Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC

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

COMMENTS OF THE SATELLITE INDUSTRY ASSOCIATION

The Satellite Industry Association ("SIA")[1] hereby responds to the Federal Communications Commission's ("Commission" or "FCC") request for further comments in the above-captioned proceeding adopting new service rules for use of the 3550-3700 MHz band ("3.5 GHz band") by new entrants.[2] SIA urges the FCC to carefully consider how to craft further rules to ensure that incumbent Fixed Satellite Service ("FSS") operators currently providing service to customers in the 3.5 GHz band are appropriately protected from interference from Citizens Broadband Radio Service Device ("CBSD") users.

As SIA has previously discussed, FSS operators currently provide many critical services

[1] SIA is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch services providers, and ground equipment suppliers. Since its creation twenty years ago, SIA has advocated for the unified voice of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business. For more information, visit www.sia.org. SIA Executive Members include: The Boeing Company; The DIRECTV Group; EchoStar Corporation; Intelsat S.A.; Iridium Communications Inc.; Kratos Defense & Security Solutions; LightSquared; Lockheed Martin Corporation; Northrop Grumman Corporation; SES Americom, Inc.; SSL; and ViaSat, Inc. SIA Associate Members include: ABS US Corp.; Airbus DS SatCom Government, Inc.; Artel, LLC; Cisco; Comtech EF Data Corp.; DRS Technologies, Inc.; Eutelsat America Corp.; Glowlink Communications Technology, Inc.; Harris CapRock Communications; Hughes; iDirect Government Technologies; Inmarsat, Inc.; Kymeta Corporation; Marshall Communications Corporation.; MTN Government; O3b Limited; Orbital ATK; Panasonic Avionics Corporation; Row 44, Inc.; TeleCommunication Systems, Inc.; Telesat Canada; TrustComm, Inc.; Ultisat, Inc.; Vencore Inc.; and XTAR, LLC.

[2] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, FCC 15-47 (rel. Apr. 21, 2015) ("*Second FNPRM*").

in the 3.5 GHz band and the adjacent conventional C-band (3700-4200 MHz).[3] The FCC should not impose any additional burdens on FSS operations in order to accommodate CBSD operations – particularly any new obligations that would restrict the current licensed operations of FSS providers. It is critical that FSS, as an incumbent, primary service in the C-band, maintain the flexibility necessary to operate consistently with existing and future licenses and under special temporary authority. This flexibility will protect many earth stations that are licensed to track and operate across the geostationary satellite arc, including during satellite redeployments or launch and early orbit phase ("LEOP") activities. Any impairment to the operations of FSS earth stations would not only harm customers, but also place satellite safety at risk.

I. IN-BAND PROTECTION OF FSS

A. Calculation Methodology

In considering how best to protect in-band FSS earth stations, the Commission first seeks comment on the calculation methodology that would be used by the Spectrum Access System ("SAS") to calculate exclusion distances for CBSDs.[4] SIA emphasizes that any methodology used for conducting interference analyses must take into account *all* variables and factors relevant to a particular interference environment. With this in mind, SIA concludes that the methodology used in the 3650-3700 MHz proceeding (the "Appendix D Methodology"),[5] is not sufficient to adequately protect FSS operations from CBSD operations, even if some aspects of that methodology, such as the geometric analysis, are useful elements for conducting co-

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[3] *See, e.g.*, Comments of the Satellite Industry Association, GN Docket No. 12-354 filed Feb. 20, 2013 at 4-7 & 10-12.

[4] *Second FNPRM* at ¶ 437. *See also id.* at ¶ 288 ("We conclude that an analytic framework similar to what the Commission offered in Part 90, Subpart Z for Wireless Broadband Service in the 3650-3700 MHz Band, for determining interference to C-Band downlink earth stations from in-band operations, is applicable in the 3.5 GHz Band.").

[5] *Wireless Operations in the 3650-3700 MHz Band*, Report and Order and Memorandum Opinion and Order, 20 FCC Rcd 6502 at 6554-6562 (2005) ("*3.65 GHz Order*"). A correction of the distance formula in Appendix D was published in *Wireless Operations in the 3650-3700 MHz Band*, Memorandum Opinion and Order, 22 FCC Rcd 10421, 10444, n.143 (2007).

existence analyses and calculating exclusion distances for CBSDs with respect to individual FSS earth stations.

The Appendix D Methodology has two major flaws that render it insufficient for conducting co-existence interference analyses in the 3.5 GHz band. First, Appendix D does not provide a means to calculate the separation distances required when there are multiple small-cell interfering transmitters, and therefore cannot be used to consider aggregate interference to earth stations. As SIA and others have emphasized, determining the aggregate interference impact of all CBSDs in the vicinity of an earth station is essential to preventing disruption of FSS operations.[6]

Second, the formula for required separation distance in Appendix D has only three input parameters: (1) the earth station antenna azimuth; (2) the earth station elevation angles; and (3) the azimuth from the earth station to the interfering terrestrial device location. The formula does not consider other variable parameters critical to the separation analysis, including the equivalent isotropically radiated power ("EIRP") of the interfering in-band signal; the elevation profile from the earth station to the small-cell location of the interfering in-band signal; the terrain profile for the specific location; the time variability of propagation path loss; and the earth station receiver noise temperature. Because Appendix D does not discuss the origin of the formula or the constants it uses, SIA lacks the information necessary to suggest appropriate modifications of the formula to incorporate these additional data points and adapt the formula for application in the 3.5 GHz band. Given these shortcomings, the Commission must conclude that the Appendix D Methodology cannot be relied on to conduct co-existence analyses for CBSDs with respect to individual FSS earth stations.

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[6] *See, e.g.*, Reply Comments of the Satellite Industry Association, GN Docket No. 12-354 filed Apr. 5, 2013 at 14-16 & n.52 (citing other parties' comments regarding the importance of an aggregate interference analysis); Comments of the Satellite Industry Association, GN Docket No. 12-354 filed July 14, 2014 at 7-8.

B. Propagation Modeling

The *Second FNPRM* seeks comment on "what propagation model(s) are best suited for SAS-based protections of FSS."[7] ITU Study Group 3 ("SG 3"), the ITU-R study group designated specifically for propagation modeling, has a thorough and respected process that has produced successful results.[8] SG 3 has developed a propagation model for the evaluation of interference between stations on the Earth's surface, Recommendation ITU-R P.452-15, which has been extensively studied, approved by the ITU-R expert group, and ratified by ITU administrations. This ITU propagation model is thus well-suited for the point-to-point interference predictions required for protection of FSS earth stations. The model is also able to take account of the actual terrain variation between transmitter and receiver (using data extracted from a terrain database). SIA urges the FCC to mandate the use of this propagation model for SAS calculations.[9]

SIA strongly cautions against allowing SAS's to use differing propagation models because doing so would lead to disparate protection requirements among or within CBSD operational localities and cause operational inconsistencies in an already difficult sharing environment. If, however, the Commission decides to permit SAS Administrators to propose alternatives to ITU-R P.452-15, it must require that any new propagation model be vetted thoroughly by SG 3 prior to its consideration as a candidate for SAS calculations. Like ITU-R P.452-15, any proposed propagation model must be appropriate for interference modeling as opposed to network design (or network coverage) modeling. At a minimum, any new proposed model should be at least as viable as ITU-R P.452-15.

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7 *Second FNPRM* at ¶ 438.

8 *See* "Study Group 3 (SG 3)," http://www.itu.int/en/ITU-R/study-groups/rsg3/Pages/default.aspx.

9 SIA recommended this propagation model in the 3.65 GHz proceeding in 2004. *See* Comments of the Satellite Industry Association, ET Docket Nos. 04-151, 02-380, and 98-237, at Exhibit 1, p. 2 (filed Jul. 28, 2004).

C. Interference Protection Criteria

The Commission seeks 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."[10] The FSS earth station interference criteria should be based on limiting the increase of an earth station receiver's noise floor to 6%, equal to an I/N of -12 dB, as established by Recommendation ITU-R S.1432.[11] As with the ITU-R P.452-15 propagation model, the FSS protection criteria set forth in Recommendation ITU-R S.1432 reflect the results of extensive study of FSS systems and operational parameters, approval by the ITU-R expert group, and ratification by ITU administrations.

The Commission also asks how "existing link budget margins [should] 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."[12] SIA emphasizes that the FCC must treat existing link budget margins with great deference. The FSS operational link budget margins vary for different FSS services and take into account other services in the bands, error performance objectives for satellite services, and sharing conditions for FSS systems. These margins exist to ensure that the performance requirements of satellite service customers are met. The link budgets include limited margins for service impairments, but even a small decrease in interference margins could cause the degradation of FSS operations and customer services. In particular, protection of existing link budget margins is critical for C-band operations because rain impairments are minimal and, therefore, clear-sky link budget

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[10] *Second FNPRM* at ¶ 439.

[11] *See* Rec. ITU-R S.1432-1 at 2 (2006), *available at* https://www.itu.int/dms_pubrec/itu-r/rec/s/R-REC-S.1432-1-200601-I!!PDF-E.pdf ("Recommendation ITU-R S.1432-1"). The 6% of noise floor criterion, which differs from the criterion previously suggested by SIA, is a compromise position agreed to by the participants in the multi-stakeholder Wireless Innovation Forum's ("WinForum") Spectrum Sharing Committee. The Spectrum Sharing Committee is an industry and government standards body that aims to support the development and advancement of spectrum sharing technologies.

[12] *Second FNPRM* at ¶ 440.

margins tend to be relatively small, leaving little room for any reductions.

SIA submits that the Commission should not use the gain-to-temperature ratio (G/T) to "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."[13] Instead, SIA believes that the FCC should establish a default protection value based on a five degree minimum elevation angle and the corresponding antenna gain and receiving system noise temperature as a separate parameter. SIA proposes using five degrees as the elevation angle to calculate the default protection value because Commission rules permit earth stations to transmit at elevation angles as low as five degrees without a special showing.[14] A five degree minimum elevation angle is therefore necessary to protect the most vulnerable earth stations (*i.e.*, those with the lowest allowed elevation angle). SIA recommends using a receiving system noise temperature of 100K as a default value; however, actual values applicable to the licensed earth station could also be used.

D. Policy Concerns Related to Aggregate Interference Protection Criteria

In addressing policy concerns related to aggregate interference protection criteria ("IPC"), the Commission must ensure protection of FSS earth stations from aggregate harmful interference. As the Commission considers proposals for "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,"[15] it should ensure that under any such methods, the SAS always prioritizes incumbent protection and is required to swiftly resolve any interference that arises.[16]

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13 *Id*.

14 *See* 47 C.F.R. § 25.205(a).

15 *Second FNPRM* at ¶ 441.

16 In an *ex parte* letter dated June 26, 2015, Google Inc. states that General Authorized Access is a licensed service under Part 96. *See* Letter from Preston Marshall, Google Inc., to Marlene H. Dortch,

The protection of incumbent FSS stations is not possible with unconstrained interference growth. Thus, despite the Commission's search for "solutions that avoid discriminatory caps on CBSD service deployment, while protecting FSS earth stations from harmful interference,"[17] some maximum level of aggregate interference—which may result in a "cap" on CBSD service deployment—is necessary. As noted above, the maximum permissible level of aggregate interference should be based on the criteria in ITU-R Recommendation S. 1432.[18] In the alternative, as SIA has suggested earlier in this proceeding, the FCC could set deployment density constraints or provide protection zones with a significant margin to account for aggregate interference.[19] As long as the aggregate interference criteria are not exceeded, the operations of CBSDs will not cause interference. If, however, any of the interference criteria are exceeded, restrictions on CBSD operations will be necessary to avoid disruption of incumbent operations.

E. End User Devices

The *Second FNPRM* also seeks input 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."[20] SIA urges the Commission to reconsider its conclusion that a geo-location mandate on End User Devices should be avoided. Without geo-location on all End User Devices, the SAS cannot be provided with any End User Device location inputs. Absent such data, the SAS calculations to protect FSS earth stations from interference would need to be based on worst-case assumptions regarding End User Device locations. Those

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FCC, ET Docket No. 15-105 (filed Jun. 26, 2015). This does not mean, however, that the licensed General Authorized Access may cause co-channel or adjacent-band interference into FSS systems. Such third-tier services in the band are secondary to FSS and cannot cause interference to FSS.

17 *Second FNPRM* at ¶ 441.

18 Recommendation ITU-R S.1432-1 at 2.

19 *See Second FNPRM* at ¶ 441, *citing* Reply Comments of the Satellite Industry Association, GN Docket No. 12-354 filed Aug. 15, 2014 at 5.

20 *Second FNPRM* at ¶ 442.

assumptions include the maximum distance from the CBSD at which the End User Device could operate and the maximum number of End User Devices that could be served by the CBSD. Clearly, the use of such worst-case assumptions would result in fewer End User Devices being authorized – and therefore less efficient utilization of the spectrum – than if the SAS had actual location data for each device.

In the alternative, a maximum deployment radius from a CBSD for End User Devices could be defined by the FCC. Using the maximum distance from the (known) CBSD location and maximum power allowed for End User Devices, the SAS would be able to calculate the maximum interference potential from End User Devices based on the closest permissible distances to the FSS earth station and approve or decline the operations as appropriate.

II. OUT-OF-BAND PROTECTION OF FSS EARTH STATIONS

The *Second FNPRM* seeks comment on "the use of the SAS to permit a more flexible approach to out-of-band protections for FSS."[21] As SIA has explained in Section I.A. of these comments, the shortcomings of the Appendix D methodology developed in the *3.65 GHz Order* render that approach unsuitable for application in the context of this proceeding. Moreover, the Appendix D formula was developed for in-band protection of earth stations from wireless broadband licensees in the 3.65 GHz band, taking into account the maximum permissible transmitted power allowed under Part 90. The formula would need to be modified to address out-of-band protection of earth stations and to reflect the higher power levels adopted for CBSDs.

In addition, aggregation of the total received interference power from CBSD operations and End User Devices must be a component of the interference mitigation calculations given the volume of CBSDs that are expected to be in operation as a result of this proceeding. With

[21] *Id.* at ¶ 296.

thousands of CBSDs operating in the 3.5 GHz band, the total received interference power from CBSD operations at an FSS earth station receiver will be a function of the transmitting characteristics of the CBSD operations, the receive characteristics of the FSS earth station, and the number of CBSDs operating in the vicinity of the FSS earth station, which will significantly increase the risk of interference to FSS operations. As such, aggregate calculation is necessary to avoid interference into the adjacent band.

The *Second FNPRM* also asks "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 [CBRS] to C-Band FSS earth stations" and "whether the received power interference protection criteria for out-of-band FSS earth stations should be the same or different from co-channel protections."[22] The appropriate FSS earth station interference criteria should be based on 6% of noise floor criterion for in-band FSS protection and 1% of noise floor for out-of-band FSS protection, equal to an I/N of -20 dB, as established by ITU-R S.1432.[23] If the Commission proposes to use a single protection criterion, it must employ the stricter of the two options – specifically, the 1% of noise floor criterion applicable to out-of-band interference – in order to effectively manage interference.

Finally, the *Second FNPRM* asks about whether "market incentives . . . to encourage industry to deploy radios with improved (lower) adjacent emissions and thereby have greater access to spectrum" could be implemented without the need for "burdensome changes to equipment authorization requirements that do not currently require precise emission measurements below the regulatory thresholds."[24] The Commission further asks whether it would be workable to "define a small number of classes of devices, that are distinguished by

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22 *Id*. at ¶¶ 443, 444.

23 Recommendation ITU-R S.1432-1 at 2.

24 *Second FNPRM* at ¶ 445.

increasingly stringent OOBE limits" where "[t]he 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."[25] SIA cautions that relying on market incentives could undermine device quality, since competitive pricing can eliminate the price premium needed to achieve and maintain high quality in device production. The Commission should ensure that any solution does not create perverse incentives or lead to lower-quality products. In addition, where manufacturers choose to market devices that perform better than is required by out-of-band emissions limits, the devices would still need to be certified to provide consumers with adequate assurances about a given device's performance.

III. CONCLUSION

For the reasons established above, SIA respectfully requests that the Commission adopt SIA's proposals in this proceeding.

Respectfully submitted,

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[25] *Id*.