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

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

To: The Commission

**COMMENTS OF ERICSSON IN RESPONSE TO THE
FURTHER NOTICE OF PROPOSED RULEMAKING**

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EXECUTIVE SUMMARY

The U.S. has an opportunity to add 150 MHz of new spectrum for wireless broadband services and to maintain its global leadership position in mobile broadband. To make the most of this spectrum, the Commission should adopt rules that will encourage private sector investment and deployment in a shared Federal/commercial framework in the 3.5 GHz band. While this band can serve as an “innovation band,” it must also serve as a practical, near-term solution to meet the growing demand for mobile broadband service.

Under the proposed, but yet-to-be developed Spectrum Access System (“SAS”), it will be difficult to accommodate Federal and satellite incumbents, licensed Priority Access Licensees (“PAL”), and unlicensed General Authorized Access (“GAA”) users if they all must coexist in the same spectrum band in the near-term. Such multi-tiered sharing will take considerable time to implement due to the need to solve numerous technical, security, and other challenges. In the meantime this valuable spectrum will remain unused for broadband services. The Commission should instead pursue a transitional approach that will allow experimentation while providing a roadmap for investing and deploying. A balanced policy accommodating licensed and unlicensed, with separate sub-bands for PALs/incumbents, GAA/incumbents, and experimentation with multi-tier operation, will foster up-front investment in the 3550-3700 MHz band and allow the multi-tier framework to be developed and proven at the same time as the band is open for use.

The Commission should grant fixed-frequency assignments to PALs to facilitate the use of spectrum in managed networks, rather than rely on dynamic frequency assignments that would circumvent efficient spectrum planning and usage. Wireless network operators carefully manage the use of assigned frequencies from multiple bands to ensure availability when and where spectrum is needed throughout a system for coverage or for capacity, to maintain a level of service their customers demand. In addition, the Commission should not permit GAA access to spectrum assigned to PALs that has been deployed, to avoid the potential for harmful interference and the need for constant reconfiguration of frequency plans; such dynamic frequency assignment practices may preclude investment in PAL networks. The Commission should also optimize the license terms and other regulatory policies to promote PAL participation. Larger license areas, longer license terms, renewal expectancy, and higher power limits will encourage investment in 3.5 GHz networks.

The large proposed Exclusion Zones, which cover 60% of the population, threaten to scuttle investment in this band. The Exclusion Zones should be revisited, based not only on more realistic estimates of how the spectrum will be used, but also on protection of incumbents from wireless broadband, and not *vice versa*. Ultimately, the Commission should convert the Exclusion Zones to Coordination Zones. Coordination Zones would allow radio transmitters to be used in a non-interfering manner in additional geographic areas.

The Commission should reexamine the role of the SAS with respect to managed networks, including those using GAA as well as PAL spectrum. The SAS should not attempt to manage individual radios in managed networks; it should coordinate with the managed networks’ operational support systems, instead. This would preserve network operators’ ability to manage and plan spectrum usage within multiband networks and employ technologies such as carrier

aggregation. The core role of the SAS should be to manage sharing between incumbents and new commercial users and ensure that GAA does not create harmful interference to PALs. The Commission should build on the knowledge that has been developed in planning for Licensed Shared Access. The Commission should refrain from reserving GAA spectrum for Contained Access Facilities, which would add an unnecessary layer of complexity to an already intricate regulatory framework.

Ericsson supports the authorization of multiple SAS administrators, and the qualification procedure proposed in the *Further Notice* are reasonable. Likewise, allowing SAS administrators to collect fees, similar to the rules for TV white spaces, is reasonable. However, limiting such fees would be overly restrictive and unduly limit the flexibility of the SAS administrator to develop business models. The Commission should not require the SAS to manage individual radios in a managed network; likewise, it should not require the managed network operator to provide information about individual radios to the SAS. The SAS should provide a mechanism for verification and authorization of devices or networks of devices, and the communications between the SAS and devices or network operational support systems should be protected through encryption.

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Ericsson submits these comments in response to the Commission’s *Further Notice of Proposed Rulemaking*¹ proposing rules for a new Citizens Broadband Radio Service in the 3.5 GHz band.²

I. THE 3.5 GHZ BAND IS AN IMPORTANT SOURCE OF SPECTRUM TO MEET THE GROWING DEMAND FOR MOBILE BROADBAND

The 3.5 GHz band offers a great opportunity for the United States to add to the spectrum ranks available for mobile broadband.

Ericsson tracks spectrum usage and broadband deployment trends globally, and the latest *Ericsson Mobility Report* shows that North America currently is—and is projected to remain—the overwhelming global leader in mobile broadband. By 2019, 85% of North American mobile subscriptions will be LTE, while it is expected that in the runner-up region, Western Europe,

¹ *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, *Further Notice of Proposed Rulemaking*, 29 FCC Rcd 4273 (2014) (“*Further Notice*”).

² Ericsson uses the term “3.5 GHz band” in these comments to describe the spectrum from 3550 MHz to 3700 MHz, specifically including the 3650-3700 MHz band.

only 50% of mobile subscriptions will be LTE.³ Mobile wireless data traffic is projected to increase seven-fold in North America during that time.⁴ Continued U.S. leadership—and continued investment and growth to meet the U.S. market’s surging demand for mobile broadband—can only be sustained if sufficient spectrum is available. The 3.5 GHz band offers great promise to aid the nation in meeting these growing capacity demands, but its value will depend on a suitable regulatory environment.

Four years ago, the Commission’s National Broadband Plan called for 500 MHz of wireless broadband spectrum to be made available within ten years, including 300 MHz within the first five years.⁵ President Obama then issued two Presidential Memoranda on spectrum and called for a review of Federal government spectrum usage to repurpose spectrum for commercial wireless broadband.⁶ As the President stated:

Expanded wireless broadband access will trigger the creation of innovative new businesses, provide cost-effective connections in rural areas, increase productivity, improve public safety, and allow for the development of mobile telemedicine, telework, distance learning, and other new applications that will transform Americans’ lives. . . . [But t]his new era in global technology leadership will only happen if there is adequate spectrum available to support the forthcoming myriad of wireless devices, networks, and applications that can drive the new economy.⁷

³ Ericsson, *Ericsson Mobility Report on the Pulse of the Networked Society* at 9 (June 2014), <http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-june-2014.pdf>.

⁴ *Id.* at 11, 12.

⁵ See FCC, *Connecting America: The National Broadband Plan*, at 10, 75 (Mar. 2010), <http://www.broadband.gov/plan/>.

⁶ Memorandum for the Heads of Executive Departments and Agencies, *Unleashing the Wireless Broadband Revolution*, 75 Fed. Reg. 38387 (July 1, 2010) (“2010 Presidential Memorandum”); Memorandum for the Heads of Executive Departments and Agencies, *Expanding America’s Leadership in Wireless Innovation*, 78 Fed. Reg. 37431 (June 20, 2013).

⁷ 2010 Presidential Memorandum, 75 Fed. Reg. at 38387.

While repurposing spectrum from the Federal government to exclusive commercial use is preferable to sharing, there are some candidate bands where that is not possible, and in 2010, NTIA identified the 3.5 GHz band as such a band.⁸ The President’s Council of Advisors on Science and Technology (“PCAST”) followed in 2012 by calling for a novel, three-tiered sharing regime in the 3.5 GHz band.⁹ And, the Commission began this proceeding soon thereafter to develop a new framework for multi-tier access to spectrum available for mobile broadband.¹⁰

With this *Further Notice*, the Commission can adopt rules that will encourage private sector investment and deployment in a shared Federal government/private sector framework, significantly helping to meet the goal of repurposing 300 MHz of spectrum by 2015. But, the Commission must make the right decisions to make this a reality. Ericsson agrees that the 3.5 GHz band can be an “innovation band,”¹¹ but the band should also provide a practical solution to meet the actual growing demand for mobile wireless broadband. With the steps outlined below, Ericsson is confident the band can meet both of these objectives.

⁸ U.S. Department of Commerce, NTIA, *An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, 4200-4220 MHz, and 4380-4400 MHz Bands* (Oct. 2010) (“*Fast Track Report*”), http://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation_11152010.pdf.

⁹ Executive Office of the President, PCAST, *Report to the President: Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*, at x, xiv (July 20, 2012) (“*PCAST Report*”), http://www.whitehouse.gov/sites/default/files/microsites/ostp/-pcast_spectrum_report_final_july_20_2012.pdf.

¹⁰ *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*, 27 FCC Rcd 15594 (2012) (“*NPRM*”).

¹¹ *Further Notice*, 29 FCC Rcd at 4275 ¶¶ 2, 3.

II. A TRANSITIONAL FRAMEWORK WILL SPEED IMPLEMENTATION BY ENCOURAGING INVESTMENT UP FRONT

The *Further Notice* proposed to adopt a three-tiered spectrum access model and declined to pursue a temporary, transitional framework as some commenters had advocated.¹² Ericsson believes that both licensed and “unlicensed” users can be accommodated in the 3.5 GHz band, while also protecting Federal and commercial satellite incumbents in the band, but it will not be an easy task if all of the users are thrown into a common bowl of frequencies under the dynamic management of a novel system, the Spectrum Access System (“SAS”), without proven benefit and demonstrated experience. The Commission should therefore reconsider and embrace a transitional approach that will enable experimentation while providing assurances for commercial providers ready to promptly begin investing and deploying in the 3.5 GHz band.

Verizon proposed a transitional framework last year whereby the 3.5 GHz band would initially be divided into three segments: one for Priority Access Licensees (“PALs”) to share with incumbents; one for General Authorized Access (“GAA”) users to share with incumbents; and one segment in which all three tiers—incumbents, PALs, and GAA users—could engage in the experimentation needed to establish a multi-tier framework for spectrum access.¹³ As Verizon noted, implementing the three-tiered dynamic sharing model will take considerable time due to the need to develop solutions for numerous technical, security, and other challenges.¹⁴ While those issues are being addressed, the Commission could make PALs available under existing technology to protect incumbents.¹⁵ Once stakeholders demonstrate that the three-tiered

¹² *Id.* at 4281-82 ¶¶ 19-22.

¹³ *See* Supplemental Comments of Verizon and Verizon Wireless, GN Docket No. 12-354, at 4-5, 8-11 (filed Dec. 5, 2013).

¹⁴ *Id.* at 5-8.

¹⁵ *Id.* at 8-9.

dynamic spectrum access approach will protect incumbents and PALs alike, the transitional plan could be deemed obsolete and the three-tiered sharing framework extended across the band.¹⁶

The *Further Notice* acknowledged the transitional framework but tentatively dismissed it with very little discussion, noting only that it had “concerns about the impact that Balkanization of this spectrum may have in terms of limiting the development of a robust and varied shared spectrum ecosystem in the band.”¹⁷ It nevertheless sought comment on any alternate proposals.¹⁸

While the Commission expressed concern that a transitional framework would lead to “Balkanization,” the greater concern is that the 3.5 GHz band may remain largely unused in the absence of a transitional approach due to the magnitude of the challenges involved with the proposed dynamic sharing three-tiered approach. It would not serve the public interest to devote at the outset this entire critical block of spectrum to an experiment, at the expense of making some of the spectrum usable in the near term, given the pressing and growing need for mobile broadband connectivity.

A transitional framework would have the benefit of allowing both PALs and GAA users to begin operating in the 3.5 GHz band much earlier, leading to investment in infrastructure and the 3.5 GHz ecosystem in the near term. Commercial providers will have the certainty needed to deploy networks—networks they will not be able to deploy at 3.5 GHz if productive use of the band must await resolution of the challenges of three-tiered sharing. With PALs and GAA users in separate frequency blocks, a much simpler SAS can be employed to prevent their causing harmful interference to incumbent operations. At the same time, stakeholders can develop the

¹⁶ *Id.* at 3.

¹⁷ *Further Notice*, 29 FCC Rcd at 4282 ¶ 22.

¹⁸ *Id.*; *see also id.* at 4336 (proposed Rule Section 96.1).

technology needed to solve a maze of technical and security challenges necessary to effectuate a three-tiered dynamic sharing system, while full-band interoperability requirements will ultimately address the concern about “Balkanization.”

III. LICENSING TERMS THAT FACILITATE COMMERCIAL NETWORK DEPLOYMENT WILL STIMULATE BUILDOUT

A. FIXED FREQUENCY ASSIGNMENTS FOR PALS WILL FACILITATE USE OF 3.5 GHZ IN MANAGED NETWORKS

The *Further Notice* proposed that the SAS would dynamically assign bandwidth to PALS in place of fixed channel assignments.¹⁹ Alternatively, the *Further Notice* asked for comment on “a more traditional model with static frequency assignments.”²⁰ Ericsson strongly urges the Commission to adopt a fixed, static frequency assignment paradigm for PALS.

Today’s wireless broadband networks are carefully managed to ensure capacity is available when and where it is most needed. Network operators need to be able to plan spectrum usage throughout large geographical areas and for multiple purposes, not merely at a single location when a call is made or a data session initiated. The use of a particular block of spectrum in one location affects whether and how that spectrum can be used elsewhere. Moreover, the coverage of a given base station—whether configured as a macrocell or a small cell—does not necessarily conform to an arbitrary license area on a map, such as a census tract, and may in fact serve several such areas or even serve only a portion of such an area. Network operators will undoubtedly need access to spectrum in many different license areas spanning a metropolitan area, a highway, or major portions of a rural service area. And they will most efficiently be able to use that spectrum if they hold common frequency assignments across their service areas.

¹⁹ *Id.* at 4284 ¶¶ 32-33.

²⁰ *Id.* at 4284 ¶ 34.

The use of stable, reserved frequency assignments for PALs, exclusive in nature except as to incumbents, will provide PALs with incentives to innovate and to invest in the infrastructure that is needed to provide reliable wireless broadband service across metropolitan, suburban, and some rural areas.

B. OPPORTUNISTIC GAA USE OF PAL SPECTRUM SHOULD NOT BE ALLOWED ON SPECTRUM WHERE PAL FACILITIES HAVE BEEN DEPLOYED

The Commission should not permit opportunistic use by GAA users of spectrum assigned to a PAL that has been deployed. This avoids the potential for harmful interference that would be present if a GAA user could opportunistically access the same spectrum that is actually used by a PAL network operator, even during a period when it is “unused.” Much work needs to be done before we can conclude that such opportunistic use in mobile bands can succeed without interference and other adverse impacts on the operations of a managed network. Further, dynamic control of spectrum assignments by the SAS—assuming it can be achieved—could have a daisy-chain effect, rippling across a metropolitan area, with each GAA operation in PAL spectrum potentially affecting the PAL licensee’s other locations. A single frequency reassignment could trigger reconfiguration of many different sites’ frequency plans.

Attempting to micromanage such frequency assignments would be difficult enough if only one PAL were involved, but the complexity of the task increases exponentially when there are multiple PALs, all of which must be managed together by the SAS (or SASs). SAS-based dynamic frequency assignment among PALs and GAAs to permit them to use the same spectrum is inherently inefficient and will make it much more difficult for a network operator to manage its network. The result is that such dynamic frequency assignment practices will discourage investment in PAL networks.

The solution to this problem is simple, as numerous commenters noted: As discussed in the previous section, provide PALs with stable, reserved frequency assignments, subject to incumbent usage under the management of the SAS. To the extent spectrum in the PAL segment of the band is truly unused—either unassigned channels (*i.e.*, channels for which no PAL holds a license) or channels where the licensed PAL has not yet deployed facilities and registered in the SAS—the SAS could grant GAA users the ability to use such unused PAL spectrum on an opportunistic basis without a risk of harmful interference.²¹ This would require establishment of a PAL “protection zone” at the census tract boundaries of the license areas where the PAL has deployed facilities, such that the GAA would not be permitted to exceed a specified signal level at the boundary of the deployed PAL license areas. Otherwise, the Commission should ensure that GAA operations remain outside PAL spectrum for which the PAL has deployed facilities and registered in the SAS.²²

PALs will be paying for access to spectrum blocks in an auction. They must be assured that the spectrum that they pay for will be available, subject only to the incumbent’s use. They should not be asked to take the risk that their access to spectrum they paid for may be disrupted because GAAs are using it. Stable frequency assignments for PALs, without incursions by GAA once facilities have been deployed, will allow for the orderly roll-out of service, the employment of carrier aggregation, and the coordinated use of the 3.5 GHz band, for both PAL and GAA use.

²¹ The Commission should require that the SAS inform a PAL about the provision of access to the PAL spectrum by a GAA device, and it should also provide a mechanism for a PAL to ask the SAS to reassign any such GAA device if its operation may impair the operation of the PAL.

²² *See, e.g.*, Comments of AT&T, GN Docket No. 12-354, at 5-6 (filed Dec. 5, 2013) (“AT&T Licensing Comments”); Comments of T-Mobile USA, Inc., GN Docket No. 12-354, at 10-12 (filed Dec. 5, 2013); Comments of Ericsson in Response to the Public Notice, GN Docket No. 12-354, at 7 (filed Dec. 5, 2013); CTIA Reply Comments to 3.5 GHz PN, GN Docket No. 12-354, at 7-8 (filed Dec. 20, 2013).

C. EXTENDING LICENSE TERMS, ADOPTING A RENEWAL POLICY, EXPANDING GEOGRAPHIC SIZE, AND ENHANCING POWER LEVELS WILL PROMOTE PAL PARTICIPATION

The Commission’s regulatory framework, notable for its novel approach to spectrum sharing and database mechanisms, is likely to result in such uncertainty that it will deter some network operators from investing in the 3.5 GHz ecosystem and the construction of facilities.

The *Further Notice* proposes a short license term of one year without expectation of renewal, with license term aggregation of up to five consecutive years for a given license area.²³ The Commission asserts that allowing aggregation for up to five years of licenses would provide PALs with the certainty needed to make capital investments.²⁴ Certainly, five years is better than one as a timeframe for business investments, but as AT&T observed, “regardless of . . . how many one year terms [a PAL] might obtain initially[], there will be uncertainty as to whether it will continue to have access to the spectrum it uses to serve its customers after its term is over, and if so, at what cost.”²⁵ With no renewal expectancy, the resulting uncertainty “will deter innovation and investment in the band.”²⁶

The small geographic size of licenses—the 74,000 census tracts—is also a source of concern. In dense urban environments, where small cells are most likely to be needed to provide capacity, census tracts may only cover a few city blocks. Manhattan, for example, had 288 census tracts in the 2010 census.²⁷ A wireless broadband operator would need to file well over a thousand applications (each with its very own filing fee) just to bid on five separate consecutive years’ worth of 10 MHz spectrum availability in a single borough of New York. The inefficiency and transaction costs

²³ *Further Notice*, 29 FCC Rcd at 4288 ¶ 49.

²⁴ *Id.*

²⁵ AT&T Licensing Comments at 4-5.

²⁶ *Id.* at 5.

²⁷ See U.S. Department of Commerce, United States Census Bureau, http://www2.census.gov/-geo/maps/dc10map/tract/st36_ny/c36061_new_york/ (last visited July 14, 2014).

resulting from this micro-licensing “building block” scheme will place burdens on applicants and PALs, as well as on the SAS and the FCC, absent any compelling countervailing benefit.

In addition to license term, renewability, and size, the Commission should support a number of use cases including small cells, backhaul, and, where appropriate, macrocells. The current proposed power limits are too low for this range of uses. Specifically, Ericsson urges the Commission to ensure PALs can operate small cells and outdoor base stations with sufficient power levels to provide for efficient network deployment, subject to incumbent protection.

IV. SMALLER EXCLUSION ZONES ARE CRUCIAL TO THE SUCCESS OF THE 3.5 GHZ BAND, AND A MOVE TOWARD COORDINATION ZONES WILL ALLOW FOR FAR MORE EFFICIENT USE

A. THE PROPOSED EXCLUSION ZONES COULD SCUTTLE DEVELOPMENT OF THE 3.5 GHZ BAND

The Commission must revise the Exclusion Zone approach that was intended to avoid harmful interference to Federal incumbents, if the 3.5 GHz band is to succeed.

The Exclusion Zones proposed in the *Further Notice* and based on NTIA’s 2010 *Fast Track Report* cover about 60% of the U.S. population, extending hundreds of kilometers into interior of the nation’s entire east, west, and Gulf coasts.²⁸ If adopted, the 3.5 GHz band would be unavailable in places like Boston, New York, Philadelphia, Baltimore/Washington, Atlanta, Miami, Houston, Dallas, Los Angeles, San Francisco/Silicon Valley, Portland, and Seattle. A fragmented U.S. market limited to 40% of the nation’s population is unlikely to be attractive to either equipment vendors or service providers, especially if that remaining area does not include many of the densely populated markets along the coasts, where small cells would be particularly

²⁸ *NPRM*, 27 FCC Rcd at 15597 ¶ 6.

beneficial. The Commission must reexamine the Exclusion Zones, as the *Further Notice* intimated.²⁹

There are several bases to revise the current Exclusion Zone approach. First, the *Fast Track Report* based the Exclusion Zones on the assumption that mobile broadband service at 3.5 GHz would be high-powered WiMAX-based, rather than the predominantly small-cell service contemplated at this point.³⁰

In addition, any restrictions on spectrum availability, whether in the form of modified Exclusion Zones or, as discussed below, Coordination Zones, should be based exclusively on protection of Federal incumbents from mobile and base station transmissions, and not on protection of mobile and base stations from interference by Federal radar transmissions.³¹

Wireless networks can employ a variety of techniques that are ever-evolving to address temporary instances of interference, and placing the burden on wireless operators for addressing interference from a primary user makes more sense than using an Exclusion Zone that provides no incentive to innovate and stretch performance by developing new interference mitigation techniques.

The *Fast Track Report* noted that the Exclusion Zones might need to be revised based on the technology to be used for base and mobile operations, and the *Further Notice* committed to work with NTIA to tailor the Exclusion Zones to more realistic premises.³² Ericsson strongly supports reexamination of the extent of the current Exclusion Zones based on more realistic criteria. While Ericsson does not believe the 3.5 GHz band should be limited to small cell

²⁹ *Further Notice*, 29 FCC Rcd at 4276 ¶ 5, 4315-16 ¶¶ 140-141.

³⁰ *Fast Track Report* at 5-3 – 5-7.

³¹ *See id.* at 5-6; *id.* at 1-6 – 1-7 (exclusion zones were, in part, designed to “protect base stations from high power U.S. Navy radar systems”).

³² *See id.* at 1-7; *Further Notice*, 29 FCC Rcd at 4316 ¶ 141.

operations, and macrocells should be available as an option, the SAS can ensure that macrocell operations take place only outside appropriately defined areas.

**B. OVER THE LONG TERM, A COORDINATION ZONE APPROACH
COULD OPTIMIZE SPECTRUM UTILIZATION WHILE PROTECTING
INCUMBENTS**

Ultimately, policymakers should consider use of Coordination Zones rather than just Exclusion Zones, with the goal of optimizing spectrum availability without posing an interference threat to Federal operations. Specifically, a Coordination Zone approach would allow certain radio transmitters to be deployed within what would otherwise be the Exclusion Zone, subject to coordination with the Federal incumbent.³³ A Coordination Zone could cover all or part of an Exclusion Zone—thus there very well could be some areas where the incumbent would not allow any other transmitters, thus remaining a full Exclusion Zone, while other areas could have softer requirements that allow certain radio transmitters, subject to specified emission levels, limits on the time of operation, or other constraints.

Although consideration of this approach may take some time, enabling the establishment of Coordination Zones could further increase the geographic availability of 3.5 GHz spectrum.

³³ This would be similar to the Protection Zones that have been recommended for commercial sharing with Federal meteorological-satellite incumbents in the 1695-1710 MHz band. *See* Commerce Spectrum Management Advisory Committee, *Final Report: Working Group 1 – 1695-1710 MHz Meteorological-Satellite* (Jan. 22, 2013) (“The framework provides for deployment of commercial operations outside of the Protection Zones without any coordination. It also permits commercial operations within the Protection zone following a successful coordination process concluding that such commercial operations can meet specified conditions and will not cause harmful interference to ensure no loss of federal capability within the protection zones.”), http://www.ntia.doc.gov/files/ntia/publications/wg-1_report_v2.pdf (last visited July 14, 2014).

V. THE COMMISSION SHOULD TAILOR THE SAS ROLE TO ENSURE THAT PROVIDERS CAN INCORPORATE 3.5 GHZ SPECTRUM INTO MANAGED NETWORKS

Mobile broadband providers carefully manage their networks, employing spectrum assets and coordinating spectrum utilization as end users seamlessly enjoy access to wireless connectivity. Operators' spectrum inventories vary considerably, and their spectrum management approaches do as well. One operator could have limited spectrum available for wireless broadband in a market, and thus assign that spectrum so as to maximize coverage, while another may prioritize capacity for enhanced throughput. The same carrier might experience both scenarios simultaneously in neighboring markets or in different parts of a single market. At the same time, operators need to ensure adequate spectrum availability for handoffs as users travel throughout a region while using their devices. In the case of 3.5 GHz spectrum, the Commission should carve out an important supervisory role for the SAS, but it must avoid giving the SAS an unduly intrusive role into network management.

As a practical matter, network operators can best use the 3.5 GHz spectrum—both via PALs and by employing GAA—as an effective complement to other spectrum, incorporating it into the network and managing it just as they manage the use of their spectrum from 700 MHz, PCS, AWS, BRS, and other bands, as pieces of a multiband network. There are significant differences between managed networks, and unmanaged networks. For example, managed networks are subject to network planning, and this is so regardless of whether a network uses licensed PAL spectrum or unlicensed GAA spectrum. In the network planning process, power limits, transmitter frequencies, neighboring cell information, and other characteristic information is taken into account. The transmissions within a managed network can therefore be controlled under carrier supervision and regulatory framework. This would greatly simplify the role of the

SAS, which would not need to track the location of all CBSDs, for example.³⁴ In contrast, external intervention with an individual cell within a managed network will impact the carrier service quality, coverage, and mobility. None of this is possible in an unmanaged network.

Moreover, intervention into the operations of a managed network can have unforeseen consequences. For example, intervening in a managed network's power control would prevent its use for managing functionality needed by the network to manage interference. Furthermore, self-organizing networks ("SONs")³⁵ are increasingly essential for today's complicated cellular networks, where network planning needs to be made easier. By using SON technology, wireless broadband networks are able to organize and optimize their performance. Operators can then benefit from significant improvements in terms of both capital expenditure and operational expenditure. Ceding network planning authority to the SAS would diminish the efficiency of system performance.

In this respect, the Commission should account for the knowledge that has been built up over recent years by other nations in developing the Licensed Shared Access (or Authorized Shared Access) model ("LSA"). The LSA model was developed specifically to deal with access to spectrum already occupied by non-commercial users, on a non-interfering basis.³⁶ The LSA

³⁴ The FCC proposed requiring CBSDs to provide the SAS with detailed geographic location information (within 50 meters horizontally and 3 meters vertically). *Further Notice*, 29 FCC Rcd at 4293 ¶ 63. The SAS would not require geolocation data on individual devices that are under the control of a managed network, because the geolocation information is only necessary if the SAS needs to make coverage and interference calculations for individual devices.

³⁵ See Tammy Parker, *T-Mobile to use Eden Rock's SON to reduce dropped calls, increase throughput*, FierceWirelessTech (June 22, 2014), <http://www.fiercewireless.com/tech/story/t-mobile-use-eden-rocks-son-reduce-dropped-calls-increase-throughput/2014-06-22>.

³⁶ GSMA, *GSMA Public Policy Position: Licensed Shared Access (LSA) and Authorised Shared Access (ASA)*, at 4 (Feb. 2013) ("*LSA and ASA*"), <http://www.gsma.com/spectrum/wp-content/uploads/2013/04/GSMA-Policy-Position-on-LSA-ASA.pdf>; see generally Econstor, C. Carciofi et al., *Analysis of different authorization approaches for the*

concept involves cognitive radio techniques, including geolocation and use of spectrum databases,³⁷ and is thus similar in concept to the approach the Commission is pursuing. Ericsson is working with Verizon and others to test LSA in the 3.5 GHz band, both in field trials under experimental licenses and in laboratory tests.³⁸

The LSA model, however, addresses only a two-tiered sharing model, not the vastly more complex three-tiered model the Commission is considering. Under the LSA approach, its database relies on the network manager to ensure that the sharing system will not interfere, rather than directly controlling the network's base stations' frequency usage or transmitter output power. This is instructive for how SAS should operate, but if the Commission follows a three-tiered solution, it will need to take into account the additional complexity added by participation by a potentially unlimited number of additional unmanaged GAA participants that will not have negotiated with the incumbent. Ericsson views LSA as a viable stepping-stone to more dynamic sharing models, and quite compatible with the transitional sharing approach supported here.

As a related issue, the Commission should consider the extent to which contained access facilities ("CAFs")³⁹ should be treated as a form of managed network employing GAA spectrum. While a CAF employing GAA spectrum would not have the right to interference protection *per se*, it could be treated similarly to a managed network, in that it would have an operational support system that would interact with the SAS to provide it with a degree of *de facto* protection

shared access to radio spectrum, 24th European Regional Conference of the International Telecommunication Society, Florence, Italy (Oct. 20-23, 2013), <https://www.econstor.eu/dspace/bitstream/10419/88458/1/773100741.pdf>.

³⁷ See generally *LSA and ASA*.

³⁸ Patrick Welsh, Verizon Policy Blog, *Sharing in the 3.5 GHz Band* (July 11, 2014), <http://publicpolicy.-verizon.com/blog/entry/spectrum-sharing-in-the-3.5-ghz-band> (last visited July 14, 2014).

³⁹ See *Further Notice*, 29 FCC Rcd at 4291-92 ¶¶ 58-61.

from interference from ordinary GAA users. Rather than creating a CAF set-aside, the market could accommodate CAFs as a class of PAL customers for which the PAL provides a customized form of managed RF environment.

VI. REGULATIONS GOVERNING SPECTRUM ACCESS SYSTEMS

A. MULTIPLE SAS ADMINISTRATORS

The proposed rules assume that multiple SAS administrators would be authorized to operate in the 3.5 GHz band, just as multiple databases are authorized to operate in the television white space (“TVWS”) band.⁴⁰ Ericsson supports the authorization of multiple competing SAS operators in the 3.5 GHz band. We believe this will benefit the overall ecosystem by providing a choice of SAS system providers to stakeholders in the band. This approach will promote innovation in SAS development and operation and will result in a more robust SAS ecosystem.

The FCC is interested in determining whether it is feasible for multiple SASs to operate effectively in the 3.5 GHz band. Just as TVWS databases synchronize information with each other in near real-time using secure web service techniques, so could SAS operators achieve near real-time synchronization and information interchange. Techniques for information interchange using web services are both mature and secure. Endpoints can be authenticated using certificate authentication techniques to prevent unauthorized access and the information interchange can be secured from eavesdropping through use of HTTP on top of the SSL/TLS transport protocol.

The SAS administrator qualification procedure defined in the *Further Notice*⁴¹ closely reflects the procedures used to qualify and govern the operation of TVWS databases currently in

⁴⁰ See *id.* at 4300-01 ¶¶ 91, 4337 (definition of Spectrum Access System), 4349 (proposed Rule Section 96.48).

⁴¹ See *id.* at 4304-05 ¶¶ 105-108, 4349-50 (proposed Rule Section 96.48).

service in the TV bands. We believe these requirements are reasonable and sufficient to qualify and govern SAS administrators.

The proposal to allow SAS administrators to collect fees for PAL and GAA users for associated services in a similar manner to rules adopted for TVWS⁴² is reasonable and appropriate. Ericsson believes that limiting fees to PALs is overly restrictive and unduly limits the flexibility of the SAS administrator to develop business models required to operate services in the 3.5 GHz band. The Commission should refrain from prescribing regulations regarding business models. The database enables use of spectrum in this band and SAS operators should have the option to be compensated through a nominal fee for enabling use of this spectrum.

B. SAS PURPOSES AND FUNCTIONALITY

The proposed core SAS functions put forward in the *Further Notice* assume that the SAS will interact directly with all CBSDs.⁴³ However, the Commission should differentiate treatment applicable to CBSDs operating in a managed network from that applied to CBSDs operating on a stand-alone, opportunistic basis. As discussed in previous sections, managed networks, whether operating in GAA or PAL spectrum, are subject to network planning where power limits, transmitter frequencies, neighboring cell information and physical cell identities are set. The emissions within a managed network are carefully controlled under the carrier's supervisory framework, consistent with regulatory limits. In the managed network scenario, the SAS should interact at the network management function level within the mobile broadband network instead of at the level of the individual CBSDs. Such an assignee would be certified differently from a GAA CBSD that interacts directly with the SAS.

⁴² See *id.* at 4305 ¶ 109, 4350 (proposed Rule Section 96.49).

⁴³ See *id.* at 4302 ¶ 95, 4347-48 (proposed Rule Section 96.43).

Specifically, the SAS should not assign specific frequencies to individual CBSDs operating in an operator-managed network, whether in PAL or GAA spectrum. Instead, the SAS should provide a frequency block range to the managed network's operational support system ("OSS"). In the case of PAL, the frequency block range would be defined as part of the license agreement, *i.e.*, the 10 MHz spectrum assigned for a specific PAL. The SAS would not provide specific frequency allocations to each separate transmitter. Furthermore, for managed networks, the SAS can oversee the network's OSS by providing a set of restrictions stemming from the rules the Commission adopts. This would allow for flexibility and innovation within those constraints, as opposed to the SAS managing the CBSDs within a managed network.

This type of alternate SAS-OSS operation could additionally be supported by defining OSS areas of operations specified by polygonal geographic regions with associated maximum allowed power threshold levels at the boundaries of the assigned area. The OSS within the mobile broadband network could then determine how to allocate those channels to each individual CBSD. The network's OSS would be free to assign channels to individual CBSDs within the area and would also be free to assign power levels to these devices, as long as the power levels do not exceed the proscribed maximum received values at the area boundaries. It is feasible for the SAS to specify signal levels at the license area boundary (or the boundary of multiple license areas operated together as a network under common control), so as to avoid interference to incumbent users and to adjacent PAL users.

Once the network's OSS assigns channels to individual CBSDs, information regarding channel use at locations within the assigned operational area can be reported back to the SAS, with any information regarding the identity of the CBSD end-user removed to preserve the privacy of individuals using such devices. This information will be used by the SAS to reserve

use of the channels and prevent GAA access in the area now assigned to a PAL. The information can also be used by the SAS to allow grouping of multiple GAA sites within the census tract into a common management framework, so that the SAS can attempt to serve the requirements of the service provider, *e.g.*, by assigning the same channel across the network. This information could also be used by the FCC in the event of interference problems experienced by incumbents.

Although the Commission proposes to allow PAL and GAA users to coexist in all parts of the band from the outset, transitional band approach, as proposed by Verizon and others, could also be accommodated by the SAS, using a different initial set of rules that allows a partitioned band operation (PAL in one sub-band, GAA in a separate sub-band, and experimentation with multi-tiered operations in a third sub-band). Once the interim trial period is over, the SAS could then change the rules to allow PAL/GAA coexistence within the same band. Through use of geospatial rules in the SAS, it is even possible to allow PAL/GAA spectral coexistence only in limited initial trial areas to assess any interference issues. However, any changes in operational characteristics must be done only after extensive testing and verification.

As described in the *Further Notice*, the FCC describes an SAS-to-CBSD interaction where the SAS interacts directly with all CBSDs, whether PAL or GAA devices.⁴⁴ In the case of CBSD devices that are managed by mobile network operators, the SAS should support interaction with an OSS that is owned and operated by the mobile network operator to allow operator-managed frequency assignment within their network instead of communications directly between the SAS and individual CBSDs. An SAS can provide a description of allowed channels and maximum power limits on those channels to the network's OSS within a defined

⁴⁴ See *id.* at 4304 ¶ 103, 4348 (proposed Rule Section 96.46).

area of operation. The OSS can then choose appropriate frequency assignments and power levels for each of the CBSDs within that area and report back to the SAS the channels, power levels, and locations of the CBSDs (with personal identifying information stripped to protect end-user privacy). The *Further Notice* describes the case where CBSDs that are thought to be causing harmful interference are deactivated or reassigned upon request. The method of operation described above allows for this possibility with the SAS directing any offending CBSDs through the intermediate OSS.

C. INFORMATION GATHERING AND RETENTION

The *Further Notice* proposes that the SAS retain information on all operations within the 3.5 GHz band.⁴⁵ A certain amount of information protection between device level information and network level information should be allowed. Operators should be required to have an OSS that interfaces with the SAS. But there is no need for a network operator to provide information about individual CBSDs to the SAS. Also, there are competitive concerns regarding the collection of deployment characteristics such as antenna sectors, design characteristics, *etc.*, that must be safeguarded. The *Further Notice* also proposes that the SAS collect information regarding location and look-angles of fixed satellite service (“FSS”) operators so as to create FSS geographic exclusion zones and geographic coordinates necessary to create exclusion zones for protect Federal incumbent users. Ericsson believes this exclusion-based methodology is sound, as it has been shown to be effective in protecting incumbents in TVWS operation thus far. However, as stated in Section IV.A above, the size of the Exclusion Zones for protecting federal incumbents along the coasts of the U.S. as proposed in the *Further Notice* is currently so large as to discourage use of this spectrum by commercial entities.

⁴⁵ See *id.* at 4303 ¶¶ 99-101, 4348 (proposed Rule Section 96.44).

Additional knowledge regarding use of the 3.5 GHz band by Federal users, such as time of use or general location of use, could allow more efficient sharing of this spectrum with commercial users, through the use of coordination zones. If Federal users are uncomfortable with sharing the necessary information with commercial SAS providers, we support the incorporation of a separate Federal SAS to maintain this sensitive information in a secure manner and provide obfuscation of the actual locations and times of use of these Federal systems.

Use of spectrum sensing information could be helpful in validating assumptions used to provide protection to incumbent users from PAL and GAA users. Spectrum sensing information could be collected by managed networks and GAA CBSDs during periods of inactivity or through the use of a secondary radio receiver. This information could be used by the SAS for evaluation of protection criteria and to support management functions performed by SAS, but sensing should not be required for operation.

D. REGISTRATION AND AUTHORIZATION OF CITIZENS BROADBAND RADIO SERVICE DEVICES

The SAS can verify the identity of CBSDs (or an OSS supervising a network of CBSDs) through use of certificate based authentication or through verification of a shared secret between a device/network controller and the SAS.⁴⁶ Since there would need to be a commercial arrangement between a device and a SAS, the SAS provider and device manufacturer can share a set of information known only to the two and embed this shared secret into the two systems for use by an authentication/validation process. When a device contacts the SAS for the first time, it includes this shared secret in the interchange and the database validates the shared secret content through a lookup that associates the devices serial number/FCC ID pair (or ESN) with the shared

⁴⁶ See *id.* at 4303 ¶ 102, 4348 (proposed Rule Section 96.45).

secret message. If a certificate based approach is used, a third party certificate authentication service can be used to provide identity validation/authentication.

E. SECURITY

Ericsson supports a system in which the communication between SAS and CBSDs (or OSSs) are protected using standard Internet security procedures; specifically, encrypted communications to prevent eavesdropping and certificate based authentication of the endpoints to verify identity of the end nodes.⁴⁷

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ERICSSON

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⁴⁷ See *id.* at 4304 ¶ 104, 4348-49 (proposed Rule Section 96.47).