RESOLUTION 677 (WRC-23)

Use of the frequency range 40-50 MHz allocated to the Earth exploration-satellite service (active) for spaceborne radar sounders

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that spaceborne active sensors operating in the Earth exploration-satellite service (EESS) (active), described in Recommendation ITU-R RS.2042, can provide unique information on the physical properties of the Earth, such as characteristics of polar ice sheets and subterranean fossil aquifers in desertic environments;

b) that spaceborne active remote sensing requires specific frequency ranges depending on the physical phenomena to be observed;

c) that worldwide, periodic measurements of subsurface water/ice deposits require the use of spaceborne radar sounder active sensors;

d) that the measurement of reflectivity from subsurface scattering layers as deep as 10-100 metres for shallow aquifers and groundwater conduits, and on the order of 5 km for basal interface topography and ice-sheet thickness, is necessary;

e) that spaceborne radar sounders operating in the EESS (active) are intended to be operated from polar orbits, only in either uninhabited, sparsely populated or remote areas, with particular focus on deserts and polar ice fields;

f) that the 40-50 MHz frequency range is preferable to satisfy all operational requirements for such spaceborne radar sounder active sensors,

recognizing

a) that, given the complexity of the EESS (active) instrument implementation in these low frequencies and the high investment costs associated with these observation missions, very few such platforms are expected to be in orbit at the same time; consequently, aggregate interference from multiple spaceborne radar sounders into incumbent services is not anticipated and could be mitigated by coordination between the operators of such instruments;

b) that measurements by these radar sounders are only possible when the total electron content of the ionosphere is near its daily minimum, which normally occurs in a window of a few hours, centred at approximately 4 a.m. local time;

c) that No. **21.16.8** provides the equation to determine mean power flux-density (pfd) values for the EESS (active);

d) that wind profiler radars in the VHF band are addressed in Resolution **217 (Rev.WRC-23)** and are ideally suited for meteorological measurements (wind, atmospheric turbulence, tropopause height) up to high altitudes of 20-25 km that cannot be accommodated in other frequency bands;

e) that coordination between operators of EESS (active) systems and operators of wind profiler radars in the 40-50 MHz band may be needed on a case-by-case basis to ensure coexistence between the corresponding stations, acknowledging that there is no compatibility issue between those stations when they operate in adjacent bands;

f) that, at a pfd level of −189 dB(W/(m^2 · 4 kHz)), EESS (active) systems are not functional or are in mute mode,

resolves

1 that the use of the frequency band 40-50 MHz by the EESS (active) is limited to spaceborne radar sounders, as described in the most recent version of Recommendation ITU-R RS.2042;

2 that, for the purpose of protecting in-band and adjacent-band services, the following conditions outlined in *resolves* 2.1 to 2.4 shall apply to the EESS (active) in the frequency band 40-50 MHz when the subsatellite[1] point is located within any of the following areas:

a) the spherical cap formed by latitudes between 72 and 90 degrees North;

b) the spherical cap formed by latitudes between 60 and 90 degrees South;

c) the quadrangle formed by latitudes between 59 and 72 degrees North and longitudes between 25 and 55 degrees West;

2.1 stations operating in the EESS (active) shall transmit within the areas defined in *resolves* 2 for no more than a total of 90 minutes within a 24-hour period;

2.2 the mean pfd level per spaceborne radar sounder produced at any given point on the surface of the Earth shall not exceed −147 dB(W/(m^2 · 4 kHz)), under clear sky propagation conditions, for more than 0.05% of the time within a 24-hour period;

2.3 the mean pfd level per spaceborne radar sounder produced at any given point on the surface of the Earth shall not exceed −136 dB(W/(m^2 · 4 kHz)), under clear sky propagation conditions;

[1] The subsatellite point is defined as the location of the projection of the satellite's nadir-pointing vector onto the Earth's surface.

2.4 if more than one spaceborne radar sounder is in operation:

– administrations shall ensure collectively that the pfd limit in *resolves* 2.2 is not exceeded for more than 0.1% of the time and shall have consultations accordingly;

– until such consultations enable to ensure compliance with that pfd limit, each system will have to ensure that the limit in *resolves* 2.2 is not exceeded for more than $0.1/N$% of the time, where N is the number of spaceborne radar sounders;

3 that, for the purpose of protecting in-band and adjacent-band services, the following conditions shall apply when the subsatellite point is located outside the areas provided in *resolves* 2;

3.1 in order to ensure that the spaceborne radar sounder is not operational or is in mute mode, the peak pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed −189 dB(W/(m^2 · 4 kHz)), under free-space propagation conditions;

3.2 for the use of the frequency band 40-50 MHz by the EESS (active) for operation of spaceborne radar sounders outside the areas defined in *resolves* 2, if the pfd level of −189 dB(W/(m^2 · 4 kHz)) per spaceborne radar sounder produced at the surface of the Earth over the territory of any administration is exceeded, this exceedance is only permitted subject to an explicit agreement obtained;

3.3 stations operating in the EESS (active) in the 40-50 MHz frequency band shall not claim protection from stations operating in the radiolocation service in the frequency bands 42-42.5 MHz in Region 1, 41-44 MHz in countries included in No. **5.161,** and 46-50 MHz in countries included in No. **5.162A**; No. **5.43A** does not apply,

invites the ITU Radiocommunication Sector

to regularly review the number and characteristics of spaceborne radar sounders and the application of *resolves* 2.4 by Member States concerned,

instructs the Radiocommunication Bureau

to ensure the examination of the maximum pfd level given in *resolves* 2.3,

instructs the Director of the Radiocommunication Bureau

to report to future competent world radiocommunication conferences on the number of EESS satellites in operation in the frequency band 40-50 MHz and on the application of *resolves* 2.4 above.