



Space Communications and Navigation

CORF: Spectrum Policy Considerations above 70 GHz

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15 October 2020

Agenda

Pros and Cons of spectrum above 70 GHz

Radio wave propagation considerations

Existing uses by science (Passive sensing & radio astronomy)

WRC-23/27 Agenda Items of Interest to the sciences

- **AI 1.14 (Passive sensing in 231.5-252 GHz)**
- **AI 2.1 (Radiolocation in 231.5-276 GHz and 275-700 GHz)**
- **AI 2.4, 2.5, 2.7 (Fixed-satellite Service in 71-76 GHz and 81-86 GHz)**

Formulating policy based on science

Spectrum above 70 GHz: Pros and Cons

Pros:

- **Smaller antennas/More directionality**
- **More bandwidth**
- **Less congested spectrum – for now**

Cons:

- **Table of allocations above 70 GHz was developed long before there was technology ready to operate**
 - ITU Radio Regulations 1968 went to 40 GHz; extended to 275 GHz in edition of 1971
 - “May” not reflect modern technology or requirements
- **Not all device characteristics are not well-defined (Chicken and the Egg)**
- **Above 275 GHz, there are no allocations domestically or internationally**
 - Frequency ranges are identified for use by passive sensing and radio astronomy in the frequency range 275-1000 GHz (RR No. 5.565) (Extended from 400 GHz to 1000 GHz at WRC-2000)
 - Frequency ranges are identified for use by fixed and land-mobile applications in the frequency range 275-450 GHz (5.564A) (WRC-19)
 - No priority is given to any application

Radio Wave Propagation Considerations

Higher frequencies (> 70 GHz) tend to have propagation characteristics that make certain frequencies more or less suitable for specific applications

- Indoor or short path-length devices
- Penetration of surfaces becomes more difficult
- Atmospheric losses may be higher
 - Good for shorter range applications
 - Atmospheric windows do exist; often used by passive sensors or radio astronomy

Considerations from a sharing and compatibility perspective:

- How to model deployment/aggregation
- Amount of outdoor use(s)

Some scientific uses of spectrum above 70 GHz

Earth exploration-satellite service (passive)

- **Phenomena monitored above 70 GHz**
 - Snow/Ice
 - Sea surface conditions
 - Clouds
 - Temperature profiles
 - Atmospheric chemistry
- **Uses**
 - Climate monitoring*
 - Providing data for numerical weather prediction models*
 - Pollution*

Radio Astronomy

- Line measurements (100's of MHz)
- Continuum measurements (10's of GHz)

* Policy about spectrum could impact other policy about public safety and/or environmental regulation

WRC-23/-27 Agenda Items of Interest (> 70 GHz)

Agenda Item 1.14 (WRC-23) “to review and consider possible adjustments of the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution 662 (WRC-19)”

- **Proposed by a group of European countries**
- **Many allocations related to passive sensing were agreed at WRC-2000**

Draft Agenda Item 2.1 (WRC-27) “to consider, in accordance with Resolution 663 (WRC-19), additional spectrum allocations to the radiolocation service on a co-primary basis in the frequency band 231.5-275 GHz and identification for radiolocation applications in frequency bands in the range 275-700 GHz for millimetre and sub-millimetre wave imaging systems”

- **To be used for active and passive detection of concealed objects/public safety/counter-terrorism**
- **Active systems would require bandwidths of > 30 GHz to achieve range resolutions on the order of one centimeter**
- **Passive systems would require wide bandwidths larger than those currently allocated to receive enough power for detection**

WRC-27 Draft Agenda Items 2.4, 2.5, and 2.7

All consider satellite operations in 71-76 GHz and 81-86 GHz

- **Draft Agenda Item 2.4 – Compatibility with the fixed service**
- **Draft Agenda Item 2.5 – Compatibility with passive services**
- **Draft Agenda Item 2.7 – Compatibility with the fixed-satellite service**

Science services have interest in protecting:

- **Radio astronomy in 76-77.5 GHz, 79-81 GHz, and 84-92 GHz**
- **Passive sensing in 86-92 GHz**

Radio Regulation 5.340 states that in 86-92 GHz, “all emissions are prohibited”

Out of band emissions into radio astronomy sites and space-based passive sensors are modeled very differently

Formulating policy based on science

ITU-R four-year study cycle

ITU-R Conference Preparatory Meeting (CPM-23/1) has assigned the Agenda Items to “Responsible” and “Contributing” groups

Policies/Regulations need to be based on science but...

- **How to model future technologies which may not exist yet?**
- **Even technologies which exist probably do not have global deployments without allocations or spectrum identifications**
- **Predicting how existing technologies will evolve**

Communication between communities of technology operators is essential



Thank you!

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