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March 13, 2015

SUBMITTED ELECTRONICALLY

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Notice of Ex Parte Presentation

WT Docket No. 12-354, ***Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band***

Dear Ms. Dortch:

On March 11, 2015, the undersigned, John Hunter and Karri Kuoppamaki (via telephone), all of T-Mobile US, Inc. ("T-Mobile") met with Julius Knapp, Robert Pavlak and Navid Golshahi of the Office of Engineering and Technology and John Leibovitz, Chris Helzer, Paul Powell and Kamran Etemad of the Wireless Telecommunications Bureau regarding the above-referenced proceeding. The attached presentation was distributed at the meeting.

During the meeting, we described how carriers like T-Mobile may use the segments of the 3550-3650 MHz band (the "3.5 GHz band") proposed for Priority Access License ("PAL") and General Authorized Access ("GAA") use. We urged the Commission to adopt rules that are sufficiently flexible to accommodate a range of technology platforms. We explained that while T-Mobile is, and will continue to be, a significant user of Wi-Fi technology, it is also exploring the use of Licensed Assisted Access ("LAA") in, among others, the 3.5 GHz band. We noted the benefits of LAA and that it is compatible with other technologies, including Wi-Fi. Finally, we discussed how sharing among incumbents, PAL, and GAA users should operate and the role that the Spectrum Access System ("SAS") should play in the use of the 3.5 GHz band.

Pursuant to Section 1.1206(b)(2) of the Commission's rules, an electronic copy of this letter is being filed for inclusion in the above-referenced docket. A copy of this letter, along with the attachment distributed is also being provided to FCC staff that participated in the meeting.

Please direct any questions regarding this filing to the undersigned.

Respectfully submitted,

/s/ Steve B. Sharkey

Steve B. Sharkey
Chief Engineering and Technology Policy, Federal Regulatory Affairs

Attachment

cc (each electronically with attachment):
Julius Knapp
Robert Pavlak
Navid Golshahi
John Leibovitz
Chris Helzer
Paul Powell
Kamran Etemad

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Promoting Innovation in the 3.5 GHz Band

March 11, 2015

Overview

- Use of Access License ("PAL") Spectrum and General Authorized Access ("GAA") Spectrum
- Importance of Wi-Fi and Licensed Assisted Access ("LAA") technologies
- LAA and Wi-Fi Coexistence
- Technology Agnostic Rules for 3.5 GHz
- Spectrum Access System ("SAS") Operation

3.5 GHz PAL Spectrum

- 3.5 GHz provides an important opportunity to meet increasing capacity demand

- Making available sufficient spectrum with functional certainty for PAL use will drive investment to the band
  - Licensed spectrum necessary for highly reliable services

- PAL rules should provide the certainty carriers need to integrate the spectrum into existing networks for small cell operations, including backhaul and offload
  - sufficiently long terms
  - renewal expectancy
  - construction obligations
  - larger geographic areas
  - 10 megahertz blocks

3.5 GHz GAA Spectrum

- Carrier use of GAA spectrum will facilitate innovation, drive investment and advance sharing and efficient use of the spectrum
  - Unlicensed spectrum is an important augmentation to licensed spectrum
- GAA spectrum should not be limited by technology
  - Commission policy has correctly focused on the minimum technical and operational rules required for co-existence while maximizing flexibility for service and technology innovation
- Wi-Fi and LAA can efficiently co-exist

..the 3.5 GHz Band could be an "innovation band," where we can explore new methods of spectrum sharing and promote a *diverse array of network technologies*, with a focus on relatively low-powered applications.

President's Council of Advisors on Science and Technology (PCAST) Report

Wi-Fi and Uncarrier

- **Wi-Fi will continue to be an important technology for carriers for the foreseeable future**
  - T-Mobile has a long and proud history of using unlicensed spectrum
  - In 2007, T-Mobile introduced calling over Wi-Fi with HotSpot @Home™ using Unlicensed Mobile Access technology in the 2.4 GHz band

- **Uncarrier 7.0**
  - In 2014 T-Mobile launched Wi-Fi Worldwide and unveiled Personal CellSpots using Wi-Fi technology in the 2.4 and 5.8 GHz bands
    - Today, T-Mobile has 20.5 million customers on its network with Wi-Fi calling capabilities
    - Nearly 5 million T-Mobile customers use Wi-Fi calling each month
    - T-Mobile handles an average of 6.6 million Wi-Fi originated calls daily
  - T-Mobile unleashed Wi-Fi calling on Apple's iOS 8 platform

LAA Benefits to Consumers

- T-Mobile is testing LAA in existing unlicensed spectrum bands
  - LAA allows unlicensed spectrum to be aggregated with licensed spectrum to enhance the capacity of carrier systems while providing highly reliable services
  - Unlike current carrier use of Wi-Fi, LAA works with an operator's existing spectrum and network design in a robust and integrated fashion
- Benefits of LAA include:
  - Higher peak and average data speeds to smartphones and mobile broadband devices with reduced packet latencies
  - Brings all of LTE's efficiencies – sophisticated Quality of Service controls and robustness – to the unlicensed band in a way that would complement Wi-Fi access points, yet provides far greater coverage performance

LAA Compatibility with Wi-Fi

- LAA includes features to function as a good neighbor with other technologies
  - Similar, not superior, access to spectrum as other GAA users
  - Based on a premise of fair usage of the spectrum by all applications and services
- Technology features incorporated specifically to enhance sharing:
  - “listen before talk”
  - Reserves time slots for other technologies
  - Selects "cleanest" channel based on Wi-Fi and LTE measurements
  - Creates "on/off" time pattern when energy is sensed above specified level
  - Deactivates particular small cells when not in use
- 3.5 GHz is an ideal test bed for compatibility development among multiple technologies and services

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Technology Agnostic Rules for 3.5 GHz

- The FCC should not adopt rules that would require or restrict particular technologies in the 3.5 GHz band
  - Additional rules could have the effect of locking in outdated technologies
  - Additional obligations would contravene the FCC's policy of allowing all compatible technologies to be deployed, without picking winners and losers
- As long as the FCC establishes basic parameters designed to allow all technologies to work together as it has in Section 96.38 (*i.e.,* power, emission limits, etc.), there should be no further restrictions or specifications on how unlicensed spectrum can be used
- With respect to LAA in particular, no additional regulation is necessary because it many cases, it will be a better neighbor than other GAA technologies.

The Evolution of Sharing

- Sharing in Tier I and Tier II bands should be initially conservative and evolve as confidence and experience increases
- Tier I – Initial protection based on coordination or exclusion zones
  - Fixed exclusion zones in initial phase can be reduced and still provide sufficient protection
  - Subsequent phases will allow Tier II and III licensees more dynamic access based on sensing and certified SAS
    - Provides opportunity to gain confidence
  - Tier III GAA users should be required to employ geolocation technologies to prevent operation on incumbent channels in appropriate zone.

The Evolution of Sharing (cont.)

- Tier II - PALs should receive static licensed frequency assignments – they should not be dynamically controlled by the SAS database
  - Current network technology does not support dynamic assignment
  - Initially, GAA users may only have access to PAL frequencies in advance of PAL notifying SAS that channels are in operation. Once that occurs, there should be no opportunistic use of PAL channels by GAA users
  - As experience is gained there may be greater sharing opportunities

- Tier III - GAA users will be heaviest users of SAS
  - Should be required to report their location to SAS. In addition, SAS should be required to sense all GAA use in that area. Based on those reports, SAS can provide channel options
  - SAS should not be able to control GAA devices – just provide channel options
  - SAS should not balance coexistence between GAA devices and should be technology agnostic

Role of the SAS

- The SAS should not directly control devices or networks

- SAS is “Traffic Cop” that keeps track of which channels are available
  - Devices and network operators inform the SAS when they use or relinquish a channel
  - SAS combines knowledge of channel use gathered through direct sensing as well as device and operator reporting to determine channel availability
  - Operators and devices check SAS to find available channels, but final channel selection and operation should be determined by operator