

Recommendation ITU-R RS.2165-0

(12/2023)

RS Series: Remote sensing systems

Evaluation of the potential for pulsed interference from planned and future spaceborne synthetic aperture radar sensors in the earth exploration-satellite (active) service to radionavigation-satellite service receivers in the 1 215-1 300 MHz band

Foreword

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Series of ITU-R Recommendations

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Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
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 RS.2165-0

Evaluation of the potential for pulsed interference from planned and future spaceborne synthetic aperture radar sensors in the earth exploration-satellite (active) service to radionavigation-satellite service receivers in the 1 215-1 300 MHz band

(Question ITU-R 234/7)

(2023)

Scope

This Recommendation recommends the methodology to be used for performing a preliminary evaluation of the potential for pulsed interference from planned and future Earth exploration-satellite service (active) (EESS (active)) spaceborne synthetic aperture radars (SARs) to receiving earth stations in the radionavigation-satellite service (RNSS) (space-to-Earth) operating in the 1 215-1 300 MHz frequency band. This Recommendation has not been evaluated for application to RNSS (space-to-space) receivers on board spacecraft. As soon as the studies of EESS (active) scatterometers operating the frequency band 1 215-1 300 MHz are completed, the relevant information can be included in a future ITU-R Recommendation or Report, as appropriate.

The evaluation of the pulsed interference caused by SARs in the EESS (active) to RNSS receivers (space-to-Earth) should also consider the cumulative impact of multiple spaceborne active sensors that may simultaneously illuminate the RNSS receivers, wherever relevant.

Keywords

EESS, pulsed RF interference, RNSS, spaceborne active sensor, spaceborne synthetic aperture radar, scatterometer

Abbreviations/Glossary

EESS	Earth exploration-satellite service
RNSS	Radionavigation-satellite service
SAR	Synthetic aperture radar

Related ITU Recommendations, Reports

Recommendation ITU-R RS.577 – Frequency bands and required bandwidths used for spaceborne active sensors operating in the Earth exploration-satellite (active) and space research (active) services

Recommendation ITU-R M.1318 – Evaluation model for continuous interference from 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, 1 559-1 610 MHz and 5 010-5 030 MHz bands

Recommendation ITU-R RS.1347 – Feasibility of sharing between radionavigation-satellite service receivers and the Earth exploration-satellite (active) and space research (active) services in the 1 215-1 260 MHz band

Recommendation ITU-R RS.1749 – Mitigation technique to facilitate the use of the 1 215-1 300 MHz band by the Earth exploration-satellite service (active) and the space research service (active)

Recommendation ITU-R M.1787 – Description of systems and networks in the radionavigation-satellite service (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

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

Recommendation ITU-R M.1902 – Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 215-1 300 MHz

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

Recommendation ITU-R RS.2105 – Typical technical and operational characteristics of Earth exploration-satellite service (active) systems using allocations between 432 MHz and 238 GHz

Report ITU-R M.2220 – Calculation method to determine aggregate interference parameters of pulsed RF systems operating in and near the frequency bands 1 164-1 215 MHz and 1 215-1 300 MHz that may impact radionavigation satellite service airborne and ground-based receivers operating in those bands

Report ITU-R M.2305 – Consideration of aggregate radio frequency interference event potentials from multiple Earth exploration-satellite service systems on radionavigation-satellite service receivers operating in the 1 215-1 300 MHz frequency band

The ITU Radiocommunication Assembly,

considering

a) that sharing studies have shown compatibility between certain typical Earth exploration-satellite service (active) (EESS (active)) spaceborne sensors and certain radionavigation-satellite service (RNSS) receivers in the acquisition and tracking phases;

b) that an appropriate analytic method would facilitate evaluation of the potential for pulsed interference from an EESS (active) sensor to an RNSS system or network (space-to-Earth) operating in the frequency band 1 215-1 300 MHz;

c) that the analytic method referred to in *considering b)* would necessarily be limited to evaluation of the potential for pulsed interference from an individual EESS (active) sensor to an RNSS system or network (space-to-Earth) operating in the frequency band 1 215-1 300 MHz;

d) that the potential for aggregate pulsed interference to receivers of RNSS (space-Earth) systems or networks from two or more individual EESS (active) sensors that simultaneously operate in the same frequency bands needs to be considered, even where the interference assessment is for two or more individual EESS (active) sensors that are considered by evaluation not to exceed interference allowances,

recognizing

a) that the RNSS ((space-to-Earth) and (space-to-space)) is allocated on a primary basis in the 1 215-1 300 MHz frequency band;

b) that the EESS (active) is allocated on a primary basis in the frequency band 1 215-1 300 MHz subject to the limitations of certain Radio Regulations (RR) including Nos. **5.332** and **5.335A**;

c) that synthetic aperture radar (SAR) is one type of EESS (active) spaceborne sensor;

d) that notwithstanding RR No. **5.332**, SAR sensors and RNSS receivers have been able to operate in the 1 215-1 260 MHz frequency band for decades;

e) that several Recommendations, including ITU-R M.1901, ITU-R M.1902, and ITU-R M.1787, provide technical and operational characteristics and protection criteria for RNSS system and network operations;

f) that Recommendation ITU-R M.2030 and Report ITU-R M.2220 provide, respectively, a general method for analysing the potential for pulsed radio-frequency interference to RNSS receivers and a means of characterizing the received pulsed emissions from potential interference sources, and

Recommendation ITU-R M.2030 provides the allowable degradation ratios from pulsed interference for some RNSS receivers (space-to-Earth) operating in the band 1 215-1 300 MHz;

g) that Report ITU-R RS.2537-0 presents examples of applying the relevant methodology for evaluating the interference from a single spaceborne synthetic aperture radar in the EESS (active) into receiving earth stations in the RNSS (space-to-Earth) operating in the 1 215-1 300 MHz band;

h) that Report ITU-R M.2305 includes consideration of aggregate radio-frequency interference event potentials from multiple Earth exploration-satellite service systems on radionavigation-satellite service receivers operating in the 1 215-1 300 MHz frequency band,

noting

that for scatterometers in the EESS (active) service that would operate in the frequency band 1 215-1 300 MHz, the applicable methodology and example application thereof remains under study in the ITU-R,¹

recommends

1 that the method in Recommendation ITU-R M.2030 should be used, as appropriate, along with Report ITU-R M.2220, Recommendations ITU-R M.1901, ITU-R M.1902, and ITU-R M.1787, for the preliminary evaluation of the potential for pulsed interference from planned EESS (active) SAR sensors into the 1 215-1 300 MHz frequency band, including consideration of the interference resulting from all planned and currently operating EESS (active) sensors in this frequency band (see Note 1)²;

2 that, taking into account *recognizing b)* above, if the application of the method specified in *recommends 1* indicates that the allowable degradation ratio for receiving earth stations in RNSS (space-to-Earth) systems or networks (see Table 2 in Annex 1 to Recommendation ITU-R M.2030) would not be exceeded, then the result of this analysis can be referenced by the affected RNSS systems and networks, and can be used by administrations in further consideration of the cumulative impact of multiple spaceborne active sensors, including all known planned and currently operating SAR sensors, that simultaneously illuminate the RNSS receivers, wherever relevant (see Note 1);

3 that if the application of the method specified in *recommends 1* indicates exceedance of the allowable degradation ratio from Table 2 in Annex 1 to Recommendation ITU-R M.2030 for receiving earth stations in RNSS (space-to-Earth) systems or networks, or if the administration(s) of an affected RNSS system or network so requests, then a more detailed analysis should be performed that:

- involves the administration(s) of the operators of the intended EESS (active) sensor and the administration(s) of the affected RNSS system or network; and
- takes into account operational parameters of the individual EESS (active) SAR sensor under consideration, detailed RNSS receiver characteristics, and any other relevant factors (see Note 1);

¹ When the studies are complete, relevant material could be included in a revision to this Recommendation and/or in a new or revised ITU-R Report. In the meantime, the potential for harmful interference from scatterometers into RNSS systems or networks should be assessed on a case-by-case basis between operators using mutually-agreed parameters and criteria.

² “Planned” EESS (active) sensors in this Recommendation are understood to be sensors that are notified and preparing to enter into simultaneous operation with the EESS (active) sensor under evaluation.

4 that, taking into account *recognizing b*) above, when the application of the detailed analysis of *recommends 3* involving the administration(s) of the operators of the planned EESS (active) sensor and administration(s) of the affected RNSS systems and networks, determines that the allowable degradation ratio from Table 2 in Annex 1 to Recommendation ITU-R M.2030 for receiving earth stations in RNSS (space-to-Earth) systems or networks would not be exceeded, then the result of this analysis (which can be individual or aggregate as of the time of analysis) can be referenced by the affected RNSS systems and networks, and can be used by administrations in further consideration of the cumulative impact of multiple spaceborne active sensors, including all known planned and currently operating SAR sensors, that simultaneously illuminate the RNSS receivers, wherever relevant (see Note 1);

5 that Note 1 is considered as an integral part of this Recommendation.

NOTE 1 – Notwithstanding *recommends 2* and 4, the evaluation of the potential pulsed interference from a planned EESS (active) sensor in this Recommendation should consider the cumulative impact of multiple spaceborne active sensors, including all planned and currently operating SAR sensors, that simultaneously operate in the same frequency band in the same area with RNSS receivers, wherever relevant. One potential means of mitigating the potential aggregate interference from multiple spaceborne active sensors is through operational coordination by EESS (active) operators of such sensors. Further consideration on the evaluation of potential aggregate interference from multiple spaceborne active sensors is provided in Report ITU-R M.2305.
