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| U.S. Radiocommunications SectorFact Sheet |
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| **Purpose/Objective:** This contribution proposes technical and operational characteristics of maritime and aeronautical mobile service applications in the frequency bands 71-76 GHz and 81-86 GHz. |
| **Abstract:** In accordance with Resolution **775**, this contribution offers the characteristics of a representative maritime and aeronautical mobile service operating in the frequency bands 71-76 GHz and 81-86 GHz, including the receiver characteristics and protection criteria necessary to inform studies to determine power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) limits to be included in Article 21 for satellite services (fixed-satellite service (FSS), mobile-satellite service (MSS) and broadcasting-satellite service (BSS)) to protect the current and planned fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz. |

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| **Radiocommunication Study Groups** |  |
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| Draft Technical characteristics and protection criteria for aeronautical mobile service systems in the frequency range 71-76 & 81-86 GHz |

# 1 Introduction

Given the highly directional propagation of point-to-point systems in these bands, systems that links to platforms in motion posed no incremental risk of interference to other terrestrial point-to-point links, so long as they meet certain technical criteria and are appropriately coordinated in a similar manner to other links. These end points in motion receive the same protections from interference from the Fixed Satellite Service as all other point-to-point systems in the bands.

Systems operating under these rules provide critical connectivity from base station transmitters to aircraft and ships in motion using tracking antennas that ensure a reliable link.

# 2 Operational deployment

Systems providing point-to-point services to platforms in motion in these bands rely on a base station transmitter operating a link to a platform, either an aircraft or a ship. The aircraft or ship utilizes highly directional antennas for a return link. Given the power levels in these bands, these platforms can provide service over tens or hundreds of kilometers. In addition, these platforms may utilize intermediary links to extend the range. The links in this platforms can include aircraft-to-aircraft links and ship-to-aerostat, aerostat-to-ship, shore-to-aerostat, aerostat-to-shore, and ship-to-ship links. These intermediary links must also meet similar rules to the ground transmitter to mobile platform link.

# 3 Technical characteristics of aeronautical mobile systems

Representative technical characteristics for airborne data links in the AMS for the frequency range 71-76 GHz and 81-86 GHz are provided in Table 1. These technical characteristics reflect studies that are designed to protect the Fixed Service and federal allocations for Radio Astronomy and Earth Exploration Satellite.

## 3.1 Receiver characteristics

Receivers operating in these band for end points in motion have typical characteristics of other receivers in the band, with the difference being that they may be pointed above the horizon and therefore must be protected from emissions from earth-to-space links. Receivers use a target C/N of 15 dB, with a 7dB noise figure. Channelization plans for 71-76 GHz and 81-86 GHz would be Recommendation ITU-R F.2006, which provides different channel sizes from 250 MHz up to 5 GHz and includes a plan for 1.25 GHz segmentation. Typical operating bandwidths for the AMS are 500-1000 MHz. The target thermal noise is -164 dBm/Hz and the target RX power is -92dBw.

## 3.2 Antenna characteristics

A variety of different types of antennas are used by systems in the frequency ranges 71-76 GHz and 81-86 GHz. Antennas in this band 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 antennas gain is typically in the range 44-51 dBi. The ground-based antenna gain is typically near 51 dBi. Horizontal, vertical and circular polarizations are used with circular as the preferred polarisation.

If antenna characteristics provided in Table 1 are sufficient, these characteristics should be used in sharing analyses. If additional characteristics are required, the first source of the data should be measured antenna characteristics. ITU F.699 patterns are used.

# 4 Protection criteria for the aeronautical mobile service in the frequency range 14.5‑15.35 GHz

When operating near the maximum radio line-of-sight distance separation between the transmitter and receiver, the performance of the communication link is often noise limited. An increase in receiver effective noise of 1 dB would constitute significant degradation communication range, equivalent to a reduction in communication range of approximately 10% in a free‑space propagation environment.

Such an increase effective receiver noise 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 these systems.

TABLE 1

Representative technical characteristics of the aeronautical mobile service systems

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Units | System ATG or GTAAirborne | System ATG or GTAGround | System ATAAirborne |  |
| Receiver |
| Tuning range | GHz | 81-86 | 71-76 | 71-76 & 81-86 |  |
| RF selectivity  | 3 dB | MHz | 100 | 100 | 100 |  |
| 20 dB | MHz | 500 / 750 / 1000 | 500 / 750 / 1000 | 500 / 750 / 1000 |  |
| 60 dB | MHz | 5000 | 5000 | 5000 |  |
| IF selectivity  | 3 dB | MHz | 100 | 100 | 100 |  |
| 20 dB | MHz | 500 / 750 / 1000 | 500 / 750 / 1000 | 500 / 750 / 1000 |  |
| 60 dB | MHz | 5000 | 5000 | 5000 |  |
| NF | dB | 7 | 7 | 7 |  |
| Sensitivity  | dBm | −75 to −80 | −80 to −90 | −75 to −80 |  |
| Image rejection  | dB | 20 | 20 | 20 |  |
| Spurious rejection  | dB | 20 | 20 | 20 |  |

TABLE 1 (*continued*)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Units | System ATG or GTAAirborne | System ATG or GTAGround  | System ATAAirborne |  |
| Antenna |
| Antenna gain  | dBi | 51 | 51 | 51 |  |
| 1st sidelobe | dBi | 5 @ 0.2° | 5 @ 0.2° | 5 @ 0.2°  |  |
| Polarization |  | RHCP1  & LHCP2 | RHCP1 & LHCP2 | RHCP1 & LHCP2  |  |
| Antenna pattern/type |  | Parabolic or phased array | Horn | Parabolic or phased array |  |
| Horizontal BW  | degrees | 0.5 | 0.5 | 0.5 |  |
| Vertical BW  | degrees | 0.9 | 0.5 | 0.9 |  |
| Antenna model |  | RecommendationITU F.699 | RecommendationITU F.699 | Recommendation ITU F.699 |  |
| Notes:(1) RHCP – Right Hand Circularly Polarized(2) LHCP – Left Hand Circularly Polarized. |