks of interference from FSS into EESS (passive) in some areas.
- No studies currently available on the interference into EESS (passive) in 8400-8500 MHz from RLS in 8500-8550 MHz
- Overlap between AI 1.19 and AI 1.7: interference from IMT in 7125-8400 MHz into EESS (passive) in 8400-8500 MHz
  - 3 studies: possible compatibility subject to assumptions on IMT unwanted emission levels. To be further discussed.
  - Cooperation between WP 7C and WP 5D. Study results to be provided to WP 5D, when completed.

AI 1.19 CPM text

4200-4400 MHz:

- NOC
- Primary allocation to EESS (passive). EESS (passive) shall not claim protection from the aeronautical mobile (R) and aeronautical radionavigation services that operate in accordance with recognized international aeronautical standards.
- Primary allocation to EESS (passive). EESS (passive) shall not claim protection from the aeronautical mobile (R) and aeronautical radionavigation services that operate in accordance with recognized international aeronautical standards. EESS (passive) shall not claim protection from the land mobile service in the 4400-4800 MHz band.

8400-8500 MHz

- NOC
- Primary allocation to EESS (passive). EESS (passive) shall not claim protection from the fixed, mobile except aeronautical mobile and space research (space-to-Earth) services. In 8400-8500 MHz, administrations shall not introduce high-density mobile systems.
- Primary allocation to EESS (passive). EESS (passive) shall not claim protection from the fixed, mobile except aeronautical mobile and space research (space-to-Earth) services. EESS (passive) shall not claim protection from the fixed satellite service (Earth-to-space) in the 8 215-8 400 MHz band.

AI 19: Issues to be addressed

- Further develop initiated studies

- Develop compatibility studies for scenarios currently not addressed (e.g. LMS in 8400-8500 MHz, RLS in 8500-8550 MHz)

- **How to address scenarios where interference into EESS (passive) might be expected** (e.g. AM(R)S, ARNS in 4200-4400 MHz)?
  - "Shall not claim protection"
  - Consensus in CPM Methods on in-band services
  - Further discussion required on adjacent band services

- **In case of interference, would the new allocations be usable by EESS (passive)?**
  - Initiated study on retrieval of SST measurements through a combination of channels, including the possible 2 new allocations.

- **Topic of "high density MS applications" in 8400-8500 MHz to be further discussed**

- **Relation between WRC-27 AI 1.19 and AI 1**.7: Conditions for adjacent band compatibility between:
  - EESS (passive) in 4200-4400 MHz and IMT in 4400-4800 MHz?
  - EESS (passive) in 8400-8500 MHz and IMT in IMT in 7125-8400 MHz ?