RECOMMENDATION ITU-R M.1318*

Interference protection evaluation model for the radionavigation-satellite service in the 1 559-1 610 MHz band

(Question ITU-R 217/8)

(1997)

Scope

This Recommendation provides a model for use in the initial evaluation of the potential to cause interference to a radionavigation-satellite system operating in the 1 559-1 610 MHz band.

The ITU Radiocommunication Assembly,

considering

a) that the radionavigation-satellite service (RNSS) provides radionavigation relating to safety and regularity of flight;

b) that Radio Regulations (RR) provision No. 4.10 recognizes that radionavigation services require special measures to ensure freedom from harmful interference;

c) that RR provision 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.";

d) that Recommendations ITU-R M.1088 and ITU-R M.1317 provide technical data for Global Positioning System (GPS) and Global Navigation Satellite System (GLONASS-M) radionavigation-satellite operations;

e) that the band 1 559-1 610 MHz is allocated on a primary basis to the aeronautical radionavigation service and RNSS in all ITU Regions;

f) that some administrations additionally allocate the 1 559-1 610 MHz band on a primary and secondary basis to the fixed service in some areas;

g) that emissions, including unwanted emissions, from services in the band allocated for RNSS and spurious emissions from other bands, may have the potential to cause harmful interference to radionavigation-satellite receivers,

recognizing

a) that radio transmitters generally emit a level of out-of-band emissions dependent on the conditions of their use;

b) that the received radionavigation-satellite signals are at low levels, and that, being spread-spectrum, are usually impervious to thermal noise and interference levels higher than the signal level up to a certain level;

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* Radiocommunication Study Group 8 made editorial amendments to this Recommendation in 2004 in accordance with Resolution ITU-R 44.

c) that while RR Appendix 3 specifies the maximum permitted spurious emission power levels, it also notes that these levels may not provide adequate protection for receiving stations in the 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 are not applicable to systems using digital modulation techniques,

recommends

1 that the simplified static model, in Annex 1, be used for the initial evaluation of the potential for interference to RNSS from emissions, including spurious, of other services;

2 that if this model indicates that there is a potential for interference that would impair the specific navigation function, then a more detailed and dynamic analysis may be required, taking into account the statistical nature of the probability of occurrence of interference and changing receiver carrier-to-total noise requirements for a given performance.

Annex 1

Model for the evaluation of radionavigation-satellite interference levels

	Desired Signal	Interference Signal	Comments
a) Minimum satellite signal level specified at receiving antenna's surface (dBm)	____dBm		Depends on RNSS design
b) Interference-to-carrier specified for receiver per bandwidth (dB(MHz) or kHz)	____dB(MHz)		Receiver rated maximum value of interference-to-carrier ratio allowed and still meet performance requirements
c) Allowable interference at receiver (dBm/MHz)		____dBm/MHz	Maximum allowed interference level based on specified RF signal level at or near the Earth's surface and receiver interference-to-carrier ratio specification at interference bandwidth
d) Antenna gain difference (dB)		____dB	The difference in antenna gain towards the desired satellite signal and the interference signal
e) Allowable interference signal at antenna's surface (dBm/MHz)		____dBm/MHz	Maximum interference density allowed at the antenna's surface
f) Nominal path loss between antenna and interference source (dB)		____dB	Propagation loss between receiver antenna and interference source: 20 log (frequency (MHz)) + 20 log (D)-27.56 (D = distance (m))
g) Extra margin of protection (dB)		____dB	Extra margin to ensure protection against factors like multipath
h) Multiple interference source factor (dB)		____dB	If there is a potential for more than one source of interference at the same time, an allowance should be made for the aggregate interference
i) Interfering emission in the RNSS bandwidth at the distance specified (dBm/MHz)		____dBm/MHz	If this power density is exceeded at the specified distance, further analysis is required

NOTE 1 – The interference-to-carrier ratio specified for the RNSS receiver is the rated maximum value of interference-to-carrier ratio allowed for the RNSS receiver while it still meets its performance requirements for normal operations. Since RNSS receivers respond differently to different interference bandwidths, the bandwidth of the emission that has a potential to cause interference should be used. The model lists dB(MHz) or dB(kHz) for use for the interference-to-carrier ratio for the RNSS receiver. The same value should be used throughout the model because it represents the bandwidth of the interfering signal and the capability of the receiver to function with that type of interference.

NOTE 2 – The emission i) by the interference source in the RNSS bandwidth is equal to a) + b) – d) + f) – g) – h). If the model suggests a potential for interference, then a more detailed analysis could address dynamics, modulation and access types as a minimum.

NOTE 3 – Pulsed interference requires a separate analysis based on pulse duration, peak power and duty cycle.