Radio TechCheck
The NAB Labs Newsletter for Radio Broadcast Engineers
NAB LABS
November 3, 2014

To Infinity and Beyond: FCC Issues NOI on Use of Spectrum Above 24 GHz

On October 17, 2014, the FCC issued a Notice of Inquiry (FCC 14-154) on the potential for provision of mobile services in spectrum above 24 GHz—sometimes called the *millimeter-wave* (mmW) bands. The Commission points out up front that this examination is not a substitute for its other current efforts to obtain lower frequency spectrum for mobile services, but is intended to supplement those efforts and develop new spectrum for innovative future services, such as those contemplated in nascent 5G standards or for the Internet of Things (IoT).

The NOI remarks that earlier assumptions on the infeasibility of providing viable mobile service at such high frequencies—due to line-of-sight limitations, building-penetration difficulties and other propagation characteristics—are being challenged by current research and development, by which non-line-of-sight service and increased coverage are becoming increasingly possible. Moreover, these very limitations can be turned to advantages for certain applications because their constrained coverage areas allow high frequency re-use. The wavelengths involved also lend themselves to extremely directional applications through beam-forming and steering with active antennas. (An example in current consumer electronics is the WirelessHD [WiHD] standard, intended for "wireless HDMI" transmission over distances of up to 30 feet within a single room, using 7 GHz-wide channels in the 60 GHz band.)

Some of the possible targets for future services envisioned by the NOI include satisfying expected high traffic demands for wireless data with connectivity bandwidths of 10 Gbps or more, accompanied by low latency and high spectrum and power efficiencies. To achieve these goals it is predicted that—as opposed to traditional standalone service provision—new system architectures will need to be developed, which may integrate numerous, simultaneous transmissions on heterogeneous networks in multiple, widely spaced frequency bands, using diverse access technologies including large and small cells, device-to-device links, and in both licensed and unlicensed spectrum.

A broad survey of known work in this space to date is cited in the NOI, which seeks comment to identify further technology development and potential applications. It also inquires about suitable, specific frequency bands and interference mitigation techniques therein, as well as thoughts on appropriate licensing and authorization mechanisms. The latter is particularly important given the new "mesh-networking" topologies under consideration.

Specifically, the NOI asks for input on relevant antenna technology for base stations and mobile devices (e.g., MIMO and adaptive beam-forming), and seeks comment on bandwidth requirements, duplexing techniques, suitable modulation schemes and appropriate multiple-access methods.

Questions are also raised on system performance metrics, coverage requirements and suggested technical rules, for both point-to-point and broader distribution services.

While the NOI acknowledges that technology development is still in its early stages, it nevertheless asks for general input on appropriate channel plans, bandwidth and power limits and tolerances, out-of-band emission limits, antenna gains, and channel-loading requirements, particularly on how these parameters might contrast with current practice. Commenters are also asked to consider whether certain non-mobile services (e.g., backhaul links, point-to-multipoint services or fiber extension) might be feasible in this spectrum.

The NOI calls out specific bands already established above 24 GHz and their applications, and asks how new services might interoperate with existing services in these bands, or how existing parameters may need to change (e.g., bandwidth, channelization, allocation and licensing status, international considerations).

Finally, the NOI asks for comment on appropriate licensing procedures, such as what the size of licensed service areas should be, how to handle possible spectrum sharing (e.g., using automated frequency coordination and dynamic spectrum access), whether to consider hybrid licensed/unlicensed handoffs and prioritization (e.g., for managing outdoor-to-indoor transitions), and how to otherwise maximize spectrum usage at these high frequencies.

The NOI builds on material developed by the FCC Technology Advisory Council (TAC) and acts on its 2013 recommendation to initiate such an NOI. While the NOI specifically addresses frequencies up to the 70/80 GHz bands, the TAC investigations also looked at the applicability of operations in the 95-275 GHz bands, and even into the Terahertz region. A 2012 article in IEEE Spectrum Magazine, "The Truth about Terahertz," identifies the challenges of dealing with frequencies having such short wavelengths.

The FCC has received other input on how to treat high-frequency proposals. For example, IEEE-USA, an organizational unit of the Institute of Electrical and Electronics Engineers, noted in 2013 that the Commission's radio service rules end at an upper bound of 95 GHz, and filed a petition with the Commission meant to streamline Commission-sanctioned usage of frequencies above 95 GHz and encourage innovation in this frequency region. ET Docket 13-259 was established to collect comments on the proposal.

The current NOI (14-154) appears to open the door to a process of exploration for a new era of wireless transmission. Its results may ultimately have significant impact—for better or for worse—on the broadcasting industry.

Comments are due December 16, 2014, and Reply Comments due January 15, 2015.

The complete text of the NOI (43 pp) is here.

\

Important Dates and Upcoming Events

CCW + SATCON

November 12 - 13, 2014

New York, NY