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Recommendation ITU-R RS.1260-2 (09/2017)

Feasibility of sharing between active spaceborne sensors and other services in the range 420-470 MHz

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Remote sensing systems



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Foreword

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RA	Radio astronomy
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SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
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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.1260-2

Feasibility of sharing between active spaceborne sensors and other services in the range 420-470 MHz

(Question ITU-R 218/7)

(1997-2003-2017)

Scope

This Recommendation provides the technical and operational characteristics to be respected by EESS (active) sensors operating in the band 432-438 MHz in order to ensure protection of the other primary services operating in the band.

Keywords

EESS, active sensors, Synthetic Aperture Radar (SAR), space object tracking radar, exclusion zone

Related Recommendations and Reports

Recommendations ITU-R F.758, ITU-R F.1108 ITU-R M.1462, ITU-R M.1462.

The ITU Radiocommunication Assembly,

considering

- a) that synthetic aperture radars (SARs) can measure soil moisture, forest biomass, can detect buried geologic structures such as faults, fractures, synclines and anticlines, and can map and measure the depth of Antarctic ice, and hydrogeological properties of arid and semiarid regions;
- b) that experimental SARs mounted on aircraft have demonstrated the potential for making these measurements;
- c) that these spaceborne SARs must operate at frequencies below 500 MHz in order to penetrate dense vegetation and the Earth's surface on a worldwide repetitive basis;
- d) that frequency bands between 420-470 MHz are currently allocated to the radiolocation, fixed, amateur, space operations and mobile services;
- e) that within the amateur service weak-signal operations (including Earth-Moon-Earth) are conducted centred around 432 MHz, and amateur-satellite operations (both uplink and downlink) are conducted in the band 435-438 MHz;
- f) that other uses are made of portions of these bands including:
 - wind profilers in the range 440-450 MHz, and in case of incompatibility between wind profiler radars and other applications, in the bands 420-435 MHz and 438-440 MHz (Resolution **217 (WRC-97)**);
 - launch vehicle range safety command destruct receivers in the band 449.75-450.25 MHz (No. **5.286** of the Radio Regulations (RR)), as well as around 421.0, 425.0, 427.0, 440.0 and 445.0 MHz in the United States of America and Brazil and, in the French Overseas Departments in Region 2 and India, the band 433.75-434.25 MHz (RR No. **5.281**);
- g) that certain spaceborne SARs could produce pfd's at the Earth's surface in excess of the pfd levels that may be required to protect the fixed service and the land mobile service allocated in this frequency range;

- h) that co-frequency sharing with wind profilers is likely to be unfeasible due to interference to the spaceborne active sensor;
- i) that SARs and the amateur service (primary in Region 1 and secondary in Regions 2 and 3, except as in RR No. 5.278) can coexist in the band 430-440 MHz, by taking appropriate technical and operational measures defined in Annex 1 to this Recommendation;
- j) that in addition, the provisions of RR Nos 5.274, 5.275, 5.276, 5.277, 5.278, 5.281 and 5.283 list countries that have defined portions of the band between 430 and 440 MHz as having primary status for the fixed, mobile, space operation and/or the amateur services;
- k) that some sharing studies have indicated that co-frequency sharing between the amateur services and some proposed SARs in the Earth exploration-satellite service (EESS) is possible for some amateur modes of transmission such as FM and time division multiple access (TDMA), but would be difficult with continuous wave and single sideband modes of operation;
- l) that Recommendation ITU-R M.1462 contains the technical and operational characteristics of, and protection criteria for, radars (airborne, shipborne, and space object tracking) operating in the radiolocation service operating in the band 420-450 MHz;
- m) that there is a potential for unacceptable interference from some spaceborne SARs to terrestrial space object tracking radars operating in the band 420-450 MHz if the spaceborne SAR radar is within the view of the terrestrial radars (i.e. above the radars' visible horizon);
- n) that some spaceborne SARs will be tracked by terrestrial space object tracking radars, and that the resultant unwanted received power level at a spaceborne SAR can approach its maximum power-handling capability;
- o) that there is a potential for unacceptable interference from some spaceborne SARs to airborne and shipborne radars operating in 420-450 MHz, the probability and severity of which is highly dependent upon the characteristics of the SARs;
- p) that any harmful interference, even for very short periods, by SARs into launch vehicle command destruct receivers could impede the safety of life and property;
- q) that given the complexity of the EESS (active) instruments implementation in these low frequencies, very few such platforms are expected to be in orbit at the same time,

recommends

- 1 that active spaceborne sensors operating in the bands used by the amateur service, the amateur satellite service, the fixed, radiolocation, space operation, mobile services and the MSS in the range 420-470 MHz, respect the technical and operational constraints provided in Annex 1 to this Recommendation;
- 2 that spaceborne active sensors operating in the range 420-450 MHz not be put into operation within view of the terrestrial space object tracking radars listed in Table 2, unless detailed analysis, on a case-by-case basis, to include consideration of the effects of the radars' receiver processing upon unwanted SAR signals, and possibly field testing have been performed to confirm compatibility with the mutual agreement of the affected administrations;
- 3 that a spaceborne SAR intended for operation in the 420-450 MHz band be designed to tolerate the unwanted signal power levels that will result from being tracked by terrestrial space object tracking radars;
- 4 that sufficient frequency and geographical separation between spaceborne SARs and wind profilers operating in the ranges 420-432 MHz and 438-450 MHz may need to be provided;
- 5 that spaceborne active sensor frequency bands be selected in such a way as not to overlap with launch vehicle range safety command destruct receive frequency bands listed in *considering f)*;

6 that in cases where *recommends* 5 becomes difficult to implement, spaceborne active sensors operating in the frequency ranges allocated for launch vehicle range safety command destruct receive frequency bands should not be put into operation within the specific distance of locations where launch vehicle commands are used, in order to avoid interference from spaceborne active sensors into launch vehicle receivers.

Annex 1

Technical and operational constraints for EESS (active) operating in the range 420-470 MHz

For the purposes of protecting stations operating in the existing services, SAR transmissions from stations in the EESS (active) operating in the frequency range 420-470 MHz are subject to the technical and operational constraints specified in this Annex.

The following constraints are based on ITU-R studies. Annex 2 provides information on the feasibility of sharing between active spaceborne sensors and other services in the range of 420-470 MHz.

1 Technical constraints

TABLE 1

Technical constraints for EESS (active) instruments
in the range 420-470 MHz

Parameter	Value
Peak pfd on Earth's surface from antenna main lobe	−140 dB(W/(m ² · Hz))
Maximum mean pfd on Earth's surface from antenna main lobe	−150 dB(W/(m ² · Hz))
Maximum mean pfd on Earth's surface from 1st antenna side lobe	−170 dB(W/(m ² · Hz))

2 Operational constraints

EESS (active) operating in the band 420-450 MHz shall not transmit within view of the terrestrial space object tracking radars listed in Table 2, unless detailed analysis, to include consideration of the effects of the radars' receiver processing upon unwanted SAR signals, and possibly field testing, have been performed to confirm compatibility.

As a consequence of the above constraints, EESS (active) instruments shall be designed in such a way as to allow programmable turning off of all RF emissions over geographical areas or countries where ITU regulations or national regulations do not allow their operations.

The EESS (active) instruments operation profile shall be campaign-oriented, targeted to specific geographical areas and shall limit the instrument active time to the minimum required to achieve the campaign objectives. Thus, the measurements carried out by the instrument do not require continuous operation of the instrument, and intervals of months between successive measurements on the same area can be expected.