Current ITU-R Study Group Issues of Likely Interest to Wireless Researchers

Michael J. Marcus

In previous columns of this column, we have made the point that spectrum policy does not have to be solely viewed as a "spectator sport." That is, wireless engineers need not view national and international spectrum policy actions as decisions that come from a distant and isolated governmental mechanism but rather from a process that they could have input into on key technical issues related to their research interests. While IEEE has many technical publications of interest to such researchers, so does the International Telecommunication Union (ITU). Most of these technical publications are developed in the process of developing spectrum policy decisions, and thus may have more immediate and direct impact on radio systems than many technical journals.

The ITU's Radiocommunication Standardization Sector (ITU-R) has a mission to "to ensure rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including those using satellite orbits, and to carry out studies and adopt recommendations on radiocommunication matters."[1] Much of this work, including preparation for the World Radiocommunication Conferences (WRCs) that take place every few years, is done in the six ITU-R study groups[2] that "develop the technical bases for decisions taken at WRCs and develop global standards (Recommendations), Reports and Handbooks on radiocommunication matters."[3] Final versions of these documents are available on the ITU's website without charge, although pending drafts are usually only available to participants in ITU-R deliberations. These final documents[4] often contain detailed technical information for the radio technology community on topics such as radio propagation calculations and other technical issues for radio system design.

While participation at WRCs is usually limited to those who make international spectrum policy a major focus of their careers, participation in ITU-R study groups, and their more specialized working parties, is accessible to technical experts in various radio disciplines who want to have an impact on *both* technical issues *and* related policy decisions. Participation in ongoing ITU-R study groups is a possible path to pursue technical research interests that also influence ITU and national policy for radio technology. The author urges readers to consider becoming involved in such deliberations *either* through their country's national ITU-R deliberations *or* through universities[5] and other private entities[6] that have joined ITU-R individually and that participate in studies independent of national regulators. At present more than 160 universities worldwide are ITU-R members. Opportunities to participate in ITU-R study groups through a country's national delegation should be discussed with the national spectrum regulator in that country, but collaboration with a university or private sector ITU-R member does not directly require governmental approval.

In the remainder of this article we give a sample of topics that are now being addressed in ITU-R study groups. The large total number of topics makes it impractical to review all in this issue; rather, we have selected a few that are likely to be of interest to readers that show the range of issues under consideration. These topics might also be interesting to students who are selecting thesis topics as they show radio technology questions of broad interest to the radio policy community, including manufacturers of such equipment.

The examples below are drawn from two sources: first, the ongoing studies that are part of the regular work of the ITU-R study groups and working parties[7] and second, the studies to be conducted that were approved in resolutions in the *Final Acts* of WRC-19[8] requesting ITU-R input for decisions at WRC-23. The WRC-19 invitations to ITU-R for studies have been recently consolidated in early ITU preparations for WRC-23.[9]

In the discussion below, the ITU designation of each issue is given. Issues beginning with a "Q" are from the ITU-R study list, while the others are resolutions from WRC-19 and in many cases are updates of requests for studies from earlier WRCs. Studies reflected in a WRC Resolution (Res.) through "invitation" have a higher priority in ITU-R than the other long-term Questions as results are needed for the next conference, in this case for WRC-23.

Resolution 145 "Use of the frequency band 27.9–28.2 GHz by high-altitude platform stations in the fixed service." This band is shared with the fixed service, and studies on appropriate interference mitigation techniques are requested as well as a recommended protection criterion that would allow interference-free sharing of this band. This work will be addressed in Working Party 5C.

Resolution 241 "Use of the frequency band 66-71 GHz for International Mobile Telecommunications (IMT) and coexistence with other applications of the mobile service." 66–71 GHz was identified for IMT/5G, which in this case will include both licensed and unlicensed operations depending on national regulator decisions. This Resolution calls for the ITU-R to develop harmonized frequency arrangements for the implementation of the terrestrial component of international moble telecommunications (IMT) in this band. This work will be addressed in Working Party 5D.

Resolution 242 "Terrestrial component of International Mobile Telecommunications in the frequency band 24.25–27.5 GHz." As explained in a previous column here,[10] this band has been very contentious due to concerns about possible interference to the passive Earth exploration-satellite service (EESS) band at 23.6–24 GHz used for weather forecasting. The Resolution calls for the development of an ITU-R Recommendation on methodologies for calculating coordination zones around EESS/SRS Earth stations in order to avoid harmful interference from IMT systems in the frequency band 25.5–27 GHz, among other actions. This work will be addressed in Working Party 5D and the Working Parties of Study Group 7.

Resolution 731 "Consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz." While passive allocations are a minor issue below 30 GHz, they are much more common and use a much larger faction of available spectrum above 71 GHz where technology is now becoming available for possible telecommunications use. This Resolution calls for studies to determine if and under what conditions sharing is possible between active and passive services in the bands above 71 GHz and to conduct studies to determine the specific conditions to be applied to the land mobile and fixed service applications to ensure the protection of EESS (passive) applications in the frequency bands 296–306 GHz, 313–318 GHz, and 333–356 GHz. This work will be addressed in a number of Working Parties.

Q. 208-1/1 "Alternative methods of national spectrum management." This requests studies of alternative spectrum management solutions to spectrum management problems, including the use of non-profit user groups and private sector spectrum management organizations. This question is addressed in Working Party 1B.

Q. 240/1 "Assessment of spectrum efficiency and economic value." This contains three enigmatic but key questions: What is the method to quantify spectrum efficiency? Which are the factors that define the economic value of spectrum? What is a general model to assess the economic value of spectrum? This question is addressed in Working Party 1B.

[1] https://www.itu.int/en/ITU-R/information/Pages/mission-statement.aspx

[2] https://www.itu.int/dms_pub/itu-r/opb/res/R-RES-R.4-8-2019-PDF-E.pdf

[3] https://www.itu.int/en/ITU-R/study-groups/Pages/default.aspx

[4] https://www.itu.int/pub/R-REC

[5] https://www.itu.int/en/join/academia/Pages/default.aspx

[6] https://www.itu.int/online/mm/scripts/gensel11?_memb=A

[7] https://www.itu.int/pub/R-QUE

[8] https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.13-2019-PDF-E.pdf

[9] ITU Radiocommunication Bureau, Results of the first session of the Conference Preparatory Meeting for WRC-23 (CPM23-1), Dec. 2019 at Annex 7 (https://www.itu.int/dms_pub/itu-r/md/00/ca/cir/R00-CA-CIR-0251!!PDF-E.pdf)

[10] M. J. Marcus, "5G/Weather Satellite 24 GHz Spectrum Disagreement: Anatomy of a Spectrum Policy Issue," *IEEE Wireless Commun.*, vol. 26, no. 4, Aug. 2019, pp. 4–5.

Q. 231-1/3 "The effect of electromagnetic emissions from man-made sources on the radiocommunication systems and networks." This asks how can the distribution of the radiation from individual unintentional transmitter sources be described and measured? This question is addressed in Working Party 3L.

Q. 204-6/3 "Propagation data and prediction methods required for terrestrial line-of-sight systems." This long-standing question seeks information on a variety of questions for modeling propagation loss for terrestrial systems and the impact of phenomena such as precipitation, diffraction, and multipath. This question is addressed in Working Party 3M.

Q. 201-1/4 "Frequency sharing between mobile-satellite services (MSS) and other services." MSS spectrum is shared with geostationary satellite spectrum, non-geostationary satellite spectrum, and terrestrial uses. What sharing techniques can be used by non-geostationary MSS systems in frequency bands shared with other services? What technical and operational means can be used to avoid interference between these types of users and hence increase the usage productivity of spectrum? This question is addressed in Working Party 4C.

Q. 1-6/5 "Interference protection ratios and minimum field strengths required in the land mobile services." Interference protection ratios are key limits to how much spectrum sharing is possible between different radio services and neighboring radio systems in a given radio sersvice. In most cases, it is not static as the signals involved are impacted by propagation fading. This question is addressed in Working Party 5A.

Q. 229-5/5 "Further development of the terrestrial component of IMT." This question is the umbrella question for basic long-term 5G issues. Included are: What are the overall objectives and user needs for the further development of IMT, beyond the work carried out so far by ITU-R on IMT? What are the new applications and service requirements associated with further development of IMT? What are the technical and operational issues, and spectrum-related issues for the further development of IMT and increasingly efficient use of spectrum? This question is addressed in Working Party 5D.

There are many more questions on a wide variety of radio technology topics all over the spectrum and dealing with a wide variety of radio services. They range from very technical issues to more policy-related issues. The author urges readers to review both the questions and resolutions given here and the others to see if there is a topic to which he/she can contribute. If so, consider seeking out an ITU-R member entity to participate in a working party or publish through other mechanisms your analysis and suggestions. Spectrum policy need not be a spectator sport — wireless researchers can get involved and contribute to the process!

Biography

Michael J. Marcus [S '66, M '72, SM '01, F '04] (mjmarcus@marcus-spectrum.com) 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.

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