**Chapter:** One
**Service:** Fixed Satellite Service (FSS) and Broadcasting Satellite Service (BSS)
**Agenda Item:** 1.3
**Description of the AI:** Consider studies relating to the use of the frequency band 51.4-52.4 GHz to enable use by gateway earth stations transmitting to non-geostationary-satellite orbit systems in the fixed-satellite service (Earth-to-space), in accordance with Resolution **130 (WRC-23).**

**Focus:** Examining the technical and regulatory conditions under which the frequency band 51.4-52.4 GHz can be used by non-GSO FSS gateway earth stations while ensuring protection of Earth exploration-satellite service (passive) systems operating in the adjacent frequency band 52.6-54.25 GHz.

## Status of Studies

Studies under Agenda Item 1.3 are being conducted within ITU-R Working Party 4A in coordination with relevant ITU-R groups responsible for Earth exploration-satellite service (passive) studies.

The studies are examining the possible use of the frequency band 51.4-52.4 GHz by gateway earth stations communicating with non-GSO FSS systems. The band is already allocated to the fixed-satellite service (Earth-to-space) for geostationary-satellite orbit (GSO) systems and is currently limited to gateway earth stations.

The studies focus on:

i. Sharing and compatibility between non-GSO FSS gateway earth stations and EESS (passive) systems operating in the adjacent band 52.6-54.25 GHz.
ii. Aggregate interference from non-GSO gateway earth stations into EESS (passive) sensors.
iii. Possible unwanted emission limits and mitigation measures.
iv. Regulatory and operational conditions applicable to non-GSO gateway earth stations.
v. Harmonization with existing regulatory provisions applicable to 40/50 GHz non-GSO FSS systems.

The studies recognize that the 51.4-52.4 GHz band could support future gateway feeder links for high-capacity non-GSO satellite systems, including broadband satellite constellations.

## Objective of the Studies

The objective of the studies is to determine whether the frequency band 51.4-52.4 GHz can be used by non-GSO FSS gateway earth stations under technical and operational conditions that ensure adequate protection of EESS (passive) systems.
The studies seek to:

*i.* Facilitate additional spectrum resources for non-GSO FSS gateway feeder links.
*ii.* Ensure continued protection of EESS (passive) systems operating in adjacent bands.
*iii.* Develop appropriate unwanted emission limits and operational conditions.
*iv.* Harmonize regulatory treatment of GSO and non-GSO FSS systems where appropriate.
*v.* Support future broadband satellite system deployments.
*vi.* Maintain efficient spectrum utilization and regulatory certainty.

## Frequency bands under consideration

The band under consideration is;

- 51.4 – 52.4 GHz (Earth-to-space)

This band is currently allocated to the following services:

| Allocation to services | | |
|---|---|---|
| **Region 1** | **Region 2** | **Region 3** |
| **50.4-51.4** | FIXED<br>FIXED-SATELLITE (Earth-to-space) 5.338A 5.550C<br>MOBILE<br>Mobile-satellite (Earth-to-space) | |
| **51.4-52.4** | FIXED<br>FIXED-SATELLITE (Earth-to-space) 5.555C<br>MOBILE<br>5.338A 5.547 5.556 | |
| **52.4-52.6** | FIXED 5.338A<br>MOBILE<br>5.547 5.556 | |
| **52.6-54.25** | EARTH EXPLORATION-SATELLITE (passive)<br>SPACE RESEARCH (passive)<br>5.340 5.556 | |

The current allocation permits use by GSO FSS gateway earth stations subject to RR No. 5.555C. Under the existing framework:

- Use by GSO FSS systems is limited to gateway earth stations;
- Gateway earth stations must use a minimum antenna diameter of 2.4 metres.

Agenda Item 1.3 studies whether similar access could be extended to non-GSO FSS gateway earth stations.

The adjacent frequency band:

- 52.6 - 54.25 GHz is allocated to the Earth exploration-satellite service (passive), which is used for passive remote sensing measurements critical for:

  *i.* Weather forecasting;
  *ii.* Climate monitoring;
  *iii.* Environmental observation;
  *iv.* Disaster prediction and management.

**Importance of EESS (Passive)**

EESS (passive) systems measure naturally occurring emissions from the Earth and atmosphere. These measurements are essential for meteorological and environmental applications.

The studies recognizes that:

- Passive sensing frequencies are determined by the laws of nature and cannot be shifted to other frequencies
- Long-term protection of EESS (passive) bands is critical for weather prediction and disaster management.

Studies are therefore focused on ensuring that unwanted emissions from active services do not cause unacceptable interference to passive sensors.

## Methods to Satisfy the Agenda Item

Several methods are under consideration and are still under development.

**Method A**. proposes no change to the Radio Regulation

**Method B.** proposes to add the frequency band 51.4-52.4 GHz in RR Table 22-2 to include epfd limits for the Earth-to-space direction to protect GSO FSS space station from non-GSO FSS gateway emissions; to update Resolution 750 (Rev.WRC-19) with additional regulatory provisions to ensure protection to EESS (passive) operations in the frequency band 52.6-54.25 GHz;and to update Appendix 7; noting there is no need to modify RR Article 21 as RR Tables 21-2 and 21-3 already include FSS in the frequency band 51.4-52.4 GHz.

**Method C**. proposes that non-GSO FSS gateway earth station use would be subject to coordination under RR No. 9.12; to update Resolution 750 (Rev.WRC-19) with additional regulatory provisions to ensure protection to EESS (passive) operations in the frequency band 52.6-54.25 GHz; to extend the provisions of RR Nos. 22.5L and 22.5M, and associated [WRC] Resolutions, to include non-GSO FSS systems operating in the new allocation, for protection of GSO FSS networks from single-entry and aggregate unacceptable interference from non-GSO FSS gateway earth stations in the frequency band 51.4-52.4 GHz; and to update Appendix 7, noting there is no need to modify RR Article 21 as RR Tables 21-2 and 21-3 already include FSS in the frequency band 51.4-52.4 GHz

**Method D.** proposes to update Resolution 750 (Rev.WRC-19) with additional regulatory provisions to ensure protection to EESS (passive) operations in the frequency band 52.6-54.25 GHz; modified provisions based on RR Nos. 22.5L and 22.5M for protection of GSO FSS networks from single-entry and aggregate unacceptable interference from non-GSO FSS gateway earth stations in the frequency band 51.4-52.4 GHz; and to update Appendix 7, noting there is no need to modify RR Article 21 as RR Tables 21-2 and 21-3 already include FSS in the frequency band 51.4-52.4 GHz.

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## Regulatory and Technical Framework

The studies are examining compatibility using ITU-R Recommendations and Reports related to passive sensing protection and satellite sharing studies.

Relevant studies include:

*i.* Report ITU-R SM.2092;
*ii.* Report ITU-R S.2463;
*iii.* Recommendation ITU-R RS.2017.

The studies recognize that:

*i.* EESS (passive) sensors are highly sensitive to unwanted emissions;
*ii.* Aggregate interference from multiple gateway earth stations may be significant;
*iii.* Both technical and operational mitigation techniques may be required.

Potential mitigation techniques under consideration include:

*i.* Improved filtering.
*ii.* Antenna discrimination.
*iii.* Power control.
*iv.* Operational restrictions.
*v.* Coordination procedures.
*vi.* Guardbands where necessary.

**Key Issues Under Discussion**

*i.* Protection of EESS (Passive): The primary issue under discussion is whether non-GSO gateway earth stations can operate without causing unacceptable interference to passive sensing systems.

*ii.* Aggregate Interference: Studies are examining whether large numbers of gateway earth stations could create aggregate unwanted emissions exceeding protection thresholds.

*iii.* Spectrum Demand: Many administrations and satellite operators support additional feeder-link spectrum for non-GSO systems to support future broadband satellite deployments.

*iv.* Regulatory Harmonization:Some administrations support harmonizing the treatment of GSO and non-GSO FSS systems within the 40/50 GHz framework.

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## Technical and Regulatory Challenges

Several challenges remain under discussion.

Regulatory Challenges

*i.* Defining appropriate operational conditions for non-GSO gateway earth stations.
*ii.* Maintaining adequate protection for EESS (passive).
*iii.* Harmonizing new provisions with existing FSS regulatory frameworks.
*iv.* Managing coordination between multiple non-GSO systems.

Operational Challenges

*i.* Controlling aggregate unwanted emissions.
*ii.* Ensuring practical implementation of mitigation measures.
*iii.* Preserving operational certainty for passive sensing systems.
*iv.* Accommodating future growth of broadband satellite constellations.

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## Conclusion

Agenda Item 1.3 seeks to determine whether the frequency band 51.4-52.4 GHz can be used by non-GSO FSS gateway earth stations while ensuring protection of Earth exploration-satellite service (passive) systems operating in adjacent frequency bands.

The studies reflect increasing demand for feeder-link spectrum to support next-generation non-GSO satellite systems and broadband satellite connectivity.

While some administrations support retaining the current framework limiting use of the band to GSO FSS gateway earth stations, others support introducing new regulatory provisions that would permit non-GSO gateway operations under specified technical and operational conditions.

The outcome of these studies will have important implications for future satellite broadband systems, passive sensing protection, spectrum efficiency, and the development of 40/50 GHz satellite communications frameworks.