

December 3, 2015

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: Written Ex Parte Communication
Current Trends in LTE-U and LAA Technology, ET Dkt. No. 15-105

Dear Ms. Dortch:

A recent filing by NCTA and certain other Wi-Fi interests (“NCTA *et al.*”) seeking to delay introduction of LTE in unlicensed spectrum bands (“LTE Unlicensed”) pending a formal review by a “standards-setting body” puts at risk the permissionless innovation that lies at the heart of the FCC’s unlicensed policy.¹ NCTA *et al.* want the Commission to impose a review process outside of its rules that will delay entry of a promising new technology at the expense of consumers and innovation. The Commission should reject this effort at unlicensed spectrum-squatting and reiterate its support for technological neutrality in the unlicensed bands.

By way of background, there are two types of LTE Unlicensed technologies in development today: LTE-U and Licensed Assisted Access (“LAA”). The LTE-U Forum developed LTE-U with a “coexistence-by-design” philosophy that makes it a good neighbor to Wi-Fi – often better than Wi-Fi is to itself.² LTE-U achieves this coexistence by only using unlicensed spectrum when necessary for capacity; constantly looking for a vacant (or, if not available, the least occupied) channel; operating on unlicensed spectrum for no longer than its proportionate share; and vacating the spectrum when not needed. Additionally, 3GPP is developing specifications for LAA, which features a “listen-before-talk” (“LBT”) protocol that is another technique to achieve coexistence with Wi-Fi.³ LTE-U’s “coexistence-by-design” and

¹ Letter from Boingo Wireless, Broadcom Corporation, Google, Hewlett-Packard, National Cable & Telecommunications Association, Paul Nikolich, and Ruckus Wireless, to Marlene H. Dortch, Secretary, FCC, ET Dkt. No. 15-105 (Oct. 21, 2015) (“NCTA *et al.* Letter”).

² The LTE-U Forum was formed in 2014 by Verizon in cooperation with Alcatel-Lucent, Ericsson, Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, and Samsung. See LTE-U Forum, <http://www.lteuforum.org/> (last visited Dec. 3, 2015). Multiple presentations demonstrate LTE-U coexistence with Wi-Fi. See, e.g., Qualcomm, New Tests in Collaboration with CableLabs Confirm LTE-U and Wi-Fi Fair Coexistence (Nov. 10, 2015), <https://www.qualcomm.com/news/onq/2015/11/10/new-tests-confirm-lte-u-and-wi-fi-fair-coexistence>; Signals Research Group, Wi-Fi / LTE-U Coexistence and the User Experience (Sept. 2015), <http://signalsresearch.com/issue/wi-fi-lte-u-coexistence-and-the-user-experience/> (“SRG Research Results”).

³ The 3rd Generation Partnership Project (“3GPP”) unites seven telecommunications standard development organizations – ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC – and “provides their

LAA's LBT are just two ways in which coexistence can be accomplished. As seen with LTE-U's "coexistence-by-design," the coexistence mechanism can be a technology differentiator improving the overall user experience for itself and other technologies within the unlicensed bands. Restricting or regulating this aspect of the technology potentially impacts innovation, its pace of evolution, and ultimately the end user experience.

Critically, proponents of LTE-U have engaged and continue to engage in constant technical collaboration. As detailed further below, LTE-U Forum members are strong Wi-Fi proponents and are working closely with other key Wi-Fi stakeholders to address their technical questions and concerns, and NCTA and others have been able to participate in that process. Indeed, while NCTA *et al.*'s filing characterizes LTE-U as a "non-standardized form of unlicensed LTE," it fails to mention that the LTE-U Forum has conducted itself as an open, transparent organization dedicated to developing a specification to coexist with Wi-Fi or that LTE-U is based on the existing 3GPP Release 10/11/12 specifications.⁴ In fact, the specification for LTE-U Carrier Sense Adaptive Transmission ("CSAT") or enhanced CSAT has been shared publicly and made available for review by interested parties.

NCTA et al.'s call for a formal standards review upends the permissionless innovation that is the hallmark of unlicensed spectrum policy.⁵ NCTA *et al.* want to convert the highly successful unlicensed model of permissionless innovation into a permission-based scheme that would require new technologies like LTE-U to go through a formal standards-setting process before the FCC would allow them to be introduced. In effect, NCTA *et al.* would have the Commission bar new entrant technologies by requiring proponents to obtain formal third-party "approval" for a new technology that otherwise fully complies with the Commission's unlicensed rules. Injecting a standards-body approval requirement, however, would be an unprecedented and unnecessary departure from the Commission's Part 15 policies.

The Part 15 rules are technology neutral and do not specify the types of technologies required to be used. Rather, the rules establish basic technical and operational parameters for unlicensed devices. As long as a device meets these basic parameters, it is permissible to operate in unlicensed bands.

members with a stable environment to produce the Reports and Specifications that define 3GPP technologies." See 3GPP, About 3GPP, <http://www.3gpp.org/about-3gpp> (last visited Dec. 3, 2015).

⁴ See Declaration of William Stone at ¶¶ 4, 6-10 (June 11, 2015), *appended to Verizon Comments*, ET Dkt. No. 15-105 (June 11, 2015); *Comments of Qualcomm Incorporated*, ET Dkt. No. 15-105, at 5, 11, 14 (June 11, 2015) ("Qualcomm Comments").

⁵ See Remarks of Commissioner Mignon Clyburn, Second Annual Americas Spectrum Management Conference (Oct. 23, 2012) ("Why has Wi-Fi been such a success? For one, unlicensed spectrum is a vibrantly free market: Anyone can innovate in this spectrum. And anyone can use these products. You do not need permission."); Statement of Commissioner Jessica Rosenworcel, FCC, Hearing Before the Senate Comm. on Commerce, Science & Transp., "Wireless Broadband and the Future of Spectrum Policy," at 5-6 (July 29, 2015) ("Unlicensed spectrum, like Wi-Fi, democratizes Internet access, encourages permissionless innovation, and contributes \$140 billion in economic activity annually.").

- *First, the rules require unlicensed devices to comply with basic technical parameters.* Through the equipment authorization process, manufacturers demonstrate that their devices will comply with the Commission’s Part 15 technical standards, including emission limits.⁶ These rules are “designed to ensure that there is a low probability that these devices will cause harmful interference to other users of the spectrum.”⁷
- *Second, the rules require unlicensed devices to operate on a non-interference / interference tolerance basis.* This means that unlicensed devices may not cause harmful interference to licensed users and must accept any interference they receive from other compliant devices. If a Part 15 transmitter does interfere with licensed communications, it must cease communications until the problem is corrected.⁸

It is undisputed that LTE-U devices will fully comply with these rules. The difference is that NCTA *et al.* seek to erect a separate set of requirements that would bar wireless providers from introducing the benefits of unlicensed LTE-U services to consumers indefinitely, while exempting their own unlicensed Wi-Fi services from those very same requirements.

NCTA *et al.*’s position is nakedly anti-competitive and contravenes FCC rules and practices. Apart from the core requirements identified above, unlicensed device manufacturers and operators are free to innovate by developing and using equipment that is appropriate for a particular application. Indeed, the power of the unlicensed framework, propelled by permissionless innovation, lies in what it does *not* require:

- *The rules do not mandate spectrum sharing conditions or protocols.* More than once, the Commission has found that unlicensed spectrum sharing “etiquette” mandates could stifle innovation or preclude the use of certain devices.⁹ Instead, the

⁶ See, e.g., 47 C.F.R. §§ 15.15, 15.101(a), 15.201(a).

⁷ *Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, First Report and Order, 29 FCC Rcd 4127, 4128 (2014).

⁸ 47 C.F.R. § 15.5.

⁹ See, e.g., *Modification of Parts 2 & 15 of the Commission’s Rules*, Order and Second Memorandum Opinion and Order, 29 FCC Rcd 6366, 6367-70 (2014) (declining to adopt a spectrum etiquette requirement, which could “potentially stifle innovation or preclude the use of certain types of devices”); *Modification of Parts 2 and 15 of the Commission’s Rules*, Report and Order, 19 FCC Rcd 13539, 13552-53 (2004) (declining to impose a spectrum etiquette for any Part 15 bands, citing the efficient use of unlicensed spectrum without a spectrum etiquette requirement and concern that such a requirement could limit unlicensed development). As the Commission has made clear, it does not make sense to “delay access” to unlicensed spectrum until industry develops standards or protocols to facilitate device compatibility, given the existence of technical rules and the ability for industry to “develop[] any voluntary standards that it deems appropriate in the future.” *Operation of Unlicensed NII Devices in the 5 GHz Band*, Report and Order, 12 FCC Rcd 1576, 1606 (1997).

Commission encourages industry stakeholders to voluntarily develop etiquette protocols that foster coexistence.¹⁰

- *The rules do not require a full standards-setting review process as a prerequisite to operate in unlicensed bands.* What the Commission has not done before – and should not do here – is make standards-body approval a gating factor required to introduce a new technology into the unlicensed bands. Such a result not only would contravene the basic permissionless innovation goals of unlicensed, it would also run counter to the many other equipment approvals issued by the Commission to “non-standards approved” devices and technologies that operate in unlicensed bands today.

Against this backdrop, and consistent with the Commission’s vision, LTE-U Forum members have been working closely with Wi-Fi stakeholders to ensure coexistence, and extensive tests have shown that LTE-U will not adversely impact Wi-Fi.

Many non-standardized technologies operate in the unlicensed bands. NCTA *et al.* ignore the presence of multiple technologies in the unlicensed bands, whether operating in the absence of formal standards or before they have been finalized, and focus only on LTE-U. Yet there are multiple unlicensed technologies that have not undergone formal review by an independent third party standards-setting body, like 3GPP or IEEE.¹¹ Cambium Networks, for instance, has deployed a solution in the 5 GHz unlicensed (U-NII) bands absent any formal standards-setting review process. According to its filing in this docket, Cambium has deployed more than four million radios around the world, delivering point-to-point wireless broadband access and backhaul solutions in rural areas.¹² These include devices approved by the FCC to operate with very high duty cycles in the 80-90% percent range,¹³ meaning they will be transmitting and using a channel nearly constantly. (LTE-U, by comparison, will use a duty cycle that is chosen adaptively based on the number of active Wi-Fi access points and their channel usage to allow equitable sharing with other devices using the same channel.¹⁴) The fact that NCTA *et al.* have not objected to these other technologies underscores that their campaign is about competition, not technology.

¹⁰ See *Operation of Unlicensed NII Devices in the 5 GHz Range*, 12 FCC Rcd at 1606 (encouraging the development of etiquette protocols through a voluntary cooperative approach).

¹¹ See RYSAVY RESEARCH, LTE AND 5G INNOVATION: IGNITING MOBILE BROADBAND 38 (Aug. 2015), http://www.4gamericas.org/files/9214/3991/2167/4G_Americas_Rysavy_Research_LTE_and_5G_Innovation_white_paper.pdf (citing, *e.g.*, LoRa, Sigfox, OnRamp Wireless, and Weightless technologies).

¹² Comments of Cambium Networks, Ltd., ET Dkt. No. 15-105, at 2-3 (June 11, 2015).

¹³ For example, in October 2015, the FCC issued grants of equipment authorization to Cambium for two non-standardized devices in the U-NII-1 band (QWP-45700 and QWP-50450I), and in February 2012, the FCC approved a non-standardized U-NII-3 device (QWP5X250).

¹⁴ See Qualcomm, R10-Based LTE-U Supports Early Launches of LTE in 5 GHz Unlicensed Spectrum with Wi-Fi Coexistence, <https://www.qualcomm.com/invention/research/projects/lte-unlicensed/r10-based-lte-u> (last visited Dec. 3, 2015).

In any event, a standards body review is no panacea. Adoption of a formal standard through a standards-setting body does not itself ensure peaceful coexistence among unlicensed users. Wi-Fi, under the IEEE 802.11 standard, does not have a coexistence testing specification, only an LBT protocol. This means that there is no enforcement mechanism to provide assurance of Wi-Fi coexistence. As Qualcomm has explained, “[c]urrently, there are some poor Wi-Fi implementations that are bad neighbors to Wi-Fi,” and while the Wi-Fi Alliance tests Wi-Fi equipment for interoperability, “it does not test for Wi-Fi to Wi-Fi coexistence.”¹⁵ As a result, fair coexistence among Wi-Fi nodes today is neither clearly defined nor achieved, even with standards-setting approval. By contrast, LTE-U includes extensive coexistence specifications to ensure that there will be no adverse impact on Wi-Fi.¹⁶

Tests have shown that LTE-U will be a better neighbor to Wi-Fi than Wi-Fi is to itself and collaborative efforts with Wi-Fi stakeholders continue. The LTE-U Forum designed LTE-U to be a good neighbor to Wi-Fi and other technologies sharing the unlicensed bands. The reason is obvious: mobile broadband customers rely on Wi-Fi every day and will continue to do so. This reliance demands that mobile broadband providers – including members of the LTE-U Forum – ensure that LTE-U and Wi-Fi coexist peacefully.¹⁷ And they do.¹⁸

LTE-U has been exhaustively tested for coexistence with Wi-Fi. Tests conducted by the Signals Research Group (an independent third-party assessor), Qualcomm, and the LTE-U Forum have shown that the two technologies work well together.¹⁹ Specifically, these test results

¹⁵ Qualcomm Comments at 18; *see also* Letter from Dean R. Brenner, Qualcomm, to Marlene H. Dortch, Secretary, FCC, ET Dkt. No. 15-105, at 2 (July 23, 2015).

¹⁶ *See* LTE-U FORUM, LTE-U SDL COEXISTENCE SPECIFICATIONS V1.3 (2015-10), http://www.lteuforum.org/uploads/3/5/6/8/3568127/lte-u_forum_lte-u_sdl_coexistence_specifications_v1.3.pdf.

¹⁷ *See, e.g.*, Stacey Black, *Supporting Innovation in Unlicensed Bands*, AT&T PUBLIC POLICY BLOG (Oct. 1, 2015), <http://www.attpublicpolicy.com/fcc/supporting-innovationin-unlicensed-bands/> (“AT&T and other wireless operators have more than 300 million devices deployed, many of which currently rely on Wi-Fi operations as an important part of the customer experience. It would run directly contrary to wireless industry interests to introduce new technologies that will cause interference with those Wi-Fi operations.”); Comments of T-Mobile, ET Dkt. No. 15-105, at 4 (June 11, 2015) (“T-Mobile has a particularly strong incentive – because of its leadership in integrating Wi-Fi and licensed technologies – to ensure effective co-existence.”); Verizon Reply Comments, ET Dkt. No. 15-105, at 4 (June 26, 2015) (“Verizon is a major Wi-Fi provider with a strong incentive to ensure nothing harms this important technology.”); *see also* Dean Brenner, *9 Myths About LTE-U – Setting the Record Straight*, QUALCOMM BLOG (Sept. 9, 2015), <https://www.qualcomm.com/news/onq/2015/09/09/9-myths-about-lte-u-setting-record-straight> (“All founding members of the LTE-U Forum are also members of the Wi-Fi Alliance, and they all have a substantial stake in the continued success of Wi-Fi.”).

¹⁸ *See, e.g.*, Letter from the LTE-U Forum and T-Mobile, to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC, ET Dkt. No. 15-105 (Sept. 9, 2015).

¹⁹ *See* SRG Research Results, *supra*; Qualcomm Comments at 4, 6-7, 13, 17-19, App. A (providing results of extensive coexistence tests performed by Qualcomm Research); Reply Comments of Qualcomm

show that adding an LTE-U small cell has no more impact on existing Wi-Fi hotspots than adding a new Wi-Fi hotspot; in fact, adding an LTE-U node actually causes *less* interference to existing Wi-Fi operations than a new Wi-Fi hotspot.²⁰

To ensure that LTE-U and Wi-Fi will coexist well and to address stakeholder questions and concerns, LTE-U Forum members have been collaborating for many months with key Wi-Fi stakeholders, including the Wi-Fi Alliance, CableLabs, and others in the cable industry. For example, in March 2015, the Wi-Fi Alliance and members of its Coexistence Task Group were given their first technical briefing on LTE-U. Two months later, Wi-Fi Alliance staff received a second technical briefing on LTE-U, along with an invitation to do LTE-U/Wi-Fi coexistence testing. The offer to test was declined. On May 28, 29 companies, including Wi-Fi Alliance, IEEE 802, CableLabs, and Google, attended a LTE-U workshop in San Diego. Based on the feedback provided by Wi-Fi stakeholders, additional test cases were added to the LTE-U Forum Coexistence Specification. In July, LTE-U Forum members gave a presentation on LTE-U/Wi-Fi coexistence to the IEEE 802.19 Wireless Coexistence Working Group. On August 29, presentations by IEEE 802.11, Wi-Fi Alliance, and other key stakeholders were given at the LAA industry workshop in Beijing. Most recently, LTE-U Forum members participated in a Wi-Fi Alliance LTE-U/Wi-Fi Coexistence Test Workshop on November 4, 2015. In addition to the events described above, there have been numerous one-on-one and multilateral meetings between LTE-U Forum members and Aruba, CableLabs, Cisco, Google, Microsoft, Ruckus, and other parties. Moreover, CableLabs has been invited to perform additional LTE-U/Wi-Fi coexistence testing.

NCTA et al.’s campaign is nothing more than an effort to impede new unlicensed technologies. At its core, NCTA *et al.*’s filing asserts that the introduction of LTE-U without standards-setting body approval will disrupt Wi-Fi operations and result in a “tragedy of the commons” in unlicensed spectrum. In point of fact, their campaign stands for the corollary principle – the “tragedy of the *uncommons*.” As Tom Hazlett explained, this corollary “results from use limitations that prevent over-exploitation by being too restrictive, leaving socially valuable uses unrealized.”²¹

Incorporated, ET Dkt. No. 15-105, at App. (June 26, 2015) (providing additional test results); LTE-U FORUM, LTE-U TECHNICAL REPORT, COEXISTENCE STUDY FOR LTE-U SDLV1.0 (Feb. 2015), *appended to Qualcomm Comments as App. B.*

²⁰ See SRG Research Results; *see also* Qualcomm Snapdragon 820 with X12 LTE: a First with LTE-U, https://www.youtube.com/watch?v=EalEd7fu_K0&feature=youtu.be&t=19s (last visited Dec. 3, 2015).

²¹ Thomas W. Hazlett, *The Wireless Craze, the Unlimited Bandwidth Myth, the Spectrum Auction Faux Pas, and the Punchline to Ronald Coase’s “Big Joke”*: An Essay on Airwave Allocation Policy, 14 HARV. J.L. & TECH. 335, 361 (2001) (“Hazlett”); *see also* Patrick S. Ryan, *Application of the Public-Trust Doctrine and Principles of Natural Resource Management to Electromagnetic Spectrum*, 10 MICH. TELECOMM. & TECH. L. REV. 285 (2004) (noting that under exploitation of a resource can be as problematic as overconsumption, and the “tragedy of the uncommons” results where “severe access restrictions leave socially valuable uses untappable”) (citing Hazlett).

Here, NCTA *et al.* want to preserve the status quo in “their” (unlicensed) spectrum: continued expansion of their offerings and denial of a new, promising technology that competitors are eager to deploy. In their view, it does not matter that “their” spectrum is unlicensed; more relevant is that they view themselves as incumbent users in the unlicensed bands and are keen to preclude new, innovative, competitive developments. According to Hazlett, “it would be tragic to ‘protect’ spectrum by blocking” such socially valuable uses.²² Yet this is exactly what NCTA *et al.* would have the FCC do here with respect to LTE-U. The Commission should adhere to its existing – and successful – permissionless approach to unlicensed spectrum, and decline invitations to needlessly stifle new technology.

Ironically, NCTA *et al.* allege that LTE-U proponents are acting non-cooperatively and are engineering a “prisoner’s dilemma” by seeking to enter the market without a formal standards body review – even though FCC rules do not require such review *and* test results show LTE-U is a good neighbor to Wi-Fi. The record shows that the LTE-U Forum and other advocates have undertaken extensive informal and formal outreach to the Wi-Fi community on coexistence, and are continuing to do so. NCTA *et al.* nonetheless continue to call for a formal standards-setting process, as it is they who “view the payoff of non-cooperation to be higher than the rewards of cooperation.”²³ Ultimately, they are doing nothing more than preserving their own perceived incumbent status at the expense of consumers and innovation in the unlicensed ecosystem.

* * *

NCTA *et al.* want to convert the highly successful unlicensed model of permissionless innovation into a permission-based scheme that would require a new technology like LTE-U to go through a formal standards-setting process before it could be introduced. The Commission should reject NCTA *et al.*’s efforts, and confirm its commitment to technological neutrality in the unlicensed bands.

Pursuant to Section 1.1206 of the Commission’s rules, 47 C.F.R. § 1.1206, this letter is being electronically filed via ECFS. If you have any questions, please do not hesitate to contact me.

Sincerely,

/s/ Scott K. Bergmann
Vice President Regulatory Affairs
CTIA – The Wireless Association®

²² Hazlett at 359.

²³ See NCTA *et al.* Letter at 6.