



Radio astronomy spectrum impacted by WRC23 mobile service agenda items

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Abstract

The agenda of the 39th World Radiocommunications Conference (WRC23) planned to be held in autumn 2023 includes several agenda items for new frequency allocations or upgrades to the spectrum used by mobile services. This includes new frequency allocations for the International Mobile Telecommunications (IMT) services, upgrades to aeronautical mobile services and enhanced regulatory provisions for the maritime mobile services. The proposed changes to the radio spectrum regulations under these agenda items could directly impact several frequency bands allocated to the Radio Astronomy Service (RAS). Sharing and compatibility studies during the current cycle would be required to ensure proper protection for RAS as a passive service in these bands.

1 Introduction

The protection of RAS is a recurring activity during every cycle of the World Radiocommunications Conference. Several items for the various radiocommunication services in the agenda of the next WRC23 are related to RAS frequencies. Among these are agenda items of mobile services such as IMT, aeronautical mobile service and maritime mobile service, including the Global Maritime Distress and Safety System (GMDSS).

A regular agenda item for several consecutive conferences now continues with new candidate frequencies for IMT in the mid-band range. Also, the introduction of high-altitude platform stations as IMT base stations (HIBS) would require compatibility studies to mitigate the risk of additional visibility of high base stations by radio telescopes. New allocations for non-safety aeronautical mobile applications for air-air, ground-air and air-ground communications of aircraft systems are adjacent to RAS primary bands. Proposed regulatory provisions for the maritime mobile services through the introduction of a new satellite operator providing GMDSS services would also require sharing studies with RAS frequencies.

The discussions on the various agenda items are still at a preliminary stage. Studies to evaluate the impact on the RAS allocated bands should commence by late 2021. In this paper, a preliminary overview on the impacted RAS bands is summarized.

2 Mobile services at WRC23

2.1 IMT

New identifications of the frequency bands 3 300–3 400 MHz, 3 600–3 800 MHz, 6 425–7 025 MHz, 7 025–7 125 MHz and 10.0–10.5 GHz for IMT are proposed under agenda item 1.2. WRC19 Resolution 245 limited the sharing and compatibility studies only for the services that have primary allocation in these bands. There are no primary allocations for RAS in these bands. The bands 3 300–3 400 MHz and 6 425–7 025 MHz are overlapping with the RAS bands 3 332–3 339 MHz, 3 345.8–3 352.5 MHz and 6 650–6 675.2 MHz protected by RR No. 5.149. The footnote urges administrations to take all practicable steps to protect the radio astronomy service from harmful interference. In case no sharing and compatibility studies will be made under this agenda item, RAS would support no change for the radio regulations in these bands. For any new allocations to IMT in the 10–10.5 GHz band, compatibility studies will be required for the primary RAS band 10.6–10.7 GHz.

Table 1. Candidate bands for IMT new allocations under agenda item 1.2

IMT candidate bands	Impacted RAS bands
3 300–3 800 MHz	3 332–3 339 MHz, 3 345.8–3 352.5 MHz
6 425–7 125 MHz	6 650–6 675.2 MHz
10.0–10.5 GHz (Region 2)	10.6 – 10.7 GHz

Using high-altitude platform stations as IMT base stations (HIBS) as part of terrestrial IMT networks is proposed under agenda item 1.4. The proposed frequency bands for global and regional harmonization are 694–960 MHz; 1 710–1 885 MHz; and 2 500–2 690 MHz. The band 2 500–2 690 MHz is adjacent to the RAS primary band 2 690–2 700 MHz (RR No. 5.340). The RAS bands 1 718.8–1 722.2 MHz and 2 655–2 690 MHz are included under RR No. 5.149. In addition, second harmonics spurious emissions from the systems operating in the band 694–960 MHz may fall into the important RAS bands 1 330–1 400 MHz (5.149), 1 400–1 427 MHz (primary, passive, 5.340) 1 610.6–1 613.8 MHz and 1 660–1 670 MHz (primary, 5.149). Compatibility studies will be required for the above-mentioned bands taking into account the characteristics of HIBS and their deployment nature.

Table 2. Candidate bands for HIBS under agenda item 1.4

HIBS candidate bands	Impacted RAS bands
694-960 MHz	2 nd harmonics into RAS primary 1 400 – 1 427 MHz, 1 610.6 – 1613.8 MHz, and 1 660 – 1 670 MHz bands
1710 – 1885 MHz	1718.8 - 1722.2 MHz (RR 5.149)
2500 – 2690 MHz	2690 – 2700 (RR 5.340) 2655 – 2690 MHz (RR 5.149)

2.2 Aeronautical mobile services

Additional allocations for new non-safety aeronautical mobile applications for air-air, ground-air and air-ground communications of aircraft systems are proposed under agenda item 1.10. The primary generic mobile global allocation at the band 22–22.21 GHz will be a candidate for these applications by studying possible revision or deletion of the “except aeronautical mobile” restriction in the allocation table. Additionally, a new allocation is proposed in the band 15.4–15.7 GHz, a band that is already used by aeronautical radio navigation.

The frequency band 22–22.21 GHz is adjacent to the frequency band 22.21–22.5 GHz which is allocated to the RAS, the Earth exploration-satellite service (passive) and the space research service (passive) on a primary basis. The frequency band 15.4–15.7 GHz is adjacent to the frequency band 15.35–15.4 GHz which is allocated to the RAS on a primary basis (RR No. 5.340). The band 22.01–22.21 GHz is also covered by RR No. 5.149, which urges administrations to take all practicable steps to protect the radio astronomy service.

The H₂O-band 22.21-22.5 GHz is one of the most important for spectroscopy for radio astronomy. While the band 15.35-15.4 GHz is an important radio astronomy band in the continuum series that provides some of the best angular resolutions for monitoring the intensity variability of the enigmatic quasars. Observations in the band is usually widened to 15.3-15.55 GHz. Compatibility studies will be required for RAS protection taking into account the characteristics of aeronautical mobile services under this agenda item.

Table 3. Candidate bands for aeronautical mobile services under agenda item 1.10

Aeronautical mobile candidate bands	Impacted RAS bands
22-22.21 GHz	22.21 – 22.5 GHz (Primary) 22.01 – 22.21 GHz (5.149)
15.4-15.7 GHz	15.35-15.4 GHz (Primary, 5.340)

2.3 Maritime mobile services

The Chinese satellite network BEIDOU is a candidate to join the GMDSS services under agenda item 1.11. The BEIDOU network is a geostationary satellite system using the frequency bands 1 610–1 626.5 MHz (Earth-to-space) and 2 483.5–2 500 MHz (space-to-Earth).

For the candidate satellite system the uplink band will be overlapping with the RAS spectral lines in the primary 1 610.6–1 613.8 MHz band. It can be foreseen that in order to protect the RAS stations, the new satellite user terminals will need to implement geofencing or geolocation mechanisms around the RAS observatories.

Also, second harmonics from the 2 483.5–2 500 MHz (space-to-Earth) could fall into the RAS bands, 4 990–5 000 MHz (primary, 5.149) and 4 950–4 990 MHz (secondary, 5.149). This is also supported by RR 5.402 that urges administrations to take all practicable steps to prevent harmful interference to the radio astronomy service from emissions in the 2 483.5-2 500 MHz band, especially those caused by second harmonic radiation that would fall into the 4 990-5 000 MHz band allocated to RAS worldwide. Accordingly, studies will be required for the protection of the RAS band 4 950–5 000 MHz from second harmonics in the downlink band 2 483.5–2 500 MHz.

Table 4. Bands used by the new GMDSS satellite operator under agenda item 1.11

GMDSS new operator bands	Impacted RAS bands
1 610 – 1626.5 MHz	1 610.6 – 1613.8 MHz (Primary)
2483.5 – 2500 MHz	4990 - 5000 MHz (5.402)

3 Summary

A preliminary overview on the RAS frequencies that could be impacted by the regulatory provisions proposed under WRC23 agenda items of mobile services is presented. Agenda items 1.2 and 1.4 for IMT new allocations and introduction of HIBS will require compatibility studies while taking into account harmonically related frequencies. Similarly, aeronautical mobile services proposed allocations under agenda item 1.10 might require strict operational constraints to avoid causing data loss in the adjacent primary RAS bands. The introduction of a new satellite system for GMDSS services under agenda item 1.11 should take into account the protection from harmful interference in frequencies shared with or harmonically related to the RAS bands.

The listed agenda items are those determined at this preliminary stage in the study cycle. Other items in the WRC23 agenda for mobile services might still show relevance to RAS bands at later stages.