

Recommendation ITU-R RS.1263-3

(12/2023)

RS Series: Remote sensing systems

**Interference criteria for meteorological
aids operated in the 400.15-406 MHz and
1 668.4-1 700 MHz bands**



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| RS | Remote sensing systems |
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| SM | Spectrum management |
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| 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.

Electronic Publication
Geneva, 2024

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RECOMMENDATION ITU-R RS.1263-3

**Interference criteria for meteorological aids operated in the 400.15-406 MHz
and 1 668.4-1 700 MHz bands**

(1997-2010-2018-2023)

Scope

This Recommendation provides interference criteria data which should be used for compatibility and sharing studies for MetAids operating in the 400.15-406 MHz and 1 668.4-1 700 MHz bands.

Related ITU-R Recommendations and Reports

Recommendation ITU-R P.528 – Propagation curves for aeronautical mobile and radionavigation services using the VHF, UHF and SHF bands

Recommendation ITU-R RS.1165 – Technical characteristics and performance criteria for systems in the meteorological aids service in the 403 MHz and 1 680 MHz bands

Recommendation ITU-R SA.1021 – Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services

Keywords

MetAids, radiosondes, rocketsondes, dropsondes

Abbreviations/Glossary

| | |
|---------|---------------------------------|
| AM | Amplitude modulation |
| FM | Frequency modulation |
| FSK | Frequency shift keying |
| GFSK | Gaussian frequency shift keying |
| MetAids | Meteorological aids |
| METSAT | Meteorological satellite |
| MSS | Mobile satellite service |
| NAVAID | Navigational aid |
| QAM | Quadrature amplitude modulation |

The ITU Radiocommunication Assembly,

considering

- a) that interference criteria are needed to ensure that systems can be designed to achieve adequate performance in the presence of interference;
- b) that the performance objectives for radiosonde, dropsonde, and rocketsonde systems are specified in Recommendation ITU-R RS.1165;
- c) that interference criteria assist in the development of criteria for sharing bands among systems, including those operating in other services;
- d) that systems in the meteorological aids (MetAids) service must specify interference thresholds at least equal to the permissible levels,

recommends

that the interference levels specified in Tables 1, 2 and 3 should be used as the permissible total levels of interfering signal power at the antenna output of receiving stations operating in the MetAids service based on the MetAids parameters of representative systems as provided in Annex 1.

TABLE 1

Interference criteria for radiosonde systems in the MetAids service operating in the frequency band 1 668.4-1 700 MHz⁽¹⁾

| Parameter | Radio direction finding (RDF) radiosonde system 1 668.4-1 700 MHz | GPS radiosonde system 1 675-1 683 MHz |
|---|--|--|
| System reference bandwidth (kHz) | 1 300 | 150 |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than $P_{LOCK-LOSS}$ % of the time | -135.3 | -137.2 |
| Percentage of time, $P_{LOCK-LOSS}$ (%) ⁽²⁾ | 0.02 | 0.025 |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than $P_{DATA-LOSS}$ % of the time | -148.5 | -145.7 |
| Percentage of time, $P_{DATA-LOSS}$ (%) ⁽²⁾ | 0.08 | 0.125 |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than 20% of the time ⁽²⁾ | -149.36 | -151.51 |

⁽¹⁾ See § 3 for link margin calculations and § 4 for derivation of interference signal power levels.

⁽²⁾ This percentage of time shall not be exceeded on a per-flight basis.

TABLE 2

**Interference criteria for radiosonde systems in the MetAids service operating
in the frequency band 400.15-406 MHz⁽¹⁾**

| Parameter | Type A | Type B | Type C | Type D | Type E |
|--|--------|-------------------------------|--------|-------------------------------|--------|
| System reference bandwidth (kHz) | 300 | 6 | 11 | 17 | 18.8 |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than $P_{LOCK-LOSS}$ % of the time (dBW) | -141.2 | Not applicable ⁽²⁾ | -145.6 | Not applicable ⁽²⁾ | -142.7 |
| Percentage of time, $P_{LOCK-LOSS}$ (%) ⁽³⁾ | 0.02 | Not applicable ⁽²⁾ | 0.02 | Not applicable ⁽²⁾ | 0.02 |
| Interference signal power in the reference bandwidth to be exceeded no more than $P_{DATA-LOSS}$ % of the time (dBW) | -151.7 | -146.5 | -150.7 | -149.7 | -148.0 |
| Percentage of time, $P_{DATA-LOSS}$ (%) ⁽³⁾ | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Interference signal power in the reference bandwidth to be exceeded no more than 20% of the time ⁽³⁾ (dBW) | -156.0 | -158.9 | -162.4 | -160.0 | -156.8 |

⁽¹⁾ See § 3 for link margin calculations and § 4 for derivation of interference signal power levels.

⁽²⁾ Systems with omnidirectional antennas are not vulnerable to losing antenna lock on the signal due to interference or signal fading.

⁽³⁾ This percentage of time shall not be exceeded on a per-flight basis.

TABLE 3

Interference criteria for rocketsonde and dropsonde systems in the MetAids service

| Parameter | Airborne dropsonde systems 400.15-406 MHz | Rocketsonde systems 400.15-406 MHz |
|--|--|---------------------------------------|
| System reference bandwidth | 20 kHz | 3 MHz |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than $P_{LOCK-LOSS}$ % of the time | Not applicable ⁽¹⁾ | -116.9 |
| $P_{LOCK-LOSS}$ (%) ⁽²⁾ | Not applicable ⁽¹⁾ | 0.02 |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than $P_{DATA-LOSS}$ % of the time | -161.6 | -122.1 |
| $P_{DATA-LOSS}$ (%) ⁽²⁾ | 0.060 | 0.060 |
| Interference signal power (dBW) in the reference bandwidth to be exceeded no more than 20% of the time | -167.06 | -132.98 |

⁽¹⁾ Systems with omnidirectional antennas are not vulnerable to losing antenna lock on the signal due to interference or signal fading.

⁽²⁾ This percentage of time shall not be exceeded on a per-flight basis.

Annex 1

Basis for performance and interference criteria for MetAids in the frequency bands 400.15-406 MHz and 1 668.4-1 700 MHz

1 Introduction

The bands 400.15-406 MHz (referred to as the 403 MHz frequency band throughout) and 1 668.4-1 700 MHz (referred to as the 1 680 MHz frequency band throughout) are allocated to MetAids on a primary basis. The frequency bands 400.15-403 MHz and 1 670-1 700 MHz are also allocated to the meteorological satellite (METSAT) users on a co-primary basis; and the frequency band 400.15-401 MHz is allocated to the mobile-satellite service (MSS) worldwide. The frequency band 1 668.4-1 675 MHz is allocated to the mobile-satellite service (MSS) on a worldwide basis.

The term MetAids is used to describe a variety of types of meteorological equipment; radiosondes, dropsondes and rocketsondes. MetAids are flown worldwide for the collection of upper atmosphere meteorological data for weather forecasts and severe storm prediction, collection of ozone level data, and measurement of atmospheric parameters for various other applications. The data collected from these flights, or soundings, is of extreme importance for the protection of life and property through the prediction of severe storms and providing vital data for commercial airlines operations.

2 Methodology for determining MetAids interference criteria

Since MetAids are typically most vulnerable to interference at the maximum slant range of operation, the interference criteria will be established based on the link margin at the maximum slant range. Although this assumption does not allow other potential users of the frequency bands the flexibility of taking advantage of the higher link margins at shorter slant ranges, this factor may be applied, if appropriate, in detailed sharing studies. This range will be a typical maximum slant range for most of the world, but does not represent the extreme conditions encountered in wintertime at high latitudes.

The interference criteria of MetAids will be established at three points for systems with directional antennas: an interference level and percentage time for loss of receiver tracking lock, an interference level and percentage time for loss of data, and a long-term interference level to be exceeded for no greater than 20% of the time. The loss of receiver tracking lock values is not applicable to MetAids systems with omnidirectional antennas since the antennas cannot be misdirected away from the signal during a period of signal loss or interference. For MetAids systems with omnidirectional antennas, an interference level and percentage of time will be calculated for data loss and for a long-term interference level to be exceeded for no greater than 20% of the time. Since the different types of MetAids are utilized in different applications and exhibit different characteristics, criteria will be established for each.

The first level of short-term interference criteria to be established, applicable only to systems with directional tracking antennas, will be the level associated with loss of receiver tracking lock, which is allowable for only a brief period of time and is only applicable to systems with directional tracking antennas. This is the maximum time in which the receiver can withstand loss of signal and still recover and lock the tracking antenna back on the signal when it returns. The total time percentage, $P\%_{TOTAL}$, loss of tracking lock that may occur will be calculated according to the system and application. That percentage will then be subdivided into a percentage for intrasystem sources, and a percentage for intersystem sources. In this case, loss of lock will be subdivided so that 25% of $P\%_{TOTAL}$ is attributed to intersystem interference.

The interference criteria for loss of tracking lock will be calculated in the following manner:

$$I_{LOC-LOSS} = N_{RX} + 10 \log(10^{M/10} - 1) \quad (1)$$

where:

N_{RX} : receiver noise spectral density from link budget (see Tables 5, 6 and 7)

M : margin calculated for loss of lock calculated from link budget (see Tables 5, 6 and 7).

The level, $I_{LOCK-LOSS}$, shall not be exceeded more than $P\%_{LOCK-LOSS}$, where:

$$P\%_{LOCK-LOSS} = 0.25 (P\%_{TOTAL})$$

The second level of short-term interference criteria, applicable to all systems, is the level at which loss of data will occur. The percentage of time for this occurrence may be obtained from the user's data availability objectives. The published data availability requirements of MetAids typically are for all sources of data loss and data error. MetAids flights experience sensor data errors, in addition to data loss, which are filtered out during data processing. 25% of the total data loss/error percentage $P\%_{TOTAL}$ will be attributed to interference and 25% of this may be attributed to intersystem interference, hence:

$$P\%_{DATA-LOSS} = (25\%) (25\%) (P\%_{TOTAL}) = (6.25\%)(P\%_{TOTAL})$$

The interference criteria for data loss will be calculated in the following manner:

$$I_{DATA-LOSS} = N_{RX} + 10 \log(10^{M/10} - 1) \quad (2)$$

where:

N_{RX} : receiver noise spectral density from link budget (see Tables 5, 6 and 7)

M : margin calculated for data loss from link budget (see Tables 5, 6 and 7).

The level $I_{DATA-LOSS}$ shall not be exceeded more than $P\%_{DATA-LOSS}$

The third interference level will be the long-term level, to be exceeded no more than 20% of the time. The long-term interference level can be calculated based on both the short-term margins for loss of lock (when applicable) and data loss. The level calculated from the short-term loss of lock margin is insignificant since it is dominated by the level calculated from the data loss margin. For the long term (20%), two thirds of the margin associated with data loss will be retained for MetAids. The interference criteria for data loss will be calculated in the following manner:

$$I_{20\%} = N_{RX} + 10 \log(10^{M/30} - 1)$$

or

$$N_{RX} - 10 \text{ dB, whichever is greater} \quad (3)$$

where:

N_{RX} : receiver noise spectral density from link budget (see Tables 5, 6 and 7)

M : margin calculated for data loss from link budget (see Tables 5, 6 and 7).

The level $I_{20\%}$ shall not be exceeded more than 20% of time.

TABLE 4

Percentages of time associated with representative MetAids systems

| Percentage | RDF system 1 668.4- 1 700 MHz | GPS system 1 675- 1 683 MHz | NAVAID system with directional antenna | NAVAID system with omnidirectional antenna | Dropsonde system | Rocketsonde system |
|--|-------------------------------------|-----------------------------------|---|--|--------------------|--------------------|
| Tracking loss percentage of time ($P\%_{TOTAL-LOCK}$) | 0.08% | 0.1% | 0.08% | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 0.08% |
| Percentage of tracking loss attributed to intersystem interference ($P\%_{LL-INTERSYSTEM}$) | 25% | 25% | 25% | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 25% |
| Maximum link unavailability percentage of time ($P\%_{TOTAL}$) ⁽²⁾ | 13.5% | 2.0% | 1% | 1% | 1.0% | 1.0% |
| Percentage of data loss attributed to interference ($P\%_{DL-INTERFERENCE}$) | 25% | 25% | 25% | 25% | 25% | 25% |
| Percentage of data loss attributed to intersystem interference ($P\%_{DL-INTERSYSTEM}$) | 25% | 25% | 25% | 25% | 25% | 25% |
| Resulting percentage of time for tracking loss interference criteria ($P\%_{LOCK-LOSS}$) | 0.02% | 0.025% | 0.02% | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 0.02% |
| Resulting percentage of time for data loss interference criteria ($P\%_{DATA-LOSS}$) | 0.8% | 0.125% | 0.2% | 0.2% | 0.06% | 0.06% |

N/A: Not applicable.

⁽¹⁾ Systems with omnidirectional antennas are not vulnerable to losing antenna lock on the signal due to interference or signal fading.

⁽²⁾ Elements of this Table are derived from total flight data availability data taken from Rec. ITU-R RS.1165-2.

3 Link budget analysis for MetAids

The various types of MetAids are utilized for different purposes and have different system characteristics, and as a result have different link budget calculations. Tables 5, 6 and 7 list the link budget calculations for representative systems used worldwide.

TABLE 5

**Link budget calculations for MetAids (excluding radiosondes) operated in
the frequency band 400.15-406 MHz**

| Performance factor | Dropsondes | Rocketsonde | |
|--|-------------------|--------------------|-------------------|
| Modulation type | FM | AM | |
| Frequency range (MHz) | 400.15-406 | | |
| Per cent time performance is not exceeded (%) | 0.06 data loss | 0.02 track loss | 0.06 data loss |
| Transmitter output power (dBW) | -8.5 | -5.2 | |
| Antenna gain average (dBi) | 2.0 | 0.0 | |
| Transmitter e.i.r.p. (dBW) | -6.5 | -5.2 | |
| Maximum link length (km) | 350 | 70 | |
| Free-space path loss (dB) | 135.4 | 121.4 | |
| Excess path loss (rain, fading, etc.) (dB) | 4.0 | 0.25 | |
| Ground station antenna gain (dBi) | 0.0 | 20 | |
| Ground station antenna pointing error (dB) | 0.0 | 0.5 | |
| Receiver system loss (antenna feed, cables, etc.) (dB) | 0.0 | 2.0 | |
| Polarization mismatch loss (dB) | 0.0 | 0.5 | |
| Received signal power (dBW) | -145.9 | -109.85 | |
| Receiver reference bandwidth (kHz) | 20 | 3 000 | |
| Reference bandwidth (dBHz) | 42.5 | 64.8 | |
| Received energy per Hz, C_0 (dB(W/Hz)) | -188.4 | -174.65 | |
| Receiver system noise temperature (K) | 410 | 738 | |
| Receiver system noise power (dBW) | -160 | -165 | |
| Receiver noise spectral density, N_0 (dB(W/Hz)) | -202.5 | -200.5 | |
| Minimum C_0/N_0 (dB) | 12 | 7 | 12 |
| Actual C_0/N_0 for flight (dB) | 14.1 | 25.8 | |
| Margin (dB) | 2.1 | 18.9 | 13.8 |

TABLE 6

Link budget calculations for Radiosonde MetAids operated in the frequency band 400.15-406 MHz

| Type System | Type A | | Type B | Type C | | Type D | Type E | |
|--|--------------------|------------------|------------------|--------------------|------------------|------------------|--------------------|------------------|
| Frequency range (MHz) | 400.15-406 | | | | | | | |
| Modulation Type | FM | | GMSK | GFSK | | QAM | FSK | |
| Per cent time performance is not exceeded (%) | 0.02 track loss | 0.2 data loss | 0.2 data loss | 0.02 track loss | 0.2 data loss | 0.2 data loss | 0.02 track loss | 0.2 data loss |
| Airborne transmitter output power (dBW) | -6 | | -6 | -11.6 | | -10 | -11.5 | |
| Airborne antenna gain average (dBi) | 2 | | 2 | 2 | | 3 | 2 | |
| Airborne transmitter e.i.r.p. (dBW) | -4 | | -4 | -9.6 | | -7 | -9.5 | |
| Maximum link length (km) | 250 | | 150 | 250 | | 150 | | |
| Free-space path loss (dB) | 132.5 | | 128.1 | 132.5 | | 128.1 | 132.5 | |
| Excess path loss (rain, fading, etc.) (dB) | 1.5 | | 1.5 | 1.5 | | 1.5 | 1.5 | |
| Ground station antenna gain (dBi) | 8 | | 2.15 | 8 | | 2.15 | 11 | |
| Ground station antenna pointing error (dB) | 0.5 | | 0.5 | 0.5 | | 0.5 | | |
| Receiver system loss (antenna feed, cables, etc.) (dB) | 2 | | 2 | 2 | | 2 | | |
| Polarization mismatch loss (dB) | 0.5 | | 0.5 | 0.5 | | 0.5 | | |
| Received signal power (dBW) | -133.0 | | -134 | -138.6 | | -137.4 | | |
| Ground receiver reference bandwidth (kHz) | 300 | | 6 | 11 | | 17 | | |
| Ground receiver reference bandwidth (dBHz) | 54.8 | | 37.8 | 40.4 | | 42.3 | | |
| Received energy per Hz, C_0 (dB(W/Hz)) | -187.8 | | -172.2 | -179.0 | | -179.7 | | |
| Ground receiver system noise temperature (K) | 600 | | 600 | 170 | | 255 | | |
| Ground receiver system noise power (dBW) | -146.0 | | -163.0 | -165.9 | | -162.2 | | |
| Ground Receiver noise spectral density, N_0 (dB(W/Hz)) | -200.8 | | -200.8 | -206.3 | | -204.5 | | |
| Minimum C_0/N_0 (dB) | 7 | 12 | 12 | 7 | 12 | 12 | | |
| Actual C_0/N_0 for flight (dB) | 13.0 | | 28.6 | 27.3 | | 24.8 | | |
| Margin (dB) | 6.0 | 1.0 | 16.6 | 20.3 | 15.3 | 12.8 | | |

TABLE 7

Link budget calculations for MetAids operated in the frequency band 1 668.4-1 700 MHz

| Performance factor | Type G RDF System | | Type H GPS System | |
|--|----------------------|-------------------|------------------------|--------------------|
| | Modulation type | AM | | FM |
| Frequency range | 1 668.4-1 700 | | 1 675-1 683 | |
| Per cent time performance is not exceeded (%) | 0.02 track loss | 0.08 data loss | 0.025 track loss | 0.125 data loss |
| Airborne transmitter output power (dBW) | -6.0 | | -5.0 | |
| Airborne antenna gain average (dBi) | 2.0 | | -2 | |
| Airborne radiosonde e.i.r.p. (dBW) | -4.0 | | -3.0 | |
| Maximum link length (km) | 250 | | 250 | |
| Free-space path loss (dB) | 144.9 | | 144.9 | |
| Excess path loss (rain, fading, etc.) (dB) | 2.0 | | 5.0 | |
| Ground station antenna gain (dBi) | 28.0 | | 26 | |
| Ground station antenna pointing error (dB) | 0.5 | | 0.0 | |
| Receiver system loss (antenna feed, cables, etc.) (dB) | 3.0 | | 0.5 | |
| Polarization mismatch loss (dB) | 0.5 | | 3 | |
| Received signal power (dBW) | -126.9 | | -130.4 | |
| Ground receiver reference bandwidth (kHz) | 1 300 | | 150 | |
| Ground receiver reference bandwidth (dBHz) | 61.1 | | 52 | |
| Received energy per Hz, C_0 (dB(W/Hz)) | -188.0 | | -182.4 | |
| Ground receiver system noise temperature (K) | 738 | | 1 000 | |
| Ground receiver system noise power (dBW) | -168.7 | | -146.8 | |
| Ground receiver noise spectral density, N_0 (dB(W/Hz)) | -200.5 | | -197.4 | |
| Minimum C_0/N_0 (dB) | 7 | 12 | 6 | 12 |
| Actual C_0/N_0 for flight (dB) | 12.5 | | 15 | |
| Margin (dB) | 5.5 | 0.5 | 9.0 | 3.0 |

4 Calculation of MetAids interference criteria**4.1 Radiosondes**

The interference criteria can be calculated utilizing equations (1), (2) and (3), and the results of the link budget analysis in Tables 5, 6 and 7. The interference criteria established for each of the three radiosonde systems are presented in Tables 8 and 9.

TABLE 8

Interference criteria for non-NAVAID radiosonde systems operating in the frequency band 400.15-406 MHz⁽¹⁾

| Type System | Type A | Type B | Type C | Type D | Type E |
|--|--------|----------------|--------|----------------|--------|
| Parameter | FM | GMSK | GFSK | QAM | FSK |
| Receiver noise spectral density (dB(W/Hz)) | -200.8 | -200.8 | -206.3 | -204.5 | -199.9 |
| Receiver reference bandwidth (dB/Hz) | 54.8 | 37.8 | 40.4 | 42.3 | 42.7 |
| Link margin (dB) $P_{LOCK-LOSS} = 0.02\%$ (dB) | 6.0 | ⁽¹⁾ | 20.3 | ⁽¹⁾ | 14.7 |
| Link margin (dB) $P_{DATA-LOSS} = 0.2\%$ (dB) | 1.0 | 16.6 | 15.3 | 12.8 | 9.7 |
| Interference level not to be exceeded more than $P_{LOCK-LOSS} = 0.02\%$ of the time (equation (1)) (dBW (REF BW)) | -141.2 | ⁽¹⁾ | -145.6 | ⁽¹⁾ | -142.7 |
| Interference level not to be exceeded more than $P_{DATA-LOSS} = 0.2\%$ of the time (equation (2)) (dBW (REF BW)) | -151.7 | -146.5 | -150.7 | -149.7 | -148.0 |
| Interference level not to be exceeded more than 20% of the time (equation (3)) (dBW (REF BW)) | -156.0 | -158.9 | -162.4 | -160.0 | -156.8 |

⁽¹⁾ Systems with omnidirectional antennas are not vulnerable to losing antenna lock on the signal due to interference or signal fading.

TABLE 9

Interference criteria for radiosonde systems operating in the frequency band 1 668.4-1 700 MHz

| Parameter | Type G RDF system 1 668.4-1 700 MHz | Type F GPS system 1 675-1 683 MHz |
|--|---|--|
| Receiver noise spectral density (dB(W/Hz)) | -200.5 | -197.4 |
| Receiver reference bandwidth (kHz) | 1 300 | 150 |
| First short-term link margin (dB), $P_{LOCK-LOSS}$ | 5.5 | 9.0 |
| First short-term percentage of time, $P_{LOCK-LOSS}$ (%) | 0.02 | 0.025 |
| Second short-term link margin (dB), $P_{DATA-LOSS}$ | 0.5 | 3.0 |
| Second short-term percentage of time, $P_{DATA-LOSS}$ (%) | 0.08 | 0.125 |
| Interference level not to be exceeded more than $P_{LOCK-LOSS}\%$ of the time (equation (1)) (dBW within ref. bandwidth) | -135.3 | -137.2 |
| Interference level not to be exceeded more than $P_{DATA-LOSS}\%$ of the time (equation (2)) (dBW within ref. bandwidth) | -148.5 | -145.7 |
| Interference level not to be exceeded more than 20% of the time (equation (3)) (dBW within ref. bandwidth) | -149.36 | -151.51 |

4.2 Dropsondes

Equations (1), (2) and (3) can be used to calculate the interference criteria for dropsondes. The interference criteria for dropsondes are presented in Table 10.

TABLE 10
Interference criteria for dropsonde systems

| Parameter | Dropsonde systems 400.15-406 MHz |
|---|-------------------------------------|
| Receiver noise spectral density (dB(W/Hz)) | -202.5 |
| Receiver reference bandwidth (dB/Hz) | 42.5 |
| Link margin (dB) $P_{DATA-LOSS} = 0.06\%$ | 2.1 |
| Interference level not to be exceeded more than $P_{DATA-LOSS}\% = 0.06\%$ of the time (equation (2)) (dBW(20 kHz)) | -161.6 |
| Interference level not to be exceeded more than 20% of the time (equation (3)) (dBW(20 kHz)) | -167.06 |

4.3 Rocketsondes

Equations (1), (2) and (3) can be used to calculate the interference criteria for rocketsondes. The interference criteria for rocketsondes are presented in Table 11.

TABLE 11
Interference criteria for rocketsonde systems

| Parameter | Rocketsonde systems 400.15-406 MHz |
|--|---------------------------------------|
| Receiver noise spectral density (dB(W/Hz)) | -200.5 |
| Receiver reference bandwidth (dB/Hz) | 64.8 |
| Link margin (dB) $P_{LOCK-LOSS} = 0.02\%$ | 18.9 |
| Link margin (dB) $P_{DATA-LOSS} = 0.06\%$ | 13.85 |
| Interference level not to be exceeded more than $P_{LOCK-LOSS} = 0.02\%$ of the time (equation (1)) (dBW(3 MHz)) | -116.9 |
| Interference level not to be exceeded more than $P_{DATA-LOSS} = 0.06\%$ of the time (equation (2)) (dBW(3 MHz)) | -122.1 |
| Interference level not to be exceeded more than 20% of the time (equation (3)) (dBW(3 MHz)) | -132.98 |