Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of

Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations.	)	IB Docket No. 97-95

To: The Commission

COMMENTS OF THE SATELLITE INDUSTRY ASSOCIATION

SATELLITE INDUSTRY ASSOCIATION

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SUMMARY

The Satellite Industry Association ("SIA") urges the Commission to regulate the sharing between terrestrial and satellite services in the 37.5-42.5 GHz ("V-band") with a light hand. Commercial satellite use of V-band spectrum is now just over the horizon. Its ultimate success depends upon a regulatory approach that allows satellite systems to operate with flexibility and consistent with established international and Commission spectrum frameworks.

The Commission should jointly consider and concurrently adopt its related proposals to delete the Broadcasting-Satellite Service and broadcasting allocations from, and to add a Fixed-Satellite Service ("FSS") allocation to, the 42.0-42.5 GHz band. Both seek to implement the Commission's recognition that meaningful satellite use can be made of the 42.0-42.5 GHz band in a way that is compatible both with fixed service operations and with adjacent-band radio astronomy service ("RAS") observations.

The Commission should reject the idea of further constraining satellite operations to protect RAS observations. The limits adopted by the ITU in Nos. 5.551H and 5.551I and in Resolution 743 (WRC-03) already protect – indeed, overprotect – RAS observations. The Commission should also adopt a modest revision of the protection criteria for RAS observations that would apply the "per 500 kHz" elements of the EPFD and PFD limits in Nos. 5.551H and 5.551I and in Resolution 743 only from 42.7-43.5 GHz in the United States.

Regarding coordination of fixed service stations with FSS earth stations in the 37.5-40.0 GHz and 42.0-42.5 GHz downlink bands, the Commission should adopt coordination requirements consistent with the prevailing "soft segmentation" approach. To this end, SIA offers in these comments a hybrid method of coordination that has the advantage of limiting the

number of instances where FSS earth station operators have to be taken into account by fixed-service planners.

Finally, SIA believes that the proposals in the NPRM restricting the manner in which satellite operators in the 37.5-40.0 GHz and 42.0-42.5 GHz bands may increase PFD to overcome rain fade are based on flawed studies and overlook FSS operational realities. In any event, no additional provisions for determining when and how satellites can overcome fading conditions are necessary because the strict PFD limits that apply in the 37.5-40.0 GHz and 42.0-42.5 GHz bands already protect fixed service links. In lieu of unwarranted additional restrictions, the Commission should revise Sections 25.208(q) to (u) of its rules to reflect the sharing conditions from No. 21.16.14 of the ITU Radio Regulations. SIA offers an example of a revised Section 25.208 as Appendix 1.

In sum, SIA supports the Commission's efforts to improve upon the existing framework for sharing between the FSS and FS in the 37.5-42.5 GHz band. The ability to develop the V-band to its fullest capacity requires a regulatory approach that promotes operator flexibility and which complements the carefully considered work of the Commission and ITU to date.

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To: The Commission

COMMENTS OF THE SATELLITE INDUSTRY ASSOCIATION

The Satellite Industry Association ("SIA") hereby submits these comments in response to the Commission's Third Notice of Proposed Rule Making in the above-captioned proceeding.[1] In the Third NPRM, the Commission proposes several measures intended to increase the potential for sharing between terrestrial and satellite services in the 37.5-42.5 GHz band ("V-band").

SIA is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch services providers, remote sensing

[1] *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations*, Third Notice of Proposed Rulemaking, IB Docket No. 97-95, FCC 10-186 (rel. Nov. 1, 2010) ("Third NPRM").

operators, and ground equipment suppliers.[2] SIA is the unified voice of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business. As the primary spokesperson for the U.S.-based satellite industry, SIA has a direct interest in this proceeding.

I. INTRODUCTION

The history of V-band dates back nearly 15 years ago as technology above 30 GHz became affordable, and has since gone through many twists and turns as the regulatory relationships among services in the band have been developed. As a follow-up to the open issues from the landmark 2003 V-Band Second Report and Order,[3] the Third NPRM focuses on the spectrum in the 37.5-42.5 GHz band. The NPRM addresses service allocations, protection issues, and sharing between satellite services (where this is a downlink band) and other services with reference to prior FCC decisions and actions in the ITU at the 1997, 2000, and 2003 World Radiocommunication Conferences ("WRCs").

SIA comments here on the five major proposals that are advanced in the Third NPRM. In SIA's view, it is critical that the Commission regulate with a light hand at this ultimate stage

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[2] SIA Executive Members include: Artel, Inc.; The Boeing Company; CapRock Communications, Inc.; The DIRECTV Group; Hughes Network Systems, LLC; DBSD North America, Inc.; Echostar Satellite Services, LLC; Integral Systems, Inc.; Intelsat, Ltd.; Iridium Communications Inc.; LightSquared; Lockheed Martin Corporation.; Loral Space & Communications, Inc.; Northrop Grumman Corporation; Rockwell Collins Government Systems; SES WORLD SKIES; and TerreStar Networks, Inc. SIA Associate Members include: Arqiva Satellite and Media; ATK Inc.; Cisco; Cobham SATCOM Land Systems; Comtech EF Data Corp.; DISH Network LLC; DRS Technologies, Inc.; Eutelsat, Inc.; GE Satellite; Globecomm Systems, Inc.; Glowlink Communications Technology, Inc.; iDirect Government Technologies; Inmarsat, Inc.; Marshall Communications Corporation.; Panasonic Avionics Corporation; Spacecom, Ltd.; Spacenet Inc.; Stratos Global Corporation; TeleCommunication Systems, Inc.; Telesat Canada; Trace Systems, Inc.; and ViaSat, Inc. Additional information about SIA can be found at http://www.sia.org.

[3] *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations*, Second Report and Order, 18 FCC Rcd 25428 (2003) ("V-Band Second Report and Order").

of the process in order to ensure that both satellite and terrestrial services have the opportunity to develop communications solutions that will make efficient use of this fertile and potentially transformational spectrum. The Commission has the opportunity in this phase of the V-band proceedings to resolve the open issues from the V-Band Second Report and Order, and SIA encourages the FCC to do so while retaining maximum flexibility for the operators who will make the initial forays into commercial V-band.

If SIA has an overarching comment, it is that commercial satellite use of V-band spectrum is now just over the horizon. The 44 GHz band immediately above the spectrum addressed in this NPRM has long been used for military satellite communications. Just as military development of government Ka-band has led to an explosion of commercial efforts in adjacent bands, the development of technology in the V-band is well into the process of opening this "next frontier" for cost-effective wideband satellite services. The satellite industry has seen significant capacity increases in successive generations of FSS spacecraft (most recently at Ka-band), and a significant limitation on capacity today is the shortage of feeder link spectrum that can accommodate the types of applications that broadband users want. The satellite industry is perhaps just one spacecraft generation (*i.e.*, fewer than five years) away from seeing V-band spectrum tapped to relieve the demand for feeder link spectrum.[4] While satellites already are an integral part of the National Broadband Plan and the only way to reach millions of unserved or

[4] Next year, a European experimental program will be attempting to characterize propagation at 39 GHz in the European Union for the purposes of establishing diversity sites and is set to run communications signals between Ka-band "users" and V-band "feeder" links. The European Space Agency's Alphasat program will be launched in 2012 and use the portions of the band where fixed service operations are preferred under both U.S. and European spectrum use approaches. The Alphasat V-band power levels are considerable for a demonstration payload -- the RF power is over 200W and EIRP is 58dBW. *See "The Alphasat TDP#5 Mission Segment,"* Presentation at the 16th Ka and Broadband Communications, Navigation and Earth Observation Conference (Oct. 20, 2010), Milan, Italy), available at http://www.space.sitiwebpro.it/index.php?option=com_docman&task=doc_download&gid=62&Itemid=282 (last visited Jan. 6, 2011).

underserved households in rural areas around the country, V-band FSS spectrum – including the downlink bands being addressed in the Third NPRM – will soon enhance satellite broadband capabilities and capacity. Meaningful terrestrial use of the spectrum has also had significant growing pains but continues to be an option for addressing growing mobile wireless backhaul and Internet extension needs.

SIA and its members have worked closely with the Commission and the terrestrial wireless industry to establish a basic, workable framework for sharing in this band. Although it has taken a long time, all parties deserve credit for the considerable effort over the course of multiple WRCs that resulted in the Commission's first two V-band Report and Orders, which together provided a degree of regulatory certainty to next-generation developers in all affected services.

Most of the difficult technical work has been done in the ITU over the course of three WRCs and in the two prior FCC rulemaking decisions. For the remaining issues, SIA urges the Commission to embrace a flexible regulatory approach that does not impinge unnecessarily on satellite operators that are designing systems to work within the established international and Commission spectrum frameworks. To this end, as SIA explains below, guidance is preferable to mandates in most instances, and simple is preferable to complex.

II. THE COMMISSION SHOULD ADOPT ITS RELATED PROPOSALS TO DELETE THE BSS ALLOCATIONS FROM, AND ADD AN FSS ALLOCATION TO, THE 42.0-42.5 GHZ BAND.

The Commission's first two proposals – to delete the Broadcasting-Satellite Service ("BSS") and broadcasting allocations from, and to add a Fixed-Satellite Service ("FSS") allocation to, the 42.0-42.5 GHz band[5] – should be considered and adopted in tandem. The

[5] *See* Third NPRM at ¶¶ 12, 17.

objective behind both is to implement the Commission's recognition that meaningful satellite use can be made of the 42.0-42.5 GHz band in a way that is compatible both with widespread fixed service ("FS") operations and with adjacent-band radio astronomy service ("RAS") observations. The Commission's justification for removing the BSS allocation from 42.0-42.5 GHz is based on the fact that BSS "usually involves ubiquitous deployment of consumer receivers and very broad coverage by the satellite signal."[6] The Commission is concerned about the potential impact of ubiquitous-coverage BSS on sensitive RAS observations in the adjacent 42.5-43.5 GHz band.[7] The Commission goes on in the next section to support making 42.0-42.5 GHz available for FSS downlinks.[8] It observes that FSS gateways are not ubiquitous, and FSS spot beams communicating with gateway earth stations should be able to operate successfully within the ITU power limitations for protection of RAS observations and potential urban-centric fixed service operations.

To the extent that the Commission proposes deleting the "usual" type of BSS allocation, and replacing it with a spot-beam based FSS allocation, the proposal clearly is sound. The technical reality of V-band satellite operations dictates that the 42.0-42.5 GHz band will be unlikely to be able to be used for a ubiquitous-coverage BSS service of the type that has developed in the Ku-band frequencies. Moreover, it appears that any satellite service objectives that can be attained in the 42.0-42.5 GHz band under the current technical constraints can be attained in the FSS, and thus the BSS allocation can be safely suppressed upon reinsertion of the

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[6] *Id.* at ¶ 14. The Commission cites the same reason as the basis for proposing the deletion of the terrestrial broadcasting allocation from 42.0-42.5 GHz.

[7] *Id.* at ¶ 15.

[8] *Id.* at ¶¶ 17-19.

FSS.[9] To be sure, the Commission's rationale for deleting the terrestrial broadcasting allocation is absolutely correct and SIA supports this proposal.

Thus, the Commission should use the opportunity of this rulemaking proceeding to optimize efficient use of the 42.0-42.5 GHz band. It should adopt its proposal to remove the BSS allocation and concurrently add an FSS space-to-Earth allocation for the band. SIA urges the Commission to remain flexible about applications that may develop in this band over time, and not use artificial distinctions to inhibit technical and/or service innovation.[10] Finally, as the Commission's original rationale for "usual" ubiquitous-coverage BSS still inevitably applies to the terrestrial broadcasting service, and such operations could cause harmful interference to both fixed service and RAS operations, the Commission should follow through on its proposal to suppress the broadcasting allocation from the 42.0-42.5 GHz band.

III. EXISTING ITU LIMITS ADEQUATELY PROTECT THE RAS AT 42.0-42.5 GHZ, AND NO ADDITIONAL PROTECTIONS ARE NEEDED.

The Commission next seeks comments on what limitations should be imposed on FSS systems in 42.0-42.5 GHz to protect RAS in that band.[11] SIA strongly believes that the Commission must avoid imposing more stringent limits on GSO and non-GSO FSS satellites to

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[9] The fact that the international BSS allocation in 42.0-42.5 GHz predates both the RAS at 42.5-43.5 GHz and any notion of high-density fixed service provides an interesting, but ultimately not determinative, reason for the Commission to hesitate before deleting the allocation. Because non-ubiquitous-coverage BSS operations are not immediately and obviously compatible with the Commission's soft segmentation approach, and because other BSS-like applications (including DTH) may be provided in FSS bands, it makes sense for the Commission to digress from the international satellite allocation table for this band to achieve its policy objectives. SIA believes that the more the Commission can meet its objectives in a manner consistent with the established international framework, the better.

[10] At a minimum, FSS gateway operations using spot beams will be able to operate successfully within the ITU power limitations for protection of RAS observations and potential urban-centric fixed service systems, and any coordination agreements for later fixed service entry into the band should be relatively limited in numbers and straightforwardly achievable.

[11] *See* Third NPRM at ¶ 20.

protect RAS observations than those adopted by the ITU in Nos. 5.551H and 5.551I, and Resolution 743 (WRC-03). In fact, the Commission can take a small step toward promoting satellite operations in the 42.0-42.5 GHz band by applying the "per 500 kHz" components of the power limitations on non-geostationary systems and geostationary satellites in Nos. 5.551H and 5.551I of the ITU Radio Regulations and associated Resolution 743 (WRC-03) only in the band 42.7-43.5 GHz.

At the time of the V-Band Second Report and Order, WRC-03 had just confirmed three years of study by adopting new power flux-density ("PFD") limits on GSO and non-GSO satellites – including special procedures in Resolution 743 (WRC-03) for Region 2 RAS facilities. The Commission noted that the limits were new, and stated that it was reviewing them.[12] The ITU limits, which protect RAS sites during periods of observation, allow some flexibility to FSS systems – particularly spot-beam-intensive operations.

The ITU limits were the product of intense study and negotiation, and have not been revisited in the seven years since WRC-03. From the RAS perspective, these limits appear to be stable – as well they should. The commercial satellite industry perspective was and remains that the actions taken by WRC-03 in Nos. 5.551H and 5.551I (along with Resolution 743) accord RAS greater protection than the service objectively requires. While the power limit values are adequate, it is important for the Commission to clarify that the single-dish telescope limit in No. 5.551I of the Radio Regulations is to be applied using the typical maximum antenna gain of 93 dBi that is specified in *recommends 3* of ITU-R Recommendation RA.1631 for RAS antenna

[12] V-Band Second Report and Order, 18 FCC Rcd at 25459 at ¶ 70.

stations in the 42.5-43.5 GHz band.[13] The Commission should include this clarification in its rules. Otherwise, the ITU regulations could be interpreted to require protection of small-diameter RAS antennas that were never contemplated when the international regulations were adopted, placing an untenable constraint on FSS earth stations in the 42.0-42.5 GHz band.

There is one area where SIA believes that a modest revision of the protection criteria for RAS observations could allow for improved satellite operations without negatively impacting RAS observations. In Nos. 5.551H and 5.551I of the ITU Radio Regulations, there are multiple equivalent power flux-density ("EPFD") and PFD limits imposed on non-geostationary systems and geostationary satellites to protect RAS sites.[14] The values of the limits that apply in a 500 kHz reference bandwidth are not a difficulty in absolute terms, but the application of these limits across the entire 42.5-43.5 GHz range is a significant design constraint on satellite beams that use the 42.0-42.5 GHz band for space-to-Earth transmissions.[15]

The decision of WRC-03 to apply the EPFD and PFD limits across the 42.5-43.5 GHz band was the result of the controversial decision taken at the ITU Radiocommunication Assembly that immediately preceded WRC-03. There, the delegates decided to incorporate a new spectral line of the Silicone monoxide ("SiO") molecule into the ITU technical recommendation that identifies spectral lines the RAS seeks to protect, where practicable. The

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[13] ITU-R Recommendation RA.1631, Reference radio astronomy antenna pattern to be used for compatibility analyses between non-GSO systems and radio astronomy service stations based on the EPFD concept (2003), at recommends 3. Such a high antenna gain can only be generated in this frequency range using a large-diameter receiving antenna that concentrates the faint signals being received.

[14] *See*, *e.g.*, No. 5.551H of the Radio Regulations, where limits are imposed in both 1 MHz and 500 kHz reference bandwidths to protect registered single-dish RAS telescopes, and a different per 500 kHz limit is imposed to protect the sites of RAS stations registered as very long baseline interferometry stations.

[15] In essence, meeting the per 500 kHz limit at the 42.5 GHz band edge requires the satellite designer to avoid transmitting in spectrum that would otherwise be available for FSS use between 42.0 and 42.5 GHz, and to increase filtering requirements that result in added weight on the satellite and added expense. Both of these results impede the efficient use of the entire 42.0-42.5 GHz band.

new SiO line, which had never previously been identified as a line of importance for RAS until a week before WRC-03, happens to be at 42.47-42.57 GHz, where the nearest relevant line during the years of study prior to WRC-03 was several hundred megahertz away from the 42.5 GHz boundary – at 42.77-42.86 GHz.[16]

The Commission's decision to permit satellite operations in 42.0-42.5 GHz means that RAS observations on the 42.47-42.57 GHz SiO line will indeed be impracticable as Recommendation ITU-R RA.314-10 recognizes. Spectral line observations of the SiO molecule will necessarily have to be conducted at one of the six other SiO spectral lines of "greatest importance" to RAS – all of which are at or above 42.77 GHz.[17] Under this circumstance, applying the EPFD and PFD limits in Nos. 5.551H and 5.551I (and in associated Resolution 743 (WRC-03)) across the entire 42.5-43.5 GHz band is technically unjustified and thus unduly burdensome to both non-geostationary systems and geostationary satellites that operate in the 42.0-42.5 GHz band. SIA urges the Commission to mitigate this unreasonable burden by determining that the per-500 kHz limitations on EPFD and PFD produced by 42.0-42.5 GHz band satellites and systems are to be applied in the United States only from 42.7-43.5 GHz. If the Commission were to make this adjustment, there would be no diminution at all in the protection afforded by the Radio Regulations for RAS spectral line observations of the SiO molecule on lines where observations are practicable under the Table of Frequency Allocations, and satellite designers would have more latitude to develop systems that can optimize the

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[16] *See* ITU-R Recommendation RA.314-10, Preferred Frequency Bands for Radio Astronomical Measurements at Table 1. Importantly, the recommendation includes a note warning that a portion of the "suggested minimum band" for the SiO line at 42.47-42.57 GHz "extends outside the band allocated to the radio astronomy service. Protection for observations conducted in this portion of the band may not be practicable." *Id.* at Table 1, n.8.

[17] *Id.* at Table 1. In all, there are over two dozen SiO spectral lines identified by the International Astronomical Union at frequencies up to 1 THz.

efficient use of the 42.0-42.5 GHz band they share with fixed service systems under the Commission's approach to V-band sharing.[18]

As a final point, SIA notes that the general prospect of aeronautical mobile service ("AMS") operation in the 40.5-42.5 GHz band does not raise any immediate concerns for satellite downlink operations, depending on the type of AMS deployments expected. Unfortunately, AMS system characteristics are not known at this time. Satellite operators envision no material coordination difficulties with AMS if the AMS system characteristics and deployment allow use of gateway earth stations nearby, and assuming the resulting criteria for protecting AMS are reasonable. Thus, based on these assumptions, elimination of AMS from this band[19] is not necessary to protect FSS networks under this scenario.

In sum, the Commission should reject the idea of further constraining satellite operations to protect RAS observations. The levels of the PFD and EPFD limits established by the ITU on satellites in the 42.0-42.5 GHz band at WRC-03 are acceptable to satellite operators, even if they tend to overprotect the RAS. There is no basis for either extending those limits to bands below 42.0 GHz or for making the limits on satellite operations in 42.0-42.5 GHz more stringent. The Commission should, however, recognize the impracticability of RAS observations of the SiO molecule on the 42.47-42.57 GHz spectral line, and determine that the per-500 kHz elements of the EPFD and PFD limits in Nos. 5.551H, 5.551I, and Resolution 743 should be used to protect only observations on the three SiO spectral lines from 42.77-43.5 GHz. Accordingly, the Commission should apply the per-500 kHz limits only from 42.7-43.5 GHz in the United States.

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[18] SIA recognizes that full implementation of this modest "relaxation" of the ITU EPFD and PFD limits may require technical study within the ITU and possible action by a future WRC. In the meantime, the United States, like all administrations, is authorized to allow any PFD or EPFD limit to be exceeded on its territory, as long as it does not impact other territories' operations. *Compare* No. 21.17 of the ITU Radio Regulations.

[19] *See* Third NPRM at ¶ 25.

Satellite use of 42.0-42.5 GHz will advance important and unmet user requirements for wireless communications capability, and the Commission should use the opportunity of this final V-band rulemaking proceeding to maximize the efficiency with which this high-potential frequency band will be used.

IV. THE COMMISSION SHOULD ADOPT FIXED SERVICE-FSS COORDINATION REQUIREMENTS THAT ARE CONSISTENT WITH THE "SOFT SEGMENTATION" APPROACH.

The Commission has been pursuing an effective approach to coordination of fixed service stations with FSS earth stations operating in receive mode at 37.5-40.0 GHz and 42.0-42.5 GHz since before the 2003 Second V-band Report and Order,[20] and has received comment on several approaches from interested satellite participants.[21] In response to the Commission's call for comments on two previously-introduced methods of ensuring coordination between FSS earth stations and FS stations to prevent interference,[22] SIA urges the Commission to embrace the spirit of both proposals by adopting a straight-forward coordination scheme that incorporates elements from each approach and ensures that earth stations operating in the 37.5-40.0 GHz and 42.0-42.5 GHz FSS downlink bands are adequately protected from FS interference in a manner consistent with the prevailing "soft segmentation" approach.

SIA recognizes the fact that under soft segmentation, ubiquitous fixed service is encouraged in the 37.5-40.0 GHz and 42.0-42.5 GHz band segments by virtue of the fact that

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[20] The coordination issue deals only with the potential for interference to the FSS earth stations from fixed service transmissions; the PFD limits adopted by the ITU and incorporated into the Commission's Rules provide for adequate protection of fixed service systems in the 37.5-40.0 GHz and 42.0-42.5 GHz bands from FSS downlink transmissions.

[21] *See*, *e.g.*, Comments of TRW Inc., IB Docket No. 97-95 (filed Sept. 4, 2001); *Ex Parte* Submission of Northrop Grumman Space & Mission Systems Corporation, ET Docket No. 95-183, PP Docket No. 93-253 (filed Jan. 21, 2005).

[22] *See* Third NPRM at ¶ 27.

more restrictive PFD limits are imposed on satellite operations in these segments than in the 40.0-42.0 GHz segment.[23] Nevertheless, the Commission has made clear its intention that FSS earth station operators that deploy earth stations in the 37.5-40.0 GHz and 42.0-42.5 GHz bands under the mechanisms made available to them in the V-band Second Report and Order are entitled to the same interference protection from adjacent-area fixed-service operations as any similarly-situated fixed service licensee would be.[24]

To assure this protection, and minimize the burden on fixed service operations, SIA urges the Commission to adopt the following hybrid approach in lieu of either of the coordination methods proposed in the Third NPRM:

- If an operating or previously-proposed FSS earth station is located more than 16.0 kilometers from a later-proposed fixed service station, no coordination is required.
- If the operating or previously-proposed FSS earth station is located within 16.0 kilometers of a later-proposed FS station, the fixed service proponent is required to coordinate with the FSS earth station operator unless it can show that the PFD at the FSS earth station site would be less than -125 dB(W/m2) in any 1 megahertz band.[25]
- Notwithstanding the two criteria above, no coordination is required with respect to any earth station or class of earth stations that have chosen to operate on are unprotected basis with respect to harmful interference caused by nearby fixed-service stations.

The result of this approach is to limit the number of instances where FSS earth station operators have to be taken into account by fixed-service planners. Adding favorably to this expectation is the reality that earth stations with which coordination is needed are likely to be

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[23] *See id.* at ¶ 4.

[24] *Id. See also* V-Band Second Report and Order, 18 FCC Rcd at 25430, ¶ 2.

[25] The showing under this prong of the proposed standard can be made by relying on any available factors, such as terrain shielding or absence of optical line of sight, or by demonstrating that the PFD at the border of the FS licensee's service area is below -125 dB(W/m2) in any 1 megahertz band.

limited in number – because many will be gateway operations or, possibly, unprotected terminal operations.[26] Moreover, those FSS earth stations that seek protection will likely be sited, to the extent possible, in areas where coordination with fixed service developers would either be unneeded or infrequent, including in locations that are geographically separated from the urban cores where the higher-density fixed service systems will concentrate their operations. These factors will further promote efficient spectrum use. Under these circumstances, a practical approach that is both simple to apply and not unduly burdensome to either service should provide a satisfactory solution to this outstanding implementation element of the soft segmentation approach.

V. THE COMMISSION SHOULD ADOPT THE ITU APPROACH TO FADE COMPENSATION FOR V-BAND SATELLITES.

SIA recognizes and appreciates the significant effort and analysis that the Commission has clearly put into addressing rain fade compensation, which was one of the most seemingly intractable issues from the genesis of the soft segmentation approach. The reality, however, is that the Commission's proposals in the Third NPRM[27] for regulating the manner in which satellite operators in the 37.5-40.0 GHz band may use increases in power flux-density to overcome fading condition effects are too inflexible and restrictive and are not necessary to protect fixed service links. SIA urges the Commission to use the opportunity of this proceeding to implement easily understandable and enforceable rules that are not based on the flawed premise and exaggerated statistics that prompted the development of the "rain fade" set of companion PFD limits now in Sections 25.208(q)-(u) of the Commission's Rules, but on

[26] SIA emphasizes that voluntary operation by some earth stations on a non-protected basis with respect to the fixed service does not alter in any way the fact that the FSS is a co-primary service in the band.

[27] *See* Third NPRM at ¶¶ 30-55.

internationally-accepted limits in Article 21 of the ITU Radio Regulations. The practical limitations on the nature of satellite use of the 37.5-40.0 GHz band, and a more refined understanding of fixed service deployment patterns, justify this reexamination.

The entire debate over when and to what extent satellite networks can and will use fade compensation techniques seems to assume that satellite systems would overuse fade compensation if not strictly regulated. This assumption is baseless. Satellite systems historically resort to power-hungry fade compensation techniques only when such techniques are essential to maintain link availability. The objective of the satellite system designer is to minimize or even eliminate the need to use these techniques, as the techniques inevitably increase the cost of capacity and impose undesirable limitations on network operations. The satellite designer has many tools – including location selection and earth station diversity – that are employed long before a rain storm develops to reduce the likelihood that an increase in satellite PFD levels will be needed. Use of these tools very significantly reduces the already tiny probability that a fixed service link operating in clear-sky conditions will ever receive interference at higher than clear-sky levels from satellites that are using increased power to overcome the rain fading conditions on the path to their earth stations. Other factors pertaining to the statistics of fading conditions and fixed service elevation angle distribution combine to eliminate much of the rest of this risk.

At the end of the day, the purported rationale for imposing significant limitations on how and when a satellite operator with links in the 37.5-40.0 GHz band may use fade compensation techniques has itself evaporated. There is no reason for the Commission to fear abuse by satellite systems of the use of power control, and thus no reason for Draconian regulations that would complicate applications, be difficult to enforce, and limit the legitimate utility of the band for satellite operations. SIA calls upon the Commission to decline to adopt rigid fade

compensation regulations for V-band earth stations, and instead align its regulations with the ITU Radio Regulations on this important subject.

The first consideration supporting this change in approach is the practical reality that earth stations in the 37.5-40.0 GHz and 42.0-42.5 GHz bands will, to the maximum extent consistent with overall system design considerations, be located in low-rainfall areas to minimize disruptions. Earth station operators generally seek to maximize link availability, such that locating an earth station in a high rain-rate area is not the optimal approach, particularly for gateway facilities. While there may be cases where service objectives will lead to the placement of an earth station in a location where rain rates are less than optimal, in such cases satellite network architects are more likely to utilize other design features to reduce the percentage of time that fade compensation techniques are required.[28]

Second, the relatively small diameter of V-band spot beams as they illuminate the Earth leads to a high probability that fixed service links in the spot beam coverage area are suffering the same propagation conditions – and using techniques of their own such as high elevation angle satellites, adaptive power control or adaptive coding and modulation techniques to overcome these effects. As there will not likely be global beams or even regional beams on satellites in this frequency range, the probability of asymmetric fading conditions for gateway earth stations and nearby fixed stations is acceptably low. A fixed station network employing

[28] For example, earth station operators may use two or more earth stations separated by more than the size of a typical rain cell. That way, if there is atmospheric attenuation on the path between one earth station and the satellite, the network can switch to the second antenna which should be far enough away that the path from this second antenna to the satellite will not be suffering the same attenuation. Only on those rarest of times when both (or all) earth stations are simultaneously suffering attenuation would it be necessary for the operator to consider power control. Significantly, a rain event so widespread as to encompass two earth stations separated by such a substantial distance would also result in very low likelihood that there are any fixed service stations in the same satellite beam that are in clear-sky conditions.

measures to overcome rain fade itself is unlikely to be affected by a satellite system's temporary power increase.

Third, as the Commission recognizes, ITU studies in several instances used unrealistic assumptions, resulting in overstating the risk to FS from FSS networks.[29] For example, the statistics of FS stations pointing at high elevation angles were grossly overstated in the technical studies leading up to WRC-2000 and WRC-03.[30] Several years after controversial studies based on the assumption that nearly 50 percent of FS links in V-band have elevation angles above 10 degrees, the ITU had occasion again to consider fixed service deployment statistics in connection with a sharing issue between satellites and the fixed service in the Ka-band frequencies at 20/30 GHz. There are at least some areas of the world where deployment and service objectives for the Ka-band fixed service are of the high-density, urban-centric system design contemplated by U.S. fixed service proponents for the 37.5-40 GHz band. Significantly, when it looked at Ka-band fixed-service deployment characteristics and statistics, the ITU found that at least 98 percent of FS links operate at elevation angles of 5 degrees or less.[31] Furthermore, the Commission noted in its analysis that other considerations of high-elevation angle urban operation of fixed service links – *e.g.*, the fact that if an FS receiver were mounted on the side of

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[29] *See* Third NPRM, Appendix A, at 9.

[30] As satellite links in V-band would be designed for high elevation angles to minimize rain effects, high elevation-angle fixed stations are theoretically more likely than low elevation-angle fixed stations to see satellite interference.

[31] *See* CPM Report for WRC-07 on FS elevation angles for 17.7-19.7 GHz FS: Section 4/1.18/1.2.1.2, "[t]he majority of FS receivers in the 17.7-19.7 GHz band operate with elevation angles of between –3° and 3°. In some administrations, there is a non-negligible proportion of receivers (on the order of 2%) that have elevation angles above 5°."

a building, "in many cases the building itself will shield the receiver from the satellite PFD" – were not taken into consideration.[32]

The skewed assumptions about elevation angles, which undoubtedly had a profound effect on the Commission's adoption of the two-step PFD limit approach in Section 25.208(q)-(u), were not the only technical flaws. In fact, the Commission itself cites five major areas in which the assumptions regarding interference to the fixed service (which were included in ITU studies supporting the 12 dB limitation on satellite power increases to overcome fading conditions) were found to "produce results that overstate the risk of interference to FS links from FSS."[33]

Based on this flawed data, the Commission is considering a domestic regulatory scheme that is both inconsistent with the ITU Radio Regulations and unnecessarily constraining on the satellite systems that are seeking limited access to the band consistent with the soft segmentation approach. The inherently international nature of satellite service makes it particularly important to maintain consistency with the international regulations for satellite services as much as is possible. The Commission's proposals for micro-regulating satellite network use of power control are impractical; they could be difficult to enforce in real-world situations and would unnecessarily add cost and complexity to satellite designs in ways that increase costs to users.

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[32] Third NPRM, Appendix A, at 9 n.130. Not mentioned in either the ITU studies or Appendix A to the Third NPRM is the undeniable fact that where a fixed service link includes a high elevation-angle station, the link is invariably very short (*e.g.*, from one building rooftop to the side of a nearby building), and thus is inherently more robust than longer links.

[33] *Id.* at 9 (emphasis added). In addition to the failure to consider shielding effects of buildings in urban cores, the Commission noted that the ITU studies make incorrect assumptions about the loading of the geostationary arc and satellite power, fail to take account of the fact that rain fade losses would be expected to be lower due to high satellite-to-earth station elevation angles, incorrectly assume that all FSS satellites visible to a fixed service receiver are illuminating the site with interference power, and fail to account for polarization isolation, power control, and other technical factors within the fixed service system. *Id.* at 8-9. Unfortunately, after making these significant observations, the Commission's response was to observe that the "overstatement" provides "a desirable safety margin for [the fixed service]." *Id*.

Techniques such as data throughput adjustment are not feasible for use with earth stations in a multibeam system.[34] Even the Commission's consideration of "costs" to FSS operations of various other non-power ameliorative measures and lost channel capacity is made with reference to impact on channels available to end users, ignoring the fact that satellite use of bands such as 37.5-40.0 GHz will be for gateway operations.[35]

In addition, the Commission's proposal to limit use of power increases to 1.5 percent of the time is too restrictive.[36] While satellite design considerations will attempt to minimize the duration of power increases, a hard limit at 1.5 percent of the time that leads to link availability dropping to a level below 99.9 percent is unacceptable – especially when the Commission has recognized that the studies on which this figure is at least partially based overstated the risk of interference to the fixed service.

The alternative approaches identified by the Commission are even more restrictive "solutions" to a problem that either does not exist or is not significant for the FS.[37] For example, the Commission's suggestion that power increases to overcome rain fade conditions should be subject to a cumulative 12 dB maximum is both unnecessary and unworkable.[38] Since the beamwidth of a high-sensitivity FS link is by definition narrow (typically less than satellite orbital spacing), treating the single-entry limits in the Radio Regulations as a cumulative limit

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[34] A single feeder link may carry signals from many user link beams in a different band, each with a large number of unique terminals and networks. Imposing power controls across all the users in a different band and in beams far removed from the area of propagation impairment would be both impractical and highly inefficient.

[35] *See* Third NPRM, Appendix A at 14.

[36] *See* Third NPRM at ¶ 38.

[37] *See id.* at ¶¶ 50-55.

[38] *Id*. at ¶ 53.

for exceedances is unnecessary, and it is not an approach that was foreseen or otherwise contemplated when the single-entry limits were studied and adopted.

The Commission's suggestions stemming from its observation that V-band downlink spectrum is asymmetrical with V-band uplink spectrum are also unnecessary.[39] There is no requirement that V-band downlink spectrum be paired with V-band uplink spectrum. The 37.5-40.0 GHz and 42.0-42.5 GHz bands can be used with the Ka-band or other frequency bands, or in other novel ways. It is worth noting that the bandwidth required is generally higher on the feeder downlink, also known as feeder return link, from the satellite to the gateway earth station than on the user return link from the user terminal to the satellite, even in symmetric applications, because due to the satellite power constraints, the systems would not be able to operate with higher-order modulations. In addition, in the uplink, V-band gateway earth stations operating with high EIRP can utilize higher-order modulations than the V-band satellites in the downlink direction.

The notion of limiting FSS bandwidth to reduce unwanted power at a fixed service site is also flawed.[40] Not all FSS systems serving an area will need to use power increases at the same time. For example, FSS gateway downlinks are generally not single carriers but aggregates of many individual carriers from disparate users. Band-limiting all of them at the same time is impractical and unnecessary. There is no evidence that multiple satellites operating at higher PFD levels to overcome fading conditions would or could cause excess unwanted power that interferes with an FS link.

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[39] *Id*. at ¶ 55.

[40] *Id.*

Finally, missing from the Commission's Third NPRM is any indication of the type of showing that an FSS earth station applicant would have to make to demonstrate compliance with the implementation standard the Commission has outlined. SIA believes that applications for FSS earth stations would become exceedingly complex, and this fact alone could unnecessarily deter applications for the band or at least delay their grant.

In light of the flaws in the initial studies that led to an overstatement of the interference risk downlinks to earth stations pose to fixed service networks, the impossibility that satellite systems can use some or all of the non-power ameliorative techniques identified by the Commission, the need for flexibility in regulation that will allow a nascent service opportunity to develop with a minimum of regulatory interference, the unavailability of suitable alternatives, and the fact that satellite network designers are operationally incentivized to minimize the amount of time they have to employ power control, SIA suggests that the Commission abandon its attempt to regulate satellite use of rain fade compensation techniques in the 37.5-40.0 GHz. Instead, the Commission should opt for a "simpler is better" approach. Specifically, SIA calls upon the Commission to embrace for the U.S. commercial satellite industry the PFD approach that is included in the ITU Radio Regulations for the 37.5-40.0 GHz band.

The ITU Radio Regulations, in addition to imposing clear-sky PFD limits on V-band satellites in Table 21-4 in Article 21, specify in No. 21.16.14 that "the power flux-density at the Earth's surface from any FSS satellite should be no greater than the level(s) required to meet the FSS link availability and performance objective of the subject applications, taking into account the technical and operational requirements of the overall design of the satellite network. In any case, the levels shall not exceed the applicable PFD limits in Table 21-4."[41] This additional note,

[41] ITU Radio Regulations, Article 21, Table 21-4, Note 16 (No. 21.16.14).

which could be incorporated as a requirement into the Commission's regulations, is all the protection that the fixed service requires from the prospect of satellite downlink power measures to overcome rain fade conditions, and is flexible enough to accommodate FSS innovation and evolution.

This approach is consistent with international regulations and has the added benefit of providing flexibility to the systems under development in the V-band frequency range. The last thing the Commission should want is to adopt an order with rigid rules that require revisitation in five or ten years to fine tune the approach in light of the development, deployment and life cycles of satellite systems.

In conclusion, no complicated and limiting Commission restrictions on the use of compensation techniques (power or non-power) to overcome rain fade conditions are required. The Commission should accept and recognize that with the stricter PFD limits that apply in the 37.5-40.0 GHz band, fixed service links are protected, and no additional provisions for determining when and how satellites can overcome fading conditions are necessary. There is nothing unique about this shared satellite/terrestrial band that requires the adoption of special and unprecedented provisions regarding rain fade compensation. Rather than the complex, unnecessary, and burdensome two-level approach now in Section 25.208 and the Third NPRM, the Commission should adopt the requirement from No. 21.16.14 of the Radio Regulations[42] and state that for sharing conditions between the fixed service and the FSS in the bands 37.5-40.0 GHz and 40.5-42.5 GHz, the PFD at the Earth's surface from any FSS satellite shall be no greater than the level(s) required to meet the FSS link availability and performance objectives of the subject applications, taking into account the technical and operational requirements of the

[42] *Id.*

overall design of the satellite network. In any case, the levels shall not exceed the applicable PFD limits.

The Commission should then use the opportunity of this proceeding to align the PFD limits in Sections 25.208(q)-(u) of its rules with the ITU Radio Regulations, and remove the unnecessary notion that was included for overprotection of the FS. An example revision of Section 25.208 is provided in Appendix 1.

VI. CONCLUSION

SIA supports the Commission's efforts to improve upon the existing framework for sharing between the FSS and FS in the 37.5-42.5 GHz band. The ability to develop the V-band to its fullest capacity requires a regulatory approach that promotes operator flexibility and which complements the carefully considered work of the Commission and ITU to date. Towards that end, and for the reasons discussed above, SIA urges the Commission to establish rules governing the sharing of the V-band consistent with the comments offered herein.

Respectfully submitted,

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APPENDIX 1

Example Modifications to Section 25.208 to Implement SIA Comments

§ 25.208 Power flux density limits.

* * *

(q) In the bands 37.5–40.0 GHz and 42.0-42.5 GHz, the power flux-density at the Earth's surface produced by emissions from a geostationary space station for all methods of modulation shall not exceed the following values:

~~(1) This limit relates to the power flux-density which would be obtained under assumed free space conditions (that is, when no allowance is made for propogation impairments such as rain-fade):~~

~~−139 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;~~

~~−139 + 4/3 (δ−5) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 20 degrees above the horizontal plane; and~~

~~−119 + 0.4 (δ−20) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 20 and 25 degrees above the horizontal plane;~~

~~−117 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;~~

~~(2) This limit relates to the maximum power flux-density which would be obtained anywhere on the surface of the Earth during periods when FSS system raises power to compensate for rain-fade conditions at the FSS Earth station:~~

−127 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

−127 + 4/3 (δ−5) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 20 degrees above the horizontal plane; and

−107 + 0.4 (δ−20) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 20 and 25 degrees above the horizontal plane;

−105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

Note to paragraph (q): These limits relate to the power flux density that would be obtained under assumed free-space propagation conditions. When addressing the sharing conditions between the fixed service and the fixed-satellite service in the bands 37.5-40 GHz and 42.0-42.5 GHz, the power flux-density at the Earth's surface from any FSS satellite shall be no greater than the level(s) required to meet the FSS link availability and performance objectives of the subject applications, taking into account the technical and operational requirements of the overall design of the satellite network. In any case, the levels shall not exceed the applicable power flux-density limits in this subsection. ~~The conditions under which satellites may exceed the power flux-density limits for normal free space propagation described in paragraph (p)(1) to compensate for the effects of rain fading are under study and have therefore not yet been defined. Such conditions and the extent to which these limits can be exceeded will be the subject of a further rulemaking by the Commission on the satellite service rules.~~

(r) In the band 37.5–40.0 GHz, the power flux-density at the Earth's surface produced by emissions from a non-geostationary space station for all methods of modulation shall not exceed the following values:

~~(1) This limit relates to the power flux-density which would be obtained under assumed free space conditions (that is, when no allowance is made for propogation impairments such as rain-fade):~~

~~−132 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;~~

~~−132 + 0.75 (δ−5) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and~~

~~−117 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;~~

~~(2) This limit relates to the maximum power flux-density which would be obtained anywhere on the surface of the Earth during periods when FSS system raises power to compensate for rain-fade conditions at the FSS Earth station:~~

−120 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

−120 + 0.75 (δ−5) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and

−105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

Note to paragraph (r): These limits relate to the power flux density that would be obtained under assumed free-space propagation conditions. When addressing the sharing conditions between the fixed service and the fixed-satellite service in the bands 37.5-40 GHz and 42.0-42.5 GHz, the

power flux-density at the Earth's surface from any FSS satellite shall be no greater than the level(s) required to meet the FSS link availability and performance objectives of the subject applications, taking into account the technical and operational requirements of the overall design of the satellite network. In any case, the levels shall not exceed the applicable power flux-density limits in this subsection.~~The conditions under which satellites may exceed these power flux-density limits for normal free space propagation described in paragraph (q)(1) to compensate for the effects of rain fading are under study and have therefore not yet been defined. Such conditions and the extent to which these limits can be exceeded will be the subject of a further rulemaking by the Commission on the satellite service rules.~~

(s) In the band 40.0-40.5 GHz, the power flux-density at the Earth's surface produced by emissions from a space station for all conditions and for all methods of modulation shall not exceed the following values:

-115 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

$-115 + 0.5\ (\delta - 5)$ dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and

-105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

Note to paragraph (s): These limits relate to the power flux-density that would be obtained under assumed free-space propagation conditions.

(t) In the band 40.5–42.0 GHz, the power flux density at the Earth's surface produced by emissions from a non-geostationary space station for all conditions and for all methods of modulation shall not exceed the following values:

-115 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

$-115 + 0.5\ (\delta - 5)$ dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and

-105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

Note to paragraph (t): These limits relate to the power flux density that would be obtained under assumed free-space propagation conditions.

(u) In the band 40.5–42.0 GHz, the power flux-density at the Earth's surface produced by emissions from a geostationary space station for all conditions and for all methods of modulation shall not exceed the following values:

−120 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;

−120 + (δ−5) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 15 degrees above the horizontal plane;

−110 + 0.5 (δ−15) dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 15 and 25 degrees above the horizontal plane; and

−105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

Note to paragraph (u): These limits relate to the power flux-density that would be obtained under assumed free-space propagation conditions.

* * *