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Microsoft

June 26, 2015

Ms. Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: ET Docket No. 15-105: Office of Engineering and Technology and Wireless Telecommunications Bureau Seek Information on Current Trends in LTE-U and LAA Technology

Dear Ms. Dortch:

The Commission's Public Notice on Long Term Evolution-Unlicensed (LTE-U) and Licensed Assisted Access (LAA) is serving its intended purpose of collecting information on "these technologies and the techniques they will implement to share spectrum with existing unlicensed operations and technologies such as Wi-Fi that are widely used by the public."[1] There appears to be wide agreement in the comments about the importance of co-existence mechanisms in unlicensed spectrum, as well as the importance of ensuring that LTE operated in unlicensed bands co-exists with Wi-Fi and other unlicensed technologies. However, there also appear to be a wide range of opinions on whether the various forms of unlicensed-LTE can achieve fair coexistence with Wi-Fi and other unlicensed technologies. Microsoft remains concerned about whether it will be possible to embed the technologies and techniques necessary for achieving fair coexistence in deployed unlicensed-LTE equipment so that implementation is not left to the discretion of the user of either unlicensed or licensed spectrum. The Commission should give LTE and Wi-Fi interests ample opportunity to work out their differences. If these efforts do not prove fruitful, we believe the Commission has a role to play as a convener, a facilitator, and a regulatory backstop.

Microsoft believes that LTE and Wi-Fi interests need to come to an agreement on a definition of, and mechanism(s) for achieving, fair coexistence between the different versions of unlicensed-LTE technologies and Wi-Fi. The simulation models and evaluation metrics used to develop the common definition and coexistence mechanisms should be appropriate for the high density deployment use cases – and there should be transparency in the process so that there is confidence in the results. In particular, Microsoft believes that the simulation models must include evaluation metrics that characterize how unlicensed LTE technologies may impact the delivery of real-time video and voice services over Wi-Fi in various high density deployment scenarios.

Overall, Microsoft is encouraged by those commenters who believe that a solution for unlicensed LTE to coexist fairly with unlicensed technologies is technically feasible. LTE-U presents more of a challenge because LTE-U is not an open technical standard, but a minimum technical specification.

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[1] Public Notice, *Office of Engineering and Technology and Wireless Telecommunications Bureau Seek Information on Current Trends in LTE-U and LAA Technology,* ET Docket No. 15-105, ("Public Notice") at 1.

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Additionally, even though LTE-U is built on top of 3GPP Release 10/11/12, the technology for coexistence with Wi-Fi is proprietary. Further, the definition and implementation of fair coexistence is left up to individual LTE-U Forum members. Nevertheless, there are efforts underway and successful demonstrations of what is possible have been made, albeit in limited and highly controlled environments. In general, we remain concerned whether it will be possible to embed the technologies and techniques necessary for achieving fair coexistence in deployed unlicensed-LTE equipment so that implementation is not left to the discretion of the user of either unlicensed or licensed spectrum.

Additionally, Microsoft notes that it appears that the two largest U.S. mobile operators each favor a different version of unlicensed LTE. LTE-U can be deployed starting next year, while LAA will be a global standard developed by 3GPP but will take a few more years for deployment to begin. It is highly likely that a few years from now LTE-U and LAA technologies will be operating side-by-side in the 5 GHz band. In this event, LTE-U and LAA will need to be able to co-exist when both technologies try to access the same unlicensed channel in high density deployments, while also ensuring both technologies coexist fairly with Wi-Fi.

Finally, we observe that, in several of the comments, communications between IEEE 802 and LTE-U Forum and between IEEE 802 and 3GPP were characterized as collaboration between these organizations.[2] However, IEEE 802 characterizes its communications with LTE-U Forum and 3GPP as of the time the comments were filed as not being part of any coordination.

> *"There has been no coordination between IEEE 802 and any standards body associated with LTE- U, because LTE-U was not developed by a standards body…*
> *With respect to LAA, it is the understanding of IEEE 802 that the only process "for coming to agreement on appropriate sharing characteristics to ensure coexistence with the IEEE 802.11 family of standards" is to work within the 3GPP organization. It is the understanding of IEEE 802 that 3GPP member companies will agree on sharing mechanisms and a definition of "fairness" without requiring agreement from stakeholders outside of 3GPP membership.*
>
> *There has been no coordination between 3GPP and IEEE 802 on LAA. However, IEEE 802 has had the following communications with 3GPP related to LAA…:"*[3]

As we stated in our comments, Microsoft's ideal is for stakeholders to work out "fair coexistence."[4] But, due to the inherent asymmetry of the situation, the Commission should encourage groups to work cooperatively on fair coexistence mechanisms that enable complementary technologies, such as unlicensed LTE and Wi-Fi, to co-exist. If these efforts do not prove fruitful, we believe the Commission has a role to play as a convener, a facilitator, and a regulatory backstop. Nothing in the submitted comments has caused us to change our view.

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[2] *See, e.g.,* Comments of Qualcomm, Inc. at 15-17.

[3] Letter of IEEE 802 LAN/MAN Standards Committee Chairman Paul Nikolich (June 8, 2015).

[4] Comments of Microsoft Corp. at 2.

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Importance of Simulation Models Reflecting Likely Deployment Scenarios

Microsoft agrees with AT&T that the Commission needs "a clear and concrete understanding of certain key terms"[5] and would take it a step further to say the Commission also needs to have a clear and concrete understanding of the models used by various stakeholders to make their arguments regarding fair coexistence.

Alcatel-Lucent points out that LTE deployment in the unlicensed spectrum is primarily a small cell deployment technology.[6] Both AT&T and Verizon state clearly that unlicensed LTE will be used when excess capacity is required in high-density deployments.[7] As a result, simulation models used to make arguments for fair coexistence must thoroughly examine high density deployment use cases. Further, these simulation models should reflect these high load factors using different (data) traffic mixes and the potential channel sizes for both unlicensed LTE and Wi-Fi.[8]

To date, the models seem most focused on identifying changes to throughput. Wi-Fi throughput is an important metric but by no means the only important one. We agree with Ruckus that the evaluation metrics for these simulation models must include jitter, packet loss, frame re-transmission rates, etc., in addition to looking at throughput.[9]

Fair Coexistence Would be Both Technologically and Competitively Neutral

The Public Notice states the Commission "has historically adopted rules that are technologically neutral and remains committed to this policy".[10] Several of the commenters discussed unlicensed LTE in the context of technology neutrality[11] as a primary reason for the Commission to take a completely hands-off approach on the co-existence issues discussed herein. The Commission has always viewed technological neutrality as a means to an end – that of achieving greater competition – rather than an end in itself. In particular, the Commission has applied technological neutrality to ensure that regulatory frameworks do not tip the competitive playing field. For example, in numerous instances, the Commission has adopted technical rules ensuring that users of spectrum protect other users of

[5] Comments of AT&T at 1.

[6] Comments of Alcatel-Lucent at 3.

[7] Comments of AT&T at 2; Comments of Verizon at 1.

[8] Channel sizes for 802.11 ac are 40 MHz and 80 MHz. The technical specification of LTE-U allows for up to 2 contiguous, 20 MHz channels. LAA, the channel bandwidth of the licensed carriers has not been defined but it appears that the LTE channels sizes currently under consideration are 5, 10, 15 and 20 MHz.

[9] Comments of Ruckus Wireless at 2.

[10] Public Notice at 2.

[11] *See, e.g.,* Comments of CTIA at 2; Comments of T-Mobile at 3; Comments of AT&T at 2.

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spectrum from harmful interference. Such rules are both technologically and competitively neutral even though they might limit a spectrum user's operations in some way. By this standard, Commission action ensuring that all devices and systems using unlicensed spectrum implement fair co-existence mechanisms would be technological neutral.

Conclusion

Microsoft believes that the Commission's Public Notice will give it greater visibility into unlicensed LTE technologies and the potential for these technologies to enable fair coexistence with other unlicensed users of the bands in which they operate. The use of unlicensed spectrum is so integral to our modern economy that it is in the public interest for the Commission to prevent significant consumer harms from occurring if fair coexistence between unlicensed LTE technologies and Wi-Fi cannot be implemented broadly[12]. Ideally the stakeholders will be able to work out a definition of fair coexistence and a mechanism to ensure that all manufacturers and operators implement those fair coexistence mechanisms. Real-world simulation models of different high density deployment scenarios are necessary to develop a common definition of fair coexistence. There must be transparency in the simulation models and testing process so that there is confidence in the results. While Microsoft hopes that these issues will be addressed through voluntary industry collaboration, the Commission must be available to serve as a regulatory backstop.

Respectfully Submitted,
/s/
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[12] http://research.microsoft.com/en-us/projects/spectrum/economic-significance-of-license-exempt-spectrum-report_thanki.pdf