



Recommendation ITU-R M.2115-0
(01/2018)

**Technical and operational characteristics of
and protection criteria for aeronautical
mobile systems operating in the
45.5-47 GHz frequency range**

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

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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Series of ITU-R Recommendations

(Also available online at <http://www.itu.int/publ/R-REC/en>)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
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.2115-0

Technical and operational characteristics of and protection criteria for aeronautical mobile systems operating in the 45.5-47 GHz frequency range

(2018)

Scope

This Recommendation provides information on the technical characteristics and protection criteria for aeronautical mobile service (AMS) systems operating in the mobile service within the 45.5-47 GHz frequency range.

Related ITU Recommendations and Reports

Recommendations ITU-R M.1851, ITU-R P.2108, ITU-R P.676

Keywords

Aeronautical mobile service systems, AMS, technical characteristics, protection criteria

Abbreviations/Glossary

ADL	AMS data link
ADT	Airborne data terminal
AMS	Aeronautical mobile service
GDT	Ground data terminal
I/N	Interference-to-Noise ratio
RHCP	Right hand circularly polarized
RLOS	Radio-line-of-sight

The ITU Radiocommunication Assembly,

considering

that systems and networks operating in the aeronautical mobile service (AMS) are used to provide broadband and narrow-band airborne data links to support disaster relief, scientific research, remote sensing, wildfire firefighting, land and crop surveying, pipeline monitoring, and other emergency management applications,

recognizing

- a) that frequency band 45.5-47 GHz is globally allocated on a primary basis to the mobile service;
- b) that aeronautical mobile service (AMS) is a subset of the mobile service;
- c) that the aeronautical mobile service is a mobile service between aeronautical stations and aircraft stations, or between aircraft stations;
- d) that the use of systems operated under aeronautical mobile service does not preclude the use of the frequency band by any current and planned systems in the mobile service and does not establish any priority in the Radio Regulations;
- e) that the frequency band 45.5-47 GHz is also allocated on a primary basis to mobile-satellite, radionavigation and radionavigation-satellite services in some or all parts of the frequency bands;

- f) that in these bands new systems under the mobile service are currently envisaged and studied by ITU;
- g) that operations of aeronautical mobile systems introduce more complex sharing over large areas and may require bilateral agreement between the administration operating AMS and affected administrations;
- h) that RR No. 21 contains power limits and other requirements for terrestrial and space services sharing frequency bands above 1 GHz,

recommends

1 that the technical and operational characteristics of the systems operating in the AMS described in the Annex should be considered representative of those operating in the frequency band 45.5-47 GHz;

2 that the criterion of interfering signal power to receiver noise power level, I/N , of -6 dB should be used as the required protection level for AMS receivers. If multiple potential interference sources are present, protection of the AMS requires that this criterion is not exceeded due to the aggregate interference from the multiple sources.

Annex

Technical and operational characteristics of and protection criteria for aeronautical mobile service systems in the 45.5-47 GHz frequency range

1 Introduction

Systems and networks operating in the AMS are increasingly used by local and national governments, as well as civil sector and educational and research entities, to provide broadband and narrow-band airborne data links that support scientific research, remote sensing, agriculture and urban land use survey, local and national law enforcement, forest fire mapping and pipeline monitoring applications.

The broadband data links are used to transmit data collected from one or multiple research/remote sensing equipment on the aircraft, and the narrow-band data links are used to control this remote sensing equipment on-board the aircraft.

2 Technical characteristics of aeronautical mobile service system

Representative technical characteristics for AMS system operating in the 45.5-47 GHz frequency band are provided in Table 1.

TABLE 1

**Representative technical characteristics of aeronautical mobile service system
in the 45.5-47 GHz frequency range**

Parameter		Units	System 1 Airborne			System 1 Ground
Frequency range		GHz	45.5-47.0 GHz			
Transmitter						
Power output		dBm	0 to 37			0 to 45
Bandwidth	3 dB	MHz	0.8			0.8
	20 dB	MHz	3			3
	60 dB	MHz	12			12
Receiver						
RF Selectivity	3 dB	MHz	590			520
	20 dB	MHz	1000			580
	60 dB	MHz	2600			720
IF Selectivity	3 dB	MHz	400 / 4			140 / 2
	20 dB	MHz	800 / 15			400 / 12
	60 dB	MHz	2 200 / 45			850 / 30
Noise Figure		dB	4			4
Sensitivity		dBm	-105 to -112			-105 to -110
Antenna						
Antenna gain		dB _i	27	17	13	40
Polarization			RHCP ⁽¹⁾ and linear			RHCP ⁽¹⁾ and linear
Antenna type			Slot array			Parabolic reflector
Horizontal BW		degrees	10/	15	29	3
Vertical BW		degrees	15	20	12	3
Antenna pattern model			Recommendation ITU-R M.1851 (uniform distribution)			Recommendation ITU-R M.1851 (cosine distribution)

⁽¹⁾ RHCP – Right Hand Circularly Polarized.

3 Operational characteristics

The AMS is a mobile service between aeronautical stations and aircraft stations, or between two aircraft stations. Manned and unmanned platforms equipped with AMS data links (ADL) can operate worldwide and anywhere within a country whose administration has authorized such use.

An ADL may exist between an airborne data terminal (ADT), which is an aircraft station, and a ground data terminal (GDT), which is an aeronautical station, or between two ADTs. ADLs are bi-directional by design and may operate in either a narrow-band or wide-band mode in one or both directions. A network consisting of multiple ADLs between ADTs and/or GDTs is possible. A GDT may be at a fixed location or transportable.

The link distance for the ADL is generally limited by the radio line of sight (RLOS) horizon, which is a function of the terrain within the vicinity of the GDT and the altitude of the ADT. The altitude of airborne platforms equipped with these ADLs can be up to 20 km. The link distance can vary from a few kilometres to approaching RLOS horizon distance. For an air-to-ground or ground-to-air link, the link distance may be approximately 450 km.

The link between two ADTs operates in similar manner as the link between a GDT and an ADT with the exception that the link distance is a function of the altitude of the two ADTs. In the case of a direct air-to-air link, this link distance may be up to 900 km. Other factors to consider, such as atmospheric losses (rain attenuation, gases, etc.) and clutter losses, as described in the relevant ITU-R P-Series Recommendations, could reduce the maximum distance of the link between two ADTs, or negatively impact the performance of the ADL at the maximum distance. Depending on the environmental conditions and locations of the aircraft, the crosslink distance might be shorter than 900 km.

The temporal duration of the link can span the entire flight duration. The duration during which an ADL is active is only limited by the flight time of the ADT.

4 Protection criteria

The performance of the communication link is very often noise limited. An increase in receiver effective noise of 1 dB could be manifested in several ways, e.g. a decrease in the available fade margin, a loss in the effective link distance to maintain an acceptable bit error rate, or receiver desensitization. Under free-space propagation, an increase of 1 dB in noise level translates into an approximately 10% degradation of communication range. The degradation could be higher in more noisy environments.

A 1 dB increase in receiver effective noise corresponds to Interference+Noise to Noise ratio, $(I + N)/N$, of 1.26, or Interference-to-Noise ratio, I/N , of about -6 dB. This represents the required protection criterion for the AMS systems 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.
