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| **US Radiocommunication Sector**  **FACT SHEET** | |
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| **Purpose/Objective:** The purpose of this document is to propose a revision to Recommendation ITU-R M.2116-0 | |
| **Abstract:** Recommendation ITU-R M.2116-0 contains characteristics for the aeronautical mobile service systems operating within the 4400-4990 MHz frequency range. The US would like to propose a revision to M.2116 to add systems that reflect current US system operations. This contribution also seeks to add maritime systems that operate under the mobile service allocation in the same frequency range. This will then be used for studies under Agenda Item 1.1. | |
| **Fact Sheet Preparer:** Taylor King | |

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| **Radiocommunication Study Groups** |  | |
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**1 Introduction**

WRC-19 approved Resolution **223 (Rev. WRC-19)** which calls for studying the technical and regulatory conditions for the protection of stations of the AMS and the maritime mobile service (MMS) located in international airspace or waters (i.e. outside national territories) and operated in the frequency band 4 800-4 990 MHz. This contribution seeks to revise Recommendation ITU-R M.2116-0 which documents the technical characteristics and protection criteria for aeronautical mobile service systems operating within the 4400-4990 MHz frequency range. The aeronautical mobile service operates under the mobile service allocation within the 4400-4990 MHz. Maritime mobile systems may also operate under the mobile service allocation and therefore it is proposed to add maritime systems to this recommendation as a separate table.

**2 Proposals**

The United States proposes that *ITU-R* WP 5B consider the attached proposed working document for a preliminary draft new revision *of Recommendation ITU-R M.2116-0* in response to Resolution **223 (Rev.WRC-19*).***  This revision includes language to address ground stations that may be located on a ship. This contribution also proposes to add maritime systems characteristics in a separate Annex.

**Attachments:** 1

Working Document towards a Preliminary Draft Revision to RECOMMENDATION ITU-R M.2116-0

**Technical characteristics and protection criteria for the aeronautical and maritime mobile service systems operating within the 4 400-4 990 MHz frequency range**

(20xx)

**Scope**

This Recommendation provides information on the technical characteristics and protection criteria for systems operating in the aeronautical mobile service (AMS) and maritime mobile service (MMS) planned to or currently operating within the frequency range 4 400-4 990 MHz for use in sharing and compatibility studies as needed and does not contain any aeronautical mobile telemetry system.

**Keywords**

Aeronautical mobile service, maritime mobile service, technical characteristics, protection criteria

**Abbreviations/Glossary**

ADL Aeronautical mobile service data link

AMS Aeronautical mobile service

MDL Maritime mobile service data link

MMS Maritime mobile service

**Related ITU-R Recommendations and Reports**

Recommendation ITU-R M.1851 – Mathematical models for radiodetermination radar systems antenna patterns for use in interference analyses

The ITU Radiocommunication Assembly,

*considering*

*a)* that systems and networks operating in the aeronautical mobile service (AMS) and in the maritime mobile service (MMS) are used for broadband, data-links to support remote sensing, e.g. earth sciences, land management, energy distribution, etc., applications;

*b)* that systems and networks operating in AMS and MMS are also used for narrow-band, airborne data-links;

*c)* that the physics of the propagation of electromagnetic energy, the availability of hardware components, etc., within the 4 400‑4 990 MHz frequency range facilitates the use of current or planned operating systems and networks for such applications,

*recognizing*

*a)* that the frequency range 4 400-4 990 MHz is allocated on a primary basis in all three ITU regions to the mobile service;

*b)* that other radio services are allocated on either a primary or secondary basis in all or parts of the frequency range 4 400-4 990 MHz all three ITU regions;

*c)* that the RR No. **5.442** provides some restrictions for the use of AMS in parts of the frequency band;

*d)* that technical characteristics and protection criteria for aeronautical mobile telemetry and maritime mobile telemetry systems are not contained in this Recommendation,

*recommends*

1. that the technical characteristics and protection criteria for systems operating in the AMS  given in Annex 1 should be used in performing sharing and compatibility analyses.
2. that the technical characteristics and protection criteria for systems operating in the MMS given in Annex 2 should be used in performing sharing and compatibility analyses.

**3** that the following Note is considered as part of this Recommendation.

NOTE – The characteristics and protection criteria should not have any adverse effect to Appendix **30B** of the Radio Regulations

**Annex 1  
  
Technical characteristics and protection criteria for aeronautical mobile systems**

**1 Introduction**

Systems and networks operating in the AMS are used for broadband, airborne data-links to support remote sensing, etc., applications.

**2 Operational deployment**

Aeronautical mobile data links are operated between aeronautical stations and aircraft stations, or between aircraft stations equipped with AMS data links (ADL) and can be deployed anywhere within a country whose administration has authorized their use in accordance with regulations.

ADL includes transmission from and to, either aircraft stations or a ground terminal considered as an aeronautical station. These transmissions could use bidirectional air‑to‑ground links, or relay through another airborne platform using an air‑to‑air data link. Links can be either simplex or duplex. The link lengths vary greatly in these applications. Although some of the link lengths may be relatively short, many of the link lengths approach the radio line‑of‑sight distance. The operational altitude of airborne platforms equipped with these ADLs can vary up to 20 000 m.

The ground terminals may be at a permanent location or they may be transportable. Transportable ground terminals can be moved to meet operational needs and the duration of use while it remains at a particular location is dependent upon operational requirements. Transportable ground terminals may be installed on ships.

A single ground terminal may simultaneously support several aircraft stations at the same time via different links.

**3 Technical characteristics of aeronautical mobile systems**

Typical technical characteristics for representative airborne data links for the frequency range 4 400-4 990 MHz are provided in Table 1.

**3.1 Transmitter and receiver characteristics**

The aeronautical mobile systems operating or planned to operate within the frequency range 4 400‑4 990 MHz typically use digital modulations. A given transmitter may be capable of radiating more than one waveform.

**3.2 Antenna characteristics**

A variety of different types of antennas are used by systems in the frequency range 4 400‑4 990 MHz. Antennas in this range are generally of a variety of sizes and vary between the airborne component of the link and the ground based component of the link. The airborne antenna gains are typically between +3 dBi and 19 dBi. The ground based antenna gain is typically between 3 dBi and 31 dBi. Horizontal, and vertical polarizations could be used.

Antenna characteristics available in Table 1 should be used for studies unless measured data is available.

**4 Protection criteria**

An increase in receiver effective noise of 1 dB would result in significant degradation in communication range.

Such an increase in effective receiver noise level corresponds to an (*I* + *N*)/*N* ratio of 1.26, or an *I/N* ratio of about −6 dB. This represents the required protection criterion for the AMS systems referenced herein from interference due to another radiocommunication service. If multiple potential interference sources are present, protection of the AMS systems requires that this criterion is not exceeded due to the aggregate interference from the multiple sources.

TABLE 1

**Typical technical characteristics of representative aeronautical mobile service systems operated in the frequency range 4 400-4 990 MHz**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Units** | **System 1**  **Airborne** | **System 1**  **Ground** | | | **System 2**  **Airborne** | **System 2**  **Ground** | | |
| Transmitter | | | | | | | | | |
| Tuning range | MHz | 4 400-4 990(1) | 4 400-4 990(1) | | | 4 400-4 990(1) | 4 400-4 990(1) | | |
| Power output | dBm | 45 | 45 | | | 35-39 | 30-39 | | |
| Bandwidth (3 dB) | MHz | 1 | 1 | | | 6 / 10 / 20 | 6 / 10 / 20 | | |
| Receiver | | | | | | | | | |
| Tuning range | MHz | 4 400-4 990(1) | 4 400-4 990(1) | | | 4 400-4 990(1) | 4 400-4 990(1) | | |
| Selectivity (3 dB) | MHz | 1 | 1 | | | 6 / 10 / 20 | 6 / 10 / 20 | | |
| Noise figure | dB | 3.5 | 3 | | | 3.5 | 3 | | |
| Thermal noise level | dBm | −110.5 | −111 | | | −102.5 to −97.5 | −103 to −98 | | |
| Antenna | | | | | | | | | |
| Antenna type |  | Omnidirectional | Omni-directional | Directional | | Omnidirectional | Omni-directional | Directional | |
| Antenna gain | dBi | 3 | 3 | 19 | 31 | 3 | 6 | 19 | 31 |
| 1st sidelobe | dBi | N/A(2) | N/A(2) | 6 | 11 | N/A(2) | N/A(2) | 6 | 11 |
| Polarization |  | Vertical | Vertical | Vertical | | Vertical | Vertical | Vertical | |
| Antenna pattern |  | N/A(2) | N/A(2) | Uniform distribution(3) | | N/A(2) | N/A(2) | Uniform distribution(3) | |
| Horizontal beamwidth | Degrees | 360 | 360 | 16 | 3.3 | 360 | 360 | 16 | 3.3 |
| Vertical beamwidth | Degrees | 90 | 90 | 16 | 3.3 | 90 | 90 | 16 | 3.3 |

TABLE 1 (*continued*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Units** | **System 3**  **Airborne** | | **System 3**  **Ground** | | **System 4**  **Airborne** | | **System 4**  **Ground** | |
| Transmitter | | | | | | | | | |
| Tuning range | MHz | 4 400-4 940(1) | | 4 400-4 940(1) | | 4 400-4 940(1) | | 4 400-4 940(1) | |
| Power output | dBm | 42-50 | | 42 | | 43 | | 37 | |
| Bandwidth (3 dB) | MHz | 0.158 / 0.97 / 1.23 / 4.0 | | 0.158 / 0.97 / 1.23 / 4.0 | | 0.158 / 2.4 / 4.8 / 9.6 | | 0.158 / 2.4 / 4.8 / 9.6 | |
| Receiver | | | | | | | | | |
| Tuning range | MHz | 4 400-4 940(1) | | 4 400-4 940(1) | | 4 400-4 940(1) | | 4 400-4 940(1) | |
| Selectivity (3 dB) | MHz | 0.2 / 1 / 1.5 / 4.5 | | 0.2 / 1 / 1.5 / 4.5 | | 0.2 / 2.6 / 5.0 / 10 | | 0.2 / 2.6 / 5.0 / 10 | |
| Noise figure | dB | 2.5 | | 2.5 | | 2.5 | | 3 | |
| Thermal noise level | dBm | −118.5 to −105.0 | | −118.5 to −105.0 | | −118.5 to −101.5 | | −118 to −101 | |
| Antenna | | | | | | | | | |
| Antenna type |  | Omni-directional | Directional | Omni-directional | Directional | Omni-directional | Directional | Omni-directional | Directional |
| Antenna gain | dBi | 3.5 | 16 | 3 | 30 | 4.5 | 16 | 4 | 30 |
| 1st sidelobe | dBi | N/A(2) | 9 | N/A(2) | 17 | N/A(2) | 9 | N/A(2) | 17 |
| Polarization |  | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical |
| Antenna pattern |  | N/A(2) | Uniform distribution(3) | N/A(2) | Uniform distribution(3) | N/A(2) | Uniform distribution(3) | N/A(2) | Uniform distribution(3) |
| Horizontal beamwidth | degrees | 360 | 33 | 360 | 4.4 | 360 | 33 | 360 | 4.4 |
| Vertical beamwidth | degrees | 35 | 33 | 40 | 4.4 | 35 | 33 | 60 | 4.4 |

TABLE 1 (*end*)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Units** | **System 5**  **Airborne** | | **System 5**  **Ground** | | |
| Transmitter | | | | | | |
| Tuning range | MHz | 4 400-4 990(1) | | 4 400-4 990(1) | | |
| Power output | dBm | 45 | | 45 | | |
| Bandwidth (3 dB) | MHz | 0.4 / 3 / 8.5 | | 0.4 / 3 / 8.5 | | |
| Receiver | | | | | | |
| Tuning range | MHz | 4 400-4 990(1) | | 4 400-4 990(1) | | |
| Selectivity (3 dB) | MHz | 0.4 / 3 / 17 | | 0.4 / 3 / 17 | | |
| Noise figure | dB | 3.5 | | 3.5 | | |
| Thermal noise level | dBm | −118.5 to −105.0 | | −118.5 to −105.0 | | |
| Antenna | | | | | | |
| Antenna type |  | Omni-directional | Directional | Omni-directional | Directional | |
| Antenna gain | dBi | 3 | 19 | 3 | 19 | 31 |
| 1st sidelobe | dBi | N/A(2) | 6 | N/A(2) | 6 | 11 |
| Polarization |  | Vertical | Vertical | Vertical | Vertical | |
| Antenna pattern |  | N/A(2) | Uniform distribution(3) | N/A(2) | Uniform distribution(3) | |
| Horizontal beamwidth | degrees | 360 | 16 | 360 | 16 | 3.3 |
| Vertical beamwidth | degrees | 90 | 16 | 360 | 16 | 3.3 |

Notes:

(1) RR No. **5.442** applies.

(2) N/A – Not applicable.

(3) Refer to Recommendation ITU-R M.1851.

In the Table “-“ means range of values, and “/” means discrete values.

**Annex 2  
  
Technical characteristics and protection criteria for maritime mobile systems**

**1 Introduction**

[TBD]

**2 Operational deployment**

[USA note: This section will need to be developed further at future meetings]

The maritime mobile system listed in Table 2 uses maritime mobile service data links (MDL) to create a mesh network radio system between ship stations and ground stations to transfer data between nodes. These transmissions could include ship-to-ship, ship-to-coast, or coast-to-ship datalinks. This system can be deployed near a coast or out in international waters.

**3 Technical characteristics of aeronautical mobile systems**

Typical technical characteristics for representative maritime data links for the frequency range 4 400-4 990 MHz are provided in Table 2.

**3.1 Transmitter and receiver characteristics**

The maritime mobile systems operating or planned to operate within the frequency range 4 400‑4 990 MHz typically use digital modulations. A given transmitter may be capable of radiating more than one waveform.

**3.2 Antenna characteristics**

The maritime mobile system listed in Table 2 may use various types of omnidirectional antennas that can be installed on either the ship station or ground station. These omnidirectional antenna gains are typically between 2.5 and 6 dBi.

**4 Protection criteria**

An increase in receiver effective noise of 1 dB would result in significant degradation in communication range.

Such an increase in effective receiver noise level corresponds to an (*I* + *N*)/*N* ratio of 1.26, or an *I/N* ratio of about −6 dB. This represents the required protection criterion for the MMS systems referenced herein from interference due to another radiocommunication service. If multiple potential interference sources are present, protection of the MMS systems requires that this criterion is not exceeded due to the aggregate interference from the multiple sources.

TABLE 2

Typical technical characteristics of representative maritime mobile service systems operated in the frequency range 4 400-4 990 MHz

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Units | System 1  Ship | | | System 1  Ground | | |
| Transmitter | | | | | | | |
| Tuning range | MHz | 4 400-4 940 | | | 4 400-4 940 | | |
| Power output | dBm | 39 | | | 39 | | |
| Bandwidth (3 dB) | MHz | 5.6/11.3/22.6 | | | 5.6/11.3/22.6 | | |
| Receiver | | | | | | | |
| Tuning range | MHz | 4 400-4 940 | | | 4 400-4 940 | | |
| Selectivity (3 dB) | MHz | 5.6/11.3/22.6 | | | 5.6/11.3/22.6 | | |
| Noise figure | dB | 6 | | | 6 | | |
| Thermal noise level | dBm | -101 to -93 | | | -101 to -93 | | |
| Antenna | | | | | | | |
| Antenna type |  | Omnidirectional | | | Omni-directional | | |
| Antenna gain | dBi | 6 | 4.2 | 2.5 | 6 | 4.2 | 2.5 |
| 1st sidelobe | dBi | N/A(1) | | | N/A(1) | | |
| Polarization |  | Vertical | | | Vertical | | |
| Antenna pattern |  | N/A(1) | | | N/A(1) | | |
| Horizontal beamwidth | Degrees | 360 | | | 360 | | |
| Vertical beamwidth | Degrees | 30 | 37 | 69 | 30 | 37 | 69 |

Notes:

(1) N/A – Not applicable.