Chapter: One
Service: Fixed Satellite Service (FSS) and Broadcasting Satellite Service (BSS)
Agenda Item: 1.1
Description of the AI: Considers the technical, operational, and regulatory conditions required to enable aeronautical and maritime Earth Stations in Motion (ESIMs) to operate in the **47.2-50.2 GHz** and **50.4-51.4 GHz** frequency bands while communicating with GSO and NGSO Fixed-Satellite Service systems, ensuring protection of existing services.(Resolution 176)

Focus: Spectrum allocation of the Q/V band to the Maritime and Aeraunautical ESIMS

Status of Studies

The ITU-R studies for WRC-27 Agenda Item 1.1, established under Resolution 176 (WRC-23), are being conducted primarily by Working Party 4A (WP 4A) in close collaboration with other relevant groups.
The studies have progressed through consolidated working documents incorporating contributions from multiple administrations. These studies address spectrum needs, technical and operational characteristics of A and M ESIMs, and sharing and compatibility with Primary incumbent services and adjacent services, including Passive services, technical conditions and Regulatory provisions for operation of ESIMs. Development of a new Recommendation for the NCMC and studies on the responsibility of Administrations involved in ESIM operations.

ITU-R Studies under this Agenda Item are focusing on sharing and compatibility studies of the A and M ESIMs with incumbent services in these bands. The functionality of the NCMC is also a key study item as this is envisaged to manage the operation of the ESIMs.

Objective of the Studies

The objective of the studies is to support the increasing demand for high data rate connectivity for aeronautical and maritime platforms. Main reasons for this increased demand is due to:

1. Enhanced Passenger Experience: Growing demand for seamless broadband access for communication, entertainment, productivity, and emerging applications such as video streaming and augmented reality.
2. Operational Efficiency: Need for reliable high-capacity links to support flight operations, navigation, weather updates, cargo tracking, real-time data exchange, and crew welfare.
3. Safety and Security: Improved surveillance, monitoring of critical systems, and faster emergency response through high-bandwidth communications.

Currently, A-ESIMs and M-ESIMs utilize various frequency bands, but the demand for higher capacity necessitates exploring new spectrum allocations, for greater bandwidth to support future applications in higher frequency ranges. The specific bands under consideration, 47.2-50.2 GHz and 50.4-51.4 GHz (Earth-to-space), offer the potential for large contiguous bandwidth, which is crucial for delivering high data rates.

Current Status of the Band under consideration.

Allocation to services		
Region 1	**Region 2**	**Region 3**
47.2-47.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.550C 5.552 MOBILE 5.553B 5.552A	
47.5-47.9 FIXED FIXED-SATELLITE (Earth-to-space) 5.550C 5.552 (space-to-Earth) 5.516B 5.554A MOBILE 5.553B	**47.5-47.9** FIXED FIXED-SATELLITE (Earth-to-space) 5.550C 5.552 MOBILE 5.553B	
47.9-48.2	FIXED FIXED-SATELLITE (Earth-to-space) 5.550C 5.552 MOBILE 5.553B 5.552A	
48.2-48.54 FIXED FIXED-SATELLITE (Earth-to-space) 5.550C 5.552 (space-to-Earth) 5.516B 5.554A 5.555B MOBILE	**48.2-50.2** FIXED FIXED-SATELLITE (Earth-to-space) 5.338A 5.516B 5.550C 5.552 MOBILE	
48.54-49.44 FIXED FIXED-SATELLITE (Earth-to-space) 5.550C 5.552 MOBILE 5.149 5.340 5.555		
49.44-50.2 FIXED FIXED-SATELLITE (Earth-to-space) 5.338A 5.550C 5.552 (space-to-Earth) 5.516B 5.554A 5.555B MOBILE		5.149 5.340 5.555
50.2-50.4		EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 5.340
50.4-51.4		FIXED FIXED-SATELLITE (Earth-to-space) 5.338A 5.550C MOBILE Mobile-satellite (Earth-to-space)
51.4-52.4		FIXED FIXED-SATELLITE (Earth-to-space) 5.555C MOBILE 5.338A 5.547 5.556

Methods to Satisfy the Agenda Item

Potential regulatory provisions and technical conditions have been identified to protect existing services and support administrations authorizing A-ESIMs and M-ESIMs operation under their jurisdiction.

Two methods have been identified to satisfy this agenda item:

i. **Method A:** NOC to Volumes 1 and 2 of the RR

ii. **Method B:** add a new footnote No. 5.A11 in RR Article 5, with reference to two new WRC Resolutions providing the regulatory provisions and technical conditions for the operation of aeronautical and maritime ESIMs and protection of the services to which the frequency bands are allocated, and suppression of Resolution 176 (WRC-23).

The methods propose

i. No change to the RR.
ii. Modifications to Article 5 of the Radio Regulations.
ii. New regulatory footnotes.
iii. Adoption of a new WRC Resolution defining operational, technical conditions for the Operation of the ESIMs.

iv. Adoption of a new Recommendation/Resolution for the functionalities of the NCMC.

Regulatory and Technical Framework

The studies under Agenda Item 1.1 are considering a comprehensive regulatory and technical framework to enable the operation of aeronautical and maritime ESIMs in the Q/V bands while ensuring the protection of incumbent services. The framework includes the development of new Radio Regulations provisions, a dedicated WRC Resolution, and operational characteristics for ESIMs and the functionalities of the Network Control and Monitoring Centre (NCMC).

Key elements under consideration include:

i. Authorization of ESIM operations only within the territories of administrations that have granted the necessary approvals.
ii. Notification of ESIM frequency assignments to the Radiocommunication Bureau by the notifying administration of the associated satellite network.
iii. Establishment of operational and technical conditions for both GSO and NGSO ESIMs.
iv. Development of minimum functional requirements for ESIM terminals and NCMC systems.
v. Definition of responsibilities of administrations and satellite operators in the event of interference.

The proposed framework also requires ESIMs to possess capabilities such as:

i. Geolocation functionality.
ii. Ability to communicate with the NCMC.
iii. Monitoring and control of transmission power and frequencies.
iv. Ability to receive commands and be remotely enabled or disabled.
v. Accurate antenna pointing control towards the associated satellite.

Interference protection Mechanisms

A major focus of the studies is ensuring that A-ESIMs and M-ESIMs do not cause harmful interference to incumbent terrestrial and satellite services operating in the Q/V bands.

The protection mechanisms being considered include:

Maritime ESIMs (M-ESIMs)

i. A minimum separation distance of 60 km from the coastline before operation without prior agreement from the coastal State.

ii. Limits on the equivalent isotopically radiated power (e.i.r.p.) spectral density towards the horizon.
iii. Requirement for prior agreement from the affected coastal State where these limits cannot be met.

Aeronautical ESIMs (A-ESIMs)

i. Compliance with power flux-density (pfd) limits at the Earth's surface.
ii. Development of methodologies to verify compliance with these limits.
iii. Continuous monitoring and control through the NCMC.

Network Control and Monitoring Centre (NCMC)

The NCMC is expected to play a central role in interference management by:

i. Determining the geolocation of ESIMs.
ii. Monitoring operational status.
iii. Managing transmission parameters.
iv. Collecting information from ESIMs.
v. Enabling or disabling transmissions when necessary.

Technical and Regulatory Challenges

Although significant progress has been made, several technical and regulatory challenges remain under study:

Technical Challenges

i. Demonstrating compatibility between ESIM operations and incumbent terrestrial and passive services.
ii. Developing robust methodologies for assessing aggregate interference.
iii. Defining operational requirements for NCMC systems and the regulatory vehicle to be adopted
iv. Ensuring reliable geolocation and remote-control capabilities for mobile ESIM terminals.
v. Protecting passive services operating in the adjacent 50.2–50.4 GHz band.

Regulatory Challenges

i. Determining the responsibilities of the various administrations involved in ESIM operations.
ii. Establishing procedures for handling cases of harmful interference.
iii. Defining authorization requirements for ESIM operation across multiple jurisdictions.
iv. Developing harmonized regulatory provisions applicable to both GSO and NGSO systems.
v. Addressing coordination issues associated with ESIM operations over international waters and airspace.
vi. Agreeing to the regulatory vehicle to be adopted for the NCMC functionality

Conclusion

Agenda Item 1.1 seeks to establish the regulatory and technical conditions necessary to enable the operation of aeronautical and maritime ESIMs in the 47.2-50.2 GHz and 50.4-51.4 GHz bands. The studies recognize the growing demand for high-capacity broadband connectivity for aircraft and ships and the need for additional spectrum resources to support these services.

Current studies have identified potential regulatory provisions, technical conditions, interference protection mechanisms, and NCMC functionalities necessary to facilitate ESIM deployment while protecting incumbent services. However, important issues relating to sharing studies, operational requirements, responsibilities of administrations, and NCMC implementation remain under discussion. The outcome of these studies will determine whether the Q/V bands can be made available for A-ESIM and M-ESIM operations under a globally harmonized regulatory framework for adoption at WRC-27.