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| **Document Title:** Working Document towards a Preliminary Draft New Recommendation ITU-R M.[ARNS-AMRS 960-1215 MHz], “Characteristics and protection criteria for the aviation systems operating in the aeronautical radionavigation service and the aeronautical mobile (route) service in the frequency band 960-1 215 MHz” |
| **Author(s)/Contributors(s):**Chris TourignyFAA Spectrum Engineering ServicesSandra WrightFAA Spectrum Engineering ServicesMichael TranMITRE | Phone: 202-267-3071Email: chris.tourigny@faa.govPhone: 202-603-7094 Email: sandra.a.wright@faa.govPhone: 703-983-1295 Email : mtran@mitre.org |
| **Purpose/Objective:** The purpose of this contribution is to provide the technical characteristics and protection criteria for the aviation systems operating in the aeronautical radionavigation service (ARNS) and aeronautical mobile (route) service (AM(R)S) in the frequency band 960-1 215 MHz. |
| **Abstract:** This contribution provides the technical characteristics and protection criteria for the aviation systems operating in the aeronautical radionavigation service (ARNS) and aeronautical mobile (route) service (AM(R)S) in the frequency band 960-1 215 MHz. |

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| **Radiocommunication Study Groups** |  |
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| working document towards a preliminary draft neW recommendation itu-r m. ITU-R M.[ARNS-AMRS 960-1215 MHz]**Characteristics and protection criteria for the aviation systems operating in the aeronautical radionavigation service and the aeronautical mobile (route) service in the frequency band 960-1 215 MHz** |
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**Introduction**

This contribution provides the technical characteristics and protection criteria for characteristics and protection criteria for the aviation systems operating in the aeronautical radionavigation service and the aeronautical mobile (route) service in the frequency band 960-1 215 MHz.

Attachment: 1

ATTACHMENT

working document towards a preliminary draft new recommendation ITU-r m.[ARNS-AMRS 960-1215 MHZ]

**Characteristics and protection criteria for the aviation systems operating in the aeronautical radionavigation service and the aeronautical mobile (route) service in the frequency band 960-1 215 MHz**

Scope

TBA

Keywords

AM(R)S, ARNS, DME, ADS-B, TCAS, SSR

Abbreviations/Glossary

AM(R)S: Aeronautical mobile (route) service

ICAO: International Civil Aviation Organization

Related ITU Recommendations and Reports

Recommendation

[ITU-R SM.1535](https://www.itu.int/rec/R-REC-SM.1535/en) The protection of safety services from unwanted emissions

The ITU Radiocommunication Assembly,

considering

*a)* that aeronautical safety communications are used in all areas that aircraft operate and land, and in all phases of flight;

*b)* TBA,

recognizing

*a)* that the ICAO develops standards and recommended practices for civil aviation;

*b)* that Annex 10 to the Convention on International Civil Aviation contains standards and recommended practices for aeronautical radiocommunication systems used by civil aviation;

*c)* that the ARNS and AM(R)S are safety services;

*d)* that No. **4.10** of Radio Regulations stipulates “Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies”;

*e)* that Recommendation ITU-R SM.1535 provides a guideline for the protection of safety services from unwanted emissions,

recommends

1 TBD;

2 TBD.

3 that an additional safety margin of 6 dB should be applied.

**ANNEX**

**Background**

The frequency band 960-1 215 MHz is allocated to the aeronautical radionavigation service (ARNS) and the band 960-1 164 MHz is allocated to the aeronautical mobile (route) service (AM(R)S). The frequency band 1 087.7-1 092.3 MHz is allocated to the aeronautical mobile satellite (route) service (AMS(R)S) on a primary basis, limited to the space station reception of Automatic Dependent Surveillance – Broadcast (ADS-B). These allocations are heavily used by aviation safety-of-life systems.

**Protection criteria for aviation systems**

Aviation safety-of-life systems required the highest levels of availability, integrity, and continuity. For example, the Category I integrity is 1-1e-7 and Category II/III integrity is 1-1e-9. Such high levels of requirements are achieved by ensuring no harmful interference in extreme propagation anomalies and interference conditions. Hence, a protection criterion of I/N = -10 dB should be used in the sharing and compatibility studies. This represents the aggregate protection level if multiple interferers are present. A protection criterion of I/N = -20 dB should be used for compatibility studies with interference from adjacent-band interferers.

**Aviation safety margin**

An aviation safety margin of not less than 6 dB should be included in the sharing and compatibility studies.

**DME technical parameters**

Many airport ILS/DME installations have been certified at the highest level of precision approach procedures (Category III (CAT III)) and are authorized to be used for auto-landing operations. For Category I instrument landing systems (ILS), integrity is 1 – 1e-7, for Category II and III landing systems, integrity is 1 – 1e-9. For those systems, continuity is 1 – 2 × 10−6. Such high availability and integrity are achieved by ensuring there is no harmful interference to the various components of the ILS from other systems and extreme propagation anomalies must be taken into account.

DME receiver performance and antenna parameters are in Table 1. The protection criteria provided should be considered for the aggregate of all possible interference sources.

Table 1

**DME receiver performance and antenna parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **DME/N ground** | **DME/N airborne** | **DME/P ground** | **DME/P airborne** |
| Frequency range of assignable channels, MHz | 1 025-1 150 | 9 62-1 213 | 1 025-1 150 | 962-1 213 |
| Bandwidth, MHz | 3.5 | 3.5 | 3.5 | 3.5 |
| Antenna gain, dBi  | 16 (directional),12 (omni-directional) | 5.4 | 16 | 5.4 |
| Noise figure, dB | 4 | 4 | 4 | 4 |
| Cable loss, dB  | < 2 | 4 | < 2 | 4 |
| Selectivity, attenuation (dB) @ freq offset (MHz) | 0 @ 010 @ 2.260 @ 9.6 | 6 @ 0.920 @ 1.0540 @ 1.360 @ 1.570 @ 3 | 0 @ 010 @ 2.260 @ 9.6 | 6 @ 0.920 @ 1.0540 @ 1.360 @ 1.570 @ 3 |
| Protection criteria (*I/N*), dB | -10 | −10 | −10 | −10 |
| Adjacent-band protection criteria (I/N), dB | -20 | -20 | -20 | -20 |

**SSR technical parameters**

Table 2 contains recommended characteristics and protection criteria for the SSR ground interrogator receiver and the SSR airborne transponder receiver.

Table 2

**SSR system receiver performance and antenna assumptions**

|  |  |  |
| --- | --- | --- |
| Parameters | SSR airborne transponder | SSR ground interrogator |
| Centre frequency, MHz | 1 030 | 1 090 |
| Bandwidth, MHz | 6 | 4.5 (Mode A and C)2.3 (Mode S) |
| Antenna gain, dBi | 2.8 / 5.4 | 27 |
| Antenna polarization | Vertical | Vertical |
| Cable loss, dB | 1 | 1 |
| Selectivity, attenuation (dB) @ freq offset (MHz) | 3 @ 324.6 @ 1040 @ 1560 @ 25 | 3 @ 324.6 @ 1040 @ 1560 @ 25 |
| Noise figure, dB | 5 | 5 |
| Interference criteria (I/N), dB | −10 | −10 |
| Adjacent-band protection criteria (I/N), dB | -20 | -20 |

**ADS-B 1090ES technical parameters**

Table 3 contains recommended characteristics and protection criteria for the ADS-B 1090ES airborne receiver.

Table 3

**ADS-B 1090ES system receiver performance and antenna assumptions**

| **Parameters** | **ADS-B airborne** |
| --- | --- |
| Centre frequency, MHz | 1 090 |
| Bandwidth, MHz | 11 |
| Antenna gain, dBi | 2-5 |
| Antenna polarization | Vertical |
| Cable loss, dB | 1 |
| Selectivity, attenuation (dB) @ freq offset (MHz) | 0 @ 03 @ 5.520 @ 1040 @ 1560 @ 25 |
| Noise figure, dB | 5 |
| Interference criteria (*I/N*), dB | −10 |
| Adjacent-band protection criteria (I/N), dB | -20 |

**UAT technical parameters**

Table 4 contains recommended characteristics and protection criteria for the UAT receiver. The protection criteria provided should be considered for the aggregate of all possible interference sources.

Table 4

**UAT receiver performance and antenna assumptions**

|  |  |
| --- | --- |
| Parameters | UAT airborne |
| Centre frequency, MHz | 978 |
| Antenna gain, dBi | 0-4 |
| Cable loss, dB | 1-3 |
| Bandwidth, MHz | 1.3 |
| Noise figure, dB | 6 |
| Selectivity, attenuation (dB) @ freq offset (MHz) | 0 @ 03 @ 0.62515 @ 150 @ 260 @ 10 |
| Protection criteria (*I/N*), dB | −10 |
| Adjacent-band protection criteria (I/N), dB | -20 |

**MLAT technical parameters**

Until further analysis provides more detailed information, use the ADS-B 1090ES and UAT airborne receiver technical characteristics and protection criteria to represent the MLAT receiver on the ground. Also, while the SSR airborne transponder is the desired receiver in the MLAT interrogation path, its technical characteristics are already covered in the SSR technical parameters section.

**ACAS technical parameters**

Until further analysis provides more detailed information, use the ADS-B 1090ES airborne receiver technical characteristics and protection criteria to represent the ACAS receiver. Also, while the SSR airborne transponder is the desired receiver in the ACAS interrogation path, its technical characteristics are already covered in the SSR technical parameters section.

**LDACS technical parameters**

Table 5 contains recommended characteristics and protection criteria for the LDACS receiver. The protection criteria provided should be considered for the aggregate of all possible interference sources.

Table 5

**LDACS receiver performance and antenna assumptions**

|  |  |  |
| --- | --- | --- |
| Parameters | LDACS Rx airborne  | LDACS Rx ground |
| Frequency range, MHz | 1 110-1 146 | 964-1 000 |
| Antenna gain, dBi | 5.4 | 12 (typical) |
| Cable loss, dB | 3 | 2 (typical) |
| Duplexer loss, dB | 1 | − |
| Bandwidth, MHz | 0.5 | 0.5 |
| Noise figure, dB | 6 | 6 |
| Selectivity, attenuation (dB) @ freq offset (MHz) | 0 @ 0.256 @ 0.340 @ 0.470 @ 0.580 @ 0.7590 @ 1.5 | 0 @ 0.256 @ 0.340 @ 0.470 @ 0.580 @ 0.7590 @ 1.5 |
| Protection criteria (*I/N*), dB | −6/-10 | −6/-10 |
| Adjacent-band protection criteria (I/N), dB | -20 | -20 |