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

Comments of Ruckus related to Public Notice DA 17-609 regarding petitions to further amend the Commission's rules with regard to commercial operations in the 3550-3650 MHz Band, GN Docket No. 12-354

Dear Chairman Pai, Commissioner Clyburn, Commissioner O'Rielly, Mr. Knapp, & Mr. Stockdale:

Ruckus would like to provide the following comments in regard to the Public Notice requesting input on the petitions of T-Mobile and CTIA seeking to change the rules governing the Citizens Broadband Radio Service (Petitions).

In principal, Ruckus is opposed to CBRS rule changes which would limit access to the PAL or GAA tiers to only certain types of users, or reduce the fundamental opportunity for access at either tier. If enacted, such changes would undermine the global leadership that the United States has shown with CBRS. Ruckus urges the Commission to reject the specific proposals made in the Petitions.

I. The CBRS Framework in the context of "5G"

Both Petitions justify their requests for changes to the established CBRS framework on the basis that their suggestions would better position the United States to lead in the transition from 4G to 5G wireless.[1] Ruckus fully agrees that the United States should lead in 5G, but believes that many of the requested changes in the Petitions would actually weaken our nation's leadership in 5G wireless. Our conclusion is derived from a consideration of the impacts of the Petitions' proposed changes on the United States' ability to realize the ITU-R goals for IMT 2020 (i.e. "5G") regarding low latency communications, densification of network access, reliability, and accuracy of positioning services.[2]

While there is still a great amount of discussion, and even confusion, about what exactly "5G" is, there is general consensus across the broad wireless industry that meeting the ITU goals for 5G will require an 'umbrella' of technologies, deployers, and operators. This represents a significant departure from the previous 2G, 3G, and 4G iterations, in that those prior generations were specifically associated with only cellular technologies, mobile operators, and their use cases. By contrast, 5G radio access technologies will include next generation 3GPP specifications (e.g. 5G New Radio "NR"), but will also include next generation IEEE specifications (e.g. 802.11ax and 802.11ay) and most likely newer wireless technologies for specialized communications (e.g. IoT specific technologies). Similarly, 5G networks will be deployed and

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[1] CTIA Petition, *"II. A RULEMAKING TO REMOVE UNCERTAINTY FROM THE PRIORITY ACCESS LICENSE FRAMEWORK WILL FACILITATE U.S. GLOBAL LEADERSHIP FROM 4G TO 5G."* and T-Mobile Petition, *"II. ENHANCING THE PAL FRAMEWORK WILL FACILITATE U.S. GLOBAL LEADERSHIP IN THE TRANSITION FROM 4G TO 5G"*

[2] http://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf

operated by a wide variety of entities, ranging from traditional mobile operators to private enterprises, with fixed service providers, rural access companies, municipalities, public venue owners, manufacturers, transportation/logistics companies, and others all playing a role. It is only via this 'rich tapestry' of diverse deployment types that the densification, latency, reliability, and positioning accuracy goals of 5G will be obtained – and nowhere is this more true than with regards to in-building coverage, where widespread deployments by private enterprises and managed service providers are essential. 5G use cases (i.e. applications) are anticipated to include enhanced mobile broadband, fixed wireless access, IoT (including industrial and vehicular), private wireless services and neutral-host networks. Other, unanticipated uses are also likely to emerge.

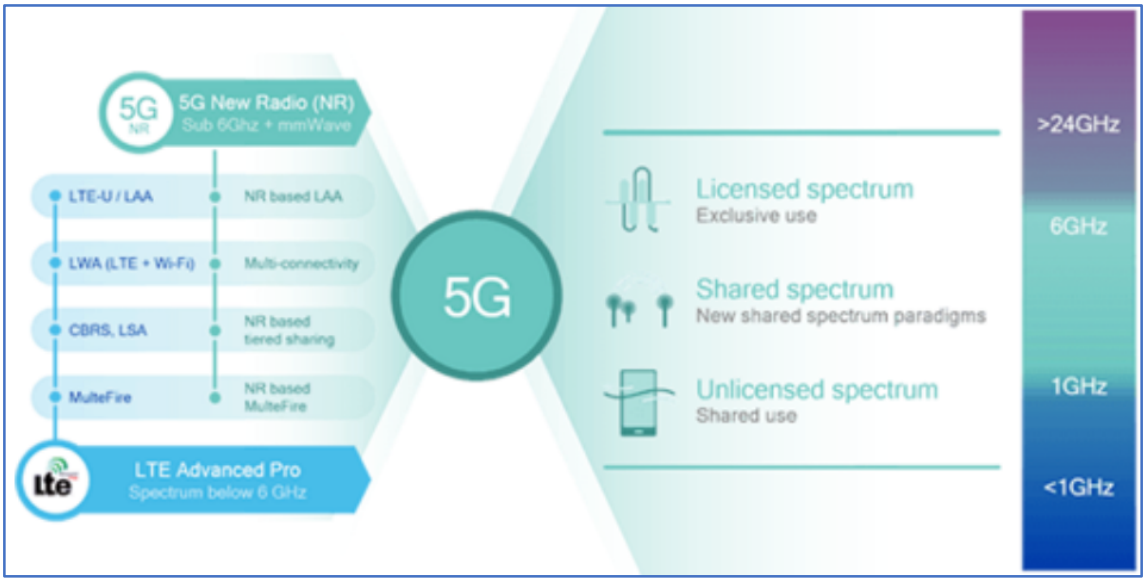
The Petitions are focused solely on optimizing the existing mobile operator deployment model and use case, at the expense of the other deployment models and use cases that will be critical in order to realize the goals of 5G.

Just as 5G will require a range of radio access technologies and enable a range of deployment models and use cases, 5G will rely upon a range of spectrum types; including licensed, unlicensed, and coordinated shared spectrum[3]. The United States should continue to pursue a balanced spectrum policy that provides adequate resources within each of these regime types at the low-band, mid-band, and high-band frequencies. Coordinated shared spectrum frameworks, like CBRS, are especially effective in the mid-band and high-band, where

[3] Coordinated Shared Spectrum is a term used to denote frameworks such as CBRS and LSA, which provide coordinated access to shared spectrum.

the propagation characteristics are well-suited to small cell deployments and local re-use of spectrum.

The following image from Qualcomm[4] points out the need for licensed, unlicensed and coordinated shared spectrum to support 5G (this is just to support the 3GPP 5G NR radio access technology and doesn't include IEEE and other 5G radio technologies):

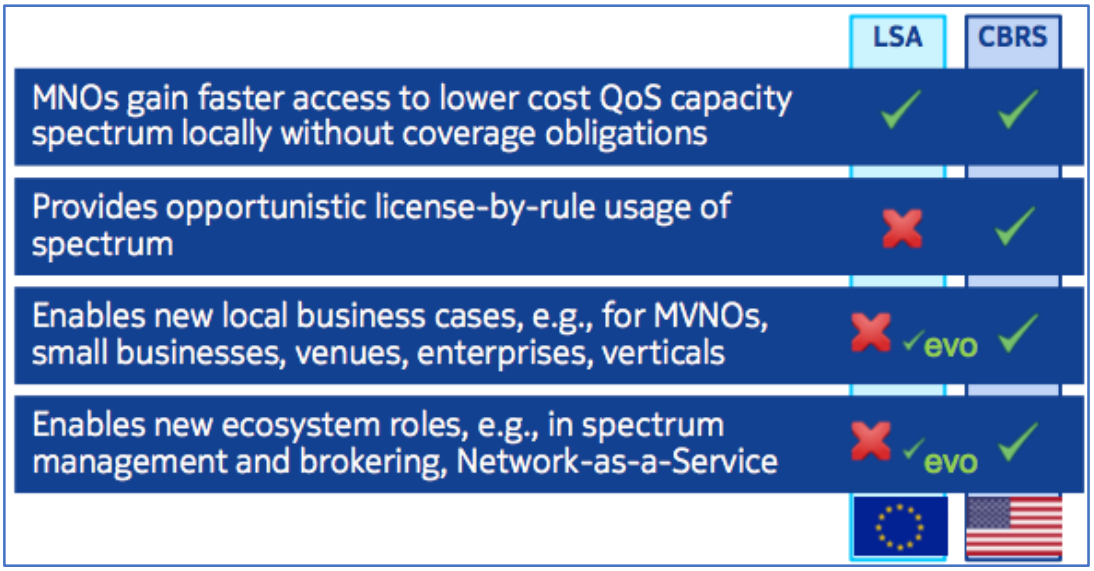


Far from compromising the United States' position in planning for 5G, the current CBRS framework puts our nation out in front of the rest of the world when it comes to the introduction of coordinated spectrum sharing, a key spectrum 'pillar' for 5G. As Ruckus interacts with regulators and policymakers around the world, there are regular and recurring requests for information about the CBRS model, how it enables permissive and local re-use of spectrum, and whether it might be adapted to other bands and national requirements.

[4] Qualcomm: "3GPP starts study on 5G NR spectrum sharing" https://www.qualcomm.com/news/onq/2017/04/26/3gpp-starts- study-5g-nr-spectrum-sharing

The other coordinated shared spectrum framework that has been put forward is Licensed Shared Access (LSA) in Europe. However, due to the fact that LSA does not enable the permissive, licensed-by-rule uses that CBRS does, LSA has not seen anywhere near the industry momentum of CBRS[5]. In fact, there are now proposals to extend the LSA framework to include some of the characteristics of CBRS in order to promote adoption.

These proposals include an LSA Evolution (LSAevo) concept from Nokia which was presented at the European Spectrum Management conference[6] in Brussels in June 2017 where the following comparison of LSA, LSAevo, and CBRS was highlighted:



As can be seen, CBRS provides much more flexibility than the existing LSA model.

[5] Note the number and range of companies participating in CBRS standardization, trials, and marketing via the Wireless Innovation Forum (http://www.wirelessinnovation.org/Current_Members) and CBRS Alliance (https://www.cbrsalliance.org/)

[6] http://eu-ems.com/agenda.asp?event_id=3320&page_id=8053

As the world's leading coordinated shared spectrum framework, with tremendous activity and investment from a wide variety of participants, and great interest from regulators around the world, CBRS is a critical area of 5G leadership for the United States. Specifically, the support for incumbent, exclusive, and permissive uses with the ability to dynamically re-balance the band amongst these use types while enforcing protections and priorities is seen as a major innovation of the United States' Federal Communications Commission.

A key principle embodied in the current CBRS framework is that operation at the PAL and GAA tiers is a realistic opportunity for all types of CBRS deployers and operators, and this principle is driving significant early investment in CBRS by a broad ecosystem of players. This key principle provides an expectation that if, for example, a public venue was to deploy a network relying on GAA permissive use today, it will have a reasonable opportunity to obtain a PAL license (or PAL access via a broad and vibrant secondary market) in the future in the event that the spectrum in that area becomes heavily utilized and there is a need for the protections afforded at the PAL tier.

The current CBRS framework has established the United States as a leader in coordinated spectrum sharing as the world moves towards 5G. Any changes to the CBRS framework that significantly impact the opportunities for participation at either the PAL or GAA tier will weaken that leadership.

II. LTE is the Near-Term Opportunity in 3400 to 3800 MHz

While it is imperative that the United States lead as the world moves towards 5G wireless (and we have already addressed how the current CBRS framework is critical in establishing and maintaining that leadership), it is also important to note that the near-term investments in the 3400 to 3800 MHz frequency range, including the CBRS band, are largely focused on LTE technologies, specifically TDD-LTE. 3GPP has defined Band 42 (3400-3600 MHz), Band 43 (3600-3800 MHz), and Band 48 (3550-3700 MHz) for TDD-LTE operation.

The CBRS framework is enabling the broadening of the LTE ecosystem by supporting access to this spectrum by all types of deployers and operators. Coupled with innovations around neutral host (i.e. multi-operator) capabilities that are being developed in industry organizations like the CBRS Alliance, this flexible spectrum access creates an opportunity for all manner of entities to deploy and operate LTE networks, both for internal (private) and external (public) uses. As mentioned earlier, it is these widespread, diverse deployments that will enable the network density and indoor coverage required, along with the macro network coverage, to meet the goals for 5G.

The deployment flexibility enabled by the current CBRS framework is positioning the United States to lead in the transition to future 5G services and also to benefit from the broadening of the LTE ecosystem in the near-term.

III. Equal Access to the PAL Tier

The specific PAL changes requested in the Petitions regarding coverage area, duration, and renewability would result in only the largest (national scale) service providers being able to obtain PAL licenses – at either the initial or subsequent auctions. If Priority Access is licensed at the PEA level with a virtually perpetual duration, it would rule out that access for all aside from those companies whose business models are based on selling services covering huge areas over very long periods. In effect, these changes would create a PAL tier tailored to the specific needs of four companies, while blocking access to the thousands, perhaps tens or hundreds of thousands, of smaller companies and entities who could otherwise benefit from Priority Access.

Further, the changes would greatly impair the formation of a dynamic secondary trading market for PAL licenses or access, due to the concentration of a smaller number of PAL licenses into the hands of a few very large companies that are not well known for making fallow licensed spectrum available to others.

If the opportunity to access the CBRS spectrum with the certainties and protections afforded at the PAL tier is taken away from all of the smaller deployers and operators (e.g. enterprises, universities, hospitals, hotels, municipal authorities, industrial manufacturers, rural Wireless ISPs, etc…) it may cause them to rethink their entire strategy for utilizing the CBRS band.

Additionally, if the Petition changes were enacted, there would be a much smaller number of entities positioned to participate in the PAL auctions. Combined with the fact that the value of PAL access in a given area would be reassessed on a much less frequent interval, the lower number of auction participants might reduce the overall licensing revenue that could

have been realized from a broader auction of smaller coverage areas with shorter durations and opportunity for turnover (i.e. broader and more frequent reassessment and revaluation of 'highest use').

Ruckus does not oppose minor adjustments to the PAL structure that would benefit all participants and is happy to engage with interested parties in developing such adjustments, but the wholesale changes to the PAL coverage area, duration, and renewability that are proposed in the Petitions would fundamentally weaken the value proposition of CBRS for a large number of our customers and would undo the key principle that PAL access should be a realistic opportunity for all.

IV. The Commission should move quickly to Authorize GAA Operation in the CBRS Band

Ruckus agrees with T-Mobile's point in their petition that, *"The Commission could continue with the process of establishing a mechanism for GAA access to the band and once these mechanisms are in place, the Commission could permit GAA access."*

It is critical that the huge amounts of time, money, and resources that industry has invested in operationalizing the current CBRS framework result in the opportunity for commercial deployments as soon as possible.

Summary

The current CBRS framework demonstrates our nation's leadership in the transition to 5G wireless, and allows for the near-term broadening of the LTE ecosystem.

Ruckus does not oppose minor adjustments to the CBRS framework that would maximize the utility of the band for all participants while protecting the existing, substantial investments which were driven by models reasonably based upon the current rules. We are ready and willing to engage with all interested parties in discussions around such adjustments. We believe that the current CBRS rules (approved in 2015 and affirmed in 2016) were carefully crafted to achieve a balanced, yet dynamic, allocation of spectrum access between the PAL and GAA tiers, with an opportunity for participation by all sorts of spectrum users at both of these tiers.

In principal, Ruckus is opposed to CBRS rule changes which would limit access to the PAL or GAA tiers to only certain types of users, or reduce the fundamental opportunity for access at either tier. If enacted, such changes would undermine the global leadership that the United States has shown with CBRS. Ruckus urges the Commission to reject the specific proposals made in the Petitions.

About Ruckus

Beginning operations in June 2004, Ruckus is one of the world's fastest growing wireless technology companies. Ruckus offers a broad range of advanced indoor and outdoor "Smart Wi-Fi" systems for service providers and enterprises. The company is credited with developing the first adaptive antenna (Smart Wi-Fi) technology that improves the reliability, performance and capacity of Wi-Fi networks. More recently, Ruckus introduced its line of "OpenG" LTE products, which bring the simplicity and economics of Wi-Fi to the market for in-building cellular services.

According to Dell'Oro's Q3 2015 report, Ruckus is #1 in the Service Provider Wi-Fi market with 38% marketshare and #3 in the Enterprise Wireless LAN market. With approximately 61,000 end customers and more than 10,000 channel partners worldwide, Ruckus sells its systems directly to broadband providers and indirectly to enterprise customers through a global network of value-added partners.

Ruckus is a business unit of Brocade Communications Systems, Inc.

This letter is being filed pursuant to section 1.405 of the Commission's rules as noted in the Public Notice. Should you have any questions, please contact me.

Respectfully Submitted,

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