

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

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

COMMENTS OF CTIA – THE WIRELESS ASSOCIATION®

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I. INTRODUCTION AND SUMMARY.

CTIA – The Wireless Association® (“CTIA”) hereby files these comments in response to the Commission’s *Public Notice* seeking information on the development of LTE-Unlicensed (“LTE-U”) and Licensed Assisted Access (“LAA”) technologies.¹ To provide the expected level of mobile broadband service required by the public, wireless providers are increasingly looking to make efficient use of spectrum resources, including the use of both licensed and unlicensed frequency bands. Over the past several years, the wireless industry has devoted significant effort to the development of technologies to make efficient use of unlicensed spectrum, including the utilization of Wi-Fi technologies in unlicensed spectrum and investigation of the use of LTE technology under Part 15 of the Commission’s rules, which will allow the benefits of LTE to be achieved in unlicensed spectrum. LTE-U and LAA development efforts are nearing the point where commercial deployment could begin. The Commission should therefore avoid engaging in unnecessary regulatory oversight that would slow these important innovations. In particular, CTIA shares the following observations regarding Part 15 LTE services:

¹ Office of Engineering and Technology and Wireless Telecommunications Bureau Seeks *Information on Current Trends in LTE-U and LAA Technology*, Public Notice, DA 15-516 (rel. May 5, 2015) (“*Public Notice*”).

- **The Commission should maintain its policy of technology neutrality for unlicensed services and adopt only minimal technical requirements.** This approach will allow parties to continue to innovate and to develop high-quality unlicensed services for consumers.
- **The two technologies utilizing LTE technology currently under development share many common technical traits but also have key differences.** These technical differences should continue to be managed by industry standards bodies, and the marketplace should ultimately determine the best technical approach to providing LTE technology under Part 15.
- **Wi-Fi will continue to play a vital role in the provision of mobile services, and it is essential that the Commission allow the wireless industry to manage coexistence between unlicensed LTE, Wi-Fi, and other Part 15 operations.** The wireless industry will continue to provide evidence of coexistence with Wi-Fi and work cooperatively to ensure that any use of LTE under Part 15 will not present concerns to other Part 15 operations.

By maintaining its hands-off, technically neutral approach to the development of LTE technology under Part 15, the Commission will allow the wireless industry to deploy mobile broadband services that will deliver to consumers higher data rates, reduced network latency, and seamless transitions between unlicensed and licensed spectrum.

II. INTEGRATION OF LTE TECHNOLOGIES INTO THE COMMISSION'S TECHNOLOGICALLY NEUTRAL PART 15 FRAMEWORK WILL CREATE SIGNIFICANT BENEFITS FOR CONSUMERS AND THE WIRELESS ECOSYSTEM.

The combination of LTE technology and unlicensed spectrum bands and principles will promote numerous consumer benefits and greatly increase spectrum efficiency and network performance. As demand for mobile services has exploded in recent years, the economic and innovation benefits of licensed and unlicensed spectrum have become more and more apparent. In particular, unlicensed spectrum resources play a vital role in serving the American public, and the Commission can ensure the continued success of unlicensed services by maintaining its policy of technological neutrality for unlicensed operations. The Commission should reaffirm that as long as an unlicensed technology satisfies the Commission's Part 15 requirements, there

is no need for further regulatory involvement beyond adopting minimal technical standards or requirements. Industry-based standards bodies have successfully crafted the standards necessary to ensure that varying wireless technologies can coexist without harmful interference, and there is no need or reason for the Commission to adopt regulations that would upset this well-established practice.

A. Use of LTE Under Part 15 Would Provide Significant Benefits to Consumers.

The use of LTE technologies under Part 15 of the Commission's rules will provide significant benefits to consumers in the form of enhanced network capacity and performance. Recent technological evolutions and the continued growth of mobile services have made clear that both licensed and unlicensed spectrum resources are essential to meeting consumers' demand for mobile connectivity. Unlicensed LTE technology will combine the spectral efficiency and quality of LTE's service capabilities with the spectral capacity and flexibility of unlicensed operations to greatly benefit U.S. wireless consumers.

Explosive growth in mobile broadband traffic has required the wireless industry to make creative and efficient use of limited spectrum resources, including the utilization of both licensed and unlicensed spectrum. Some predict that mobile data traffic will increase globally as much as 11-fold between 2014 and 2019 and grow three times faster than fixed IP traffic.² In response to this surge in demand, CTIA and its members have tirelessly advocated for the allocation and utilization of both licensed and unlicensed spectrum for mobile services. Licensed spectrum delivers more than \$400 billion annually in economic value to the United States economy, and is

² Cisco, "Cisco Visual Networking Index: Forecast and Methodology, 2014-2019," at 2-3 (May 27, 2015), available at http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white_paper_c11-481360.pdf ("Cisco VNI 2015").

critical to ensuring that the public receives robust mobile broadband services.³ Economists also have estimated that the total social benefits from licensed spectrum are at least 10 to 20 times the direct economic value of the spectrum.⁴ While licensed spectrum continues to be of paramount importance to meeting the demands by consumers for mobile broadband, the wireless industry also has worked successfully to develop and use unlicensed spectrum resources to enable better service for wireless consumers. For instance, CEA has estimated that unlicensed spectrum generates \$62 billion per year in incremental retail sales value.⁵ Another study predicts that by 2017, unlicensed services will contribute nearly \$50 billion to the annual GDP.⁶

To further leverage unlicensed spectrum for mobile broadband services, there have been extensive efforts to develop the requirements to allow use of LTE technology in these bands. LTE is the primary technology used by mobile broadband providers in licensed spectrum and has provided increased spectral efficiency, improved data rates, and reduced latency for consumers using wireless services.⁷ Using LTE in the unlicensed spectrum bands will provide a number of similar and significant benefits to consumers. By employing LTE technology, vendors and wireless providers will be able to realize the benefits of spectral efficiencies in unlicensed spectrum bands. In particular, applying LTE technology to wide-bandwidth unlicensed bands

³ Coleman Bazelon and Giuliana McHenry, “Mobile Broadband Spectrum: A Vital Resource for the U.S. Economy,” at 2 (May 11, 2015), *available at* http://www.ctia.org/docs/default-source/default-document-library/brattle_spectrum_051115.pdf.

⁴ *Id.* at 1.

⁵ CEA, “Unlicensed Spectrum and the American Economy,” at 1 (Aug. 2014), *available at* <http://apps.fcc.gov/ecfs/document/view?id=7521749845>.

⁶ Telecom Advisory Services, LLC, “Assessment of the Future Economic Value of Unlicensed Spectrum in the United States,” at 1 (Aug. 2014), *available at* <http://www.wifi4ward.org/wp-content/uploads/2014/01/Katz-Future-Value-Unlicensed-Spectrum-final-version-1.pdf>.

⁷ Rysavy Research, “Mobile Broadband Explosion: The 3GPP Wireless Evolution,” at 95 (Aug. 2013), *available at* http://www.4gamericas.org/files/9414/0622/2731/4G_Americas_Mobile_Broadband_Explosion_August_2013_9_5_13_R1.pdf.

will greatly increase network capacity. Use of LTE under Part 15 will enable providers to combine licensed and unlicensed spectrum to increase available bandwidth, deliver higher data speeds, and reduce latency. In addition, unlicensed LTE services will help deliver the successful mobile network features to unlicensed spectrum, including uniformity of base station and device implementations, rigorous performance and conformance specifications, and certification procedures.⁸ Furthermore, use of LTE technology will help to facilitate seamless transitions between unlicensed and licensed spectrum, further increasing the quality of service for consumers.

B. CTIA Supports Maintaining the Technologically Neutral Framework for Unlicensed Services.

The success of unlicensed services is directly related to the technology-neutral approach taken by the Commission in Part 15 of its rules, which govern unlicensed operations. The *Public Notice* echoes this statement, noting that “[t]he Commission has historically adopted rules that are technologically neutral and remains committed to this policy.”⁹ More specifically, the Commission has taken steps to ensure through a policy of neutrality that its technical rules do not pick technology “winners and losers.” CTIA consistently has supported policies of technological neutrality, and urges the Commission to do the same here.¹⁰ So long as a technology satisfies the Commission’s Part 15 rules, there should be no need for the Commission to be involved in dictating any more than minimal technical standards or requirements.

⁸ See, e.g., Letter from Mark Racek, Ericsson, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-354, at 2 (dated Apr. 10, 2015).

⁹ *Public Notice* at 2.

¹⁰ See, e.g., Comments of CTIA – The Wireless Association®, GN Docket No. 14-177, RM-11664, at 10 (filed Jan. 15, 2015); Comments of CTIA – The Wireless Association®, PS Docket Nos. 11-153 and 10-255, at 11-12 (filed Oct. 16, 2014).

Indeed, the Commission consistently has declined to adopt unnecessary regulatory requirements governing Part 15 operations, and there is no reason for the Commission to depart from this approach. Any assertions that the Commission must take action to “protect” unlicensed services under Part 15¹¹ are misplaced, are not novel, and indeed have been consistently rejected by the Commission. For example, the FCC appropriately rejected efforts to extend the unlicensed PCS band’s “spectrum etiquette” requirement to other Part 15 unlicensed spectrum bands.¹² The protections being sought by parties that express concern about use of LTE in the unlicensed Part 15 spectrum bands are very similar to the requirements of a spectrum etiquette. However, the Commission has wisely avoided adding such unnecessary regulatory requirements to govern other Part 15 operations, noting that “[w]e believe that design flexibility has helped industry to develop efficient sharing and modulation schemes.”¹³ Most recently, the Commission has rejected adding a spectrum etiquette requirement to the 2.4 GHz and 5.8 GHz bands.¹⁴

¹¹ See, e.g., Letter from Paul Margie, Harris Wiltshire & Grannis LLP, Counsel to Cablevision, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-354, at 1 (dated Apr. 3, 2015) (arguing that “it is imperative . . . that the FCC ensure that existing Wi-Fi consumers are protected from pre-standard LTE-U deployments that would circumvent the collaborative process that has produced successful sharing in unlicensed bands for decades”); Letter from Edgar Figueroa, Wi-Fi Alliance, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-354, at 2 (Apr. 10, 2015) (stating that “the Commission must give additional consideration to whether these technologies – which occur in conjunction with licensed spectrum – will, in practice, share spectrum fairly with other unlicensed technologies”).

¹² *Modification of Parts 2 and 15 of the Commission’s Rules For Unlicensed Devices and Equipment Approval*, Report and Order, 19 FCC Rcd 13539, ¶ 54 (2004) (“2004 Part 15 Order”). A spectrum etiquette establishes a set of steps that a device must follow before it may access the unlicensed spectrum. See 47 C.F.R. §§ 15.319, 15.321, and 15.323. It requires that devices monitor the spectrum in which they intend to operate and they may begin transmission only if no signal above a specified threshold is detected. See 47 C.F.R. § 15.321(c)(1) – (7).

¹³ *2004 Part 15 Order* ¶ 54.

¹⁴ *Modification of Parts 2 and 15 of the Commission’s Rules For Unlicensed Devices and Equipment Approval*, Order and Second Memorandum Opinion and Order, 29 FCC Rcd 6366, ¶ 12 (2014).

No new evidence has been provided to support revisiting the Commission's Part 15 approach of avoiding superfluous regulatory requirements for unlicensed devices. In fact, the record shows that the Commission's technologically neutral regulations have resulted in an unlicensed industry that provides more than \$62 billion in value to the American economy each year. The considerable success of the unlicensed wireless ecosystem can be attributed to the tireless efforts of industry-based standards bodies to develop standards and protocols necessary to ensure that varying wireless technologies coexist without harmful interference. There is no reason for the Commission to take action that would upset this well-established practice, and instead the Commission should allow its longstanding principle of technological neutrality to govern the development of new unlicensed services.

III. USE OF LTE UNDER PART 15 IS EXPECTED TO HAVE TWO VERSIONS THAT FULLY COMPLY WITH THE COMMISSION'S TECHNICAL REQUIREMENTS.

The two technological paths discussed in the *Public Notice* – LTE-U and LAA – while not identical, are similar in several respects and will comply fully with the Commission's technical requirements. As explained further below, both technologies utilize and/or will be incorporated into industry standards governing LTE technologies. Both LTE-U and LAA rely upon control channels in licensed spectrum¹⁵ and are expected to use coexistence techniques that enable flexible spectrum use. However, these technologies differ in how they manage transmission on-and-off duty cycles.

¹⁵ While CTIA's comments focus on LTE-U and LAA as discussed in the *Public Notice*, CTIA notes that Qualcomm recently announced its intention to develop a separate, standalone version of LTE Unlicensed that will not utilize a licensed anchor channel. Qualcomm notes this standalone version of LTE Unlicensed will "only use unlicensed spectrum" and benefit consumers by offering "performance that exceeds today's unlicensed technologies, and in certain instances and locations, approaches the performance of technologies that use licensed spectrum." See Comments of Qualcomm, Inc., at 18-19 (filed June 11, 2015).

A. LTE-U and LAA Utilize the 3GPP Standards Framework.

As the Commission observes in the *Public Notice*, use of LTE under Part 15 of the Commission's rules is under two paths of development, LTE-U and LAA.¹⁶ LTE-U is *not* a pre-standard version for use of LTE under Part 15 of the Commission's rules.¹⁷ Instead, LTE-U fully complies with Part 15 and uses the 3GPP standards framework for LTE (Releases 10/11/12)¹⁸ along with supplementary coexistence parameters adopted by the LTE-U Forum.¹⁹ LAA, on the other hand, is being standardized through the 3GPP process in LTE Release 13.²⁰ Certain modifications to the LTE standard – including modifications to comply with other countries' listen before talk ("LBT") requirements – are in progress and are subject to ongoing standards work.

B. LTE-U and LAA Will Comply With Part 15 Unlicensed Requirements.

The hallmark of the regulatory structure for unlicensed operations is allowing innovation to develop with minimal mandatory technical requirements to ensure an equal playing field for all technology vendors. Part 15 of the Commission's rules governs the ability of wireless vendors to develop unlicensed technologies without any undue constraint on the methodology used to comply with the technical requirements. Indeed, the Commission has consistently asserted that Part 15 allows for the operation of radio frequency devices without an individual license from the Commission because the technical standards contained in Part 15 are designed

¹⁶ *Public Notice* at 1.

¹⁷ *Id.* at 2.

¹⁸ See 3GPP, Features and Study Items, <http://www.3gpp.org/DynaReport/FeatureListFrameSet.htm> (last visited June 9, 2015).

¹⁹ LTE-U Forum, "LTE-U SDL Coexistence Specifications v. 1.0" (Feb. 2015), available at http://www.lteuforum.org/uploads/3/5/6/8/3568127/lte-u_forum_lte-u_sdl_coexistence_specifications_v1.0.pdf.

²⁰ 3GPP, Release 13, <http://www.3gpp.org/release-13> (last visited June 9, 2015).

to ensure that there is a low probability that such devices will cause harmful interference to other users of the radio spectrum.²¹

The technical parameters that govern intentional radiators (which are what devices using LTE under Part 15 rules would be classified as) are defined in Subpart C of Part 15.²² Equipment vendors, as has always been the case for development of radio frequency devices without a license, will ensure that the technical requirements of Subpart C are followed for any LTE services provided under Part 15. Therefore, in accordance with the expectations associated with the unlicensed technical rules, use of either LTE-U or LAA in compliance with the Commission's technical rules should not present a high probability of harmful interference to other users.

C. LTE-U and LAA Have a Number of Commonalities and Some Differences.

LTE-U and LAA have a number of similarities in their technical approaches.²³ Both LTE-U and LAA utilize a control or “anchor” channel in licensed spectrum that will be aggregated with a set of secondary unlicensed channels. This combination of licensed and unlicensed spectrum is achieved through the use of carrier aggregation, a technology that combines “carriers” (operating on different frequencies) at the device level to greatly increase data rates and capacity.²⁴ Carrier aggregation would be employed to combine the licensed and unlicensed frequencies to simulate a contiguous carrier using the bandwidths of both spectrum types. LTE-U and LAA also would likely use coexistence techniques such as channel selection

²¹ *Revision of Part 15 of the Commission's Rules Regarding Operation in the 57-64 GHz Band*, Report and Order, 28 FCC Rcd 12517, ¶ 4 (2013).

²² 47 C.F.R. §§ 15.201-15.257.

²³ *Public Notice* at 2 (“What are the anticipated technical characteristics . . . of LTE-U and LAA?”).

²⁴ 3GPP, Carrier Aggregation Explained, <http://www.3gpp.org/technologies/keywords-acronyms/101-carrier-aggregation-explained> (last visited June 9, 2015).

and adaptive channel occupancy. Channel selection allows for the selection of a vacant channel or “least crowded” unlicensed channel.²⁵ A channel selection algorithm monitors the status of the operating channel on an ongoing basis and, if needed, will select a more suitable one.²⁶ Adaptive channel occupancy allows the transmission on unlicensed spectrum to occur opportunistically – meaning that the unlicensed spectrum will only be used if necessary, and will not be used at all if the licensed cell is lightly loaded.²⁷

While LTE-U and LAA have these similarities, there are also differences between the two technological paths. LTE-U and LAA differ in how they manage transmission on-and-off duty cycles. LTE-U utilizes Carrier-Sensing Adaptive Transmission (“CSAT”) to provide a way for users to take turns in using unlicensed spectrum. CSAT defines a time cycle where a small cell transmits in a fraction of the cycle and “gates off” in the remainder of the cycle.²⁸ This enables LTE-U operations to take turns with neighboring operations using Wi-Fi or another unlicensed technology. LAA, meanwhile, is expected to use an energy-based LBT methodology using a standardized clear channel assignment.²⁹ The 3GPP standards body is investigating,

²⁵ Qualcomm, “LTE Unlicensed – Channel Selection,” (June 3, 2014), *available at* <https://www.qualcomm.com/videos/lte-unlicensed-channel-selection>.

²⁶ *Id.*

²⁷ NEWTON’S TELECOM DICTIONARY, 27th Ed. at 114 (2013).

²⁸ Qualcomm, “LTE in Unlicensed Spectrum: Harmonious Coexistence with Wi-Fi,” at 7 (June 2014), *available at* <https://www.qualcomm.com/media/documents/files/lte-unlicensed-coexistence-whitepaper.pdf>.

²⁹ The precise listen-before-talk methodology is still under discussion but is likely to be based upon the methods used by Wi-Fi under 802.11 standards. *See e.g.*, http://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Mobility/emob41dg/emob41dg-wrapper/ch5_QoS.html#wp1021972.

under Release 13, the LBT protocol that will be used by LAA. The next meeting of the 3GPP group working on Release 13 issues, including LAA, is scheduled for later this month.³⁰

IV. COEXISTENCE WITH WI-FI IS CRITICALLY IMPORTANT AND THE WIRELESS INDUSTRY HAS TAKEN PRECAUTIONS TO DEVELOP LTE UNDER PART 15 OF THE COMMISSION'S RULES TO ENSURE COEXISTENCE.

Wi-Fi technologies have been and will continue to be an integral part of consumers' wireless usage, and it is therefore essential that LTE technologies under Part 15 be able to coexist with Wi-Fi. Wi-Fi represents a significant portion of Internet traffic in North America, and Wi-Fi services are ubiquitous in the United States. Wireless providers are cognizant of this fact and have taken precautions to develop LTE under Part 15 in a way that will promote coexistence with Wi-Fi. CTIA supports continued efforts by the developers of LTE-U and LAA to test and ensure coexistence with Wi-Fi without regulatory oversight by the Commission of this industry-based process.

Regardless of whether LTE-U, LAA, or both are used to deliver LTE services under Part 15, wireless providers expect to continue to rely extensively on Wi-Fi to meet consumer demands. In North America, Wi-Fi made up approximately 55.2 percent of total Internet traffic in 2014.³¹ Cisco expects that Wi-Fi will grow to 66.3 percent of total Internet traffic by 2019.³² Further, Wi-Fi hotspots have been ubiquitously deployed throughout the United States. Thus, coexistence with Wi-Fi will continue to be a critical requirement well into the future. Wireless

³⁰ See e.g., calendar of 3GPP meetings including June 15-18 meetings of the RAN working group, available at http://webapp.etsi.org/MeetingCalendar/ViewMeetings.asp?qTB=373&qINCLUDE_SUB_TB=True&qSTART_DATE=today&qEND_DATE=&qSubmitBtn=Find+Meetings.

³¹ Cisco, VNI Forecast Highlights, http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html (last visited June 9, 2015).

³² *Id.*

providers are aware of the important role played by Wi-Fi in providing mobile broadband service to consumers. It is for this reason that carriers have taken significant precautions to develop LTE under Part 15 of the rules in a way that ensures coexistence with Wi-Fi.

CTIA expects that developers of both LTE-U and LAA will take the steps needed to demonstrate the ability of these technologies to coexist with Wi-Fi. The LTE-U Forum has demonstrated that LTE-U can coexist with Wi-Fi. Specifically, the LTE-U Forum has released specifications for both mobile and base station equipment, as well as a technical report demonstrating LTE-U and Wi-Fi coexistence.³³ Additionally, the LTE-U Forum defined a coexistence specification that requires the use of the channel selection and CSAT technologies highlighted above to ensure equitable spectrum sharing with other technologies in the band.³⁴ Similarly, CTIA expects that LAA will continue development through the 3GPP standards process and demonstrate its ability to coexist with Wi-Fi services. Such coexistence is necessary to ensure the continued high-quality wireless services that U.S. consumers expect from wireless carriers. As such, there is no need for additional regulatory oversight of the coexistence process. Instead, the Commission should continue to allow the industry standards bodies to work cooperatively to manage coexistence among differing technologies allowed under Part 15.

V. CONCLUSION.

CTIA believes strongly that both licensed and unlicensed spectrum play an important role in the provision of mobile broadband. Additionally, the use of LTE technologies to make more efficient use of unlicensed frequencies has the potential to further enhance the benefits of mobile broadband for the public. This is a field characterized by rapid innovation, and the Commission

³³ See LTE-U Forum, Forum Documents, <http://www.lteuforum.org/documents.html> (last visited June 9, 2015).

³⁴ *Id.*

can best facilitate the development of unlicensed LTE by adhering to its principles of technical neutrality. By not picking technological “winners and losers” and instead permitting this ecosystem to develop organically, the Commission will encourage innovation and ensure that the marketplace and technical realities determine the most appropriate technologies for consumers. Finally, while unlicensed LTE services hold great potential, CTIA notes that Wi-Fi will continue to play a primary role in consumers’ wireless experiences, and it is essential that the Commission allow the wireless industry to manage coexistence of new Part 15 LTE services with Wi-Fi and other Part 15 services.

Respectfully submitted,

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