NATIONAL PREPARATORY COMMITTEE TOWARDS WRC-27 AGENDA ITEM 1.19 BRIEF

Chapter: *4*
Service: *Science Issues*
Agenda Item : *1.19*

Description of Agenda Item: *Studies to consider possible primary allocations in all Regions to the Earth exploration-satellite service (EESS) (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz, in accordance with Resolution 674 (WRC-23);*

Focus: Compatibility and sharing studies for EESS (passive) SST measurements in the 4.2–4.4 GHz and 8.4–8.5 GHz bands.

Status of Studies

The ITU-R studies under WRC-27 Agenda Item 1.19 are ongoing and focus on sharing and compatibility with incumbent services to determine the technical feasibility of such allocations.
The studies are:

- Assessing feasibility of new primary allocations to the Earth exploration-satellite service (EESS) (passive)
- Intended to support continuity and enhancement of Sea Surface Temperature (SST) measurements, currently performed mainly in the 6–7 GHz range under RR No. 5.458

Studies include:

- Sharing and compatibility analysis with incumbent services
- Interference assessment (in-band and adjacent band)
- Technical modelling of passive microwave sensing systems
- Evaluation of multi-band SST retrieval performance

Objective of the Studies

The main objective is to determine whether the bands 4 200–4 400 MHz and 8 400–8 500 MHz can be used for EESS (passive) under a future primary allocation.

Specifically, the studies aim to:

- Ensure continuity of global SST measurements
- Improve climate and weather monitoring capability
- Assess the use of additional frequency channels for improved SST retrieval
- Determine sharing feasibility without harmful interference to incumbent services

Frequency Bands Under Study

The ITU-R studies under WRC-27 Agenda Item 1.19 focus on the following frequency bands:

Primary Candidate Band

- 4 200–4 400 MHz
- 8 400–8 500 MHz

Current reference band for SST measurements:

- 6 475–7 250 MHz (RR No. 5.458)

Adjacent and related bands considered in compatibility studies:

- 3 700–4 200 MHz (Fixed and Fixed-Satellite Services)
- 4 400–4 800 MHz (Mobile Service, including IMT under WRC-27 AI 1.7)
- 8 215–8 400 MHz (Fixed-Satellite Service and Space Research Service)
- 8 500–8 550 MHz (Radiolocation Service)

Methods to Satisfy the Agenda Item

Band 1: 4 200–4 400 MHz

Method 1A — No allocation change

- No changes to the Radio Regulations.
- Suppression of Resolution 674 (WRC-23).
- EESS (passive) remains without a new primary allocation.

Method 1B — Primary allocation with non-protection

Introduces a new primary allocation to EESS (passive) in 4 200–4 400 MHz.

- Adds a footnote stating EESS (passive) shall not claim protection from:
  - Aeronautical Mobile (R) Service (RR No. 5.436)
  - Aeronautical Radionavigation Service (RR No. 5.438)
- Modifies RR No. 5.437 (upgrading passive sensing provisions).
- Suppresses Resolution 674 (WRC-23).

Method 1C — Primary allocation with extended non-protection (*includes adjacent band constraints*)

- Introduces primary allocation to EESS (passive) in 4 200–4 400 MHz.
- Adds footnote stating no protection from:
  - Aeronautical Mobile (R)
  - Aeronautical Radionavigation Service
  - Land Mobile Service in 4 400–4 800 MHz (adjacent band constraint included)
- Modifies RR No. 5.437.
- Suppresses Resolution 674 (WRC-23).

Method 1D — Primary allocation with full in-band and adjacent-band non-protection

- Introduces primary allocation to EESS (passive) in 4 200–4 400 MHz.
- Establishes that EESS (passive) shall not claim protection from:
  - Aeronautical Mobile (R)

    - Aeronautical Radionavigation Service
    - Fixed, Fixed-Satellite, Mobile services in adjacent bands (3 700–4 200 MHz and 4 400–4 500 MHz)
- Modifies RR No. 5.437.
- Suppresses Resolution 674 (WRC-23).

Band 2: 8 400–8 500 MHz

Method 2A — No allocation change

- No changes to Radio Regulations.
- Suppression of Resolution 674 (WRC-23).
- No new allocation to EESS (passive).

Method 2B — Primary allocation with protection from high-density mobile systems

- Introduces new primary allocation to EESS (passive) in 8 400–8 500 MHz.
- Adds footnote stating EESS (passive) shall not claim protection from:
    - Fixed Service
    - Mobile (except aeronautical mobile)
    - Space Research (space-to-Earth)
- Adds regulatory restriction preventing high-density mobile systems in the band.
- Suppresses Resolution 674 (WRC-23).

Method 2C — Primary allocation with additional FSS (Earth-to-space) restriction

- Introduces primary allocation to EESS (passive) in 8 400–8 500 MHz.
- Adds footnote stating no protection from:
    - Fixed Service
    - Mobile (except aeronautical mobile)
    - Space Research (space-to-Earth)
    - Fixed Satellite Service (Earth-to-space) in 8 215–8 400 MHz (adjacent band)
- Suppresses Resolution 674 (WRC-23).

Method 2D — Primary allocation with expanded adjacent-band exclusion

- Introduces primary allocation to EESS (passive) in 8 400–8 500 MHz.
- Adds footnote stating EESS (passive) shall not claim protection from:
    - Fixed Service
    - Mobile Service (except aeronautical mobile)
    - Space Research (space-to-Earth)
- Extends non-protection to adjacent bands:
    - EESS, FS, FSS (Earth-to-space), Mobile in 8 215–8 400 MHz
    - Radiolocation Service in 8 500–8 550 MHz
- Suppresses Resolution 674 (WRC-23).

Technical and Regulatory Framework

The studies under Agenda Item 1.19 provide a technical and regulatory basis for possible new primary allocations to the Earth exploration-satellite service (EESS) (passive) in the frequency bands 4 200–4 400 MHz and 8 400–8 500 MHz, in accordance with Resolution 674 (WRC-23). The framework is driven by the need to support global

sea surface temperature (SST) measurements, while operating without protection from incumbent and adjacent-band services.

The framework includes the following key elements:

i. Introduction of EESS (passive) primary allocations with non-protection status in both bands, supported by regulatory footnotes indicating that EESS (passive) shall not claim protection from incumbent and, in some cases, adjacent-band services.
ii. Modification of the Radio Regulations, including amendment of RR No. 5.437 in the 4 200–4 400 MHz band, addition of new and suppression of Resolution 674 (WRC-23) upon implementation.
iii. Coexistence studies based on representative sensor characteristics and incumbent deployment scenarios, addressing compatibility with Fixed, Mobile, Fixed-Satellite, Space Research, Aeronautical Radionavigation, and Aeronautical Mobile (R) services.
iv. Band-dependent interference characteristics, with impacts in 4 200–4 400 MHz mainly driven by aeronautical systems (radio altimeters and WAIC), and in 8 400–8 500 MHz mainly associated with fixed and fixed-satellite services near coastal areas, with additional potential impact from adjacent-band IMT if emission limits are not applied.
v. A multi-band SST observation approach using 4.3 GHz, 6.925 GHz, and 8.45 GHz channels to improve retrieval performance and ensure global measurement continuity while enhancing resilience to interference.

Interference Protection Mechanisms

To address coexistence with incumbent services, the following mechanisms and assumptions are embedded in the studies:

i. **Non-protection regulatory condition**
EESS (passive) allocations are defined on a non-protection basis, with no claim for protection from in-band incumbent services and, in some cases, from adjacent-band services such as mobile, fixed-satellite, and fixed services.

ii. **Unwanted emission limits for IMT in adjacent bands**
Protection of EESS (passive) in scenarios involving adjacent-band IMT depends on the application of unwanted emission limits, with studies providing indicative compatibility thresholds derived under different assumptions.

iii. **Geographical and scenario-based interference modelling**
Interference results depend on deployment conditions, including coastal, land, and ocean measurement areas, fixed service density, air traffic routes, and sensor geometry, including aggregation effects

iv. **Use of established ITU-R methodologies**
Studies apply recognized ITU-R propagation and scattering models, including Recommendation ITU-R P.2146 and representative sensor performance assumptions.

v. **Operational coexistence through band diversity**
Where interference is expected in one band, alternative bands (*4 GHz, 6/7 GHz, and 8 GHz* ranges) may be used, with multi-channel configurations improving retrieval robustness and reducing sensitivity to interference.

Technical and Regulatory Challenges

i. **Interference from airborne systems in 4.2–4.4 GHz band**
Radio altimeters and WAIC systems may generate aggregated interference along major air routes and in land–ocean transition areas.

ii. **Coexistence with dense fixed service deployments in 8.4–8.5 GHz band**
Fixed service deployment density strongly influences interference outcomes, with potential exceedance of protection criteria, particularly near coastal regions.

iii. **Adjacent-band IMT impact under WRC-27 AI 1.7**
IMT **systems** in adjacent bands may produce unwanted emissions affecting EESS (passive) unless appropriate emission limits are applied.

iv. **Coastal and border-area sensitivity**
The 8 GHz band is particularly sensitive in coastal and border regions due to combined effects of fixed service deployments, FSS Earth-to-space operations, and mixed propagation environments.

v. **Regulatory complexity of non-protected passive allocations**
All **proposed** methods assume EESS (passive) operation without protection rights, requiring clear regulatory provisions in Article 5 and supporting footnotes.

vi. **Requirement for multi-band SST retrieval continuity**
Ensuring global SST continuity requires coordinated use of the 4.2–4.4 GHz, 6/7 GHz, and 8.4–8.5 GHz bands to improve resilience against interference and maintain measurement coverage.

Conclusion

The studies conclude that new EESS (passive) allocations in the 4.2–4.4 GHz and 8.4–8.5 GHz bands could improve global SST monitoring, but they would need to operate on a non-protected basis due to expected interference from existing and adjacent services. While sharing is technically possible under certain conditions (*including emission limits and specific deployment assumption*s), the overall approach relies on using multiple frequency bands together to ensure reliable global coverage despite interference risk.