



Remote Sensing and 5G at mm-Wave Frequencies: What Will We Learn from the 24 GHz Experience?

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International mobile telecommunications (IMT) is the generic term used by the International Telecommunication Union (ITU) community to designate broadband mobile systems. IMT-2020 (International Mobile Telecommunications for 2020 and beyond), issued in 2015, is among the sets of mobile standards defined and developed by the ITU, and, in particular, the one that broadly encompasses today's 5G mobile networks and services. 5G networks may be deployed from low-band (below 1 GHz), mid-band (from 1 to 7 GHz) to high-band (mm-Wave frequencies above 24 GHz).

The 24.25-27.5 GHz frequency band started being studied as a candidate for International Mobile Telecommunications for 2020 and beyond (IMT-2020) in 2016 under agenda item 1.13 of the World Radiocommunication Conference 2019 (WRC-19). IMT-2020 represents the 5G framework of radio standards developed by the ITU Radiocommunication Sector (ITU-R) based on mobile broadband technology. It should be noted that, the 25.25-27.5 GHz frequency band was already allocated worldwide to the mobile service on a co-primary basis, and the WRC-19 agenda item only sought to identify it for implementation of the terrestrial component of IMT.

The nearby 23.6-24.0 GHz band is allocated to passive scientific services, including the Earth Exploration Satellite Service (EESS) passive, on a primary basis. All emissions in this frequency range are prohibited by the ITU Radio Regulations [1]. Spaceborne microwave instruments use this band for atmospheric sounding to estimate the amount of water vapor and cloud liquid water, which are critical parameters for accurate and comprehensive climatology and weather forecasting. Since naturally occurring radio emissions in the 23.6-24.0 GHz band are very weak, the passive sensors, e.g., microwave sounders, that measure them are sensitive and vulnerable to interference.

In the framework of the preparatory studies for WRC-19, several relevant scientific institutions proposed out-of-band emissions limits from transmitters operating at 24.25-25.25 GHz, however the final decisions of WRC-19 did not follow these recommendations and looser limits were approved. Several steps were subsequently taken, both to implement the WRC-19 decision and to prepare for the potential impact of interference on remote sensing instruments operating within the 23.6-24.0 GHz band. Additionally, the rollout of 5G services in the 24 GHz band have been much slower than anticipated and it is not clear how much these systems have so far been deployed and how much more deployment is planned.

The presentation will cover the technical aspects on the compatibility between 5G at 24.25-27.5 GHz and passive remote sensing at 23.6-24.0 GHz, summarize the steps taken by the USA and Europe following the WRC-19 decisions and the current situation with respect to IMT deployment in the 24 GHz band, draw conclusions and discuss what could come next in the development of mobile wireless systems at mm-Wave frequencies, with a focus on potential impact on remote sensing.