Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, DC 20554

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

REPLY COMMENTS OF FEDERATED WIRELESS, Inc.
(Formerly known as Allied Communications, LLC)

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Executive Summary

Federated Wireless, Inc. (formerly Allied Communications, LLC), a subsidiary of Allied Minds Federal Innovations, is headquartered in Boston, Massachusetts with offices in Reston, Virginia. Federated Wireless was founded in 2012 by globally recognized wireless and radio communication leaders to enable and commercialize technologies to unlock the enormous potential of dynamically shared spectrum resources.

We would like to acknowledge the many contributors to the public record regarding the Commission's Further Notice of Proposed Rule Making (FNPRM), and appreciate this opportunity to reply to the comments put forth by other stakeholders in this evolving ecosystem. Federated Wireless is pleased to see the evolution of a number of congruent themes amongst the comments received, which will indeed serve to supplement the public record on the Commission's bold step towards innovative and progressive management of spectrum resources.

As part of the rulemaking, Federated Wireless agrees with other stakeholders that significant revision to the Exclusion Zone analysis is needed and that dynamic spectrum sharing mechanisms such as sensing and collaboration should be adopted instead of the proposed fixed geographic exclusion zones. However, we note that due to the nature of the incumbents, care must be taken to avoid disclosing sensitive information. Thus, the sensing mechanisms and collaboration mechanisms proposed by other Commenters require additional obfuscation mechanisms, such as signal class detection or the use of a Federal Spectrum Access System (FSAS) as an intermediary for obfuscated Spectrum Access System (SAS) managed spectrum sharing with incumbents.

Federated Wireless further agrees with the Stakeholders that the rules and mechanisms for sharing Priority Access License (PAL) spectrum and defining use requires clarification. We

believe that the same dynamic mechanisms proposed for Citizen Broadband Radio Service Device (CBSD) - incumbent system sharing spectrum can also be applied to General Authorized Access (GAA) - Priority Access (PA) spectrum sharing. We specifically agree with Google, the Wireless Innovation Forum, and Dr. de Vries that predicted and measured interference levels and interference protection thresholds should the method used by the SAS to determine allowable transmission parameters, both for CBSD-incumbent and GAA-PA spectrum sharing. We reiterate our prior position that our proposed three-step PA authorization and two-step payment monetization process can significantly improve the reliability and efficiency of GAA-PA spectrum sharing and further note that this should address many of the concerns posed by potential PAL holders. We further propose that SAS certification require demonstration of protection of federal incumbents and PAL devices to assure national security and to benefit market uptake.

While we agree with many Commenters that the Citizen's Broadband Radio Service band is ideal for regulatory, technological, and administrative experimentation and innovation, we oppose the proposal for adoption of a transitional sub-band that would employ more traditional licensing techniques for PAL spectrum. Given the looming spectrum crisis, availability today of the technology to enable spectrum sharing, and the existing underutilization of federal spectrum resources, there is little incentive to delaying policy innovation. Such delays exacerbate current spectrum utilization inefficiencies by continuing traditional licensing arrangements.

We agree with Commenters that there remain aspects of SAS functionality and interfaces that should be clarified in the Final Report and Order. However, any further refinements in SAS regulations should be designed to promote innovation and competition in the SAS marketplace in functionality and price. Thus we disagree with Commenters who suggest that every SAS should

support interfaces beyond a common SAS - CBSD Internet interface, e.g., requiring a non-Internet based interface or requiring an interface to a network manager controlling multiple CBSDs. Finally, we agree with Motorola Solutions, AT&T and Motorola Mobility that remaining technical issues should be addressed by a multi-stakeholder group.

Federated Wireless offers the following reply to the submitted comments in support of the Commission's rulemaking efforts.

Reply to Comments

I. THERE IS A CONSENSUS TO SIGNFICANTLY REVISIT THE ANALYSIS AND MECHANISM FOR MANAGING COEXISTENCE WITH FEDERAL INCUMBENTS INCLUDING SHIP-BORNE RADAR SYSTEMS

In the comments to the FNPRM, there was a broad consensus that the exclusion zones based on the National Telecommunications and Information Administration (NTIA) Fast Track report analysis would significantly hamper efforts to commercialize the Citizen's Broadband Radio Service band as the proposed zones excluded 60% of the US population. Further, the analysis used to generate the exclusion zones were flawed due to the following:

- the analysis was outdated and should have been supplanted by a later NTIA analysis[1]
- the analysis assumed properties of devices and networks not representative of the devices expected to be deployed in the band and can accept significantly more interference than considered in the Fast Track Report[2]
- in principle CBSDs should not be protected from interference from incumbents[3]
- it is unreasonable to protect the entire coast all the time when incumbent systems would only rarely be in the associated analysis locations.[4]

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[1] Comments of Microsoft in Response to FNPRM ("Microsoft"), pp. 6-9
[2] Among others, *see* Comments of Wireless Innovation Forum in Response to FNPRM ("WInnF"), p 3, Microsoft p. 8, Comments of Motorola Mobility in Response to FNPRM ("Motorola Mobility"), p. 14-15, Comments of 4G Americas in Response to FNPRM, pp. 2-3.
[3] Among others, *see* WInnF p. 3, Comments of White Space Alliance in Response to FNPRM ("WSA") p. 2, Google, pp. 4-8.
[4] Comments of Alcatel-Lucent in Response to FNPRM, p. 8.

We concur with all of these assessments.

Beyond addressing the specific analysis issues, Commenters proposed the following alternate approaches for sharing spectrum with ship-borne radar systems:

- reduce the fixed exclusion zones to approximately 10 km[5]
- provide the SAS with sensing capabilities to detect when ship-borne radar systems are present[6], potentially augmented by adding beacons to the incumbent systems[7]
- collaboration with incumbents (also called coordination zones in some filings) [8]

We agree that all of these approaches, considered broadly, are preferable spectrum sharing mechanisms to the fixed exclusion zones proposed in the FNPRM, but believe that the dynamic approaches via sensing and collaboration are more appropriate given the non-stationary nature of ship-borne radar systems. However, in the following we reply briefly to the specifics of these proposals, focusing on critical security aspects of dynamic spectrum sharing and endorse the use of predicted interference levels or received signal power to facilitate more efficient spectrum sharing.

1. Due to the nature of the incumbents in the Citizen's Broadband Radio Service band, steps should be taken to minimize access to sensitive information about incumbents when employing dynamic spectrum sharing methods

While strongly endorsing the adoption of dynamic spectrum sharing methods in the Citizen's Broadband Radio Service band, the sensitive nature of the incumbents in the band imply that the

[5] Comments of Qualcomm in Response to FNPRM ("Qualcomm") pp. 7-8.
[6] Among others, see Comments of Shared Spectrum Company in Response to FNPRM, pp. 6-9, Google pp. 3-4, WInnF pp. 5-6.
[7] WSA pp. 1-2.
[8] Among others, *see* Comments of Ericsson in Response to FNPRM ("Ericsson") p. 12, Comments of Mobile Future in Response to FNPRM, pp. 6-7 Comments of Verizon in Response to FNPRM ("Verizon") pp. 5-6, Comments of T-Mobile USA in Response to FNPRM ("T-Mobile"), pp. 10-11.

implementation of these methods may unnecessarily expose sensitive information that may be detrimental to the incumbent systems.

Sensing the presence of an incumbent system implies the ability to detect and classify the signal(s) used by the incumbent system and designing these sensors traditionally requires exposing information about the incumbent system's signals. However, the details of many military signals are considered to be sensitive information. As such, deploying traditional sensors for the incumbent systems at the SASs or on CBSDs will widely disseminate sensitive information about the incumbents' signals. Thus sensing, should be adopted for the Citizen's Broadband Radio Service band, and should be done in a way that essentially eliminates the dissemination of incumbent signal information. In our comments to the FNPRM, we disclosed such a method wherein the detection and classification of individual incumbent signals is eschewed by instead employing a neural-net like classifier trained to the entire class of incumbent signals by an authorized party such as a FSAS.[9] Then because of the infeasibility of reverse-engineering a neural net to ascertain the original signals, this classifier could be safely distributed without compromising this class of sensitive information. We strongly recommend that the Commission adopt incumbent sensing as proposed by several Commenters, and that steps are taken to obscure the incumbent signal information in the sensors, via methods such as we previously disclosed.

Similarly, the incumbent systems' movements and location, especially when "under way" may also be viewed as sensitive information. Naive collaboration schemes with the incumbents would dramatically increase the risks of exposure of sensitive defense and other national security information. For instance, a handful of comments proposed direct collaboration between

[9] Comments of Federated Wireless in Response to FNPRM ("Federated Wireless"), pp. 16-18.

licensees and incumbents[10] while others suggest similar mechanisms between SASs and the incumbents.[11] In addition to the increased risk of exposure simply from having a larger number of entities directly accessing the information, adopting such an approach would require the directly collaborating entities to undertake US national security responsibilities, which they may not otherwise be equipped to do. Direct collaboration between network operators and incumbents should not be utilized as these extra interference management interfaces would add an additional layer of synchronization issues.

Instead, dynamic sharing via collaboration should be enabled via a Federal SAS (FSAS) provided via a designated responsible entity that is government controlled to an appropriate degree and would be responsible for the technical and interpersonal interfaces to the incumbents. The FSAS would be responsible for achieving appropriate obfuscation, protecting sensitive information, and providing the necessary interference protection guidance to the multiple SAS competitors. The FSAS would provide synchronization and would centralize the ultimate responsibility for interference management and enforcement with federal incumbents while minimizing risk to national security.

We further advise that the Citizen's Broadband Radio Service Report and Order (R&O) specify general requirements for a Federal SAS in cooperation with the NTIA and federal incumbents (e.g., the US Navy). The FSAS requirements should include, at a minimum:

1. Personnel having Department of Defense (DoD) SECRET security clearances (or above) and having additional in-depth understanding of and access to more sensitive RF knowledge to enable the FSAS to manage and enforce the protection of federal incumbents on commercial industrial time lines.

[10] T-Mobile p. 4.
[11] Comments of iConnectiv in Response to FNPRM ("iConnectiv") p. 6.

2. Existing Research and Development agreement(s) with the DoD that enable rapid convergence on mechanisms to provide commercial use of unused DoD spectrum while obfuscating the sensitive details of incumbent capabilities and limitations.
3. Demonstrating a scalable SAS architecture having a secure Federal SAS orchestrating regional SAS instances provided by multiple alternative commercial entities and employing open interfaces in a way that promotes deployment of competing SAS instances without risking the sacrifice of national security information.
4. Demonstrating the ability to ascertain the presence of incumbents and mitigate interference to incumbents through secure message exchange with a SAS (i.e., by commanding CBSD devices to cease use of channels)

2. Managing interference via predicted and reported interference levels at protected devices will maximize spectrum utilization and efficiency

Comments filed by Pierre de Vries, Google, and the Wireless Innovation Forum support the adoption of an interference management paradigm in place of the fixed geographic exclusion zones and argue that greater spectrum efficiencies will result from adopting this approach.[12] Sony Electronics proposes a similar approach for managing CBSD authorizations to limit aggregate interference levels at Fixed Satellite Service (FSS) Earth Stations.[13]

We concur and present the following evidence to support this position.

Figure 1 shows measurements taken in Blacksburg, Virginia and previously submitted to the Commission.[14]

[12] Comments of Pierre de Vries in Response to FNPRM ("de Vries"), pp. 1-23, Google pp. 10-17. WInnF, pp 6-7.
[13] Comments of Sony Electronics, Inc. in Response to FNPRM, p 5.
[14] Comments of Allied Minds in Response to Public Notice, pp. 9-13.

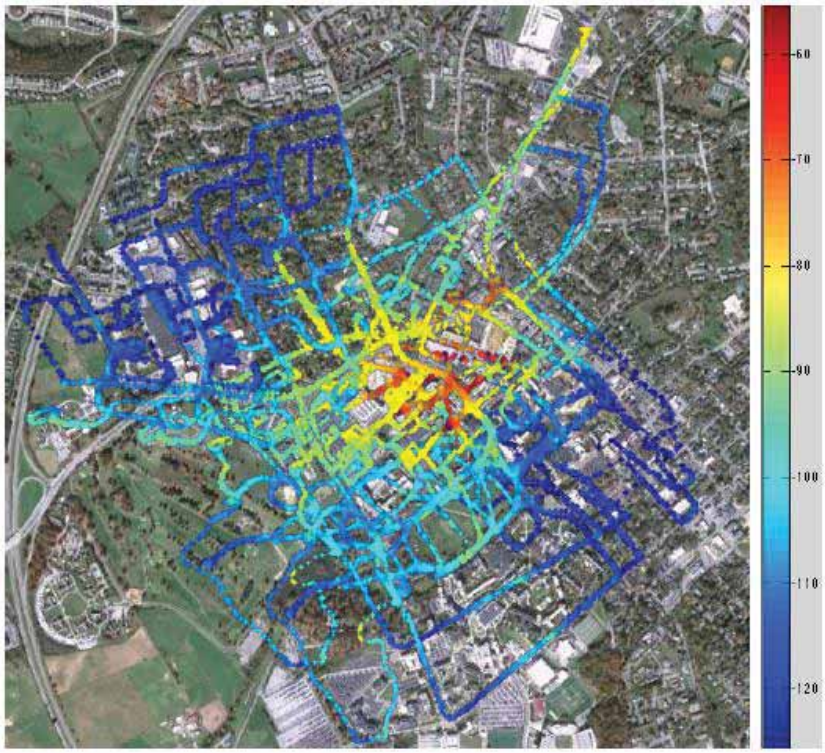

Figure 1 Received Signal Strength Intensity (RSSI) Physical Boundaries (2km x 2km), Blacksburg VA 3395 MHz.

In this response, we note that the RSSI contours of a notional CBSD small cell in the center of the figure correspond to geophysical features including terrain, vegetation, buildings, roads, power lines and other fixed infrastructure. On the one hand, it is clear that if multiple such small cells are operated by a single Radio Access Network (RAN) operator, then the siting, power levels, and user equipment (UE) assignments to a given small cell may be managed effectively. It is also clear from the physical properties of the figure that if two such small cells are both adjacent and are controlled by different RAN operators, then the potential for unacceptable PA-PA interference may substantially exist; furthermore interference boundaries will not conform to census tract boundaries. To accelerate market uptake requires the FCC rules to define a type of binding arbitration between two such RAN operators such that future small disputes between operators are addressed fairly, even handedly, and in near real time such that the RAN operators

can attend to delivering service within a fair adjudication of conflicts between the laws of physics and the parameters of mutually accepted PA boundaries. Federated Wireless argues that a commercially owned and operated Federal SAS would be the one party having both the technical tools and the overarching authority if so delegated by the FCC and federal stakeholders to adjudicate interference boundary disputes in the field and in near real time (minutes to hours versus the months and years that such disputes take to resolve in the courts). Moreover Federal SAS technical measurements and conformance to industry-agreed rules can be achieved on such time lines to provide the FCC with maximum assurance that small disputes do not become large disputes ultimately decided in the courts.

Therefore, Federated Wireless endorses the comments cited above and further reinforces our recommendation with the following:

- adopting interference thresholds at protected devices is a logical extension to the receive signal strength limits defined for PAL (census tract) boundaries[15] and would be expected to simplify SAS implementation by virtue of having fewer geographic points at which to calculate RSS or interference levels.
- for dynamic spectrum sharing with nomadic or mobile incumbents, this yields a much simpler regulatory regime by eliminating the need to define countless fixed geographic exclusion zones which would ultimately be ineffective, e.g. for future federal incumbents that may include experimental airborne radar or ground based radar systems that need to be tested and employed in the US, such as during a national emergency.

[15] FNPRM §96.38(c).

- similar simplifications in the regulatory framework are seen in establishing equivalent mechanisms by which GAA devices can use PAL spectrum (i.e., not raise interference levels above a specified threshold).

In a similar vein, Shure proposes that low-power devices be permitted to operate closer to incumbents than higher power devices.[16] Conceptually, this should be permissible due to the lower levels of interference induced by the lower power devices. But this concept can be extended to other classes of devices and formalized into a generalizable interference management framework by a) exploiting the existing SAS core functionality of controlling maximum CBSD power levels for interference management[17] and b) changing the SAS interference management approach for protecting incumbents from enforcing fixed geographic exclusion zones to enforcing an appropriate maximum level of interference to incumbents.

To facilitate implementation of this approach, Receive Signal Strength Indicator (RSSI) measurements from CBSDs and emplaced devices can be used to monitor signal levels and provide feedback to SAS operation. CBSD RSSI measurements could provide general area coverage while RSSI measurements at points correlated to network operator and incumbent risk areas could provide critical sampling. In addition, RSSI measurements at FSAS specified locations would simplify SAS implementation and would accelerate market uptake by network operators by having fewer points to measure and at which to calculate RSSI and other interference-defining signal strength levels.

We further note that siting information is critical to efficient management via interference thresholds. A 100 mW emitter near a window on the 32nd floor in downtown Boston comprises more of a risk to a federal incumbent in Boston harbor than a 10 Watt small cell in the basement.

[16] Comments of Shure Incorporated in Response to FNPRM, pp. 5-6.
[17] FNPRM §96.43.

With only lat / long information, even a SAS with highly accurate propagation models would have to assume the worst case condition and the small cell in the basement would have to be treated as if it could be on the 32nd floor near a window. Thus, differentiation among PAL and GAA CBSD devices with respect to power and distance must take other significant features into account.

Certification and recertification of SAS entities should be specified by rule to assure the SAS' ability to manage interference levels at a variety of specified protected locations from a variety of emitter locations. Further, the locations of some federal incumbents require obfuscation necessitating managing interference levels to an area in this case instead of to particular locations. The Comments of Pierre de Vries describe one such method for estimating interference levels to an area for PALs that could be repurposed to protecting areas resulting from FSAS-specified obfuscated locations/areas.[18] Accordingly we propose that SAS certification require demonstration of protection of federal incumbents and PAL devices to assure national security and to benefit market uptake.

II. DEPLOYMENT SHOULD NOT BE DELAYED VIA TRANSITIONAL FRAMEWORKS

Several respondents proposed delaying the implementation of the proposed rules to the entire band.[19] Essentially, this group wants PAL spectrum to be initially managed like traditional licensed spectrum (sometimes called a transitional framework) with the rest of the spectrum

[18] de Vries, pp. 6-9.
[19] Verizon, p. 11-15, Comments of CTIA in Response to FNPRM (CTIA), pp. 3-5, Comments of AT&T in Response to FNPRM ("AT&T") pp. 11-30, Ericsson pp 4-6.

managed as proposed (sometimes called an experimental framework). This is based on the assertion that several of the SAS-based sharing techniques are unproven (with specific concern on opportunistic sharing between GAA and PAL users), poorly defined, and require further study.[20] Accordingly, they propose that GAA / PAL sharing be restricted to field trials in the experimental bands while rules and techniques are verified with the transitional framework end at some point in the future. Further, they assert that PAL spectrum should be regulated as similar to traditional licensing models as possible (e.g., 10+ year license terms, fixed band plans).

We strenuously oppose this proposal as delaying implementation is counter-productive to the goals of the FNPRM. Movement away from the three tier model endorsed by the President's Council of Advisors on Science and Technology (PCAST)[21] will reduce spectral and economic efficiencies, and temporarily adopting two sets of rules for the band will introduce regime uncertainty, reducing deployments.

Federated Wireless specifically disagrees on the infeasibility and risk of spectrum sharing between GAA and PAL users. A GAA device operating under SAS direction in PAL spectrum is conceptually no different from any other CBSD operating under SAS direction in incumbent spectrum. Further, because of the CBSD interference reporting mechanism proposed in the FNPRM, PAL devices arguably have a higher degree of protection than what is currently provided to the incumbent devices (unless a similar collaboration / coordination approach is adopted by the incumbent users). Thus, the risk borne by PA licensees from GAA access to PA spectrum should not be a consideration for delaying adoption of the FNPRM proposed regulatory scheme into PAL spectrum.

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[20] CTIA pp. 9-10.

[21] PCAST, Report to the President: Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth (rel. July 20, 2012) ("PCAST Report").

Finally, the proposals to treat PAL spectrum as similar to traditional licensing models as possible (e.g., 10+ year license terms, fixed band plans) is very similar to arguments filed in response to the Notice of Proposed Rulemaking and Order. As such, the following is an abbreviated summary of our previous reply[22] to this position.

- Adopting a light regulatory touch will promote spectrum innovation and the entire Citizen's Broadband Radio Service band should be viewed as promoting regulatory experimentation.
- While certainty of use will promote deployment of PAL networks, long lease terms will decouple spectrum value from spectrum price and will lead to inefficient use of spectrum. Market forces instead of archaic regulations or arbitrary timeframes, should determine how spectrum will be used and its value.

III. PAL / GAA SHARING RULES AND "USE" NEED TO BE CLARIFIED

We believe that the perception of risk associated with allowing GAA devices to access PAL spectrum noted in the preceding is due to a current incompleteness in the rules for GAA access to PAL spectrum, e.g., lack of a formal definition of "use". We thus encourage the Commission to resolve this issue by adopting a formal definition of PAL spectrum use and formalizing rules for GAA access to PAL spectrum and addressing the issues posed to the FNPRM PAL / GAA paradigm by dynamic spectrum sharing with incumbents.

[22] Reply Comments of Federated Wireless to the NPRM pp 16-17.

1. PAL spectrum "use" should correspond with productive use as measured by accounting streams and spectrum measurements

While there was broad agreement that unused PAL spectrum should be available, there were significant differences of opinion on what constitutes "use". Verizon proposes an expansive definition of use wherein spectrum would be considered to be used as protection zones or with low levels of traffic and that responsibility for determining “use” should reside with the PAL holder.[23] Ericsson differs slightly in that only PALs with deployed facilities would be defined as in “use” and that collaborative methods between SAS and PAL operators should be employed to prevent harmful interference.[24] On a related note, T-Mobile objects to any further payments to the SAS for their use of the spectrum due to having paid for the PAL.[25]

In contrast, Google asserts that GAA devices should be able to operate anywhere as long as the GAA device would "not exceed the interference protection afforded to nearby PAL deployments."[26]

We agree with Google's position and note that a unified framework for interference management for all three-tiers could be achieved via SAS-directed dynamic interference management based on ensuring interference levels (or received signal strengths) at protected devices do not exceed agreed-upon thresholds. As with coexistence with incumbent systems, dynamic spectrum sharing between PAL and GAA devices can be accomplished via sensing, collaboration, or a combination of the two. However, security issues associated with PAL / GAA

[23] Comments of Verizon in Response to FNPRM, pp. 10-11.
[24] Comments of Ericsson in Response to FNPRM p. 8.
[25] Comments of T-Mobile in Response to FNPRM, p. 15.
[26] Google, p. 18. *See also* WSA, p. 3.

sharing would be minimal,[27] so dynamic PAL / GAA spectrum sharing should be more straight-forward.

We further note that we proposed in our comments to the FNPRM what we called a "**second-best**" approach to managing PAL / GAA spectrum usage wherein actual spectrum usage is measured via sensing and GAA frequencies are rapidly reassigned by the SAS as needed. However, our preferred solution to both measuring "use" and managing GAA access to PAL spectrum augment the preceding with our proposed two-part tariff monetization scheme wherein the PAL licensing fee is broken up into an accounting stream as the PAL spectrum is used.[28]

In addition to providing an additional mechanism to verify productive use of PAL spectrum, the resulting accounting stream would help to address the following concerns raised by Commenters.

- As the PAL payment is broken up into a stream and only made when in use, budget-constrained operators would be better positioned to bid on spectrum and maintain transmission rights during network deployment and planning without excluding others from making use of the spectrum.
- Mission-critical networks with low average spectrum utilization operating in PAL spectrum should find spectrum relatively more affordable and have a direct mechanism for reasserting priority access.
- Network operators, such as Verizon, who wish to hold spectrum fallow for guard bands / areas may nonetheless demonstrate that this is the most economically efficient use of the spectrum via their continuing accounting stream. Further, by being able to turn off and on

[27] Beyond an obligation to hold sensitive PAL network data in confidence and not release it for unauthorized uses as noted by AT&T p. 6.

[28] *See* Comments of Federated Wireless Inc. in Response to Licensing PN in GN Docket No. 12-354 (filed December 5, 2013) (Federated Licensing PN Comments) at 17-25.

access to these guard bands by adjusting their payment stream, such operators would be free to experiment in order to assess the impact of GAA access to this guard spectrum while incentivized to release the spectrum when the protection is not needed.

2. The rules for allocation of spectrum between PAL and GAA devices when dynamically shared with incumbents needs to be defined

Verizon[29] notes that if true dynamic access to incumbent spectrum is permitted (e.g., by sensing or collaboration), then the proposed 50% spectrum reservation for GAA use becomes problematic for PAL holders. We similarly request that how to manage PAL spectrum in this scenario be clarified. The simplest method is to treat all additional spectrum as GAA spectrum, which would be consistent with the existing rule that reserves at least 50% of all spectrum for GAA use. However, it is also conceivable that encumbered PAL licenses could be allowed wherein for the periods of time when no incumbent is present, and the associated census tract and frequency could be held as a PAL. But, this would dramatically reduce the price paid for such spectrum, quite possibly to zero, making it identical to GAA spectrum.

IV. THE COMMISSION SHOULD CLARIFY AND FORMALIZE SPECIFIC SAS INTERFACES AND FUNCTIONALITIES

Based on the filed comments, there appears to be confusion on SAS functionalities and interfaces beyond the issue of GAA access to PAL spectrum highlighted in the preceding. To eliminate this confusion, we request that the Commission clarify the following:

1. **The SAS CBSD Management Functionalities Should be Clarified**

[29] Verizon pp. 18-20.

Several Commenters object to the SAS direction for network management operations and note that network operators should be free to internally manage the power levels, frequencies, and other technical parameters of the devices in the network.[30] While we strongly endorse SAS-directed dynamic interference management[31], we had not read the FNPRM as granting the SAS the degree of operational control that these Commenters suggest.

For instance on power levels, a SAS is not permitted to set the operating power level of any device, but instead is required to "Determine the maximum permissible radiated transmission power level for CBSDs at a given location and communicate that information to the CBSDs"[32] while "A CBSD shall only operate at or below the maximum power level."[33] Thus the network operators are free to configure and optimize the operating power of their devices subject to maximum transmit power constraints, similar to what would be expected in any other band.

More generally, the ability of the SAS to set maximum power levels and assign frequencies is critical to Citizen's Broadband Radio Service band interference management. As this ability will further increase in importance if more dynamic spectrum sharing approaches (e.g., sensing and / or coordination) are adopted to increase spectrum availability, eliminating this core SAS functionality would be detrimental to the successful use of the 3550-3560 MHz band.

We believe that this confusion derives from paragraph 45 of the Public Notice (PN) wherein the Commission speculated that "The maximum operational EiRP of individual base stations might be reduced by the SAS to prevent interference and promote efficient network

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[30] *See* CTIA, p. 13, (" Nor should the SAS control the operating power or other technical parameters of a PAL network"), T-Mobile p. 14, Verizon p.9 ("The Commission should reject proposals under which operators (in particular, Priority Licensees) would be obligated to permit third party SAS Managers to dynamically manage their transmitter power levels or other radio parameters.").
[31] Comments of FW to FNPRM, p. 13.
[32] Paragraph 95, FNPRM.
[33] FNPRM §96.36(c).

operation," with the particular point of contention being SAS-directed maximum operational Effective Isotropic Radiated Power (EIRP) reductions for the purpose of promoting efficient network operation. While promoting network efficient operation is not in the rules in the FNPRM, its past consideration was mentioned in paragraph 70 of the FNPRM. To address this, the Commission should clarify that SAS-directed adjustments to maximum operational EIRP and frequencies will be to protect the spectrum rights of Citizen's Broadband Radio Service users and incumbents with accompanying commentary that Citizen's Broadband Radio Service users and SAS administrators are free to engage in any other mutually-agreeable direction subject to the constraints of the rules.

2. **SAS Administrators Should Be Allowed to Deploy Additional Interfaces while Preserving SAS Functionalities**

Two Commenters from the energy communities suggested that all SAS administrators should be required to provide a non-Internet based method for database access due to the costs and security issues expected to be encountered for their networks to communicate with a SAS.[34] Likewise several Commenters from the cellular industry requested that all SAS administrators be required to support interfaces tailored to their networks, e.g., interacting at the network management level instead of directly with individual CBSDs.[35] iConnectiv extended this concept to introducing Operator Support Services areas as part of the SAS-network interface design.[36]

We believe that trying to mandate support for the unique desires of every CBSD user class will be counter-productive, expensive, will delay time to SAS certification, and will delay time to bring CBSDs to market. Secure individual CBSD interactions with the SAS over the

[34] See Comments of American Petroleum Institute in Response to FNPRM p. 10, Comments of ENTELEC in Response to the FNPRM p. 5.
[35] Ericsson p. 17.
[36] Comments of iConnectiv in Response to FNPRM pp. 3-6.

Internet represent the single interface that can serve the purposes of the greatest number of Citizen's Broadband Radio Service uses. As such, it is appropriate as the required minimum interface for SAS authorization. However, SAS administrators should be permitted to offer interfaces beyond the minimum required interface in order to better meet the market needs of any Citizen's Broadband Radio Service user class, subject to the interface satisfying the remaining rules, to promote market and technology innovation and competition.

3. **SAS Administrators Should Be Allowed to Employ Alternate Channel Models**

In responding to the FNPRM request for comments on the appropriateness of the proposed rules for the SAS[37], Spectrum Bridge proposes that the Hata model be established as a common propagation model for SAS vendors to perform functions such as determining maximum CBSD transmit power as it "strikes an excellent balance between accuracy and computational complexity."[38] We disagree with any formal requirement for SAS use of a specific channel model. Such a requirement would stifle innovation and investment in more sophisticated and extant channel models that will lead to more efficient spectrum utilization.

Instead, we propose that the SAS certification process require a minimum accuracy requirement for receiving power predictions, but enable the certification of ever more accurate models as these are developed and demonstrated to be dependable. In this way, CBSDs and incumbents would be assured of the minimum level of interference protection via the SASs enforcing the no-harmful interference requirements, while SAS vendors would be allowed to compete on price and performance.

4. **Promoting Competition and Innovation in SAS via pricing**

[37] *See* Further Notice of Proposed Rule Making ¶ 97 (FNPRM).
[38] Comments of Spectrum Bridge In Response to the FNPRM, p 7.

There was a broad agreement among Commenters that the Commission should refrain from regulating specific business models and that in general collecting fees from both PAL and GAA users was reasonable and appropriate.[39] This is generally in agreement with our comments that setting prices of homogenizing services via regulation would be inimical to fostering competition and innovation.[40] We also reiterate that permitting the Commission to review and change SAS fees[41] will create market uncertainty and is less preferable to ensuring that there is competition among SAS administrators employing competing business models.

Promoting SAS innovation and competition would also be hindered in a comment filed by AT&T, wherein- while expressing a valid concern about the need to protect potentially sensitive network performance data- AT&T proposes that the SAS system software be developed under contract from the Federal Communications Commission (FCC) and the General Services Administration as a "'work made for hire to ensure that the FCC owns the SAS system software."[42] Presumably, this FCC-owned software would then be required for use by all SAS vendors, or even worse, the FCC would be required to run the SAS system themselves, a role we believe that the FCC should be unwilling to assume. We strenuously disagree with this position as it would stifle the highly desirable intent of the FNPRM to sponsor innovation and true competition among SAS vendors who would be unable to offer a differentiated product.

As military radio programs have amply demonstrated, federal ownership of software invariably succeeds in locking the government into a very expensive support tail and rarely achieves the degree of innovation originally anticipated. Further, most such programs have been cancelled after spending billions of dollars in well-motivated, but ultimately failed attempts to

[39] Comments of Ericsson In Response to the FNPRM ("Ericsson"), AT&T p. 33.
[40] Comments of Federated Wireless In Response to the FNPRM ("Federated Wireless"), p. 27-28.
[41] Such as was endorsed by AT&T, p. 34 in favor of fee review.
[42] AT&T p. 32.

control industry instead of leveraging industry. These lessons learned from military radio acquisitions may be applied to adjust AT&T's intent that SAS software be widely available to a more focused and effective policy that SAS interfaces should be publically available (Open Standards) and that one or more reference (Open) implementations could be available to multiple competitors. Federal ownership of SAS software, however, would run counter to the public interest.

V. THE COMMISSION SHOULD QUICKLY MOVE TO ISSUE A REPORT AND ORDER WHILE A MULTI-STAKEHOLDER GROUP SHOULD FINALIZE TECHNICAL DETAILS

Motorola Solutions, AT&T, and Motorola Mobility all explicitly endorse the use of a multi-stakeholder group to finalize technical details. We concur, and reiterate that given the disparate stakeholders, once principles are agreed to in the form of a Report and Order, a technically-focused industry-led group is best suited to finalize implementation details. Further, we concur with Motorola Solutions that the WinnForum is a well-suited group to bring together stakeholders from government, licensed and unlicensed operators and equipment vendors, and SAS operators to resolve the outstanding technical issues.

VI. CONCLUSION

For the foregoing reasons, Federated Wireless encourages the FCC to continue making progress towards promoting and enabling innovative spectrum access management in the 3.5 GHz band,

providing an example for a new paradigm in spectrum management. We encourage the Commission to quickly address the remaining issues and to issue a Final Report and Order so commercial use of this inefficiently used spectrum and productive experimentation can commence to drive comprehensive solutions to challenges that arise both in this and many other spectral regions in the future.

Respectfully submitted,

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