ITU WRC-19 Spectrum Policy Results

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The International Telecommunication Union's (ITU) World Radiocommunication Conference 2019 (WRC-19) convened in Sharm el-Sheikh, Egypt, from 28 October to 22 November 2019. The conference had about 3000 delegates from around the world. These conferences are held every three to four years. Previous columns of this series have discussed aspects of WRC-19, a major news event in the radio technology community. [1] It is the function of WRC to review, and if necessary, revise the ITU Radio Regulations [2], the international treaty governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits. Revisions are made on the basis of an agenda determined by the ITU Council, which takes into account recommendations made by previous World Radiocommunication Conferences. [3] The WRC-19 agenda [4] included about 25 items spanning a wide variety of radio services. ITU Secretary-General Houlin Zhao said at the end of the conference [5]: "WRC-19 paves the way for new, more innovative ways to connect the world using both terrestrial and space-based communication technologies. As leading edge broadband technology manifests itself in new industrial developments, people in the remotest areas will also get better and more affordable access."

The Provisional Final Acts of the conference are now available[6] and document, in 567 pages, all the conclusions that were reached on the agenda of the conference as well as agenda plans for future conferences in 2023 and 2027. The conclusions include both changes to the Radio Regulations as well as study requests to ITU-R, the international technical study groups that are part of the ITU spectrum process. A new version of the ITU Radio Regulations incorporating all the changes adopted is not yet available and is expected later in 2020.

There clearly is not enough space in this column to review all the issues addressed at WRC-19 and their outcomes. So we will discuss a few that are most likely to be of interest to readers and urge those with other interests to review the Provisional Final Acts as well as the technical press for coverage of the conference.

ITU identified [7] key outcomes of the conference that we will build our discussion around:

Additional Bands for 5G (known in ITU jargon as IMT-2020): Spectrum in the 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz bands, were identified for 5G. 45.5-47 and 47.2-48.2 GHz were not immediately identified on a worldwide basis primarily due to conflicts with other systems in China and Turkey. 4.8-4.99 GHz are now identified for 5G in 40 countries including China, South Africa, Nigeria, Gambia, Uruguay and Iran. The 24.25-27.5 GHz band had been the subject of controversy due to out-of-band emissions into the passive satellite band used for weather satellites at 23.6-24 GHz. This issue was resolved with a quantitative limit for base station emissions into the satellite band. The limit will become more restrictive in 2027 and equipment installed prior to that date with be grandfathered in as acceptable. This compromise will allow immediate rollout of 5G in this band while pressing manufacturers to decrease in the long term out-of-band emissions into the nearby passive band where they may impact weather prediction data.

Non-Geostationary Satellites: Regulatory procedures were established for non-geostationary satellite constellations in the fixed-satellite service [8], opening the skies to next-generation communication capabilities. Mega-constellations of satellites consisting of hundreds to thousands of spacecraft in low-Earth orbit are becoming a popular solution for global telecommunications, as well as remote sensing, space and upper atmosphere research, meteorology, astronomy, technology demonstration and education.

High-altitude Platform Stations (HAPS): Additional frequency bands were identified for High Altitude Platform Systems — radios on aerial platforms hovering in the stratosphere — to facilitate telecommunications within a wide coverage area below for affordable broadband access in rural and remote areas. These bands include 38-39.5 GHz globally and 21.4-22 and 24.25—27.5 GHz in Region 2.

Wi-Fi Networks: Regulatory provisions revised to accommodate both indoor and outdoor usage and the growth in demand for wireless access systems, including RLANs for end-user radio connections to public or private core networks, such as Wi-Fi, while limiting their interference into existing satellite services. The bands involved are 5150-5250, 5250-5350 and 5470-5725 MHz. Each band has different power limits to enable band sharing with incumbent users. For example, use of the 5250-5350 MHz band requires the national regulators try to limit most use to indoor locations only and outdoor use is subject to elevation angle based e.i.r.p. limits.

Railway Radiocommunication Systems Between Train and Trackside (RSTT): Resolution approved on railway radiocommunication systems to facilitate the deployment of railway train and trackside systems to meet the needs of a high-speed railway environment, in particular for train radio applications for improved railway traffic control, passenger safety and security for train operations.

Intelligent Transport Systems (ITS): ITU Recommendation (standard) approved to integrate ICTs in evolving Intelligent Transport Systems (ITS) to connect vehicles, improve traffic management and assist in safer driving.

Broadcasting-Satellite Service (BSS): Protection of frequency assignments, providing a priority mechanism for developing countries to regain access to spectrum orbit resources.

Global Maritime Distress and Safety System (GMDSS): Expanded coverage and enhanced capabilities for GMDSS.

Earth Stations in Motion (ESIM): The decision on ESIMs will connect people while in planes, ships, and trains to communication links with geostationary satellites. Previously, many satellite bands had the restriction that they could only be used for communications with fixed earth stations. Some of these bands are now shared with terrestrial services and require coordination to prevent interference. With today's technology, it is now possible to use high gain/narrow beam antennas on moving platforms for satellite communications, track location, and keep transmissions away from other radio services. Traditional frequency coordination procedures were based on static locations and did not anticipate this use of satellite spectrum by antennas in motion.

WRC-19 also included questions for ITU-R to study in the next four-year period as well as agenda items for the next two WRCs. The WRC-23 agenda includes the following items that might be of interest to readers of this publication:

- Possible identification of the frequency bands 3300-3400, 3600-3800, 6425-7025, 7025-7125 MHz and 10.0-10.5 GHz for 5G.
- Possible primary allocation of the band 3600-3800 MHz to mobile service within ITU Region 1.

- Possible use of high-altitude platform stations as 5G base stations in certain frequency bands below 2.7 GHz.

The preliminary agenda for WRC-27 includes the following items that also might be of interest to readers of this publication:

- Possible modification of ITU provisions for 5G use of 694-960 MHz by changing protection for another service in this band.
- Possible allocation somewhere in 1.5-5 GHz for the future development of narrowband mobile-satellite systems.
- Possible additional spectrum allocations to the mobile service in the frequency band 1300-1350 MHz to facilitate the future development of mobile-service applications.

At WRC-23 these preliminary items will be reviewed and more will be added for the final agenda for WRC-27.

WRC-19 also asked for various ITU-R technical studies that will inform future ITU spectrum policy deliberations. An example of this is Resolution 731 dealing with "Consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz". This request has six specific questions including "studies to determine if and under what conditions sharing is possible between active and passive services in the bands above 71 GHz, such as, but not limited to, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz."

Readers are advised that such spectrum policy issues need not be viewed as a "spectator sport," but are a legitimate part of communications engineering in the broad sense. While direct participation in such a conference usually requires years of active participation in national and international spectrum policy deliberations, and national level participation in conference preparation is subject to national government policies, participation in ITU-R deliberations is generally more accessible at both the national and international levels.

Some engineers around the world make such issues the focus of their career, but this need not be a binary choice. The author urges readers to become more knowledgeable in such issues and consider getting involved in their country's ITU-R activities that will contribute to future ITU WRCs. Universities and private entities may also join ITU-R individually and participate in studies independent of any national regulators. At present more than 160 universities worldwide have done so. [9]

References

[1] M.J. Marcus, "5G/Weather Satellite 24 GHz Spectrum Disagreement: Anatomy of a Spectrum Policy Issue", IEEE Wireless Comm Mag, Vol. 26, No. 4, p. 2-3 (August 2019); M.J. Marcus, "ITU WRC-19 Spectrum Policy Preview", IEEE Wireless Comm Mag, Vol. 26, No. 1, p. 9 (February 2019)
[2] https://www.itu.int/pub/R-REG-RR-2016
[3] https://www.itu.int/en/ITU-R/conferences/wrc/Pages/default.aspx
[4] https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0027PDFE.pdf
[5] https://www.itu.int/en/mediacentre/Pages/2019-PR24.aspx
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Biography

MICHAEL J. MARCUS (mjmarcus@marcus-spectrum.com) (S '66, M '72, SM '01, F '04) is Director of Marcus Spectrum Solutions, Cabin John, Maryland and adjunct professor at Virginia Tech's Bradley Department of Electrical and Computer Engineering. He retired from the Federal Communications Commission in 2004 after nearly 25 years in senior spectrum policy positions. While at FCC, he proposed and directed the policy developments that resulted in the bands used by Wi-Fi, Bluetooth, and licensed and unlicensed millimeter wave systems above 59 GHz. He was an exchange visitor from FCC to the Japanese spectrum regulator (now MIC) and has been a consultant to the European Commission and the Singapore regulator (now IMDA). During 2012-13 he was chair of the IEEE-USA Committee on Communication Policy and is now its vice chair for spectrum policy. In 2013, he was awarded the IEEE ComSoc Award for Public Service in the Field of Telecommunications "for pioneering spectrum policy initiatives that created modern unlicensed spectrum bands for applications that have changed our world." He received S.B. and Sc.D. degrees in electrical engineering from MIT.