



Recommendation ITU-R M.2120-0
(01/2019)

**Technical characteristics and protection
criteria for aeronautical mobile systems
operating in the mobile service in the
frequency range 21.2-22 GHz**

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

Foreword

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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

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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.2120-0

Technical characteristics and protection criteria for aeronautical mobile systems operating in the mobile service in the frequency range 21.2-22 GHz

(2019)

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 in the frequency range 21.2-22 GHz for use in sharing and compatibility studies as needed.

Keywords

Aeronautical Mobile Service, Technical Characteristics, Protection Criteria

Abbreviations/Glossary

AMS	Aeronautical mobile service
FM	Frequency modulation
GMSK	Gaussian minimum shift keying
I/N	Interference to noise ratio

The ITU Radiocommunication Assembly,

considering

- a) that the mobile service is a broadly defined service, of which the aeronautical mobile service (AMS) is a subset of mobile service;
- b) that such use of broadly defined services allows flexibility of service allocations;
- c) that the use of broadly defined services does not preclude the use of the frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations;
- d) that systems and networks operating in the AMS are used for broadband, narrow-band, airborne data links to support remote sensing applications in the areas of, e.g. earth sciences, land management, and energy distribution. Examples of these applications include e.g. monitoring sea ice thickness and distribution, local and national law enforcement, forest fire mapping, petroleum pipeline monitoring, agricultural and urban land use and natural resource surveys;
- e) that there are increasing numbers of various planned and operating systems and networks in the AMS,
- f) that while use of broadly defined radio service may increase the flexibility of the allocation process, it may introduce more complex sharing arrangements within a frequency band;
- g) that because of the attributes of a station operating on an aeronautical mobile platform, some administrations may have excepted aeronautical systems from operating within mobile allocations;
- h) that where broadly defined services are used, coexistence conditions to address the regional or worldwide use of certain bands may be necessary,

recognizing

- a) that the frequency band 21.2-22 GHz is globally allocated on a primary basis to the fixed and mobile services;
- b) that the frequency band 21.2-21.4 GHz is also globally allocated on a primary basis to the earth exploration satellite (passive) and space research (passive) services;
- c) that the frequency band 21.4-22 GHz is also allocated on a primary basis to the broadcasting-satellite service in Regions 1 and 3;
- d) that the aeronautical mobile service includes radiocommunication between aeronautical stations and aircraft stations, or between aircraft stations;
- e) that in the frequency band 21.4-22 GHz RR No. **5.530A** states in part, “Unless otherwise agreed between the administrations concerned, any station in the fixed or mobile services of an administration shall not produce a power flux-density in excess of $-120.4 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ at 3 m above the ground of any point of the territory of any other administration in Regions 1 and 3 for more than 20% of the time”;
- f) that in the frequency band 21.4-22 GHz, RR No. **5.530B** encourages administrations in Regions 1 and 3 not to deploy stations in the mobile service and are encouraged to limit the deployment of stations in the fixed service to point-to-point links in order to facilitate the development of the broadcasting-satellite service,

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 range 21.2-22 GHz;
- 2 that the technical characteristics and protection criteria for AMS receiving and transmitting stations given in the Annex should be used in performing sharing and compatibility analyses as needed.

Annex**Technical characteristics and protection criteria for aeronautical mobile service systems in the frequency range 21.2-22 GHz****1 Introduction**

Systems and networks operating in the AMS are increasingly used by local and national governments, as well as civil sector and educational entities, for broadband, airborne data links to support remote sensing applications (e.g. earth sciences, land management, and energy distribution). Examples of these applications include monitoring Arctic sea ice thickness and distribution, local and national law enforcement, forest fire mapping, pipeline monitoring, agricultural and urban land use, and natural resource surveys.

2 Operational deployment

The platforms operate in groups of four spanning 100 miles across airspace using the aeronautical mobile systems to communicate with other platforms and fly anywhere between 500 ft (152.4 m) and 50 000 ft (15 240 m).

3 Technical characteristics of aeronautical mobile systems

Representative technical characteristics for airborne data links in the AMS for the frequency band 21.2-22 GHz are provided in Table 1.

3.1 Transmitter characteristics

The system 1 aeronautical mobile systems operating or planned to operate in the frequency band 21.2-22 GHz typically uses digital gaussian minimum shift keying (GMSK) modulations on a FM carrier. The given transmitter only operates on one waveform. A solid states power amplifier output devices are used in the transmitters.

System 1 transmitter RF emission (3 dB) bandwidths of mobile systems operating or planned to operate in the frequency band 21.2-22 GHz. Transmitter peak output powers is 50 dBm and is fixed output. Each System 1 station transmits at a duty cycle below 20% of the operational deployment period.

3.2 Receiver characteristics

System 1 uses digital signal processing to enhance system performance. The signal processing in the newer generation of System 1 uses other advanced techniques to produce a processing gain for the desired signal and may also provide suppression of undesired signals.

3.3 Antenna characteristics

The airborne antenna gain for System 1 is 0 dBi and omnidirectional vertical polarization.

4 Protection criteria for the aeronautical mobile service in the frequency band 21.2-22 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 of about -6 dB. This represents the required protection criterion for the AMS from interference due to another radiocommunication service. 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.

TABLE 1

**Representative technical characteristics of the aeronautical mobile service systems
in the frequency band 21.2-22 GHz**

Parameter	System 1
Communication direction	Air-to-air
Transmitter tuning range (GHz)	21.2-21.5
Transmitter power output (dBm)	50
Transmitter bandwidth (MHz)	
-3 dB	310
-20 dB	315
-60 dB	360
Transmitter spurious attenuation (dB)	> -80
Transmitter modulation	FM/GMSK
Receiver tuning range (GHz)	21.2-21.5
Receiver IF selectivity (MHz)	
-3 dB	306
-20 dB	315
-60 dB	380
Receiver RF selectivity (MHz)	
-3 dB	310
-20 dB	315
-60 dB	360
Receiver noise figure (dB)	7
Receiver image rejection (dB)	30
Receiver spurious rejection (dB)	60
Antenna gain (dBi)	0
Antenna 1 st sidelobe (dB)	Not applicable
Antenna polarization	Vertical
Antenna pattern/type	Omni