Chapter: One
Service: Fixed Satellite Service (FSS) and Broadcasting Satellite Service (BSS)
Agenda Item: 1.2
Description of the AI: Considers possible revisions of sharing conditions in the frequency band 13.75-14 GHz to allow the use of uplink fixed-satellite service earth stations with smaller antenna sizes, in accordance with Resolution **129 (WRC-23)**

Focus: Reviewing the existing regulatory and operational conditions applicable to FSS earth stations operating in the 13.75–14 GHz band to facilitate the use of smaller earth station antennas while ensuring the continued protection of incumbent radiolocation and space research services.

Status of Studies

Studies under Agenda Item 1.2 are being conducted within ITU-R Working Party 4A in coordination with other relevant working parties, including WP 5B, WP 7B, and WP 3M.

The studies are examining possible revisions to Radio Regulations Nos. 5.502 and 5.503, which currently establish minimum antenna diameter requirements and associated power limitations for FSS earth stations operating in the 13.75-14 GHz frequency band.

The studies are focused on:

i. Compatibility between GSO and non-GSO FSS earth stations and incumbent radiolocation systems.
ii. Compatibility between FSS earth stations and space research service systems.
iii. The impact of reducing the minimum antenna diameter requirements for FSS earth stations.
iv. Aggregate interference scenarios involving large numbers of FSS earth stations.
v. Possible mitigation techniques and operational measures to protect incumbent services.

The studies recognize the increasing development of modern FSS applications and the growing availability of small antenna technologies, including phased-array and advanced Ku-band terminals.
The studies also recognize that any revision to the existing regulatory framework must remain conditioned on demonstrated technical compatibility with incumbent services.

Objective of the Studies

The objective of the studies is to determine whether the current operational and regulatory limitations applicable to FSS earth stations in the 13.75-14 GHz band remain appropriate, or whether revised technical and operational conditions could permit the use of smaller antennas while continuing to protect incumbent services.
The studies seek to:

i. Facilitate the deployment of smaller GSO and non-GSO FSS earth stations.

ii. Improve spectrum efficiency and flexibility in the use of the 13.75-14 GHz band.
iii. Support modern broadband satellite applications and next-generation satellite systems.
iv. Ensure continued protection of radiolocation and space research services.
v. Assess technical and operational mitigation techniques.
vi. Maintain regulatory certainty and compatibility with existing ITU Radio Regulations.

Frequency bands under consideration

The band under consideration is;

- 13.75-14 GHz (Earth-to-space)

This band is currently allocated to the following services:

Allocation to services		
Region 1	**Region 2**	**Region 3**
13.75-14	FIXED-SATELLITE (Earth-to-space) 5.484A RADIOLOCATION Earth exploration-satellite Standard frequency and time signal-satellite (Earth-to-space) Space research 5.499 5.500 5.501 5.502 5.503	

Both FSS and RLS operate on a co-primary basis in the band and are subject to the provisions of RR Nos. 5.502 and 5.503.

Currently, RR Nos. 5.502 and 5.503 impose operational and technical limitations on FSS earth stations operating in this band.

Under RR No. 5.502:

i. GSO FSS earth stations must have a minimum antenna diameter of 1.2 metres.
ii. Non-GSO FSS earth stations must have a minimum antenna diameter of 4.5 metres.
iii. Additional power flux-density limits apply to protect incumbent systems.

RR No. 5.503 establishes additional e.i.r.p. density limits to protect existing space research service systems operating in portions of the band.

The existing framework was established through decisions taken at WARC-92, WRC-2000 and WRC-03. These provisions were last reviewed during WRC-03 and were developed based on compatibility studies available at that time.
Since then, satellite technology has evolved significantly, including:

i. High-throughput satellites (HTS)
ii. Software-defined satellites
iii. Advanced antenna technologies
iv. Non-GSO satellite constellations
v. Smaller broadband user terminals.

Many administrations and satellite operators believe that current restrictions may unnecessarily constrain efficient and flexible use of the band.

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 and suppression of Resolution 129 (WRC-23);

Method A1-No Change to RR No. 5.502

This method proposes no change to RR No. 5.502, maintaining the existing provision that specifies minimum antenna diameter requirements and associated pfd limits in order to ensure the protection of incumbent RLS systems

Method B. proposes modifications to Radio Regulations Nos. 5.502 and 5.503 to introduce new conditions for the use of FSS earth stations in the 13.75-14 GHz band. This method discontinues the application of RR Nos. 5.502 and 5.503, which currently specify the minimum antenna diameter requirements and the associated power flux-density (pfd) limits for GSO FSS systems operating in the 13.75-14 GHz band.

Method B1. proposes to allow the operation of FSS earth stations with antennas smaller than the current regulatory limits provided they are deployed beyond a specified distance from the border of a neighbouring administration, while removing the current pfd limits in RR No. 5.502 and the limits in RR No. 5.503.

Method B2. Proposes modifications to RR Nos. 5.502 and 5.503 to introduce new conditions for GSO FSS earth stations, enabling operation with antennas of any size without the limitations previously associated with these provisions.

Method B3. Proposes modifications to RR Nos. 5.502 and 5.503 to introduce new conditions for GSO and non-GSO earth stations, enabling operation with antennas of any size with updated limitations associated with these provisions.

Method C. Proposes to suppress all conditions on FSS ES operations from footnote RR No. 5.502 and suppress footnote RR No. 5.503, which are the regulatory measures dedicated to the protection of the incumbent RLS systems operating in the band 13.75-14 GHz.

Key issues under discussion

i. **Protection of Radiolocation Systems**

One of the principal concerns is whether smaller FSS earth station antennas and increased deployment densities could cause harmful interference to maritime, airborne and ground-based radar systems.

ii. **Aggregate Interference**

Many studies are focusing on aggregate interference effects associated with large-scale deployments of small FSS terminals, particularly for non-GSO systems.

iii. **Deployment Density Modelling**

Different studies apply different deployment assumptions and modelling approaches, leading to varying conclusions regarding coexistence feasibility.

iv. **Technological Advancements**

Many administrations argue that advances in phased-array antennas, beamforming, tracking techniques and interference mitigation justify reconsideration of the current restrictions adopted at WRC-03.

v. **Regulatory Balance**

Discussions continue regarding how to balance greater operational flexibility for FSS systems with continued protection of incumbent services and preservation of regulatory certainty.

Regulatory and Technical Framework

The studies are examining various technical parameters and methodologies.

Key technical aspects include:

Propagation Models

i. ITU-R P.452
ii. ITU-R P.619
iii. ITU-R P.2108
iv. ITU-R P.2001

FSS Technical Characteristics

i. Antenna sizes and radiation patterns.
ii. E.i.r.p. and power density limits.
iii. GSO and non-GSO deployment models.
iv. Aggregate earth station densities.

Radiolocation Protection

i. Interference-to-noise (I/N) criteria.
ii. Radar operational characteristics.
iii. Maritime, airborne and land radar systems.

Space Research Protection

i. Protection criteria for SRS systems.
ii. Existing operational parameters.
iii. Interference thresholds.

Technical and Regulatory Challenges

Several challenges remain under discussion.

Regulatory Challenges

i. Balancing flexibility for FSS systems with protection of incumbent services.
ii. Maintaining consistency with existing Radio Regulations.
iii. Defining appropriate technical and operational conditions.
iv. Determining appropriate interference protection criteria.

Operational Challenges

i. Managing aggregate interference from large numbers of earth stations.
ii. Ensuring realistic deployment assumptions.

iii. Preserving operational certainty for radiolocation and space research services.
iv. Accommodating both GSO and non-GSO operational characteristics.

Conclusion

Agenda Item 1.2 seeks to determine whether revisions to the current technical and operational limitations applicable to FSS earth stations in the 13.75-14 GHz band could facilitate the deployment of smaller antenna systems while continuing to protect incumbent radiolocation and space research services.

The studies reflect increasing demand for broadband satellite connectivity and the rapid evolution of satellite earth station technologies, including the deployment of small and advanced user terminals.

While some administrations support retaining the current regulatory framework, others support revising or suppressing existing operational limitations in RR Nos. 5.502 and 5.503 based on the outcome of the compatibility studies.

The outcome of these studies will have important implications for future satellite broadband deployment, spectrum efficiency, coexistence between satellite and radiolocation services, and the regulatory framework governing FSS operations in the 13.75-14 GHz frequency band.