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

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.

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| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

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| ***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](https://www.itu.int/pub/R-QUE-SG07.234))

(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](https://www.itu.int/rec/R-REC-RS.577/en) – 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](http://www.itu.int/rec/R-REC-M.1318/en) – 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](https://www.itu.int/rec/R-REC-RS.1347/en) – 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](https://www.itu.int/rec/R-REC-RS.1749/en) – 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](http://www.itu.int/rec/R-REC-M.1787/en) – 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](http://www.itu.int/rec/R-REC-M.1901/en) – 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](http://www.itu.int/rec/R-REC-M.1902/en) – 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](http://www.itu.int/rec/R-REC-M.2030/en) – 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](https://www.itu.int/rec/R-REC-RS.2105/en) – 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](http://www.itu.int/pub/R-REP-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](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2305-2014-PDF-E.pdf) – 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](http://www.itu.int/rec/R-REC-M.1901/en), [ITU-R M.1902](http://www.itu.int/rec/R-REC-M.1902/en), and [ITU-R M.1787](http://www.itu.int/rec/R-REC-M.1787/en), provide technical and operational characteristics and protection criteria for RNSS system and network operations;

*f)* that Recommendation [ITU-R M.2030](http://www.itu.int/rec/R-REC-M.2030/en) and Report [ITU-R M.2220](http://www.itu.int/pub/R-REP-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](http://www.itu.int/rec/R-REC-M.2030/en) 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](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2305-2014-PDF-E.pdf) 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]](#footnote-1)

recommends

1 that the method in Recommendation [ITU-R M.2030](http://www.itu.int/rec/R-REC-M.2030/en) should be used, as appropriate, along with Report [ITU-R M.2220](http://www.itu.int/pub/R-REP-M.2220), Recommendations [ITU-R M.1901](http://www.itu.int/rec/R-REC-M.1901/en), [ITU-R M.1902](http://www.itu.int/rec/R-REC-M.1902/en), and [ITU-R M.1787](http://www.itu.int/rec/R-REC-M.1787/en), 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]](#footnote-2);

2that, taking into account *recognizing b)* above, if the application of the method specified in *recommends* 1indicates that the allowable degradation ratio for receiving earth stations in RNSS (space-to-Earth) systems or networks (seeTable 2 in Annex 1 to Recommendation [ITU-R M.2030](http://www.itu.int/rec/R-REC-M.2030/en)) 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* 1indicates exceedance of the allowable degradation ratio from Table 2 in Annex 1 to Recommendation [ITU-R M.2030](http://www.itu.int/rec/R-REC-M.2030/en) 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);

4that, 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](http://www.itu.int/rec/R-REC-M.2030/en) 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](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2305-2014-PDF-E.pdf).

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. [↑](#footnote-ref-1)
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. [↑](#footnote-ref-2)