

UPDATE ON ACTIVITIES OF THE U.S. NATIONAL ACADEMIES' COMMITTEE ON RADIO FREQUENCIES & Views on WRC-23

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Scientific Use of the Spectrum:

- Radio Astronomy Service (RAS): origins and evolution of the Universe; chemistry and formation of stars and solar systems; matter in extreme environments; gravitational radiation; solar activity.
- Earth Exploration-Satellite Service (EESS): critical tool for predicting weather & investigating climate change; satellites provide data on issues including food, transportation, energy, and national security.
- Represents billions of \$\$\$ in federal investment in numerous satellites and radio observatories.

Spectrum Management:

- Radio spectrum shared between commercial, governmental, and scientific uses.
- Passive observations are particularly vulnerable to RFI given the intrinsically weak nature of the signals being observed – our signal is their noise.
- These frequencies are largely dictated by the fundamental properties of nature, such as the opacity of Earth's atmosphere and the location of spectral signatures of molecules.
- Radio regulations are international & domestic.
- Increasing commercial demand/usage for radio frequencies. For example, 5G technologies are pushing to higher frequencies for increased bandwidth.
- **Increased need for spectral sharing and coordination. It is difficult to reverse regulations and recover spectrum when passive services are negatively impacted.**

Acronyms:

FCC: U.S. Federal Communications Commission
 FSS: Fixed-Satellite Service
 GSO: geostationary orbit
 IMT: International Mobile Telecommunications
 ITU: International Telecommunications Union
 RFI: Radio Frequency Interference



ESIM: Earth Stations in Motion
 Aircraft, maritime, land (17.7-20.2 GHz & 27.5-30 GHz);
 (www.itu.int)

Views of US National Academies on Agenda Items at WRC-23 (report released 4 June 2021)

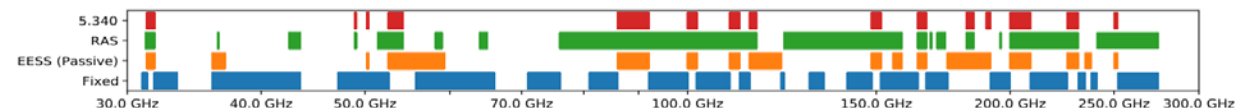
Background: Every 3 - 5 years, the ITU convenes a World Radiocommunication Conference (WRC) that revises the Radio Regulations (RR).

- Agenda Items identify possible changes to the RR and initiate sharing and compatibility studies to be completed in advance of the next WRC.
- Between WRCs, stakeholders work to develop possible ways to address the various items on the WRC agenda.

WRC-23 Views: Numerous WRC-23 and WRC-27 agenda items have potential impact on the passive science services. Views report summarizes significant concerns, including:

- Out-of-band and spurious emissions, including intermodulation products and harmonics.
- Aggregate emissions, particularly from mobile devices that are intermittent and difficult to remediate.

- 1.2** Allocations for IMT at 3.3-3.4, 3.6-3.8, 6.425-7.125, and 10.0-10.5 GHz (AMSR2/3; GMI; CIMR)
- Concerns re: aggregate interference, recommend primary allocations for bands currently only listed in RR 5.149 & RR 5.458
- 1.10** Allocations to the Aeronautical Mobile Service at 15.4-15.7 and 22-22.1 GHz (DMSP SSMI/S)
- If additional allocations are considered at 22.0-22.1 GHz, consider a primary allocation at 22.0-22.21 GHz band.
- 1.14** Allocation to the Earth Exploration Satellite Service (EESS) passive in 231.5-252 GHz
- New EESS (passive) allocation would provide unique information on cloud ice particles in the mid-upper troposphere.
- 1.15** GSO-ESIMs at 12.75-13.25 GHz
- Concerns about out-of-band emission into adjacent EESS (active) allocation at 13.25-13.75GHz; sharing studies needed
- Altimeters, scatterometers & precipitation radars: sea-ice elevation & thickness, sea surface height & significant wave height.
- {1.16** non-GSO-ESIMs at 17.7-18.6, 18.8-19.3, and 19.7-20.2 GHz, 27.5 GHz and 29.5 GHz ...
- 1.17** Inter-satellite links at 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz, and 27.5-30 GHz)
- Concerns regarding adjacent EESS (passive) allocation at 18.6-18.8 GHz and direct-beam coupling into "space view" of EESS (passive) sensors. Recommend that out-of-band emission masks and/or guard bands should be required that the ITU-R RS.2017 interference threshold, in the aggregate, is not exceeded in the 18.6-18.8 GHz band.
- 9.1 Topic D:** Protection of EESS(passive) from non-GSO at 36-37 GHz
- Recommend considering aggregate emissions and paying attention to potential damage to EESS (passive) sensors.



Distribution of primary allocations in the International Table of Frequency Allocations. **Fixed Services (blue), EESS (passive; orange), RAS (green).** Bands with RR 5.340 **"All emissions prohibited" protection (red).**

References

National Academies of Sciences, Engineering, and Medicine, Handbook of Frequency Allocations and Spectrum Protection for Scientific Uses: Second Edition, The National Academies Press, Washington, D.C., 2015

National Academies of Sciences, Engineering, and Medicine. 2021. Views of the U.S. National Academies of Sciences, Engineering, and Medicine on Agenda Items at Issue at the World Radiocommunication Conference 2023. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26080>.

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