



Recommendation ITU-R M 2116-0
(01/2018)

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

M Series
**Mobile, radiodetermination, amateur
and related satellite services**

Foreword

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P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R M.2116-0

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

(2018)

Scope

This Recommendation provides information on the technical characteristics and protection criteria for systems operating in the aeronautical mobile service (AMS) 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, technical characteristics, protection criteria

Abbreviations/Glossary

ADL Aeronautical mobile service data link

AMS Aeronautical mobile service

The ITU Radiocommunication Assembly,

considering

- a) that systems and networks operating in the aeronautical mobile service (AMS) are used for broadband, airborne data-links to support remote sensing, e.g. earth sciences, land management, energy distribution, etc., applications;
- b) that systems and networks operating in AMS 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 systems are not contained in this Recommendation,

recommends

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

2 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

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.

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 the 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	dB _i	3	3	19 31	3	6	19 31
1 st sidelobe	dB _i	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		System 3		System 4		System 4	
		Airborne		Ground		Airborne		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
1 st 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	-114.5 to -98		-114.5 to -98		
Antenna						
Antenna type		Omni-directional	Directional	Omni-directional	Directional	
Antenna gain	dBi	3	19	3	19	31
1 st 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.