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

COMMENTS OF QUALCOMM INCORPORATED ON 3.5 GHz LICENSING PUBLIC NOTICE

QUALCOMM Incorporated ("Qualcomm") hereby comments on the FCC's *3.5 GHz Licensing Public Notice* that seeks input on several new licensing concepts that the FCC is exploring to enable the 3.5 GHz band to be quickly put into use to address the wireless industry's ever-increasing needs for additional mobile broadband spectrum.[1]

INTRODUCTION & SUMMARY

Qualcomm is very excited by the FCC's proposal to enable deployment of small cells in the 3.5 GHz band using Authorized Shared Access ("ASA"),[2] a licensed regulatory framework that provides mobile operators and subscribers exclusive access to the 3.5 GHz band when and where U.S. government incumbents are not operating. In this way, ASA provides the users of the 3.5 GHz band with a predictable quality of service when they use the band. Implementation of ASA in the 3.5 GHz band is the quickest way to open this underutilized band for mobile

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[1] *See FCC Public Notice*, Commission Seeks Comment on Licensing Models and Technical Requirements in the 3550-3650 MHz Band, GN Docket No. 12-354, FCC 13-144 (Nov. 1, 2013) ("*Licensing Public Notice*"). *See also* 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 (Dec. 12, 2012) ("*NPRM*").

[2] *See NPRM* at ¶ 84.

broadband use, for, as Qualcomm has explained, the underlying technical work is complete. Operation within the ASA framework does not require any changes to the device or the underlying cellular technology. In fact, implementation of ASA is completely transparent to the mobile device; from the perspective of the user device, operating on 3.5 GHz under ASA is no different from operating on any other band. The small cell base station, like a macro cell base station, simply tells the user device when and where it is able to operate, and ASA tells the small cell base station when and where it is clear to operate in the 3550 to 3650 MHz band.

ASA can be implemented rapidly because no changes to small cells are necessary either. Under typical operation, a base station is in constant communication with its core network (either on another frequency or via wireline backhaul). Meanwhile, under ASA, only the core network communicates to the ASA database and vice versa, and gets information on whether/which 3.5 GHz channel is available at what geo-locations. The core network would then indicate the information to the small cells.

This design means that neither devices nor small cells would need to register with the database. There is a strict command-and-control hierarchy in built into licensed cellular systems and ASA design leverages that hierarchy to the fullest extent. Even more significantly, this design also means that there is full accountability for the incumbent federal users at all times. Only an authorized network would be able to communicate with the database and vice versa, and there will be a responsible party to reach on a 24/7 basis in case of any unauthorized transmission, security breach, or other issue.

Moreover, the ASA database does not need to know when and where all incumbent federal users are operating, it need only know the aggregate receive power level that the federal incumbents can tolerate at a given time, location, and frequency. Once a small cell is cleared for

communications, wireless operations occur in the small cell service area within acceptable power levels, much like it would within a macro cell. The small cell, in turn, controls all user devices operating in that spectrum and thus prevents interference to and from incumbents.

Furthermore, the FCC should take advantage of the extensive standardization work on ASA that has already occurred. Since the time we first proposed the ASA framework to the FCC more than three years ago, Qualcomm and its industry partners have been hard at work standardizing ASA in ETSI, and that process is progressing rapidly.[3]

Qualcomm is pleased that the Revised Framework for the 3.5 GHz band in the *Licensing Public Notice* includes open eligibility for the Priority Access tier and the assignment of mutually exclusive spectrum rights by auction. However, the *Licensing Public Notice* proposes some novel spectrum licensing concepts, such as one-year spectrum licenses with no right of renewal (even if such rights can be aggregated for ten years) and the auction of license rights at the highly granular census tract level — proposals that Qualcomm finds concerning in the context of the 3.5 GHz band. While Qualcomm commends the FCC for considering "outside the box" licensing concepts, we advise the agency against implementing these new concepts in this band for it will delay and could even preclude the necessary capital investment to deploy small cells in the band, which is badly needed to meet users' exponentially increasing data demands.

We believe that 3.5 GHz spectrum rights should be awarded by geographic area licenses that run for 10 year terms with a right of renewal (similar to licenses awarded today via auction), or allocated using a licensed-by-rule framework, or perhaps both, each in discrete portions of the 3550 to 3650 MHz band, as the *NPRM* contemplates. Licensees should be permitted to disaggregate or partition the spectrum, which accomplishes the same purposes that the FCC

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[3] *See* Qualcomm Comments (Feb. 20, 2013) at 11-13; Reply Comments (Apr. 5, 2013) at 5-7.

wants to accomplish via the one year term and the small geographic licensing units, but allows the marketplace to work freely. These tried and true licensing means, with which the Commission has had much success, would allow the mode of licensing to be network operator-driven, consumer-driven, or some combination of the two.

Finally, Qualcomm supports the FCC's proposed technical requirements for operations in the 3.5 GHz band. Specifically, Qualcomm supports allocating the 3550 to 3650 MHz band spectrum in 10 MHz or 20 MHz unpaired blocks, which would allow the spectrum to be used for Time Division Duplex ("TDD") or Supplemental Downlink ("SDL") technologies. Qualcomm also supports allowing small cells to operate with a maximum transmit power of 30 dBm EIRP.

DISCUSSION

I. The Commission Should Use Authorized Shared Access To Enable Exclusive Licensed Access To The 3550 to 3650 MHz Band Using Traditional Commission Licensing Means

As Qualcomm has repeatedly explained, and as the Commission itself has recognized on numerous occasions, the wireless industry and the federal government need to continue working together to clear additional spectrum for mobile broadband use. However, for certain spectrum, such as the 3550 to 3650 MHz band, which cannot be completely cleared of incumbent federal users in a reasonable time frame, Qualcomm and its industry partners have proposed using ASA to enable the operation of mobile broadband small cells when and where the incumbent naval radar systems are not operating. In this way, the band can be integrated into networks to support mobile operations and provide a reliable quality of service when the band is available. Qualcomm has demonstrated how ASA would allow small cells to efficiently share the 3.5 GHz band with the incumbents and greatly enhance and expand mobile broadband network capacity.[4]

ASA is a two-tier spectrum sharing means that allows commercial licensees to operate

[4] *See* Qualcomm Comments at 15-19.

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 comments filed earlier this year, "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 provided extensive technical detail showing how small cells can operate in the 3.5 GHz band at substantially lower power levels on a licensed and managed basis via the ASA framework while completely avoiding interference to federal radar systems and drastically reducing the required exclusion zones.[6] Small cells operating in this way greatly expand mobile broadband network capacity and bring some relief to the mobile broadband data capacity crunch.

Permitting the 3.5 GHz band to be shared by small cells will shrink the exclusion zones substantially, yet 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

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[5] Comments of T-Mobile USA, Inc. (filed Feb. 20, 2013) at 4. *See also* Comments of Nokia Siemens Networks US LLC (filed Feb. 20, 2013) at 19-20.

[6] *See* Qualcomm Comments at A1-A11.

100 to 150 MHz wide,[7] 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

It is critically important that mobile broadband spectrum rights that the FCC will make available at 3.5 GHz be exclusive so they can support a reliable quality of service and guarantee interference-free spectrum sharing with the incumbent federal users. Moreover, by providing a secure interface between federal users and ASA rights holders, the ASA framework is perfectly suited to protect sensitive information, such as when and where naval radars are operating (or not operating). ASA is a binary system where 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. In other words, 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.

Implementation of ASA is completely transparent to the end user device. For a device, operating on 3.5 GHz under ASA is no different from operating on any other band and does not require any changes to the device or the underlying cellular technology. So, a multi-band device that includes support for 3.5 GHz mobile operations would be controlled by a small cell base station that, like a macro cell base station, would tell the device when and where it can 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 receive power level that U.S. government

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[7] Qualcomm has asked the FCC to include the 3650 to 3700 MHz band for small cell use. *See* Qualcomm Comments at 19-20.

incumbents can tolerate at a given location, time, and frequency — and thus does not need to know exactly where and when federal users are operating. 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.

ASA also will allow the spectrum to be used with clear and full accountability at all times for the federal incumbents. Under ASA, only network OAMs will communicate with the ASA database, and vice versa. And, at any given time, at any given location, and at any given portion of the band, if an ASA rights holder is using the spectrum, they will be fully accountable for operating in compliance with the permissible parameters.

C. The FCC Should Not Experiment With Novel Licensing Concepts In The 3550 to 3650 MHz Band

The *Licensing Public Notice* proposes some novel spectrum licensing concepts for the 3.5 GHz band, including one-year spectrum licenses with no right of renewal and the auction of license rights at the census tract level.[8] While Qualcomm definitely favors exploration of innovative means of licensing spectrum and commends the FCC for seriously considering quite novel licensing concepts, there are at least four reasons why the Commission should not implement these concepts in the 3550 to 3650 MHz band.

First, the wireless industry desperately needs more mobile broadband spectrum. We are concerned that testing new licensing concepts (such as those identified above) will delay deployment of small cells in this band. *Second*, we are equally concerned that these new concepts will create a cloud of uncertainty over this important new band that would deter continued investment. *Third*, the management of spectrum use rights in 74,000 census tracts each with a one-year license term (even if aggregated into ten year terms) would be

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8 *See Licensing Public Notice* at 6-10.

administratively burdensome for the licensees and could invite rent-seeking spectrum speculators with limited interest in putting the band to use.[9] *Fourth*, the FCC is already engaged in a novel use of the 3.5 GHz band, that is, dynamic spectrum sharing between mobile users and incumbent naval radar operations, and adding on top of that a completely novel licensing scheme for the mobile licensee(s) heightens the other concerns noted above. To the extent the FCC decides to experiment with novel spectrum licensing concepts, it should do so in another band that is not already complicated by the spectrum sharing environment that will be present at 3.5 GHz.

The FCC should stick with well-established and proven licensing models in the 3.5 GHz band because mobile broadband operators desperately need to incorporate this spectrum into their networks in order to continuing meeting consumers' exponentially increasing data demands. Accordingly, Qualcomm believes that 3.5 GHz spectrum rights should be allocated by using larger geographic areas and 10 year license terms with a right of renewal, much like licenses awarded today via auction, or in a manner such as the licensed-by-rule framework, or both, each in discrete portions of the bands, as contemplated in the *NPRM*. In other words, the mode of licensing can be network operator-driven, consumer-driven, or some combination of the two. This also would allow the spectrum to be used for carrier aggregation or supplemental downlink to provide the best possible user experience.

Finally, 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.

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[9] Indeed, the *Licensing Public Notice* also proposes to not impose a build-out requirement which would further encourage this unhelpful behavior. *See Licensing Public Notice* at 7, 12.

D. The 3.5 GHz Band Should Be Allocated In 10 or 20 MHz Unpaired Blocks And Small Cells Should Be Allowed To Operate With 30 dBm EIRP

Qualcomm supports the FCC's proposed technical requirements for operations in the 3.5 GHz band. For example, Qualcomm supports licensing the 3550 to 3650 MHz mobile broadband spectrum in 10 MHz or 20 MHz unpaired blocks,[10] so that these blocks may be used for Time Division Duplex ("TDD") or Supplemental Downlink ("SDL") operations.

3.5 GHz mobile broadband small cells also should be allowed to operate with a maximum transmit power of 30 dBm EIRP.[11] Finally, Qualcomm supports the FCC allowing the band to be used for cellular deployments as well as for relays and backhaul operations.

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

There are very active efforts in the European Telecommunications Standards Institute ("ETSI") to implement ASA in Europe, where ASA is referred to as LSA for Licensed Shared Access. Since Qualcomm filed its comments and reply comments on the *NPRM*, a great deal of progress has been made in the European Union ("EU") on ASA/LSA. The Commission should leverage these rapidly advancing efforts.

- ASA/LSA is now endorsed by the 28 Regulators of EU Member States. In November, the Radio Spectrum Policy Group released its favorable Opinion on LSA;
- ASA/LSA is now defined by CEPT. The ECC approved in September of this year its Report ECC 205 on LSA for public consultation. The final approval and publication is expected in February 2014;
- ASA/LSA is being implemented in the 2.3 GHz band by CEPT. The ECC Decision is in the final stages of drafting and approval for public consultation is planned for February 2014. Final approval and publication is expected in June 2014;
- ETSI is standardizing ASA/LSA in the 2.3 GHz band. It approved TR103 113 on System Reference and is now working on the technical specification for system requirements with expected approval in June 2014;

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10 *See Licensing Public Notice* at 8.

11 *See Licensing Public Notice* at 15.

- ASA/LSA demos/trials are being planned in 2014. Two demos are planned for Mobile World Congress 2014 and live trials are under consideration later on; and
- ASA/LSA is being considered by Ministries of Defense in multiple EU member states. The implementation of ASA at 2.3 GHz is on the agenda of the CEPT/NATO meeting next month.

As Qualcomm has explained, the FCC should continue to monitor the progress of ASA/LSA in Europe (and elsewhere) and leverage this work where possible because it will help to speed the deployment of small cell technology in the 3.5 GHz band in the U.S. using ASA.

CONCLUSION

Qualcomm has been working on both ASA and small cells for years, and we are very excited about deploying these technologies at 3.5 GHz. Additional information on the technical characteristics of the incumbent federal systems is needed to qualify the extent to which mobile broadband operations can occur in the band near the coasts where the overwhelming majority of Americans live and work. Qualcomm looks forward to continuing to work with the FCC and our industry partners towards making the deployment of small cells in the 3.5 GHz band a reality.

Respectfully submitted,

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