Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band	GN Docket No. 12-354

REPLY COMMENTS OF QUALCOMM INCORPORATED

QUALCOMM Incorporated ("Qualcomm") is pleased to provide these brief reply comments on the Commission's *3.5 GHz Small Cells Notice of Proposed Rulemaking*[1] to highlight a few noteworthy items. *First*, Qualcomm is pleased to see a substantial amount of agreement on key aspects of the FCC's proposals, including the need to provide licensed access to the band for small cell use on an exclusive basis to achieve a predictable quality of service for consumers and to drastically reduce the exclusion zones identified in the NTIA Fast Track Report by deploying low-power small cell technology.[2] Implementing these key elements of the Commission's proposals will allow the 3.5 GHz band to be quickly incorporated into today's mobile broadband networks and address, in part, the data capacity crunch.

Second, Qualcomm provides an update on the continued progress of standardizing Authorized Shared Access ("ASA") in ETSI. The Commission should take advantage of these efforts given that many of the same stakeholders working to standardize ASA in ETSI are

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1 *See* Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550- 3650 MHz Band, GN Docket No. 12-354, *Notice of Proposed Rulemaking and Order*, FCC 12-148 (rel. Dec. 12, 2012) ("*3.5 GHz Small Cells NPRM*" or "*NPRM*") at ¶¶ 1-6.

2 *See, e.g.,* Comments of Ericsson at 9; Comments of Nokia Siemens Networks US at 3.

participating in this proceeding and their technical work in ETSI provides a solid basis upon which the FCC can issue rules for the 3.5 GHz band. Indeed, Qualcomm and its industry partners have been working on ASA for a number of years, and we are very excited by the Commission's 3.5 GHz band proposals to use ASA to enable small cell deployments.

I. The 3.5 GHz Small Cells Band Should Be Used For Licensed Operations Supported By Authorized Shared Access

As the Commission has repeatedly acknowledged, vast amounts of additional mobile broadband spectrum is needed to support the rapidly growing demand for mobile broadband capacity. First and foremost, the FCC needs to take all steps possible to bring on line, as soon as possible, spectrum that can be completely cleared of incumbents in a reasonable time frame; this includes the 600 MHz band currently occupied by TV broadcasters that is being repurposed via the incentive auction process. Second, it is important that the Commission allocate additional unlicensed spectrum, as the agency proposes in the recently released *5 GHz Band NPRM*,[3] that can support offloading from licensed bands in situations where a highly reliable quality of service and full mobility may not be necessary and where there is much wider bandwidth to support higher data rates.[4]

Relying only on these two sources of spectrum, however, leaves off limits a third category of spectrum that is not yet allocated for mobile broadband, but is under-utilized, such as the 3.5 GHz band. Despite the 3.5 GHz band's limitations due to its use by incumbent federal users, the band can be integrated into carrier networks to support mobile broadband operations and provide a reliable quality of service wherever and whenever the incumbents are not using it.

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[3] *See* Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, *Notice of Proposed Rulemaking*, ET Docket No. 13-49 (rel. Feb. 20, 2013) ("5 GHz Band NPRM").

[4] This includes operations using the IEEE 802.11ac standard in channels of up to 160 MHz of contiguous spectrum in the 5 GHz band and channels as wide as 2 GHz in the 60 GHz band.

ASA can allow small cells to efficiently share the 3.5 GHz band with the incumbents and greatly enhance and expand mobile broadband network capacity.

ASA enables spectrum access on a two-tiered basis, allowing commercial licensees to operate within the interstices of the frequency band where and when government users are not using it, and to quickly vacate the spectrum so incumbents can successfully operate. In this way, ASA can prevent interference to and from incumbent government users in the 3.5 GHz band and support coast to coast mobile broadband operations via small cells operating on a licensed basis where spectrum is available. As Qualcomm and others explained in their opening comments, "carriers can make even greater use of spectrum for broadband capacity if that spectrum is made available to them on an exclusive basis through licensing [because it] provides significantly greater certainty, allowing more complete integration into carrier networks using LTE technology for both wide-area cells and small cells."[5]

A. Low-Power Small Cell Deployments In The 3.5 GHz Band Will Drastically Reduce The Exclusion Zones for Incumbent Federal Radars

Qualcomm's opening Comments provided extensive technical detail demonstrating that if the 3.5 GHz band is used by small cells operating at substantially lower power levels on a licensed and managed basis via the ASA framework, interference to radars can be completely avoided and the required exclusion zones can be drastically reduced.[6] And, when they are deeply integrated into existing macro cellular networks operating in other bands, small cells will greatly expand mobile broadband network capacity and help to bring some relief to the mobile broadband capacity crunch. ASA takes full advantage of today's state-of-the-art mobile cellular

[5] Comments of T-Mobile USA, Inc., at 4. *See also* Comments of Nokia Siemens Networks US LLC at 19-20.

[6] *See* Comments of Qualcomm at A1-A11. Although Qualcomm analyzed the potential use of TDD LTE-based small cells within the 3.5 GHz band, the FCC should not mandate the use of LTE or, for that matter, any air interface at 3.5 GHz.

broadband technology, including self organizing networks and advanced interference management/mitigation techniques.

Qualcomm also explained that although permitting the 3.5 GHz band to be shared by small cells will shrink the exclusion zones substantially, there will be times and locations when the small cells are not able to use the spectrum because the government incumbents are operating there. At those times and locations, mobile broadband operations can move to another portion of the 3.5 GHz band, which will be 100 to 150 MHz wide, or to another band, using the same multi-band support and frequency agility that is integral to today's macro cellular, heterogeneous networks.

B. ASA Enables A Reliable Quality Of Service, A Secure Interface With Federal Users, And Is Completely Transparent To The End-User Device

By providing a secure interface between federal users and ASA rights holders, the ASA framework will protect sensitive information, such as when and where Naval radars are operating or not operating. ASA is a binary system and thus will be relatively simple to deploy. The ASA spectrum rights holder has an exclusive right to use a given portion of the spectrum when and where it is not used by federal incumbents. At any particular location and point in time, a specific channel in the spectrum will be used either by the federal incumbent or a single ASA rights holder.

ASA rights must be exclusive in order to support the delivery of a reliable and predictable quality of service while guaranteeing interference-free spectrum sharing between incumbent systems and the ASA rights holders' networks. Making ASA rights exclusive will prevent interference between the small cells and radars. As Qualcomm explained in its opening Comments, these rights may be awarded by geographic area (similar to licenses awarded today via auction) or in some other manner (such as a licensed-by-rule framework), or perhaps both,

each in discrete portions of the bands — as contemplated in the *NPRM*.[7] In other words, the mode of licensing can be carrier-driven, consumer-driven, or some combination of the two.

It also is important to understand that the implementation of ASA is completely transparent to the end user device. From the device's perspective, operating on 3.5 GHz under ASA will not be any different from operating on any other band. In other words, operation within the ASA framework does not require any changes to the device or the underlying cellular technology. The small cell base station, like a macro cell base station, simply tells the device when and where it is able to operate.

ASA uses a database to which the ASA rights holder's Operations, Administration, and Maintenance ("OAM") network system would connect to determine the interference limits within which operations can occur within a particular channel at a given time and location. The ASA database need only know the aggregate power level that U.S. government incumbents can tolerate at a given location, time, and frequency. Once a small cell is cleared for communications by the ASA licensee's OAM, operation occurs within the small cell service area within the acceptable power levels, much like it would within a macro-cell. Moreover, the spectrum can be used for carrier aggregation or supplemental downlink to provide the best possible user experience.

II. The FCC Should Leverage ETSI's Work To Standardize Authorized Shared Access

In its opening Comments, Qualcomm explained that there are active efforts in the European Telecommunications Standards Institute ("ETSI") to standardize ASA, and Qualcomm encouraged the FCC to closely examine and, where appropriate, leverage the European efforts,

[7] For geographic area licensing, the Commission could auction channels in areas across the U.S. as it does with traditional mobile licenses, and allow the auction winners to deploy small cells using ASA within the exclusion zones and perhaps deploy macro-cells in inland areas well outside the exclusion zones originally identified by NTIA.

which are advancing rapidly. In fact, the European Radio Spectrum Policy Group, which advises the European Commission, has endorsed ASA for the 2.3 GHz band.[8]

Since Qualcomm filed its opening comments, the ETSI Draft Technical Report "System Reference Document (SRdoc)"[9] defining the criteria and operational features for ASA/LSA at 2.3 GHz and based upon cooperation between ETSI and the Electronic Communications Committee (ECC) of the CEPT, was developed by the ETSI Technical Committee on Reconfigurable Radio Systems and circulated for comment to all radio technical bodies, including all members of the ETSI technical committee ElectroMagnetic Compatibility and Radio Spectrum Matters that is in charge of coordinating ETSI internal consultation on the Report. The due date for the comments is May 2, 2013, and shortly thereafter, a comment resolution meeting will be held to create and approve final publication of the Technical Report.

The Report covers regulatory issues, technical and market information, and spectrum compatibility issues, among other items. While it focuses on the 2.3 GHz band and pan-European applications, there is no reason why the underlying concepts cannot also be applied to the 3.5 GHz band in the U.S.

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[8] On March 8, 2013, 27 European Union countries released for comment a "Strategic Opinion" on wireless broadband spectrum entitled "Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband," a document that the EU27 Regulators were actively working on for a full year. *See* Radio Spectrum Policy Group, "Draft RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband," *available at* https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp. The document calls for the release of the 2.3 GHz band using ASA (which is referred to as Licensed Shared Access or LSA in Europe) by 2015 as part of the EU goal of making available 1200 MHz of mobile broadband spectrum by 2015.

[9] *See* ETSI Technical Report, TR 103 113 (2013-02) *Reconfigurable Radio Systems (RRS); System Reference Document; Mobile Broadband Services in the 2300 MHz – 2400 MHz Frequency Band under Licensed Shared Access Regime*, (the "ETSI Technical Report").

The ETSI Technical Committee on Reconfigurable Radio Systems soon will begin developing the relevant Technical Specifications for mobile broadband service at 2.3 GHz using ASA/LSA, taking into account the regulations that CEPT developed for the band.[10] The FCC should continue to monitor the progress of ASA/LSA in Europe (and elsewhere) and leverage this work as appropriate, for Qualcomm believes that it can help to speed the development and deployment of small cell technology in the U.S. using ASA at 3.5 GHz.

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Qualcomm is very excited about the deployment of small cells at 3.5 GHz enabled via the ASA regulatory framework as our comments in this proceeding make clear. Qualcomm has been working on both ASA and small cells for years. In order for these innovations to become reality at 3550 to 3700 MHz, however, additional information about the extent and level of federal radar use is needed. Qualcomm is pleased that efforts are underway within the federal government to collect and share that information, for it is an essential ingredient to further refining the wireless industry's technical analysis and mobile broadband network design considerations.

10 *See* Comments of Qualcomm at 12-13.

CONCLUSION

Qualcomm's analysis of the 3.5 GHz band is ongoing, and before Qualcomm and its wireless industry partners can further refine their analyses, additional information on the technical and usage characteristics of the incumbent federal operations, particularly the airborne, shipborne and ground-based federal radar systems, is needed. We are eager to integrate this information into our technical work on how best to make use of this spectrum within the zones that could be affected by federal incumbent users. We look forward to continuing to work with the Commission and our industry partners towards the timely deployment of small cells in the 3.5 GHz band to support mobile broadband operations and continue to fuel America's remarkable mobile broadband ecosystem.

Respectfully submitted,

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