6712-01

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 95

[GN Docket No. 12-354; FCC 13-144]

Commission Seeks Comment on Licensing Models and Technical Requirements in the 3550-3650 MHz Band

AGENCY: Federal Communications Commission.

ACTION: Proposed rule.

SUMMARY: In this notice of proposed rulemaking, the Commission seeks comment on some specific variations of the licensing and technical proposals for the 3550-3650 MHz band (3.5 GHz Band) originally set forth in Amendment of the Commission's rules with Regard to Commercial Operations in the 3550-3650 MHz Band.

DATES: Submit comments on or before December 5, 2013 and reply comments on or before March 20, 2013.

ADDRESSES: You may submit comments, identified by GN Docket No. 12-354, by any of the following methods:

- Federal Communications Commission's Web Site: http://fjallfoss.fcc.gov/ecfs2/. Follow the instructions for submitting comments.
- Mail: All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12th St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or

fasteners. Any envelopes and boxes must be disposed of before entering the building. Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743. U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

- People with Disabilities: Contact the FCC to request reasonable accommodations (accessible format documents, sign language interpreters, CART, etc.) by e-mail: FCC504@fcc.gov or phone: 202-418-0530 or TTY: 202-418-0432.

For detailed instructions for submitting comments and additional information on the rulemaking process, see the SUPPLEMENTARY INFORMATION section of this document.

FOR FURTHER INFORMATION CONTACT: Paul Powell, Attorney Advisor, Wireless Bureau – Mobility Division at (202) 418-1613 or Paul.Powell@fcc.gov.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Public Notice in GN Docket No. 12-354, FCC 13-144A1, Notice of Proposed Rulemaking, 78 FR 1188 (January 8, 2012) (NPRM or 3.5 GHz NPRM), adopted and released November 1, 2013. The full text of this document is available for inspection and copying during normal business hours in the FCC Reference Center, 445 12th Street, SW., Washington, DC 20554. The complete text may be purchased from the Commission's copy contractor, Best Copy and Printing, Inc., 445 12th Street, SW., Room CY-B402, Washington, DC 20554, (202)488-5300, facsimile (202) 488-5563, or via email at fcc@bcpiweb.com. The full text may also be downloaded at: www.fcc.gov. Alternative

formats are available to persons with disabilities by sending an e-mail to fcc504@fcc.gov or by calling the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

Comment Filing Instructions:

Pursuant to §§ 1.415 and 1.419 of the Commission's rules, 47 CFR 1.415 and 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). See Electronic Filing of Documents in Rulemaking Proceedings, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: http://fjallfoss.fcc.gov/ecfs2/.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

- All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12th St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with

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Ex Parte Rules

As noted in the NPRM, this proceeding has been designated as a "permit-but-disclose" proceeding in accordance with the Commission's ex parte rules.

Initial Paperwork Reduction Act Analysis

The NPRM included a separate request for comment from the general public and the Office of Management and Budget on the information collection requirements contained therein, as required by the Paperwork Reduction Act of 1995, Public Law 104-13, and the Small Business Paperwork Relief Act of 2002, Public Law 107-198. This Public Notice seeks further comment on some proposals and alternatives initially raised in the NPRM. We invite supplemental comment on these requirements in light of the details and issues raised in the Public Notice.

Synopsis of the Public Notice of Proposed Rulemaking

I. INTRODUCTION

In December 2012, the Commission released a Notice of Proposed Rulemaking (NPRM) seeking comment on a new Citizens Broadband Service in the 3550-3650 MHz band (3.5 GHz Band) for shared, commercial uses, including small cell networks. The NPRM proposed a three-tier, license-by-rule authorization framework that would facilitate rapid broadband deployment while protecting existing incumbent users of the 3.5 GHz Band. See 3.5 GHz NPRM, 78 FR 1188. The NPRM solicited comment on all aspects of this proposal, including the appropriate licensing framework and the potential uses of each service tier and the Commission has received extensive comment from a wide range of stakeholders in response. The Commission also held a workshop on March 14, 2013 to bring together diverse perspectives on the band and foster productive discussion on the NPRM. Based upon our review of the substantial record before us, we have determined that it would be in the public interest to solicit further comment on specific alternative licensing proposals inspired by some of the suggestions made by commenters and workshop participants to facilitate use of the band for a diverse array of applications.

This proposed rule builds on the NPRM and elaborates on some alternative licensing concepts described in that document. We refer to these elaborated licensing concepts as the Revised Framework. The Revised Framework describes an integrated approach to dynamically authorizing access to the Priority Access and General Authorized Access (GAA) tiers of the 3.5 GHz Band and represents one logical approach towards implementing the next generation of spectrum management systems in light of

the proposals and alternative proposals set forth in the NPRM, the presentations made at the workshop, and the record in this proceeding. This proposed rule also includes examples of possible technical specifications, which could enable multiple networks to coexist in the band within a given geographic area. We seek detailed comment on the Revised Framework and the possible technical criteria. We request that commenters provide technical and cost-benefit analyses to support their positions.

Our goal in seeking comment on the Revised Framework is to supplement the record with focused comment on licensing and authorization concepts for the 3.5 GHz Band. This Public Notice does not discuss issues related to shared operations with incumbent federal and Fixed Satellite System (FSS) users, potential out-of-band interference issues, or any potential geographic restrictions on commercial use of the 3.5 GHz Band.

II. DISCUSSION

With this notice of proposed rulemaking, we seek comment on some specific variations of the licensing and technical proposals set forth in the NPRM. The Revised Framework discussed below synthesizes elements from the NPRM and various commenter proposals into an integrated authorization scheme for the 3.5 GHz Band. In doing so, we seek to advance the discussion about how new technologies can facilitate coexistence between different kinds of users with different rights in the band. The Revised Framework retains the three-tier model proposed in the NPRM but, consistent with alternative authorization methods raised in the NPRM, expands the eligibility criteria for the Priority Access tier and explores innovative means of assigning exclusive

authorizations within the tier. Like the NPRM's main proposal, the Revised Framework would leverage the unique capabilities of small cell and SAS technologies to enable sharing between users in the Priority Access and GAA tiers. Specifically, the Revised Framework contains the following core concepts: (1) an SAS to dynamically manage frequency assignments and automatically enforce access to the Priority Access and GAA tiers; (2) open eligibility for Priority Access tier use; (3) granular but administratively-streamlined licensing of the Priority Access tier; (4) mutually exclusive spectrum rights for Priority Access subject to licensing by auction, coupled with; (5) a defined "floor" of GAA spectrum availability, to ensure that GAA access is available nationwide (subject to Incumbent Access tier use); (6) additional GAA access to unused Priority Access bandwidth, as identified and managed by the SAS, to maximize dynamic use of the unutilized portion of the band and ensure productive use of the spectrum; (7) opportunities for critical infrastructure facilities to obtain targeted priority spectrum use within specific facilities (such as a building) that meet certain requirements to mitigate the potential for interference to and from other band users; and (8) a set of baseline technical standards to prevent harmful interference and ensure productive use of the spectrum.

A. Priority Access Tier

The Revised Framework further develops some alternative proposals contained in the NPRM with respect to the Priority Access tier. The approach to the Priority Access tier described in the Revised Framework reflects many commenters' desire to open the Priority Access tier to a broader class of potential users. At the same time, the Revised

Framework retains a significant amount of spectrum for GAA uses and incorporates innovative features designed to integrate with the unique aspects of the Citizens Broadband Service and the 3.5 GHz Band. The Revised Framework balances the benefits of exclusive licensing and open eligibility with the need to preserve GAA spectrum access and promote productive small cell use of the band. In this section, we describe concepts related to: (1) licensee qualifications for access to the Priority Access tier; (2) the elements of the Priority Access Licenses (PALs) which could be used to authorize access to the Priority Access tier; and (3) potential methods for assigning access to the Priority Access tier when mutually exclusive applications are received. We seek comment, including costs and benefits, on the revised approach to the Priority Access tier described below.

The Revised Framework would expand access to the Priority Access tier to a broad class of potential users. The NPRM proposed limiting Priority Access eligibility to certain "mission critical" usersIn the alternative, we also proposed a more open eligibility model. In response to the NPRM, many commenters supported the "open" eligibility alternative. Several others endorsed restricted eligibility, tailored to specific users or industries. Under the Revised Framework, any prospective licensee who meets basic FCC qualifications would be eligible to apply for Priority Access licenses. We seek detailed comment on this approach, including the potential range of eligible users and any associated costs and benefits.

1. Priority Access Licenses

In the NPRM, we asked for comment on the technical licensing and regulatory ramifications of our proposal for Priority Access users. Under the Revised Framework, a set of PALs would define and control spectrum use in the Priority Access tier. PALs are intended to ensure flexible and efficient use of the Priority Access tier, given the characteristics of small cell networks and advanced capabilities of an SAS. We envision a "building block" approach in which relatively granular PALs could be aggregated – in space, time, and frequency – to meet diverse spectrum needs. We seek specific comment below on the geographical, temporal, and frequency dimensions of potential PALs and on the administrability of PALs in the context of the broader Revised Framework.

Time. Under the Revised Framework, PALs would have a one year, non-renewable, term but licensees would be able to aggregate multiple consecutive PALs to obtain multi-year rights to spectrum within a given geographic area. PALs would automatically terminate after one year and would not be renewed. While shorter than the 10- or 15-year terms typically associated with area-licensed wireless services, a 1-year term may be more appropriate in this case. First, multiple 1-year terms could be aggregated together to replicate the predictability of a longer-term license while providing much of the flexibility inherent in shorter-term spectrum authorizations. Second, the use of a shorter, non-renewable license term could simplify the administration of the Priority Access tier by obviating the need for some administratively-intensive rules that are common to longer-term licenses. These include renewal, discontinuance, and performance requirements associated with a traditional

spectrum license. Third, shorter terms would allow for a wider variety of innovative uses and encourage consistent and efficient use of spectrum resources. Finally, short term licenses could promote greater fungibility and liquidity in the secondary market. In light of these factors, we seek comment on the appropriate duration of PALs and any associated costs and benefits of this or other proposals.

Geography. Our goal is to establish the geographic component of PALs in a way that allows flexible, micro-targeted network deployments, promoting intensive and efficient use of the spectrum, but also allowing easy aggregation to accommodate a larger network footprint. Due to their low power and small size, small cells can provide broadband coverage and capacity in targeted geographic areas. This applies whether small cells are used to offer independent broadband service, supplemental coverage for a macrocell network, or private network functions.

We envision that PALs would be authorized in a highly localized fashion, such as at the census tract level. Census tracts may provide an appropriately high level of geographic resolution for small cell deployments, while also presenting a number of other benefits. Currently, there are over 74,000 census tracts in the United States targeted to an optimum population of 4,000. Census tracts vary in size depending on the population density of the region, with tracts as small as one square mile or less in dense urban areas and up to 85,000 square miles in sparsely populated rural regions. They generally nest into counties and other political subdivisions and, in turn, into the standardized license areas commonly used by the Commission (e.g., Cellular Market Areas and Economic Areas). Census tracts could be aggregated into those or other larger areas. Census tracts

generally align with the borders of political boundaries (e.g., city lines) and often to natural features, which may affect population density (e.g., rivers). Census tracts, therefore, may naturally mirror key considerations in small cell deployment by service providers, such as tracking existing customers, plant, and permits or rights-of-way. In addition, the inclusion of census tracts in census geospatial databases could ease the incorporation of geographic and demographic data into an SAS.

We seek comment on considerations regarding the size of the geographic component of the PALs. Are census tracts an appropriate geographic unit for PALs? If not, what standard geographic unit would best promote the Commission's goals? Should other geographic areas (e.g., counties, census block groups) or licensing units (e.g., Cellular Market Areas), be used instead? Would a standardized grid (e.g., 1 kilometer x 1 kilometer or 2 kilometer x 2 kilometer square) overlaid on the United States be a more appropriate geographic unit? Alternately, could a standardized high-resolution grid be "nested" within a larger grid or a political boundary such as a county? Commenters should identify any costs or benefits, including a detailed technical analysis regarding the geographic size of the PALs.

Frequency/Bandwidth. We identify 10 megahertz unpaired channels as a standard PAL bandwidth that balances several objectives. First, 10 megahertz channels provide a practically deployable and scalable bandwidth for high data rate technologies. Second, 10 megahertz channels divide evenly into either the 100 megahertz (10 channels) available in the 3.5 GHz Band or the 150 megahertz of spectrum (15 channels) that would be available if the supplemental plan is adopted, providing flexibility for either proposal.

Third, 10 megahertz channels are sufficiently granular to license multiple Priority Access users in each geographic area, particularly where protection of incumbents limits the amount of spectrum available for commercial use. Fourth, we expect that 10 megahertz licenses would provide useful "building blocks" for licensees that might wish to aggregate larger amounts of spectrum in a given area. We seek comment on the appropriate bandwidth for PALs and, in particular, whether 10 megahertz blocks appropriately balance the needs of potential Priority Access users and the policy objectives identified herein. Commenters should identify any costs or benefits, including a detailed technical analysis of any proposed bandwidth unit.

License Flexibility and Fungibility. The purpose of the PAL approach is to encourage flexible use of the 3.5 GHz Band for an array of applications and end users. Such applications could include not only small cell commercial broadband use, but private networks, non-line of sight backhaul, and other innovative uses. Spectrum users would need to comply with certain technical criteria, such as those discussed in section III (e) below, to ensure their effective coexistence. These requirements are intended to be minimal to encourage diverse spectrum use. We seek comment on how much technical flexibility is possible in the 3.5 GHz Band given the licensing model proposed in the NPRM and elaborated upon in the Revised Framework.

Administrability. The PAL concept is intended to reduce the complexity associated with administering and automating licensing processes for a large number of granular licenses by eliminating the need for a number of regulatory requirements associated with longer term licenses. We seek comment on the implications of the PAL

concept on existing Commission licensing and authorization processes as well as for the design of an SAS.

We also seek comment on the amount and type of information that would need to be collected from potential Priority Access licensees. The Communications Act establishes certain categories of eligibility for license applications, while giving the Commission broad discretion to determine specific eligibility criteria. See 47 U.S.C. 308 (b). In the auctions context, the Commission typically requires applicants for spectrum licenses to submit short and long form applications detailing their qualifications and any supplemental information the Commission deems necessary. See 47 CFR 1.2105. The Communications Act also limits foreign ownership of FCC licenses, See 47 U.S.C. 310, and comprehensive ownership information is required for all license applications, whether or not they are subject to competitive bidding. See 47 CFR 1.2112. Certain additional qualifications are prescribed by statute. See 21 U.S.C. 862; 47 CFR 1.2001.

Given our goal of a more fungible and administratively streamlined licensing regime for the 3.5 GHz Band, we seek comment on the information that must be collected from prospective licensees in an open eligibility environment. What is the minimum amount of licensee data that must be directly collected and maintained by the Commission to meet the requirements of the Communications Act? Are there any legal or other impediments to collection and maintenance of such information by a third party, such as an SAS operator under Commission supervision? What requirements, such as for information security, would need to be imposed on such third parties? What processes and standards, and what Commission review mechanism, should be applied to ensure that

licensee information is collected in accordance with Commission rules and all licensees meet appropriate eligibility requirements?

2. Assignment of Priority Access Licenses

In the NPRM, the Commission sought comment on a proposed license-by-rule authorization regime as well as alternative licensing schemes, including auctions for Priority Access tier use within defined geographic service areas and other assignment methodologies. Under the Revised Framework, the number of applications for Priority Access rights could exceed the number of available PALs in a given area or timeframe and, in that event, we would need to provide for a means of resolving mutually exclusive applications. Section 309(j) of the Communications Act generally requires the Commission to resolve mutually exclusive applications via competitive bidding. See 47 U.S.C. 309 (j)(1). Given the unique nature of the PAL-based licensing framework, we see an opportunity with the 3.5 GHz Band to develop more flexible and dynamic auction mechanisms than we have used thus far for assigning authorizations, consistent with the requirements of section 309(j). Therefore, we seek comment on approaches to spectrum assignment and auction that could be used to productively manage use of the Priority Access tier while allowing SAS authorized opportunistic use of the GAA tier as described in the NPRM.

One authorization method that could serve the goals of this Revised Framework would be a combination of the license-by-rule approach proposed in the NPRM and a more traditional auction process. Under such an approach, GAA users would be licensed by rule under part 95, requiring registration with the SAS for operation as set forth in the

NPRM. Separate licenses would not be required for individual GAA users. For Priority Access users, the Commission would not license use by rule. Instead, on a regular basis (perhaps annually), the Commission would open windows for applications for available PALs. To accommodate the ability of licensees to aggregate consecutive one-year terms, the Commission could offer multiple consecutive years of PAL rights simultaneously. At the close of such a "window," the Commission would hold an auction to assign PALs where there are mutually exclusive applications pending. Mutual exclusivity would be triggered when more applications are submitted than can be accommodated geographically, temporally, or spectrally.

We expect that Priority Access authorizations would be issued on a PAL basis, as defined above. Licensees would have no renewal expectancy, would automatically terminate at the end of their one-year terms and would be non-renewable. We do not anticipate adopting construction or service requirements for Priority Access licensees due to the impracticability of enforcing such requirements across 74,000 or more license areas with, potentially, multiple licensees in each area if we base PALs on census tracts. However, to encourage deployment and long term network planning, we anticipate allowing potential licensees to bid for multiple consecutive years of PAL rights in a given geographic area at a single auction, up to a predetermined cap. Payment for each consecutive PAL could be due annually prior to the license start date and a license would terminate automatically if the payment is not made. Additionally, licensees may be permitted to trade future PAL rights via secondary market transactions. As noted below, we anticipate that annual auctions, combined with microtargeted licensing and annual

pre-payment requirements would sufficiently incentivize construction of network facilities and intensive spectrum use for a diverse range of uses in the public interest while discouraging warehousing.

We anticipate that this spectrum assignment process would require a greater degree of automation and, potentially, more third-party participation than the Commission has employed in past auctions. Given the large number of license areas and relatively short license terms envisioned in the Revised Framework, more flexible and dynamic auction mechanisms may be required to effectively manage use of the Priority Access tier. We also foresee an opportunity for third-parties to add value to the auction process by developing tools to help bidders manage their inventory of PALs and structure bids in regular auctions. We seek comment on the degree to which such an auction could be automated and administered by a third party. What kind of auction format would be most appropriate? Should SAS managers be permitted to administer auction process as well or should these functions be kept separate? What level of automation would be required to process the volume of applications and bids that such an auction would entail? To what degree could the Commission assign the responsibility for administering this type of auction to a qualified third party and, if it did so, what safeguards would be required to ensure the integrity of the auction process? What lessons can be drawn from prior Commission reliance on third-parties in auction or other contexts, including selection criteria for and supervision of such third parties? See, e.g., 47 U.S.C. 251(e)(10); 47 CFR 52.12; 47 CFR 54.701.

We seek comment on the auction and licensing mechanisms discussed above, including their economic and technical viability, whether they are consistent with the requirements of section 309(j), and any other potential legal issues that may arise. Commenters should identify any costs or benefits associated with the proposal. Would such an approach properly incentivize targeted use of the Priority Access tier by a diverse group of users? How many consecutive years of PALs should the Commission offer in a single auction? What, if any, limits should be placed on the aggregation of PALs – in time, location, or frequency – by a single licensee?

We also seek comment on alternative licensing and authorization mechanisms. For instance, could a license-by-rule regime encompass both the GAA and Priority Access tiers, as they are envisioned in the Revised Framework? Are other models preferable? Commenters advocating alternative assignment models should identify any costs or benefits associated with these approaches and should include a detailed technical analysis.

B. Band Plan

We seek comment on a band plan that would balance SAS-authorized opportunistic access to the GAA tier with targeted exclusive access to the Priority Access tier, as described above. Under the Revised Framework, a minimum amount of spectrum would be designated for GAA access in each geographic area, leaving the remaining bandwidth available for assignment to priority access users on a PAL basis. We seek comment on whether a minimum GAA reservation should be defined in terms a proportional ratio that can scale with the quantity of spectrum available in a given

location or time after protecting incumbent uses, rather than a fixed (megahertz) bandwidth. Would a ratio assigning a minimum of, for example, 40 or 50 percent of available bandwidth for GAA use further the public interest or would another ratio be more appropriate? We emphasize that such ratio would constitute the "floor" for GAA use. Under the Revised Framework, GAA use would be authorized and managed by the SAS, as proposed in the NPRM. In addition, when Priority Access rights have not been issued (e.g., due to lack of demand) or the spectrum is not actually in use by a Priority Access licensee, the SAS would automatically make that spectrum available for GAA use locally. Therefore, in any given location, the quantity of spectrum available for GAA use could exceed the reserved amount – sometimes by a significant margin. This approach would ensure that the greatest possible portion of the 3.5 GHz Band would be intensively used.

We seek comment on the public interest benefits of balancing GAA and Priority Access use in the 3.5 GHz Band in the manner described above. We also acknowledge that, if the supplemental proposal to include the 3650-3700 MHz band is adopted, an even split between Priority Access and GAA use would result in a fractional PAL and seek comment on the appropriate ratio to apply in this situation. We also seek comment on implementation details, including, for example, how the "use-it-or-share-it" concept described above could be implemented. What does "use" mean in this context? How should it be measured? How would such dynamically changing rights be enforced? Commenters should identify any costs and benefits associated with any proposed implementation approach.

We also envision that, in place of a static channel model, the SAS would dynamically assign specific frequencies within given geographic areas. The SAS would assign GAA users and Priority Access licensees shares of the band but the exact spectral location of a given transmission authorization within the band would not be fixed. For example, a licensee might have Priority Access rights for a single PAL, as defined above, but the specific frequencies assigned to that user would be managed by the SAS and could be reassigned from time to time (e.g., from 3550-3560 MHz to 3630-3640 MHz). The SAS would assign and maintain appropriate frequency assignments and ensure that lower tier users do not interfere with higher tier users and to minimize interference among users in the same tier. Under this approach, we ask whether authorized base stations, handsets, and other user equipment should be required to be capable of operating across the entire 3.5 GHz Band. How would a requirement to include capability to operate across the entire band affect equipment design, performance and cost?

We acknowledge that there may be benefits for Priority Access tier licensees and GAA users to ensuring that contiguous blocks of spectrum are made available for each tier and even individual licensees with multiple PALs in a given geographic area. We seek comment on whether it would be technologically feasible and in the public interest to ensure that contiguous spectrum is made available on a tier-by-tier and licensee-by-licensee basis.

We seek comment on this dynamic approach to frequency assignment. We acknowledge that this interactive approach would require the SAS to go well beyond the parameters of the current TV White Spaces databases to manage multiple users on a

dynamic, real time or near real time basis. Is this spectrum management approach feasible using current or developing technologies? Are there any technical parameters that would need to be codified in Commission rules? How do the public interest benefits of such an approach compare to a more traditional channel block band plan? Commenters should identify any costs or benefits and include a detailed technical analysis to support their positions on dynamic assignment of frequency bands.

C. Ensuring Productive Spectrum Use

The Revised Framework leverages the unique characteristics of small cells and the capabilities of modern database technologies to ensure that the 3.5 GHz Band is used intensively for a wide variety of potential applications. We seek comment on whether the PAL-based allocation model outlined above could, by assigning priority spectrum rights in a targeted and dynamic fashion, help to ensure that Priority Access rights are allocated to the parties that would make the most productive use of quality-assured spectrum within a given geographic area. Moreover, short term licenses with no renewal expectancy would provide licensees with incentives to make actual and consistent use of the spectrum and significantly reduce the risk of spectrum warehousing. This paradigm could also obviate the need for performance and construction requirements that could be especially burdensome and difficult to administer in the small cell context.

In the Revised Framework, the GAA tier plays an important role in ensuring that the 3.5 GHz Band is used consistently and productively. Ensuring that a significant GAA "floor" is maintained in all geographic areas where commercial use of the 3.5 GHz Band is permitted, regardless of the number of Priority Access tier users in the area, should

encourage widespread deployment of base stations and handsets that would operate opportunistically in the band under the control of the SAS. Moreover, under the Revised Framework, PALs that are not in actual use would be added to the pool of available GAA spectrum, as determined by the SAS. Thus, the GAA tier could be used to supplement the spectrum available to active Priority Access users and as a source of spectrum for opportunistic users as determined by the SAS. These complementary functions should maximize the utility of the 3.5 GHz Band for a diverse set of applications.

We seek comment on this approach to promoting productive use of the 3.5 GHz Band. Would the PAL concept provide strong incentives for licensees to productive use their priority rights? What technical metrics are appropriate to measure "use" in a portion of or the entirety of a PAL? How can the SAS effectively monitor actual use of the Priority Access tier to determine whether additional spectrum is available for GAA use?

D. Localized Critical Access Use

As explained in the NPRM, a variety of critical services in the United States have urgent current as well as future spectrum needs. While there is currently insufficient spectrum available to efficiently allocate dedicated spectrum bands to all of these users, we continue to believe that the 3.5 GHz Band can be used to provide localized, protected spectrum to entities with a need for reliable, interference protected spectrum access throughout much of the country. Many parties, including Motorola Solutions, UTI, EEI, and Microsoft submitted comments supporting such access to the 3.5 GHz Band for various critical access users. Even as we explore methods for expanding access to the Priority Access tier, we continue to believe that "the high spatial reuse characteristics of

low-power 3.5 GHz transmissions, combined with access management facilitated by the SAS, should allow the 3.5 GHz Band to be utilized on a shared, licensed basis by a variety of critical users to provide high quality services to localized facilities." Under the authorization method described above, critical access users would be eligible to register and, in the case of mutually exclusive applications, bid for access to Priority Access tier PALs. However, many such facilities (e.g., hospitals) generally only need access within specific buildings and therefore may not require exclusive access to even a full census tract of Priority Access tier spectrum. Moreover, these users would likely be unable to outbid well capitalized commercial interests for competitive PALs. As such, we seek comment on whether it would be possible to allow such critical users to receive interference protections, akin to Priority Access users, within a limited portion (e.g., 20 megahertz) of the GAA pool inside the confines of their facilities.

Under this approach, qualified critical access facilities would be eligible to operate indoor small cell networks on a quality-assured basis. These licensees would be required to register their networks in the SAS and comply with applicable technical rules, including low power limits. In addition, while the SAS could manage GAA use in the area to provide a measure of protection for critical access users, such users might also be required to employ interference mitigation techniques to ensure a properly interference-limited environment. Such techniques could include physical shielding or building modifications around eligible facilities. Alternatively, there may be standard specifications for building efficiency or radio frequency (RF) shielding that go beyond those applicable to normal construction that could provide enough certainty against

interference from surrounding Priority Access or GAA use so as to provide an interference "safe harbor" for those seeking critical access protections. We note that some modern building standards may incorporate materials that result in some degree of RF shielding.

We seek comment on methods to provide quality-assured spectrum for critical access users. Does the Revised Framework adequately address the needs of such critical access users? Would the SAS be able to effectively manage spectrum use by a large number of microtargeted facilities? What interference mitigation techniques should be required to ensure that these facilities do not interfere with or receive interference from other 3.5 GHz Band users? How would compliance with technical rules and interference mitigation requirements be managed? What RF emission limits would be appropriate for a "safe harbor" as described above? Would this plan unacceptably encumber GAA spectrum? We ask that commenters identify any costs and benefits and provide a detailed technical analysis to support their arguments.

We also ask whether this approach should be limited to "critical access" facilities. Could quality assured, microtargeted indoor networks be employed generally by property owners subject to appropriate technical and interference mitigation requirements? What types of mitigation techniques would such buildings need to employ to effectively prevent exterior interference? Could such buildings coexist in close proximity without unacceptably interfering with one another? Would an SAS be able to effectively manage a large number of these locations?

E. Technical Issues

While we expect that the SAS would coordinate much of the interaction between disparate users in the 3.5 GHz Band, some minimal technical requirements will be necessary to ensure that multiple networks can effectively coexist in the band. As such, we seek comment on certain technical issues related to implementing the Revised Framework. In responding to questions in this section, we ask that commenters identify any costs and benefits and provide detailed technical analysis to support their proposals. We also recognize that these issues may need to be explored in greater depth in the future and, to that end, we may seek additional comment on specific technical rules in future notices.

1. Technical Implementation of the Revised Framework

The effectiveness of dynamic spectrum sharing depends on the proper application of interference mitigation and spectrum management techniques for operating in the shared band. The Commission addressed some of the technical features of small cells in the NPRM, including allowable power limits for small cell base stations, and solicited comment on these and other potential technical rules. Below, we seek additional comment on technical rules and assumptions appropriate to implementing the Revised Framework or variations supported by commenters. We ask that commenters identify any costs and benefits and provide detailed technical analysis to support their proposals.

Building on the approach taken in the TV White Space proceeding, we expect that the SAS would manage and configure the use of authorized spectrum and policy related parameters, and communicate updates regarding spectrum availability and operational

requirements to existing and new users. The SAS could extend the TV White Spaces paradigm with a greater degree of dynamism – by incorporating information about spectrum utilization from other Citizen's Broadband users to manage access to the band on a real-time or near-real time basis. For example, infrastructure nodes, such as base stations, access points, or core network elements could interact with the SAS and provide end user devices with operational parameters and recent changes. Given these factors, we seek comment on the essential high-level requirements for the SAS and the nature of its interactions with the different technologies and network topologies in the 3.5 GHz Band.

Compared to typical macrocell deployments, small cell networks are generally characterized by: lower transmit power, lower local RF transmissions, and an ability to operate in a relatively high interference environment (relative to thermal noise; Interference-over-Thermal (IoT)). In addition, recent advancements in network self-organization and interference management technologies are expected to allow for new spectrum sharing paradigms, which are difficult to implement or impractical in traditional noise-limited environments. Given the variety of possible network deployments and the wide range of potential network parameters and RF configurations, we anticipate that many of the parameters of systems operating in the 3.5 GHz Band will be managed by the SAS. However, some preliminary estimated values for transmission power levels, whether field strength or power flux density (PFD) limits should be imposed. With regard to the Revised Framework, the key technical considerations include: (1) base station transmit power; (2) acceptable interference environment; and (3) technical

flexibility. In light of the Revised Framework described here and additional staff analysis, we seek comment on some preliminary values defining some of these technical parameters and criteria.

Base Station Transmit Power. As a baseline, we seek comment on limiting small cell base stations operating in the 3.5 GHz Band to a maximum 24dBm transmit power along with maximum antenna gain of 6dBi. These values are consistent with the 30dBm EiRP commonly assumed in various studies for small cell base stations. The maximum operational EiRP of individual base stations might be reduced by the SAS to prevent interference and promote efficient network operation. In addition, we assume end user devices to have configurable maximum power levels below typical 23dBm values and support for some form of power control to ensure effective spectrum sharing.

We seek comment on the power levels which should be considered as a baseline for spectrum sharing evaluation and if the SAS can regulate the use of such power levels. We also seek comment on the degree to which power levels in excess of 24 dBm may be appropriate to enable other use cases, such as the rural coverage case contemplated in our NPRM. Should we consider additional higher and lower base station (e.g., eNodeB or Access Point) power classes for operation in the 3.5 GHz Band to address different network deployments? What values should be assumed for EIRP? Should power control function and capability at the base station and user device be service rule requirements?

Acceptable Interference Environment. Another key factor to consider is the acceptable interference environment in which multiple small cell networks would be able to coexist. The acceptable interference rise over thermal noise for small deployments has

been studied with operational values around 20dB for picocells and even higher (e.g., greater than 40dB) for femtocells. A common understanding of tolerable IoT levels and extending them to estimate maximum acceptable intersystem co-channel interference and adjacent channel interference appear key to realizing and quantifying the potential in spectrum sharing. What are appropriate values for IoT given the Revised Framework we envision for the 3.5 GHz Band? In addressing this question, commenters should focus not only on interference issues between similar type systems (e.g., LTE to LTE), but also on coexistence issues between disparate systems (e.g., LTE to Wi-Fi). Are different considerations necessary for each of these situations? Can such an approach be integrated with the imposition of some minimal receiver standards on equipment in the band? How could such policies be implemented and enforced at licensees' geographic boundary for a single PAL or a collection of aggregated PALs? Similarly, one can estimate the maximum signal level received from each system in adjacent channels. We seek comment on noise figures, aggregate and intra and inter-system IoT thresholds, and receiver desensitization with focus on 3.5 GHz Band small cells. In addition, we seek comment on whether an approach based on field strength or PFD would be more appropriate and easier to administer and comply with. If so, at what location(s) should such limits be imposed (*e.g.*, at ground level, at some height above ground)? What additional consideration is needed if two adjacent systems use different radio access technologies or have no or poor synchronization?

Technical Flexibility. The Revised Framework is designed to flexibly accommodate different types of end users and a variety of use cases. To what extent

could technical rules facilitate the effective coexistence of disparate technologies and network topologies in the band? Should we also accommodate point to multipoint radios for wireless backhaul and WISP applications as suggested by some commenters? If so, how would their coexistence with small cells in nearby locations or adjacent channels be managed? Could spectrum coordination between different networks and technologies be automated in whole or in part and managed by the SAS? How can the SAS facilitate coexistence of disparate systems?

2. Additional Technical Considerations

We acknowledge that there may be additional technical considerations beyond those addressed in the NPRM and this Public Notice that would need to be incorporated into any technical rules adopted in this proceeding. We seek comment on what additional technical issues may need to be addressed in this proceeding to promote efficiency and intensive use of the 3.5 GHz Band. We encourage commenters to address these issues as thoroughly as possible. To the extent we see commenters identify common issues that require further discussion, we may seek additional comment as appropriate. As noted above, we envision holding a workshop on the technical aspects of the SAS in the near future. The Bureaus will solicit further input on SAS requirements in conjunction with that event.

We note that the FCC's Technological Advisory Council (TAC) has been studying spectrum interference policy and receiver standards in general, and it recommends that the Commission consider forming one or more multi-stakeholder groups to study such standards and interference limits policy at suitable service

boundaries, such as those related to the 3.5 GHz band. Should the Commission encourage the formation of one or more groups to investigate interference limit policy for the 3.5 GHz band? If so, what should be the scope of such a group or groups?

F. Extension of Revised Framework to the 3650-3700 MHz Band

The NPRM described the possibility of extending the proposed licensing framework to the 3650-3700 MHz band. Although our primary objective here is to describe how the Revised Framework would operate in the context of the 3.5 GHz Band, we also seek comment on whether and how it could be extended to the 3650-3700 MHz band. What, if any, additional considerations would apply if the Revised Framework were to be applied to the 3650-3700 MHz band? What provisions would need to be made for incumbent operators? How much transition time would be required?

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch,

Secretary.

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