



NATIONAL PREPARATORY COMMITTEE TOWARDS WRC-27 AGENDA ITEM 1.18 BRIEF

Chapter: 4

Service: Science issues (EESS passive / Radio Astronomy)

Agenda Item: 1.18

Description of Agenda Item: 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, in accordance with Resolution 712 (WRC-23).

Objective: To determine necessary regulatory measures based on the results of ITU-R compatibility studies to protect the Earth exploration-satellite service (passive) and the radio astronomy service (RAS) in specific frequency bands above 76 GHz from the unwanted emissions of adjacent and nearby active services.

Statutory Mandates: Resolution 712 (WRC-23)

The technical tasks assigned to the ITU Radiocommunication Sector are explicitly split into separate compatibility study tracks:

- **Resolves 1:** Studies on compatibility between the EESS (passive) and the corresponding active terrestrial and space services in adjacent frequency bands across four target spectrum blocks.
- **Resolves 2:** Studies on compatibility between the RAS and active satellite services in certain adjacent and nearby frequency bands with a view to setting relevant threshold levels for unwanted emissions from any geostationary-satellite orbit (GSO) and non-geostationary-satellite orbit (non-GSO) space stations.
- **Invites WRC-27 1:** To determine required regulatory measures regarding the protection of the EESS (passive) in the frequency bands listed in Table 1 from unwanted emissions of active services, and update Resolution 750 (Rev. WRC-19) accordingly.
- **Invites WRC-27 2:** To determine required regulatory measures regarding the protection of the RAS in the target frequency bands listed in Table 2, and revise and update Resolution 739 (Rev. WRC-19) accordingly.

Target Passive Frequency Blocks Under Review (Table 1 & Table 2 Framework)

The dynamic sharing and compatibility simulations evaluate specific passive bands and their interacting active neighbors:

- **86–92 GHz EESS Band:** Audited for adjacent-band interference from Fixed-Satellite Service (FSS) (Earth-to-space) and mobile service (MS) operating in the 81-86 GHz band, as well as MS and radiolocation service (RLS) operations in the 92-94GHz band.

- **114.25–116 GHz EESS Band:** Audited for adjacent emissions from the fixed service (FS) and MS operating in the 111.8-114.25GHz band.
- **164–167 GHz Dual-Science Band:**
 - **EESS Track:** Audited against adjacent FS, FSS (space-to-Earth), MS, and mobile-satellite service (MSS) (space-to-Earth) in the 158.5-164GHz block, alongside FS, FSS (space-to-Earth), inter-satellite service (ISS), and MS in the 167-174.5GHz block.
 - **RAS Track:** Audited specifically for space-to-Earth unwanted emissions originating from FSS active satellite systems in the 167-174.5GHz band.
- **The 200–209 GHz EESS Band:** Audited against adjacent active services in the 191.8-200 GHz block (FS, ISS, MS, MSS, radionavigation service [RNS], radionavigation-satellite service [RNSS]) and the 209-217 GHz block (FS, FSS [Earth-to-space], MS).
- **The 76–81 GHz RAS Band:** Audited for space-to-Earth aggregate emissions from FSS, MSS, and broadcasting-satellite service (BSS) networks operating in the 71-76GHz band.
- **The 130–134 GHz RAS Band:** Audited for space-to-Earth aggregate emissions from FSS, MSS, and RNSS systems operating in the 123-130GHz range.
- **The 226–231.5 GHz RAS Band:** Audited for space-to-Earth aggregate emissions from FSS networks operating in the adjacent 232-235 GHz band.

Potential Services Affected

- **Earth Exploration-Satellite Service (EESS - Passive):** Sensors that measure naturally occurring thermal emissions from water vapor and atmospheric layers. These frequencies are fixed by the laws of nature, making a frequency shift to avoid interference impossible.
- **Radio Astronomy Service (RAS):** Ground stations measuring natural cosmic emissions. Because space-borne transmitters can cause harmful interference through telescope side lobes, these stations are highly vulnerable to adjacent-band satellite downlinks.
- **Active Services & Active Satellite Services:** Terrestrial FS, MS, and RLS deployment networks, alongside high-capacity space services (FSS, MSS, BSS, RNSS, ISS) operating downlinks or uplinks near the passive windows.

3. Driving Anchor Documents

- **Resolution 750 (Rev. WRC-19):** The target vehicle for EESS protection updates.
- **Resolution 739 (Rev. WRC-19):** The target vehicle for RAS protection updates;

establishes coordination/consultation framework procedures between administrations.

- **Recommendation ITU-R RS.2017 & RS.1861:** Baseline interference criteria, protection targets, and typical technical/operational characteristics of passive EESS systems.
- **Recommendation ITU-R RA.769-2:** Universal protection criteria, far side-lobe models, and threshold limits for continuum, spectral-line, and VLBI observations.
- **Recommendation ITU-R RA.1513-2:** Establishes acceptable levels of data loss (the 2% criterion) and percentage-of-time criteria resulting from interference degradation.
- **Recommendations ITU-R M.1583 & ITU-R S.1586:** Mathematical calculation methodologies for unwanted emission levels and epfd modeling produced by non-GSO satellite systems at RAS sites.
- **Reports ITU-R RA.2510, RA.2508, RA.2512, & Rec. RA.1750:** Baseline technical parameters ensuring calculation consistency with earlier space-sharing work at 94 GHz and 130 GHz.

Status of Studies & Referenced Documentation

Active Equipment Profiling & Emission Characterization

- **Referenced Document:** Working document toward a draft new Report ITU-R RS.[ACTIVE_CHAR_ABOVE_76GHZ] and non-GSO network parameters provided by WP 4A.
- **Studies Carried Out:** WP 7C and WP 7D compiled the engineering profiles of next-generation millimeter-wave active assets. Simulations focused on out-of-band emissions within the unwanted domain.
- **Output:** Studies established that non-GSO characteristics and current out-of-band emissions significantly exceed standard RAS thresholds, proving that sharing parts of bands would be even more challenging.

Compatibility Analyses & Interference Simulations (RAS Focus)

- **Referenced Document:** Report ITU-R RA.[RAS-SAT 71-235 GHZ].
- **Studies Carried Out (Resolves 2):** Working Party 7D executed several compatibility studies considering varied non-GSO link types (user terminals vs. gateway stations) which vary based on ground-station density and simultaneous co-frequent satellite beam counts. For the non-GSO calculations, the epfd method described in Recommendations ITU-R M.1583 and ITU-R S.1586 was applied.
- **Technical Findings:** Based on these analyses, updated thresholds expressed in terms of pfd and epfd have been derived for continuum, spectral-line, and VLBI observations above 76 GHz in accordance with Recommendation ITU-R RA.769-2. The studies demonstrated that while interference from a single satellite system

operating under certain controlled conditions may be limited, aggregate and/or transient interference from GSO and non-GSO satellite systems operating in adjacent or nearby frequency bands may approach or exceed the thresholds in Recommendation ITU-R RA.769-2. Where thresholds are breached, the percentage-of-time/data-loss criteria discussed in Recommendation ITU-R RA.1513-2 may be considered. Further refinement of aggregate interference assessments would benefit from more detailed satellite parameters.

Regulatory CPM Text Formulation

- **Referenced Document:** Document towards draft CPM text for WRC-27 agenda item 1.18.
- **Studies Carried Out:** Slices the technical sharing boundaries into explicit regulatory methods for Issue A (EESS) and Issue B (RAS) to provide a technical basis to inform the conference plenary.

5. CPM Methods Matrix for Issue B (The Legislative Options for RAS)

The draft text organizes the options for protecting the radio astronomy service above 76 GHz into distinct, alternative regulatory approaches:

CPM Issue	Methods	Regulatory Wording
Issue B (RAS): Protection of the radio astronomy service above 76 GHz from active satellite downlinks (Table 2 bands).	Method B1: No Change (NOC)	Proposes No Change to the Radio Regulations or to Resolution 739 (Rev. WRC-19). Maintains the existing regulatory framework, asserting that the existing provisions of the RR, including Nos. 5.149 and 5.340 , together with the continued application of Resolution 739, remain sufficient. Consequentially suppresses Resolution 712 (WRC-23) upon completion of studies.
	Method B2: Update Resolution 739 (Maintain Framework Structure)	Proposes to modify Tables 1 and 2 of the Annex to Resolution 739 (Rev. WRC-19) to extend the values to include the frequency bands studied under this agenda item, based on results in Report ITU-R RA. RAS-SAT 71-235 GHz • Sub-Method B2.1 & B2.2: Updates the resolution to include the newly derived pfd and epfd thresholds from WP 7D,

CPM Issue	Methods	Regulatory Wording
		reflecting necessary clarifications (observation modes, reference bandwidths, and basic applicability considerations) while maintaining the current structure and non-mandatory, guidance-based character of the existing regulatory framework.
	Method B3: Update Resolution 739 with Explicit Technical Guidance	Proposes to modify Tables 1 and 2 of the Annex to Resolution 739 (Rev. WRC-19) to extend values to include studied frequencies, while maintaining the current structure of the Radio Regulations. Formally notes that the interference environment depends on satellite system characteristics, operational assumptions, and observation geometries; notes that aggregate and/or transient interference may approach detrimental levels and specifies that the time-percentage/data-loss concepts of Recommendation ITU-R RA.1513-2 may be considered when interpreting compatibility assessments.

Conclusions & Recommendations

The technical studies executed under WRC-27 Agenda Item 1.18 confirm that unwanted out-of-band emissions from adjacent and nearby active satellite downlinks significantly exceed the sensitive detrimental thresholds of the Radio Astronomy Service above 76 GHz. Dynamic simulations utilizing the epdf method verify that while single-entry emissions under tightly controlled conditions may remain limited, the cumulative aggregate and transient emissions from expanding GSO networks and non-GSO constellations can easily approach or exceed Recommendation ITU-R RA.769-2 limits for continuum, spectral-line, and VLBI observations.

The regulatory analyses indicate that a "one size fits all" approach is unfeasible, as the actual interference environment remains heavily dependent on satellite orbit characteristics, operational assumptions, and observation geometries. To address this, the draft CPM text provides a complete technical basis for updating Tables 1 and 2 of the Annex to Resolution 739 (Rev. WRC-19). The methods diverge not on whether to update these values, but on the level of technical explicitness required and whether to maintain the current guidance-based, non-mandatory consultation structure of the

existing treaty framework.

Recommendations

Uganda adopts the following technical positions to ensure the total, uninterrupted protection of local infrastructure and scientific observations from harmful interference:

- **Reject Method B1 (No Change):** Oppose a No Change approach, as leaving the frequency bands above 76 GHz out of Resolution 739 ignores the reality that active satellite out-of-band emissions currently exceed the safety thresholds of primary radio astronomy allocations.
- **Support Method B3 (Update Resolution 739 with Explicit Technical Guidance):** Advocate for updating Tables 1 and 2 of the Annex to Resolution 739 (Rev. WRC-19) to incorporate the newly derived pfd and epfd thresholds, while explicitly embedding comprehensive application guidance.
- **Mandate a Clean Regulatory Slate:** Support the consequential suppression of Resolution 712 (WRC-23) across all methods once the updated technical parameters and updated resolution elements are finalized at WRC-27.
- **Verify Satellite Parameters:** monitor the contribution of refined satellite system parameters from WP 4A, ensuring that local regulatory planning and regional positions (EACO/ATU) remain aligned with the most accurate aggregate interference models available.