



Recommendation ITU-R M.2030
(12/2012)

**Evaluation method for pulsed interference
from relevant radio sources other than in
the radionavigation-satellite service to the
radionavigation-satellite service systems
and networks operating in the
1 164-1 215 MHz, 1 215-1 300 MHz
and 1 559-1 610 MHz frequency bands**

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



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Foreword

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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.2030

Evaluation method for pulsed interference from relevant radio sources other than in the radionavigation-satellite service to the radionavigation-satellite service systems and networks operating in the 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz frequency bands

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

(2012)

Scope

This Recommendation provides a method for use in the initial evaluation of the potential for relevant¹ radio sources other than in the radionavigation-satellite service (RNSS) to cause pulsed interference² to a radionavigation-satellite system or network operating in the 1 164-1 215 MHz, 1 215-1 300 MHz, and 1 559-1 610 MHz frequency bands. The evaluation method components are a set of equations and a table of recommended parameters and allowable degradation ratios³ for each frequency band and RNSS receiver type. Although the evaluation method equations are applicable to RNSS receivers in the 1 559-1 610 MHz band, further studies would be needed to determine the necessary table of recommended method parameters and allowable degradation ratios for that frequency band before the evaluation method is completely defined for the 1 559-1 610 MHz band.

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 radio transmitters generally emit a level of out-of-band emissions dependent on the conditions of their use;
- c) that while Radio Regulations (RR) Appendix 3 specifies the maximum permitted spurious emission power levels, it also notes that in some cases, these levels may not provide adequate protection for receiving stations in space services and more stringent levels might be considered in each individual case in the light of the geographical position of the stations concerned, and that these levels may not be applicable to systems using digital modulation techniques;
- d) that the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz are also allocated on a primary or secondary basis to other services besides RNSS;
- e) that emissions from other RNSS systems and networks, and from other services and sources in the bands allocated for RNSS, as well as unwanted emissions, may cause interference to an RNSS system's or RNSS network's receivers and should be included in an interference evaluation;

¹ The term "relevant" refers to radio sources that transmit RF pulses or that generate equivalent RF pulses at the RNSS receiver by other means such as, for example, the use of a scanning antenna beam.

² Recommendation ITU-R M.1318-1 provides an analysis method for continuous interference sources.

³ See Annex 1, § 3 for the degradation ratio description and § 4 for more information on the allowable degradation ratio values.

f) that further work is needed to adequately characterize the interference effects on RNSS receivers from emissions of pulsed RF sources operating in and near the bands 1 559-1 610 MHz and 5 010-5 030 MHz,

noting

- a) that several ITU-R Recommendations provide technical data and protection criteria for RNSS system and network operations;
- b) that Recommendation ITU-R RS.1347 also provides a pulsed interference evaluation methodology for interference to an RNSS receiver from synthetic aperture radars and measurement test results in the band 1 215-1 300 MHz;
- c) that Report ITU-R M.2220 provides a method to calculate certain parameters used by this Recommendation along with supporting material and examples,

recognizing

that RR No. 4.5 states “the frequency assigned to a station of a given service shall be separated from the limits of the band allocated to this service in such a way that, taking account of the frequency band assigned to a station, no harmful interference is caused to services to which frequency bands immediately adjoining are allocated”,

recommends

- 1 that the analytic method in Annex 1 to this Recommendation should be used for the preliminary evaluation of the potential for pulsed interference from relevant radio sources other than in the RNSS to an RNSS system or network operating in the bands 1 164-1 215 MHz or 1 215-1 300 MHz;
- 2 that if the application of this method indicates that there is potential for pulsed interference that would impair the ability of RNSS systems or networks to function, then a more detailed analysis should be performed;
- 3 that studies should be performed to develop the parameters to be included in the analytic method for the preliminary evaluation of the potential for pulsed interference from relevant radio sources other than in the RNSS to an RNSS system or network operating in the frequency band 1 559-1 610 MHz (see Note).

NOTE – The analytic method equations in Annex 1 are applicable to the 1 559-1 610 MHz band.

Annex 1

Analytic method for the preliminary evaluation of the potential for pulsed interference from relevant radio sources other than in the RNSS to an RNSS system or network operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz

1 Introduction

An evaluation model for continuous RF interference⁴ (RFI) to RNSS receivers has been developed in Recommendation ITU-R M.1318-1, but ITU-R has also recognized the need to address pulsed RF interference. This Annex derives from basic concepts a general pulsed RFI evaluation method for use with RNSS receivers. Report ITU-R M.2220 contains background material and a methodology to calculate composite pulsed interference parameters used in the interference evaluation. Section 2 below provides some background and describes RFI degradation equations for two basic types of RNSS receivers. Section 3 describes how the degradation equations could be used to assess the impact of additional pulsed RFI. Section 4 lists recommended baseline RFI method parameters and allowable degradation ratios for the pulsed RFI evaluation.

2 Characterization of pulsed RFI effects on RNSS receivers

Studies by two aviation standards organizations⁵ have shown that the highest levels of pulsed RFI impacting RNSS air-navigation receivers operating in the 1 164-1 215 MHz band at or above Flight Level 200 (6 096 m above mean sea level (MSL)) occur in several localized regions around the world. Those studies have developed a model of a general RNSS receiver signal processing method used to mitigate strong pulsed RFI and an associated equation⁶ to express the amount of degradation to the post-correlator signal quality measure ($C/N_{0,EFF}$) of that receiver. One study⁷ also developed the comparable degradation equation for conventional receivers without special pulsed RFI mitigation. Both degradation equations handle continuous RFI present along with the pulsed RFI. As such, they can be useful for determining RFI protection criteria as well as for analysing the effects of any new pulsed or continuous RFI beyond an initial baseline case. Sections 2.1 and 2.2 below describe details of the RFI degradation equations.

2.1 Effective noise density calculation method (receiver pulse blanking)

An effective means for mitigating strong pulsed RFI in, for example, an air navigation receiver, is the pulse blanker. One aspect of the blanker is that pulsed RFI signals with peak power levels below the blanker threshold combine with the receiver noise and the un-blanked components of the continuous RFI. The other main aspect is that the blanker “zeros” the signal and noise into the

⁴ Continuous interference is used here to mean interference from sources of fairly constant power that is generally present at all times. This is distinguished from pulsed interference which requires an analysis based on pulse duration, peak power and duty cycle.

⁵ RTCA, headquartered in the United States, and EUROCAE in Europe.

⁶ SC-159, “Assessment of radio frequency interference relevant to the GNSS L5/E5A frequency band”, RTCA Document No. RTCA/DO-292, Washington, DC, 29 July 2004, Section 2.6.2.3.

⁷ *ibid* RTCA/DO-292, Appendix D.2.2.