



**Recommendation ITU-R M.1901**  
(01/2012)

**Guidance on ITU-R Recommendations  
related to systems and networks in the  
radionavigation-satellite service operating  
in the frequency bands 1 164-1 215 MHz,  
1 215-1 300 MHz, 1 559-1 610 MHz,  
5 000-5 010 MHz and 5 010-5 030 MHz**

**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
<b>BO</b>	Satellite delivery
<b>BR</b>	Recording for production, archival and play-out; film for television
<b>BS</b>	Broadcasting service (sound)
<b>BT</b>	Broadcasting service (television)
<b>F</b>	Fixed service
<b>M</b>	<b>Mobile, radiodetermination, amateur and related satellite services</b>
<b>P</b>	Radiowave propagation
<b>RA</b>	Radio astronomy
<b>RS</b>	Remote sensing systems
<b>S</b>	Fixed-satellite service
<b>SA</b>	Space applications and meteorology
<b>SF</b>	Frequency sharing and coordination between fixed-satellite and fixed service systems
<b>SM</b>	Spectrum management
<b>SNG</b>	Satellite news gathering
<b>TF</b>	Time signals and frequency standards emissions
<b>V</b>	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.1901

**Guidance on ITU-R Recommendations related to systems and networks in the radionavigation-satellite service operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz**

(Questions ITU-R 217-2/4 and ITU-R 288/4)

(2012)

**Scope**

This Recommendation is intended to provide guidance on ITU-R Recommendations related to the technical characteristics and protection criteria of radionavigation-satellite service (RNSS) receiving earth stations and characteristics of RNSS transmitting space stations planned or operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz. In addition, this Recommendation gives a brief overview of those Recommendations.

The ITU Radiocommunication Assembly,

*considering*

- a) that systems and networks in the radionavigation-satellite service (RNSS) provide worldwide accurate information for many positioning, navigation and timing applications, including safety aspects for some frequency bands and under certain circumstances and applications;
- b) that there are several operating and planned systems and networks in the RNSS;
- c) that any properly equipped earth station may receive navigation information from systems and networks in the RNSS on a worldwide basis,

*noting*

- a) that Recommendations ITU-R M.1902, ITU-R M.1905, ITU-R M.1903 and ITU-R M.1904 provide technical and operational characteristics of, and protection criteria for, system and network receivers (space-to-Earth and space-to-space) in the RNSS in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz;
- b) that Recommendation ITU-R M.1906 provides technical and operational characteristics and protection criteria of receiving space stations and characteristics of transmitting earth stations in the RNSS (Earth-to-space) operating in the band 5 000-5 010 MHz;
- c) that Recommendation ITU-R M.1787 provides technical descriptions of systems and networks in the RNSS (space-to-Earth and space-to-space) and technical characteristics of transmitting space stations operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz;
- d) that Recommendation ITU-R M.1318 provides a model for evaluating interference from environmental sources into RNSS receivers operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz;
- e) that Recommendation ITU-R M.1831 provides a methodology for RNSS intersystem interference estimation to be used in coordination among systems and networks in the RNSS,

*noting further*

that a Recommendation is being developed by ITU-R to provide technical characteristics and protection criteria of receiving earth stations and characteristics of transmitting space stations in the RNSS (space-to-Earth) operating in the frequency band 5 010-5 030 MHz,

*recommends*

1 that the material in Annex 1 should be used as guidance on ITU-R Recommendations associated with systems and networks in the RNSS operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz.

## Annex 1

### 1 Description of Recommendations relating to RNSS

ITU-R Recommendations providing technical characteristics and protection criteria of systems and networks in the RNSS are summarized in Table 1. Where a particular RNSS system is considered, some Recommendations provide details of that system in a separate annex while others have a common annex.

TABLE 1

#### Summary of ITU-R Recommendations on RNSS system characteristics and protection criteria in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 000-5 010 MHz

Rec. ITU-R	Band(s) (MHz)	Types of stations	Contents
M.1905	1 164-1 215	User receiver	RNSS user receiver characteristics in 1 164-1 215 MHz band and their protection criteria
M.1902	1 215-1 300	User receiver	RNSS user receiver characteristics in 1 215-1 300 MHz band and their protection criteria
M.1903	1 559-1 610	User receiver	RNSS user receiver characteristics in 1 559-1 610 MHz band and their protection criteria
M.1906	5 000-5 010	Satellite receiver	RNSS satellite receiver characteristics in 5 000-5 010 MHz band and their protection criteria
M.1904	1 164-1 215 1 215-1 300 1 559-1 610	Space-borne user receiver	Technical characteristics of space-to-space receivers of existing and planned RNSS systems in 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz and their protection criteria
M.1787	1 164-1 215 1 215-1 300 1 559-1 610	Satellite transmitter	Characteristics of RNSS transmitted navigation signals in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz

Table 2 lists the ITU-R Recommendations which provide models for:

- 1) evaluation of continuous interference to RNSS receivers from non-RNSS radio sources; and
- 2) evaluation of intersystem RNSS interference for the purpose of coordination among systems and networks in the RNSS.

TABLE 2

**Summary of ITU-R Recommendations on RNSS methods for evaluating interference to RNSS systems in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz**

Rec. ITU-R	Bands (MHz)	Types of stations	Contents
M.1318	1 164-1 215 1 215-1 300 1 559-1 610 5 010-5 030	All	Continuous interference evaluation model for the systems and networks in the RNSS operating in the 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz bands
M.1831	1 164-1 215 1 215-1 300 1 559-1 610 5 010-5 030	All	A methodology for RNSS inter-system interference estimation to be used in coordination among systems and networks in the RNSS

## 2 Parameters relevant to the assessment of interference to RNSS systems

RNSS system parameters relevant to the assessment of interference from radio sources other than in the RNSS are listed in Table 3. Certain RNSS signal parameters are not shown but are contained in Recommendation ITU-R M.1787.

TABLE 3

**RNSS parameter descriptions relevant to Recommendations ITU-R M.1905, ITU-R M.1902, ITU-R M.1903 and ITU-R M.1904 (see Notes 2, 3)**

Parameter	RNSS parameter description
Signal frequency range (MHz)	Frequency range of the RNSS signal of interest. For CDMA systems: carrier frequency $\pm$ half the signal bandwidth (unless otherwise noted); for FDMA systems: base frequency + (channel number * channel spacing) $\pm$ half the signal bandwidth. Channel number range should also be given.
Maximum receiver antenna gain in upper hemisphere (dBi)	Maximum receiver antenna gain in upper hemisphere with the specified polarization.
Maximum receiver antenna gain in lower hemisphere (dBi)	Maximum receiver antenna gain in lower hemisphere with the specified polarization.
RF filter 3 dB bandwidth (MHz)	Bandwidth between the 3 dB down points of the receiver's front-end RF bandpass filter.
Pre-correlation filter 3 dB bandwidth (MHz)	Bandwidth between the 3 dB down points of the receiver's IF bandpass filter (just prior to the correlator).
Receiver system noise temperature (K)	Combination of receiver equivalent input noise temperature and antenna equivalent noise temperature.

TABLE 3 (continued)

Parameter	RNSS parameter description
Tracking mode threshold power level of aggregate narrow-band interference at the passive antenna output (dBW)	The minimum narrow-band interference power level (referenced to the passive antenna output and within the RF filter bandwidth) at which the receiver loses track of a desired signal at the specified minimum received power level with a specific probability (i.e. cannot remain in track mode with the corresponding probability). This assumes the receiver had already acquired the desired signal and was tracking until the point at which the interference exceeds this threshold and the receiver fails to track properly (e.g. navigation data can no longer be properly demodulated). (See Note 1.)
Acquisition mode threshold power level of aggregate narrow-band interference at the passive antenna output (dBW)	The minimum narrow-band interference power level (referenced to the passive antenna output and within the RF filter bandwidth) at which the receiver cannot acquire a desired signal at the specified minimum received power level with a specified probability and within a specified time period (i.e. cannot acquire an available signal with the corresponding probability). Note that this interference level is lower than that for the previous (tracking mode) parameter. (See Note 1.)
Tracking mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz))	The minimum wideband interference power density level (referenced to the passive antenna output and within the RF filter bandwidth) at which the receiver loses track of a desired signal at the specified minimum received power level with a specified probability (i.e. cannot remain in tracking mode with the corresponding probability). This assumes the receiver has already acquired the desired signal and was tracking until the point at which the interference exceeds this threshold and the receiver fails to track properly (e.g. navigation data can no longer be properly demodulated). For purposes of determining this value, assume the aggregate interference is white Gaussian noise over the entire pre-correlation filter 3 dB bandwidth. (See Note 1.)
Acquisition mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz))	The minimum wideband interference power density level (referenced to the passive antenna output and within the RF filter bandwidth) at which the receiver cannot acquire a desired signal at the specified minimum received power level with a specified probability and within a specified time period (i.e. cannot acquire an available signal with the corresponding probability). Note that this interference level is lower than that for the previous (tracking mode) parameter. For purposes of determining this value, assume the aggregate interference is white Gaussian noise over the entire pre-correlation filter 3 dB bandwidth. (See Note 1.)
Receiver input compression level (dBW)	The minimum level at the output of the passive antenna at which the receiver linear gain is compressed.

TABLE 3 (*end*)

Parameter	RNSS parameter description
Receiver survival level (dBW)	The maximum power level at the output of the passive antenna at which the receiver must survive without component failure.
Overload recovery time (s)	The maximum time duration for the receiver to return to a steady-state transfer function performance after a signal exceeding the receiver input compression level drops below that level.

NOTE 1 – Unless otherwise specified, based on modulation parameters of the RNSS signal of interest, narrow-band continuous interference is considered to have a bandwidth less than 700 Hz, and wideband continuous interference is considered to have a bandwidth greater than 1 MHz.

NOTE 2 – ITU-R recognizes that it would be useful to know the threshold value(s) of pulse-like interference at the input of a receiver (in tracking mode and acquisition mode). Unfortunately, the nature of these value(s) has yet to be defined. Note that power level, pulse width, pulse repetition interval and pulse modulation type (e.g. CW, chirped, Gaussian, etc.) may all be relevant.

NOTE 3 – For the referenced Recommendations, parameter units should be the same as given in the table unless explicitly noted otherwise.

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