6712-01

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 1, 2, 90, 95, and 96

[GN Docket No. 12-354; FCC 15-47]

**Commission Seeks Comment on Shared Commercial Operations in the 3550-3700 MHz Band**

**AGENCY:** Federal Communications Commission.

**ACTION:** Proposed rule.

**SUMMARY:** In this document, the Commission seeks comment on three specific issues related to the establishment of a new Citizens Broadband Radio Service in the 3550-3700 MHz band (3.5 GHz Band). These issues are: defining "use" of Priority Access License frequencies; implementing secondary markets in Priority Access Licenses; and optimizing protections for Fixed Satellite Services.

**DATES:** Submit comments on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]** and reply comments on or before **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

**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 Second Further Notice of Proposed Rulemaking in GN Docket No. 12-354, FCC 15-47, adopted on April 17, 2015 and released April 21, 2015. 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 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, May 1, 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 rubber bands or fasteners. Any envelopes and boxes must be disposed of before entering the building.
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People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

**Ex Parte Rules**

This proceeding shall continue to be treated as a "permit-but-disclose" proceeding in accordance with the Commission's ex parte rules. See 47 CFR 1.1200 et seq. Persons making ex parte presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral ex parte presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the ex parte presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments

already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during ex parte meetings are deemed to be written ex parte presentations and must be filed consistent with § 1.1206(b). See 47 CFR 1.1206(b). In proceedings governed by Section 1.49(f), 47 CFR 1.49(f), or for which the Commission has made available a method of electronic filing, written ex parte presentations and memoranda summarizing oral ex parte presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's ex parte rules.

We note that our ex parte rules provide for a conditional exception for all ex parte presentations made by NTIA or Department of Defense representatives. See 47 CFR 1.1204. This Second FNPRM raises significant technical issues implicating federal and non-federal spectrum allocations and users. Staff from NTIA, DoD, and the FCC have engaged in technical discussions in the development of this Second FNPRM, and we anticipate these discussions will continue after this Second FNPRM is released. These discussions will benefit from an open exchange of information between agencies, and may involve sensitive information regarding the strategic federal use of the 3.5 GHz Band. Recognizing the value of federal agency collaboration on the technical issues raised in this Second FNPRM, NTIA's shared jurisdiction over the 3.5 GHz Band, the importance of protecting federal users in the 3.5 GHz Band from interference, and the goal of enabling spectrum sharing to help address the ongoing spectrum capacity crunch, we find that this exemption serves the public interest.

**Initial Paperwork Reduction Act Analysis**

This Second FNPRM contains proposed new information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget (OMB) to comment on the information collection requirements contained in this

FNPRM, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, we seek specific comment on how we might "further reduce the information collection burden for small business concerns with fewer than 25 employees."

**Synopsis of the Second Further Public Notice of Proposed Rulemaking**

## I. INTRODUCTION

On April 21, 2015, the Federal Communications Commission released a Report and Order and Second Further Notice of Proposed Rulemaking ("Report and Order" and "Second FNPRM") in this proceeding to establish a new Citizens Broadband Radio Service in the 3.5 GHz Band. While the Report and Order set forth a complete set of rules and policies related to the establishment of the Citizens Broadband Radio Service, we determined that a few focused issues remained that would benefit from further record development. We viewed these issues as opportunities to optimize the rules we had established. In the Second FNPRM, the Commission sought focused comment to the specific proposals and questions discussed below. In addition, we encouraged parties to converge on practical, multi-stakeholder solutions.

## II. BACKGROUND

In the Report and Order, the Commission adopted rules for commercial use of 150 megahertz in the 3550-3700 MHz band (3.5 GHz Band). The 3.5 GHz Band is currently used for Department of Defense Radar services and commercial fixed Satellite Service (FSS) earth stations (space-to-earth). The creation of a new Citizens Broadband Radio Service in this band will add much-needed capacity to meet the ever-increasing demands of wireless innovation. As such, it represents a major contribution toward the Commission's goal of making 500 megahertz newly available for broadband use and will help to unleash broadband opportunities for consumers throughout the country, particularly in areas with overburdened spectrum resources.

The Report and Order also adopts a new approach to spectrum management, which makes use of

advances in computing technology to facilitate more intensive spectrum sharing: between commercial and federal users and among multiple tiers of commercial users. This three-tiered sharing framework is enabled by a Spectrum Access System (SAS). The SAS incorporates a dynamic spectrum database and interference mitigation techniques to manage all three tiers of authorized users (Incumbent Access, Priority Access, and General Authorized Access (GAA)). The SAS thus serves as an advanced, highly automated frequency coordinator across the band – protecting higher tier users from those beneath and optimizing frequency use to allow maximum capacity and coexistence in the band.

Incumbent users represent the highest tier in the new 3.5 GHz framework and receive interference protection from Citizens Broadband Radio Service users. Protected incumbents include the federal operations described above, as well as FSS and, for a finite period, grandfathered terrestrial wireless operations in the 3650-3700 MHz portion of the band. The Citizens Broadband Radio Service itself consists of two tiers—Priority Access and GAA—both authorized in any given location and frequency by an SAS. As the name suggests, Priority Access operations receive protection from GAA operations. Priority Access Licenses (PALs), defined as an authorization to use a 10 megahertz channel in a single census tract for three years, will be assigned in up to 70 megahertz of the 3550-3650 MHz portion of the band. GAA will be allowed, by rule, throughout the 150 megahertz band. GAA users will receive no interference protection from other Citizens Broadband Radio Service users. In general, under this three-tiered licensing framework incumbent users will be able to operate on a fully protected basis, while the technical benefits of small cells are leveraged to facilitate innovative and efficient uses in the 3.5 GHz Band.

## III. DISCUSSION

### A. Defining "Use" of PAL Frequencies

In the Report and Order, we determined that allowing opportunistic access to unused Priority Access channels would serve the public interest by maximizing the flexibility and utility of the 3.5 GHz Band for the widest range of potential users. Thus, 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 will automatically make that spectrum available for GAA use on a local and granular basis. While there was substantial support in the record for an opportunistic use approach generally, we saw wide divergence in the record to-date regarding specific implementation of our "use-it-or-share-it" rule. We thus sought focused comment on specific options, rooted in the record, for defining "use" by Priority Access licensees.

Engineering Definition. Several commenters provided versions of an approach that would rely on an engineering definition of "use," effectively leveraging the SAS to define a boundary that would forbid GAA access near Priority Access CBSDs. Google maintained that an SAS can enforce Priority Access user protection areas based on information such as the Priority Access device's location and technical characteristics. According to Google, the SAS can protect the Priority Access device from nearby GAA operations including the aggregate effect of multiple devices operating in the vicinity. Google, at various points in the record, suggests versions of this approach with differing levels of complexity, ranging from use of simple distance-based metrics to methods based on site-specific propagation modeling. Pierre de Vries offers another variation of this concept, based on "interference limits policy," specifically the use of defined "reception limits" to specify GAA operation that does not degrade the performance of Priority Access systems.

According to Pierre de Vries, the Commission could specify the "maximum allowed resulting signal strength at the protected receiver and let an SAS calculate the allowed GAA transmit power." AT&T suggests that 3GPP standards for TD-LTE channel occupancy could be used to determine channel usage. Federated Wireless proposes that GAA devices could provide the SAS with "spectrum sensing data" upon initial operation and at regular intervals as directed by the SAS. Federated Wireless recommends that an industry group be convened to develop the details of such a sensing framework, including the measurement procedure, reporting protocol, and occupancy and evacuation times. WISPA proposes that "any CBSD that has not received 300 end-user packets within each five-minute interval

would be deemed by the SAS to be not 'in use.'" Other commenters, including Microsoft, PISC, and Shared Spectrum Company suggest that GAA use be permitted in PAL spectrum until a Priority Access licensee affirmatively requests access to its PAL from the SAS. InterDigital suggests that evacuation commands be signaled to GAA users via the SAS, which will allow for flexible channel evacuation times.

We seek comment on whether we should adopt an engineering definition of "use." We ask proponents of this approach to develop, in detail, an engineering methodology along with technical criteria and metrics that could be readily implemented by multiple, coordinated SASs. We also ask proponents to address some specific concerns about the engineering approach.

First, we note Verizon's observation that there may be occasions when a vacant channel performs a productive use, for example by serving as a guard band. Is this claim valid given the technical rules we have adopted in the Report and Order (e.g., for Category A and Category B CBSDs)? In cases where a vacant channel is serving as a guard band for high or full power use, could it be usable for localized communications at lower powers (e.g., a few milliwatts) or indoor operations?

Second, we speculate that it might be possible for Priority Access licensees to deploy low-cost CBSDs whose main purpose is to trigger SAS protections. We further observe that policing "license savers" has historically been a very challenging and administratively costly endeavor for the Commission. How could we prevent such gaming of the use-or-share rules, while maintaining our goals of technological flexibility, administrative simplicity, and light-touch regulation?

Third, the prospect of basing determinations of "use" on aggregate interference metrics raises equitable and coordination challenges with respect to the GAA tier. As discussed above, reliance on aggregate interference begs the question of which GAA user will be denied access when the aggregate threshold is exceeded. Therefore, we are not comfortable delegating this decision to third parties absent the adoption of an equitable and non-discriminatory methodology. We seek comment on whether and how aggregate metrics could be used to facilitate coordination among multiple SASs? Would the use of aggregate metrics introduce complexities that would outweigh the potential benefits of using such

metrics? If we were to utilize an approach based on aggregate interference, how could we overcome these significant concerns? Alternatively, are there simpler, non-aggregate engineering metrics available that sidestep our concerns, perhaps with slightly less optimal spectrum utilization?

Economic Definition. An alternative approach presented in the record is to define "use" from an economic perspective for the purposes of determining GAA access to PAL spectrum. William Lehr, an economist at the Massachusetts Institute of Technology, proposes that we "view the PAL as an option to exclude GAA usage. PAL licensees would acquire the right to exclude GAA access." Under this approach, actual operation as a PAL licensee would not be a trigger for excluding GAA use. A PAL licensee would have the right, but not the obligation, to exercise its option and thus exclude GAA access from the PAL. The amount ultimately paid by the licensee would depend on whether the option is exercised and GAA access is correspondingly restricted. Lehr elaborates that in a simple implementation, "A winning bidder (with a bid of P for a PAL) would expect to owe ½ P when the license is awarded and ½ P when the licensee elects to exercise the option to exclude. The opportunity to delay payment would provide winning bidders with an economic incentive to avoid excluding GAA users unless the benefits of such exclusion outweigh the costs of exercising." Lehr argues that the options approach offers multiple benefits, including: more efficient spectrum usage and expanded access for commercial users; increased participation of PAL and GAA commercial users by enabling better matching of PAL costs with network investment requirements and by expanding access for GAA; simple and low-cost implementation; reduced potential risk of PAL spectrum hoarding by PAL; and, flexibility and consistency with future dynamic shared spectrum policy. He also addresses some potential concerns, including: enforceability; auction revenue impact; foreclosure of GAA use; and mispricing of options payments. Lehr concludes by addressing some additional implementation details such as the "reversibility" of license payments and the possibility of trading option rights on a secondary market.

We seek comment on whether Lehr's economic construction of "use" would be appropriate for determining GAA admission to PAL frequencies as the concept may provide a potential way to avoid

some of the concerns raised above with respect to an engineering approach. At the same time, the proposal raises other issues, some of which, as noted above, Lehr discusses in his comments. We seek comment on these concerns.

First, we seek comment on hoarding. Would the option framework encourage or discourage hoarding of PAL spectrum? How does the risk of hoarding using options compare against the risk of hoarding through deployment of low-cost CBSDs (discussed above) in an engineering-based approach?

Second, how should we think about the payments and pricing of PALs? In the FNPRM, the Commission sought comment on employing its existing rules to address upfront, down and final payments by winning bidders, applications for licenses by winning bidders, as well as the processing of such applications and default by and disqualification of winning bidders. The Commission sought comment on whether its existing rules required any revisions in connection with the conduct of an auction of PALs. We did not receive a sufficient record to determine what payment, application, and default rule revisions are necessary in adopting a less traditional approach to licensing the PAL spectrum. For instance, if we adopt the economic definition of "use" proposed above, would a 50/50 split between initial payments and an option "strike" price provide appropriate incentives for PAL use (or non-use)? We also seek renewed comment on the other payment, application and default questions raised in the FNPRM in the event that we adopt one of the proposals discussed above.

Third, how would the options approach fit not only with our auctions authority under 47 U.S.C. 309(j) but also decades of experience in holding auctions? Would an option scheme, such as that proposed here, be sufficiently distinguishable from the Commission's prior use of installment payments since under this proposal the full rights in the license would presumably not be perfected until the time of a second payment? Would the use of a two-payment option, in practice, lead to complications similar to those experienced in the past with installment payments? Is the Commission's existing legal authority sufficient to permit it to adopt auction and payment rules to implement this option? We note that our auction authority is limited to the award of an initial "license" (or permit), and that the Act defines a

license not as the right to exclude others but rather as an "instrument of authorization . . . for the use or operation of apparatus for transmission . . ." In the case of the options approach, could economic performance serve as a legally viable substitute for traditional build out or service-based performance requirements? Are there any statutory or other legal considerations that the Commission should consider in revising its existing payment, application and default rules to accommodate these proposals?

Hybrid Definition. We also seek comment on any hybrid proposals that combine aspects of the engineering and economic approaches. For example, Federated Wireless suggests that Priority Access licensees, in the context of their proposed sensing framework, should pay a "nominal usage fee for those periods that the spectrum [is] actively needed." Federated maintains that such a usage fee would incentivize Priority Access licensees to only reserve spectrum that they intend to use. Could we think of such a usage fee as a form of "option" superimposed on an engineering definition of "use"? Do we have authority to impose such a fee and, if so, how would we set the price? How would we define the unit volume (*i.e.*, quantity) of "use" to which a price could be applied? Could such a framework make use of an auction, with price set through competitive bidding, rather than a fee? Could the auction payment be pro-rated across sub-divisions of the license area (*e.g.*, Census Block Groups) to account for use in only a portion of the geography? What would be the simplest and most practical approach to implementing a hybrid scheme?

### B. Implementing Secondary Markets in Priority Access Licenses

In the Further Notice of Proposed Rulemaking (79 FR 31247, June 2, 2014) in this proceeding, we sought comment on the extent to which our existing secondary market rules (both for license transfers and for leases) might be appropriately modified with respect to the secondary market for PALs in the 3.5 GHz Band. We emphasized that auctions would be our initial assignment methodology, but that the secondary market could provide a viable means of matching supply and demand in units more granular than our proposed PAL structure. We noted that the development of one or more spectrum exchanges, operating pursuant to our secondary market rules, could facilitate a vibrant and deep market for PAL

rights.

Relatively few commenters addressed the significant issues associated with the potential application of our secondary market rules to the transfer of PALs. Commenters who did address the issue were generally supportive of a framework in which PALs can been traded in the secondary market. These commenters note that the development of a robust secondary market in the 3.5 GHz Band would be beneficial for potential Priority Access Licensees. AT&T, for example, believes that flexibility in the deployment of PALs will be important to both commercial operators and other Priority Access Licensees as PAL use may be short term, e.g., coverage for a large event, or longer term, e.g., backhaul or access applications. AT&T maintains that partitioning and a secondary market mechanism will enable Priority Access licensees to gain access to additional spectrum as future needs arise. Qualcomm and WISPA support affording PAL licensees the flexibility to disaggregate or partition their licenses. In addition, WISPA and Spectrum Bridge argue that prior Commission approval of secondary market transactions should not be required given the absence of build-out rules for the band and a streamlined auction process, among other reasons. Instead, WISPA argues that written notification to the Commission and SAS would be sufficient to ensure that appropriate contact information is available in the event of harmful interference. TIA also supports application of the Commission's secondary market rules and emphasizes the need for secondary leasing arrangements, which will "allow providers to adjust to changing market circumstances in order to enhance their service quality." Federated Wireless, on the other hand, opposes application of the secondary market rules noting that "[t]he development of secondary markets to manage geographical subsets of PALs takes the control of spectrum management and enforcement out of the hands of the SAS and the FCC."

Some commenters support the development of one or more spectrum exchanges, operating pursuant to our secondary market rules, which could facilitate a vibrant and deep market for PAL rights. Such an exchange could improve the ability of individual licensees to obtain micro-targeted (in geography, time, and bandwidth) access to priority spectrum rights narrowly tailored to their needs on a

highly customizable, fluid basis. Cantor proposes a spectrum exchange managed by an independent third party and modeled on platforms which exist for the trading of other U.S. Government securities. Cantor envisions that such a spectrum exchange would integrate the SAS functions in order to provide market participants with use right information and to resolve any interference issues that might arise. In addition, Cantor explains that a spectrum exchange should include: "(1) universal access to information; (2) dynamic transactional access by and among authorized market participants; (3) real-time reporting of 3.5 GHz spectrum resource use right utilization; and (4) market maintenance." InterDigital suggests that the SAS could act as a spectrum exchange to manage secondary market transactions. We note that any spectrum exchange would be subject to the requirements of Section 310(d) of the Communications Act and other relevant statutory provisions.

We believe that it is in the public interest to develop a fuller record on the implications of applying our secondary market rules to the 3.5 GHz Band ecosystem. While we agree with commenters on the record thus far that application of our secondary market rules will increase liquidity of the spectrum as well as reduce costs and increase flexibility of use, we seek additional information on how we should implement the rules with respect to the 3.5 GHz Band. To the extent that commenters agree with this concept, we request specific and focused comment on any necessary changes to our Part 1 rules to facilitate the secondary market for PALs in the 3.5 GHz Band. For example, regarding partitioning and disaggregation, our initial view is to prohibit such further segmentation of PALs given their relatively small size (census tracts) and limited duration (three years) as well as the availability of significant GAA spectrum in all license areas. Some commenters, however, urge the Commission to allow partitioning and disaggregation of PALs. We seek comment on this proposal. Would partitioning and disaggregation of PALs benefit the Citizens Broadband Radio Service or would such flexibility prove administratively burdensome and unnecessary given the size and duration of these licenses? We also seek comment on the potential use of spectrum exchanges to facilitate the transfer of PALs in the secondary market. Would such exchanges be mandatory or could the existing Part 1 rules, in combination with the SAS framework

adopted in the Report and Order, above, be sufficient to allow voluntary development of exchanges to trade PALs? We are particularly interested in modifications to our rules that could reduce transaction costs and allow increased automation of transfer and lease applications. What legal, technical, or logistical issues should we consider?

For secondary markets purposes, we also seek comment on the application of our spectrum aggregation limits for PAL licensees. Should we use the attribution standard applied in our existing rules to transactions involving mobile wireless licenses for commercial use? We also seek comment on how this standard can reflect the need for a streamlined process, potentially through a database administrator, for transactions involving PALs. In addition, we seek comment on the application of our spectrum aggregation limit in the context of the initial licensing of PALs, including how any unique characteristics of PAL auctions, such as the need for streamlined processing, should be taken into account in resolving this issue.

### C. Optimizing Protections for FSS

#### 1. In-band Protection of FSS in the 3650-3700 MHz Band

We raise five topics for consideration in the Second FNPRM with respect to the methodology and parameters for protecting in-band FSS earth stations, in addition to the adoption of Section 96.17 as described in section III(G)(2) of the Report and Order.

Calculation Methodology. As noted in the Report and Order, we agree with Google that the Commission's example methodology in the 3650–3700 MHz proceeding is a useful starting point for coexistence analysis. We seek comment on the use of this methodology by the SAS to calculate exclusion distances for CBSDs with respect to individual FSS earth stations in the 3650-3700 MHz band. Is the methodology accurate? Does it require further specification?

Propagation Modeling. While we recognize the challenge of effective propagation modeling for band sharing, we believe that research in propagation path loss models in recent years has advanced considerably and offers an increasing array of practical and realistic tools and methods for predicting path

loss and determining practical bounds on prediction errors. However, despite these advances, there are many different propagation models, with little integration of these models across diverse environments. Many existing models have been tailored for specific and diversely different environments. A research article by Phillips, Sicker, and Grunwald illustrates the scope of the challenge as well as the significant benefit of improved statistical analysis of path loss prediction. They described and implemented "30 propagation models of varying popularity that have been proposed over the last 70 years" and found "…the landscape of path loss models is precarious… we recommend the use of a few well-accepted and well-performing standard models in scenarios where *a priori* predictions are needed and argue for the use of well-validated, measurement-driven methods whenever possible." We agree with this finding and believe that improved statistical analysis of propagation path loss can lead to significant improvements in shared spectrum utilization and interference prediction and mitigation. We propose that all SAS Administrators use an agreed upon set of propagation modeling methods, using models that can be tuned with measurements. We seek comment on what propagation model(s) are best suited for SAS-based protections of FSS. We solicit measurement results that validate model parameters for combined short range and long range propagation scenarios, involving indoor and outdoor propagation channels. What model(s) are the most accurate in accounting for urban clutter and other environmental factors such as rain attenuation, ducting, etc., and most suitable for modeling statistical variations to support analysis – including possible Monte-Carlo analysis – of many potential interfering sources? In order to generate the same exclusion distances between CBSDs and any individual FSS earth stations in 3650-3700 MHz, we expect each SAS to enforce the same minimum separation distance and we tentatively conclude that each SAS must use the same propagation model. We seek comment and objective analysis from anyone who believes otherwise.

Interference Protection Criteria. We agree with commenters that, in principle, an Equivalent Power Flux Density (EPFD) of aggregate interference power at the FSS earth station receiver could be an appropriate interference protection criterion (IPC) for establishing interference limits of FSS earth

stations. However, our equitable and competitive concerns about using aggregate limits is noted above and discussed further below. Were we to adopt an aggregate level, we believe it should be based not only on the theoretical thermal noise floor (I/N), but should also account for the measurement of receiver performance degradation when presented with both interfering signals and wanted desired signals (C / (I+N)). We seek comment on the appropriate FSS earth station interference protection criteria, the appropriate probability of such threshold not being exceeded, and supporting field measurements to validate such proposals. Commenters should assume the use of appropriate, commercially available earth station receiver input filtering to limit the receiver bandwidth to the authorized spectrum.

We propose that co-channel Citizens Broadband Radio Service Device (CBSD) and End User Device signal levels up to this threshold be permissible, at the antenna output after FSS earth station antenna gain and discrimination per section 25.209(a)(3) of our rules. We propose that the SAS will calculate the distance, bearing, and elevation differences between registered FSS earth stations and each CBSD that requests activation. The SAS will then authorize CBSD activation if it is at or beyond the permissible distance, and deny CBSD activation if is less than the permissible distance from the earth station. How should existing link budget margins be treated in establishing value(s) for interference protection criteria, where such margins are built in to FSS earth station link budgets to account for rain attenuation, and other impairments? What is the statistical and temporal correlation of environmental effects that may not be independent nor occur simultaneously (e.g., stable atmosphere anomalous ducting, occurring naturally at different times than convective atmospheric heavy rain)? We also invite comment as to whether we can establish a default earth station protection area based on an assumed minimum earth station receiving system gain-to-temperature ratio (G/T) and minimum antenna elevation angle, and what the assumed values of the G/T and elevation angle should be. CBSD operation outside of such a default protection area would be assumed not to cause interference to earth stations receiving in the 3700-4200 MHz band. Such a default protection area would be adjusted by the SAS to accommodate the actual operating characteristics of earth stations that are registered in order to achieve additional protection.

Avoiding Policy Concerns Related to Aggregate Interference Protection Criteria (IPC). We seek comment on fair and non-discriminatory methods of adjudicating demands for increased spectrum use at a location that would result in the IPC for an FSS earth station receiver being exceeded. SIA has argued that protection zones may be insufficient if densely deployed CBSD and End User Devices outside of these areas cause aggregate interference thresholds to be exceeded. They argue that unless the Commission is prepared to periodically revisit and enlarge protection zones to address such events, it will need to either set deployment density constraints or build in a significant margin in calculating protection zones to account for aggregate interference. We seek comment on solutions that avoid discriminatory caps on CBSD service deployment, while protecting FSS earth stations from harmful interference. For example, are there probabilistic "bilateral" approximations (between an individual CBSD and an earth station) of an aggregate metric that address our concerns about the use of aggregate interference protections while also avoiding worst-case assumptions about interference from unlikely or infeasible quantities of nearby CBSDs? To the extent that commenters do support an aggregated EPFD limit, we encourage solutions to avoid a "land rush" when balancing service demands that exceed interference limits, if they occur. How could such IPC criteria be implemented by CBSDs and the SAS?

End User Devices. Recognizing that CBSDs have geo-location requirements and End User Devices do not, the location of End User Devices and the propagation channel between such devices and FSS earth stations to be protected are indeterminate. We expect CBSDs to be deployed such that terrain, buildings, and other forms of clutter can be accounted for and will provide a certain amount of propagation loss between the CBSD and a nearby FSS earth station to ensure incumbent service protection. However, End User Devices served by such CBSDs may be portable or mobile and be situated within line-of-sight or near-line-of-sight propagation, with much less propagation loss between the End User Device and FSS earth station than the propagation channel from the CBSD to FSS earth station. The indeterminate location of the End User Devices and the uncertain propagation channel between them and FSS earth stations make it challenging to ensure protection of nearby FSS earth

stations. Moreover, assuming worst case line-of-sight propagation from End User Devices in determining allowable locations for CBSDs can lead to unnecessarily large protection distances. We seek comment on reasonable methods for ensuring that the mobility, location, and orientation of End User Devices are managed effectively to avoid excessive interference to in-band FSS earth stations, while avoiding a mandate for geo-location requirements on End User Devices.

### 2. Out-of-Band Protection of C-Band FSS Earth Stations

As discussed above, we recognize that our stringent out-of-band emissions limit of 70 + 10 Log (P), i.e., -40 dBm / MHz, for CBSDs leaves potential room for more optimization. On the one hand, additional protection may benefit C-Band earth stations when CBSDs or End User Devices are located nearby. On the other, -40 dBm / MHz may prove overly stringent in situations where Citizens Broadband Radio Service operations are distant from FSS earth stations, resulting in reduced usability of frequencies near the 3700 MHz band edge. We believe the registration and protection mechanisms of the SAS, in place of an across-the-board out-of-band limit, could provide a great deal more flexibility and protection to benefit FSS operators and Citizens Broadband Radio Service users alike. Therefore, we seek further comment on whether and how the same IPC used to ensure protection from co-channel emitters could also be used with respect to out-of-band interference from Citizens Broadband Radio Service to C-Band FSS earth stations. To the extent that many different stakeholders may find such an approach appealing, we encourage industry discussions that could lead to a consensus recommendation.

We seek comment on whether the received power interference protection criteria for out-of-band FSS earth stations should be the same or different from co-channel protections. Can a default protection area be defined based on these criteria and specific assumptions about FSS earth station receiving system G/T and minimum antenna elevation angle? For example, a C-Band licensee with an earth station having a low elevation angle above heavily populated areas may desire protection beyond that afforded with the required out-of-band emission limit. The licensee may register the earth station, including the antenna gain pattern. This information could be used by an SAS to calculate the requisite protection distance near

the main beam to enable closer CBSD operation in the back of the earth station where there is higher antenna discrimination and ensure that the IPC is not exceeded.

Moreover, we agree with Google that market incentives may be feasible to encourage industry to deploy radios with improved (lower) adjacent emissions and thereby have greater access to spectrum. However, we do not see how this can be accomplished within the current regime of equipment authorization subject to the Commission's Part 2 requirements. We seek comment on how this can practically be achieved without burdensome changes to equipment authorization requirements that do not currently require precise emission measurements below the regulatory thresholds (i.e., the noise floor of measurement equipment configurations often mask the emission performance of a device below the pass/fail regulatory limit). One possibility would be to define a small number of classes of devices, that are distinguished by increasingly stringent OOBE limits (e.g., Class X complies with -40 dBm / MHz, Class Y with -45 or -50 dBm / MHz, Class Z with -60 dBm / MHz, etc.). The device class would be tied to the device's FCC ID, and this information communicated to the SAS, which could provide protection commensurate with the class of the device. We seek comment on whether such a scenario would work, and if so, what levels of OOBE limits should be specified and how would those correspond to protection distance. At what point would lower OOBE limits cease to offer additional benefit, due to other effects such as FCC earth station receiver blocking? We also seek comment on whether we would need to make changes in our equipment authorization procedures and changes to adopted SAS rules.

## IV. Procedural Matters

### A. Ex Parte Rules

This proceeding shall continue to be treated as a "permit-but-disclose" proceeding in accordance with the Commission's ex parte rules. Persons making ex parte presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral ex parte presentations are reminded that memoranda summarizing the presentation must (1) list all

persons attending or otherwise participating in the meeting at which the ex parte presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during ex parte meetings are deemed to be written ex parte presentations and must be filed consistent with § 1.1206(b). In proceedings governed by section 1.49(f) or for which the Commission has made available a method of electronic filing, written ex parte presentations and memoranda summarizing oral ex parte presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's ex parte rules.

We note that our ex parte rules provide for a conditional exception for all ex parte presentations made by NTIA or Department of Defense representatives. This Second FNPRM raises significant technical issues implicating federal and non-federal spectrum allocations and users. Staff from NTIA, DoD, and the FCC have engaged in technical discussions in the development of this Second FNPRM, and we anticipate these discussions will continue after this Second FNPRM is released. These discussions will benefit from an open exchange of information between agencies, and may involve sensitive information regarding the strategic federal use of the 3.5 GHz Band. Recognizing the value of federal agency collaboration on the technical issues raised in this Second FNPRM, NTIA's shared jurisdiction over the 3.5 GHz Band, the importance of protecting federal users in the 3.5 GHz Band from interference, and the goal of enabling spectrum sharing to help address the ongoing spectrum capacity crunch, we find that this exemption serves the public interest.

### B. Filing Requirements

Pursuant to §§ 1.415 and 1.419 of the Commission's rules, 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: (1) the Commission's Electronic Comment Filing System (ECFS), (2) the Federal Government's eRulemaking Portal, or (3) by filing paper copies.

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: http://www.fcc.gov/cgb/ecfs/ or the Federal eRulemaking Portal: http://www.regulations.gov.
- 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. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes must be disposed of before entering the building. The filing hours are 8:00 a.m. to 7:00 p.m.
- 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.

Comments, reply comments, and ex parte submissions will be available for public inspection

during regular business hours in the FCC Reference Center, Federal Communications Commission, 445 12th Street, S.W., CY-A257, Washington, D.C., 20554. These documents will also be available via ECFS. Documents will be available electronically in ASCII, Microsoft Word, and/or Adobe Acrobat.

To request information in accessible formats (Braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the FCC's Consumer and Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (TTY). This document can also be downloaded in Word and Portable Document Format (PDF) at: http://www.fcc.gov.

### C. Initial Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980, the Commission has prepared a an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities of the policies and rules adopted and proposed in this document, respectively. The IRFA is set forth in Appendix C of the Report and Order. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments filed in response to the Report and Order and Second Further Notice of Proposed Rulemaking as set forth above, and have a separate and distinct heading designating them as responses to the IRFA. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this Report and Order and Second Further Notice of Proposed Rulemaking, including the FRFA and IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).

### D. Initial Paperwork Reduction Act Analysis

This Second FNPRM contains proposed new information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and OMB to comment on the information collection requirements contained in this document, as required by PRA. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, we seek specific comment on how we might "further reduce the information collection burden for small business concerns

with fewer than 25 employees."

FEDERAL COMMUNICATIONS COMMISSION

Gloria J. Miles,

Federal Register Liaison Officer.

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