Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 25 of the	)	IB Docket No. 17-95
Commission's Rules to Facilitate the Use of Earth	)	
Stations in Motion Communicating with	)	
Geostationary Orbit Space Stations in Frequency	)	
Bands Allocated to the Fixed Satellite Service	)	
	)	
	)	

REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULEMAKING

Adopted: September 26, 2018 **Released: September 27, 2018**

Comment Date: (45 days after date of publication in the Federal Register)
Reply Comment Date: (75 days after date of publication in the Federal Register)

By the Commission: Chairman Pai and Commissioners O'Rielly, Carr, and Rosenworcel issuing separate statements.

TABLE OF CONTENTS

I. INTRODUCTION

1. In this Report and Order, the Commission simplifies its rules to facilitate the continued deployment of Earth Stations in Motion (ESIMs) and reduce the regulatory burdens on ESIMs.[1] Specifically, we reorganize and consolidate sections in Part 25 of the Commission's rules addressing ESIMs. We also expand the scope of operations of ESIMs to communicate in additional frequency bands with geostationary-satellite orbit (GSO) satellites operating in the fixed-satellite service (FSS).[2] In addition, we continue to work to provide flexibility to the growing ESIMs market by including a Further Notice of Proposed Rulemaking to consider additional frequency bands for ESIM communication with GSO satellites. These actions will promote innovative and flexible use of satellite technology and provide new opportunities for a variety of uses.

II. BACKGROUND

2. Although FSS traditionally involves communications between satellites in orbit and earth stations in fixed locations, the growing demand for broadband communications to vessels, land vehicles, and aircraft has resulted in increased use of FSS for mobility applications.[3] Earth Stations in Motion, or ESIMs, enable the provision of very high data rate broadband communications, navigation, situational awareness, and other services to mobile platforms that often cannot be served using other communications technologies.[4] Licensees use ESIMs to deliver broadband to ships, vehicles, trains, and aircraft using the same frequency bands, hardware, satellites, transponder beams, and control stations used to serve earth stations at fixed locations.[5]

3. The Commission's current regulatory framework covers three types of Fixed-Satellite Service (FSS) earth stations that the Commission authorizes to transmit while in motion: Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs), and Earth Stations Aboard Aircraft (ESAAs).[6] Each of these types of ESIMs has its own section of technical and operational rules, as well as application rules.[7] Except for a few platform-specific exceptions, the three rule sections that govern the operation and licensing of ESVs, VMESs, and ESAAs are very similar. In addition, the current rules

[1] *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, Notice of Proposed Rulemaking, 32 FCC Rcd 4239 (2017) (*ESIMs NPRM or NPRM*).

[2] *Id*.

[3] A detailed account of the regulatory changes that permitted the increased use of FSS for mobility applications is set forth in the *ESIMs NPRM* and is not repeated here. *See ESIMs NPRM*, 32 FCC Rcd at 4241-42, paras. 3-6.

[4] *Id*.

[5] *Id*.

[6] *See* 47 CFR § 25.103 (Definitions). ESV is defined as "an earth station onboard a craft designed for traveling on water…." *Id.* VMES is defined as "an earth station, operating from a motorized vehicle that travels primarily on land… ." *Id.* ESAA is defined as "earth stations operating aboard aircraft… ." *Id.*

[7] *See* 47 CFR §§ 25.221 (ESV), 25.222 (ESV), 25.226 (VMES), and 25.227 (ESAA). *See also* 47 CFR § 25.115 (Applications for earth station authorizations).

provisions are limited to communications with GSO satellites in the conventional C- and Ku-bands, as well as portions of the extended Ku-band.[8]

4. In the *ESIMs NPRM*, the Commission proposed to consolidate these three rule sections into a single rule section and to streamline the technical, operational, and coordination requirements of the three sections.

5. The Commission further proposed rules for ESIMs operations in the conventional Ka-band.[9] Specifically, these rules apply to ESIMs communicating with geostationary-orbit (GSO) FSS space stations operating in 18.3-18.8 GHz and 19.7-20.2 GHz, and 28.35-28.6 GHz and 29.25-30.0 GHz frequency bands.[10] In response to our *NPRM*, 12 parties filed comments, and 10 parties filed reply comments.[11]

III. REPORT AND ORDER

6. Commenters generally applaud the Commission for its decision to consolidate ESIMs regulations into a single rule section.[12] AC BidCo urges the Commission to implement these revisions to eliminate redundancy in its rules and provide a unified framework for all ESIM operations.[13] Many commenters also support the proposed technical and operational changes. Several parties support extending the routine licensing of ESIMs into the Ka-band.[14] Iridium, however, expresses concerns with this proposal,[15] which are addressed below. As discussed in this decision, we generally adopt many of the changes proposed in the *ESIMS NPRM*.

7. We proposed to bring all the technical, operational and coordination requirements for blanket licensed-ESV, VMES and ESAA earth stations that are linked to GSO FSS space stations under one umbrella rule section, Section 25.228, applicable to ESIMs generally. We grouped ESIM requirements into the following categories: (1) core rules (i.e. those applicable to all ESIMs); (2) vehicle-type specific[16] rules that apply across multiple frequency bands; (3) frequency-band specific status and coordination rules; and (4) vehicle-type specific rules that apply to a single frequency band. In this Order, we adopt changes within all of these subparts to accomplish our goal of simplifying and streamlining the ESIMs rules.

---

[8] The conventional C-band refers to the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) FSS frequency bands. The conventional Ku-band refers to the 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 (Earth-to-space) FSS frequency bands, and the extended Ku-band refers to the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), and 13.75-14.0 GHz (Earth-to-space) FSS frequency bands. 47 CFR § 25.103

[9] *NPRM*, 32 FCC Rcd at 4240, para. 2.

[10] While there currently are NGSO FSS ESIM operations in portions of the 17.8-20.2 GHz and 27.5-30.0 GHz bands, authorized on a non-harmful-interference basis, O3b Limited Radio Station Authorization, IBFS File No. SES-LIC-20130528-00455 (granted May 13, 2014), this Order will only address the GSO FSS ESIM operations. The companion Further Notice of Proposed Rulemaking seeks comment on proposals to extend ESIMs rules to systems operating with NGSO FSS systems.

[11] The commenters are listed in Appendix A. Comments were due on July 31, 2017, and reply comments were due on August 30, 2017.

[12] *See, e.g.,* Boeing Comments at 1; Inmarsat Comments at 8; Joint Commenters of Kymeta Corporation and Intelsat License LLC (Joint Comments) at 1; and ViaSat Comments at 1.

[13] AC BidCo Comments at 2. AC BidCo holds an ESAA license that is used by its affiliate Gogo Inc to provide inflight connectivity and wireless entertainment services for commercial and business fleets around the world. *Id.* at 1-2.

[14] *See, e.g.,* Inmarsat Reply Comments at 1.

[15] Iridium Comments at 12.

[16] "Vehicle-type specific" means applicable only to ESAA, to ESV, or to VMES.

8. Following the structure of the *ESIMs NPRM*, we first address proposals involving changes in more than one rule section and then address proposed changes in the remaining rules in the order in which they appear in Part 25.

A. Definitions

9. As proposed in the *ESIMs NPRM*, we amend several current definitions and add new definitions to our rules to provide greater clarity regarding the operation of earth stations in motion with GSO FSS space stations.[17] In response to the proposed changes to the definitions in the *NPRM*, commenters uniformly support the changes discussed below.

10. *Definition of ESIMs*. We adopt a definition for ESIMs in Section 25.103.[18] ESIM is defined to mean a term that collectively designates ESVs, VMESs and ESAAs, which are already defined in Section 25.103.[19]

11. *Revised Definition of Blanket License*. We adopt the proposal to change the definition of Blanket License in Section 25.103 to refer to the type of satellite service in which the earth station operates, *i.e.*, FSS or MSS rather than the type of earth station, *i.e.*, fixed or mobile.[20] Changing the earth-station categorization in this definition to FSS and MSS better reflects the types of stations that can be licensed to operate anywhere in a geographic area specified in the license. Additionally, we adopt other minor rewording for clarity.

12. *Definition of Network Control and Monitoring Center (NCMC)*. We also adopt the proposed definition of Network Control and Monitoring Center in Section 25.103.[21] An NCMC, as used in the Part 25 rules, is a facility that has the capability to remotely control earth stations operating as part of a satellite network or system.[22]

13. *Eliminating Cross-References in Revised Definitions*. We revise the definitions of VMES and ESAA to eliminate cross-references to rule sections (Sections 25.226 and 25.227 respectively) that we are deleting in this Report and Order.[23] Similarly, any cross-references to those deleted sections elsewhere in the rules are deleted as well.[24] Furthermore, we revise the definitions of routine processing and a two-degree compliant space station in Section 25.103 to remove a cross-reference to Section 25.138(a), because we are consolidating Section 25.138(a) into Section 25.218(i), as explained below.

---

[17] *See NPRM*, 32 FCC Rcd at 4242-43, paras. 8-14.

[18] 47 CFR § 25.103.

[19] *Id*.

[20] *NPRM*, 32 FCC Rcd at 4242-43, para. 10.

[21] *Id*. at 4243, para. 11.

[22] As such, an NCMC would constitute a "remote control point" as that term is used in the Part 25 rules (*see, e.g.*, 47 CFR §§ 25.271(b), 25.272(d)(1)).

[23] The technical and operational rules in Sections 25.226 and 25.227 are being consolidated in Section 25.228, and the application rules are being consolidated in Section 25.115. *See* paras. 16-31 and 67-81 *infra*.

[24] While we also moved the Section 25.221 and 25.222 operating requirements for ESVs under the same umbrella that covers VMESs and ESAAs (*i.e.*, the umbrella of the proposed Section 25.228 for ESIMs), the Section 25.103 definition of ESVs does not need to be revised to eliminate any outdated cross-references because it does not now contain any cross-references.

B. Incorporating Section 25.138 into Section 25.218, and Extending the Applicability of Section 25.218 to the Conventional Ka-Band and ESIMs

14. In the *ESIMs NPRM*, the Commission proposed moving the conventional Ka-band provisions from Section 25.138 into similar paragraphs of Section 25.218.[25] The Commission also proposed applying Section 25.218 to all applications for fixed and temporary-fixed FSS earth stations transmitting to geostationary space stations in the conventional or extended C-band or Ku-band, or the conventional Ka-band, and to all applications for ESIMs in the conventional C-, Ku-, or Ka-band,[26] except for applications proposing transmission of analog command signals at a band edge with bandwidths greater than 1 MHz or transmission of any other type of analog signals with bandwidths greater than 200 kHz.[27] Section 25.218 contains off-axis equivalent isotropically radiated power (EIRP) density envelopes for FSS earth stations transmitting to GSO FSS space stations in the conventional C-band, extended C-band, conventional Ku-band, or extended Ku-band.[28] Earth stations in these frequency bands that comply with these envelopes are considered "two-degree-spacing compliant," and the operators of their target space stations are not required to coordinate the operation of these earth stations with operators of nearby space stations. As proposed in the *NPRM*,[29] we merge the off-axis EIRP density provisions of Section 25.138 into Section 25.218, thus extending the applicability of Section 25.218 to conventional Ka-band GSO FSS earth stations.[30] Commenters support adoption of a consolidated rule that eliminates duplicative references to the off-axis EIRP spectral density limits and that would apply a single set of limits across all types of FSS earth station, including those on mobile platforms.[31] The specifics of the adopted realignment are in Appendix C.

15. Similarly, for organizational coherence, the Commission proposed making the conventional Ka-band requirements in Section 25.138(f), which hold blanket licensees responsible for operations of transceivers operating under their license, applicable to earth station licensees in all frequency bands.[32] We will place this requirement in new Section 25.290,[33] and eliminate the cross-reference to Section 25.138.[34] The Commission proposed that Section 25.290 would also include the rule contained in Section 25.287(d), which imposes the same requirement on licensees of mobile transmitters or transceivers operating in some Mobile-Satellite Service frequencies, allowing that that Section

[25] *NPRM*, 32 FCC Rcd at 4243-44, para. 15.

[26] *See* 47 CFR § 25.103. The "extended C-band" refers to the 600-3700 MHz (space-to-Earth), 5850-5925 MHz (Earth-to-space), and 6425-6725 MHz (Earth-to-space) FSS frequency bands, and the "conventional Ka-band" refers to the 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space) frequency bands, which the Commission has designated as primary for GSO FSS operation. *Id*.

[27] *Id*. at para. 18.

[28] We note that the rules do not currently provide for ESIM operations in the extended C- band.

[29] *NPRM*, 32 FCC Rcd at 4243-44, para. 15.

[30] *See* 47 CFR 25.218(i). This consolidation of rules does not involve any change to existing off-axis EIRP spectral density limits.

[31] *See, e.g.,* Boeing Comments at 3; Inmarsat Comments at 3; and ViaSat Comments at 5-6.

[32] *NPRM*, 32 FCC Rcd at 4244, para. 17.

[33] In the *NPRM*, we proposed placing the requirements in new Section 25.289. *See NPRM*, 32 FCC Rcd at 4244 para. 17. Because the Commission subsequently used Section 25.289 to adopt rules governing the protection of GSO networks by NGSO systems, we instead adopt these requirements as part of new Section 25.290.

[34] 47 CFR § 25.290.

25.287(d) be removed.[35] Commenters broadly support these streamlining reorganizational moves which we adopt.[36]

C. Reorganizing and Streamlining the Technical, Operational and Coordination Requirements

1. Core ESIM Rules

16. In the *ESIMs NPRM*, the Commission sought comment on combining the core ESIMs rules that were essentially the same for each type of ESIM.[37] As both Boeing and the Joint Commenters note, the "core" rules governing ESVs, VMESs, and ESAAs are nearly but not quite identical, which creates unnecessary confusion for applicants and operators.[38] The Commission proposed to amend the core rules, where necessary, to create uniformity. Specifically, for rules related to the Commission's GSO FSS two-degree orbital spacing policy, control of operating ESIMs, operational reports, and electromagnetic radiation safety, the Commission proposed substantive changes in some cases to eliminate unnecessary variations across types of ESIMs.[39] As proposed in the *NPRM*, we also eliminate unnecessary duplication of rules across different rule sections.[40] These changes are widely applauded by commenters.[41] In the discussion to follow, we explain the substantive changes to the following areas of our ESIM rules: (1) antenna pointing accuracy requirements, (2) EIRP density limits, (3) the self-monitoring (self-diagnostics) requirement, (4) the network control and monitoring center requirement, (5) logging requirements, and (6) the installation requirements related to radiation safety.

17. *Antenna Pointing Accuracy Requirement.* As explained in the *ESIMs NPRM*, the definition of theta as revised by the *2015 Second Report and Order* obviates the need for an antenna pointing accuracy requirement, because the limit on off-axis EIRP density toward adjacent satellites is fixed regardless of the direction in which the earth station antenna is pointed.[42] Therefore, the Commission proposed to eliminate the antenna pointing accuracy requirement contained in the individual ESV, VMES, and ESAA rules in Sections 25.221, 25.222, 25.226, and 25.227.[43] Most commenters

[35] We also proposed to retain the exception for analog video earth station applications.

[36] *See, e.g.*, Inmarsat Comments at 3.

[37] *NPRM*, 32 FCC Rcd at 4245, para. 20.

[38] *See* Boeing Comments at 2; Joint Commenters at 3.

[39] *NPRM*, 32 FCC Rcd at 4245-52, section C.

[40] *Id.* at 4243-44, paras. 19-20.

[41] *See, e.g.,* AC BidCo Comments at 2; Inmarsat Comments at 2; Joint Commenters at 1; Telesat Comments at 2-3; ViaSat Comments at 4-5.

[42] *NPRM*, 32 FCC Rcd at 4246, para. 22 (referencing *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, IB Docket No. 12-267, Second Report and Order, 30 FCC Rcd 14713, 14755, para. 115 (2015) (*2015 Second Report and Order*)). This is the same as the approach taken by the ITU in Resolution 156 (WRC-15), which prescribes the operating conditions for ESIMs communicating with FSS space stations in the 19.7-20.2 GHz and 29.5-30 GHz frequency bands. In that resolution, the off-axis angle theta is defined as the angle "from the vector from the earth station antenna to the associated satellite." *See Final Acts of WRC-15* at 248. Resolution 156 does not contain any antenna pointing accuracy requirements, because its off-axis EIRP density limits, like those in Section 25.218 of the Commission's rules, are independent of the direction the ESIM antenna is pointed. *See id*. at 4246, fn. 33.

[43] *NPRM*, 32 FCC Rcd at 4246, para. 22. As noted in the *NPRM*, the definition of theta was revised by the *2015 Second Report and Order.* The definition in Sections 25.221, 25.222, 25.226, and 25.227 paragraph (a)(1)(i)(A) formerly read "theta (θ) is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite." The minor rewording of the definition takes into account the fact that not all earth stations use feedhorn-reflector type antennas with focal points, and the fact that earth station antennas pointed toward GSO FSS satellites are usually pointed to the assigned location of the satellite, and do not track the actual

(continued….)

support eliminating this requirement.[44] ViaSat notes that it is now well-established in the industry and in the Commission's precedent that GSO FSS spectrum resources can be used for service to mobile platforms without adversely changing the operating environment created by a traditional FSS earth station.[45] ViaSat further states that "commercially available pointing mechanisms enable transmissions from these earth stations to remain focused on the desired GSO FSS space station even while the earth station is mounted on a moving platform. These technologies have been proven to be reliable through almost two decades of successful coexistence."[46]

18. We adopt the proposal to eliminate the antenna pointing requirement. ESIM transmissions must remain within our off-axis EIRP density limits under all operating conditions. As discussed above,[47] these limits are specified at off-axis angles measured with respect to a vector from the earth station to the target satellite, not with respect to the direction the antenna is pointed. Thus, it is unnecessary for the Commission to prescribe limits on ESIM antenna pointing accuracy. By eliminating the antenna pointing accuracy requirement but maintaining the off-axis EIRP density limits, we give ESIM operators more flexibility in anomalous situations, because they can meet the off-axis EIRP density limits either by maintaining accurate antenna pointing or by reducing EIRP density when the antenna is mispointed, while continuing to protect adjacent-band operations.[48]

19. *Off-Axis EIRP Density Limits*. In the *ESIMs NPRM*, the Commission noted that the off-axis EIRP density limits rule, Section 25.218, applied to applications for GSO FSS earth stations at fixed locations, but specifically excepted applications for ESVs, VMESs, and ESAAs.[49] However, the numerical EIRP density limits over each specified angular range and the definition of θ in Section 25.218 are the same as those for the same frequency bands in the individual ESIM Sections 25.221, 25.222, 25.226, and 25.227. Thus, to streamline the ESIMs rules, we cross-reference the off-axis EIRP density limits that already exist in Section 25.218. And because the conventional Ka-band off-axis EIRP density limits currently in Section 25.138 are merged into Section 25.218, we only need to cross-reference Section 25.218 to cover all of the frequency bands in which our rules provide for ESIM operations. Most commenters are in favor of these changes.[50]

20. One commenter, CTIA, expresses concern that relaxing the off-axis EIRP density limits may unintentionally limit the ability for FSS and Upper Microwave Flexible Use Service (UMFUS) to coexist.[51] CTIA asserts that knowledge of the precise off-axis EIRP density from an FSS earth station is a key component in determining the interference margin between ESIMs in the presence of terrestrial operations in the adjacent spectrum bands.[52] CTIA's concerns, however, are misplaced since the Commission is not relaxing the off-axis EIRP density limits for ESIMs.

(Continued from previous page)
position of the target satellite at any given time. The same definition of theta is now used in Section 25.209, 47 CFR § 25.209. *See id*. at 4246, fn. 32.

[44] AC BidCo Comments at 3-4; Hughes Comments at 3; Inmarsat Comments at 3; Joint Commenters at 4; ViaSat Comments at 4, 7.

[45] ViaSat Comments at 2.

[46] ViaSat Comments at 7.

[47] *See* para. 17 and n.9 *supra*.

[48] Joint Commenters Comments at 4.

[49] *NPRM*, 32 FCC Rcd at 4247, para. 23.

[50] *See, e.g.*, Boeing Comments at 3; Inmarsat Comments at 3; ViaSat Comments at 5-6; AC BidCo Reply Comments at 2.

[51] CTIA Reply Comments at 4.

[52] *Id*.

21. *Shutdown Requirements*. The shutdown requirements contained in the individual ESIM sections require cessation of emissions for ESV, VMES, and ESAA transmitters based on detection of antenna mispointing.[53] Consistent with the proposed changes regarding antenna mispointing, the Commission proposed to replace the shutdown requirements with provisions in paragraphs (b) and (c) of Section 25.228 requiring cessation or reduction of emissions in the event that the ESIM or its associated network control and monitoring system detects that the ESIM has exceeded or is about to exceed the off-axis EIRP density limits.[54] Commenters generally support this proposal, which we adopt.[55]

22. *Contention Protocols*. The Commission proposed that Section 25.228 would not include the requirement in paragraphs (a)(4) of Sections 25.226 and 25.227 that VMES and ESAA applicants that plan to use a contention protocol in the uplink transmissions of their ESIMs certify that their use of the contention protocol is reasonable.[56] This requirement is already contained in Section 25.115(i), and applies by its terms to applications for ESIMs.[57] No commenters object to this revision, which is adopted.[58]

23. *Point of Contact in the United States.* The Commission proposed to consolidate the requirement that there be a point of contact in the United States with the authority and ability to cease all emissions into the platform-specific rules for ESVs, VMESs, and ESAAs in Section 25.228.[59] No commenters take exception to this proposal, which we adopt.[60]

24. *Data Logging Requirement.* The Commission proposed to eliminate the data logging requirements that are in paragraphs (a)(5) of Sections 25.221 and 25.222 for C- and Ku-band ESV operators and in paragraphs (a)(6) of Sections 25.226 and 25.227 for Ku-band VMES and ESAA operators.[61] The Commission has never requested the logs for the vehicle location, transmit frequency, channel bandwidth, and target satellite of ESIM transmissions from an ESIM operator. Commenters almost uniformly report never having been asked for this data and were consistent in their support for eliminating the requirement.[62] For example, Hughes comments that the Commission should find that the data logging requirements imposed on ESIM operators are onerous and unnecessary and, accordingly, should be eliminated.[63] In its reply comments, ViaSat notes that HNS, Gogo, Inmarsat, Kymeta, Intelsat and Boeing confirm ViaSat's experience and understanding that ESIM location information has been unnecessary because there does not appear to have been any suspected cases of interference.[64] However,

---

[53] *See* paragraphs (a)(1)(iii) of Sections 25.221, 25.222, 25.226, and 25.227.

[54] *NPRM*, 32 FCC Rcd at 4247, para. 25.

[55] Inmarsat supports the Commission's proposed shutdown and monitoring requirements, but it disagrees that ESIM applicants should have to "demonstrate how that requirement will be met. Inmarsat Comments at 4. This is discussed further in paras. 74-75 *infra*. *See also* Joint Commenters Comments at 4; ViaSat Reply Comments at 2 (concurring with Inmarsat's comments).

[56] *NPRM*, 32 FCC Rcd at 4248, para. 28.

[57] The duplication would be eliminated by deleting Sections 25.226 and 25.227 in their entireties, as proposed.

[58] *See, e.g.,* Inmarsat Comments at 4 (stating that Inmarsat supports the Commission's proposals regarding contention protocols).

[59] *NPRM*, 32 FCC Rcd at 4248, para. 29.

[60] *See, e.g.,* Inmarsat Comments at 3 (noting that "[t]hese rule revisions will promote uniformity and efficiency.").

[61] *NPRM*, 32 FCC Rcd at 4248, para. 30.

[62] AC BidCo Comments at 4; Boeing Comments at 5; Hughes Comments at 4; Inmarsat Comments at 3; Joint Commenters at 5; Telesat Comments at 6; and ViaSat at 4, 7-8; AC BidCo Reply Comments at 2-3.

[63] Hughes Comments at 4.

[64] ViaSat Reply Comments at 4.

SES and O3b state in reply comments that it had used this data to resolve interference events, without providing specifics.[65] SES and O3b requests that if the Commission chooses to eliminate the requirement, we should remind ESIM operators that they must cooperate fully to resolve instances of harmful interference.[66] Section 25.274(g) of the Commission's rules already imposes this requirement for all operators.[67] Given the experience with several years of ESIM operations, we find that the logging requirement is no longer necessary.

25. *Remote Monitoring and Control Requirement.* The Commission proposed to incorporate a remote monitoring and control requirement in our proposed Section 25.228(c), and make it applicable to all types of ESIMs.[68] The Commission proposed that each remote terminal must be (1) monitored and controlled by a network control and monitoring center (NCMC) or equivalent facility, (2) that each remote terminal must comply with "disable transmission" commands from the NCMC, and (3) that the NCMC must monitor the operation of each ESIM terminal in its network, and transmit a "disable transmission" command to a remote terminal that malfunctions in such a way as to cause unacceptable interference to another radiocommunication station. These requirements are spread throughout the existing rule sections.[69] While the Commission did not include the 100 millisecond response time for complying with a "disable transmission" command in the text of the proposed rules, the Commission did pose the question as to whether it should be maintained.[70] Commenters support the proposal to harmonize the requirements and maintain the 100 millisecond response time.[71] For example, ViaSat notes that the capability of NCMCs to command individual ESIMs to cease or reduce emissions within 100 milliseconds if the aggregate off-axis EIRP density limits are being exceeded is already required in the separate service rules for each type of ESIM and has not been a barrier to ESIM deployment.[72] Thus, ViaSat says incorporating a requirement into the consolidated rule to monitor the aggregate power density levels of all ESIMs in the network would not increase regulatory burdens or otherwise impede future deployment of ESIMs.[73] To the contrary, ViaSat points out that this requirement is necessary to ensure that ESIM networks that use variable power control are capable of complying with the off-axis EIRP density limits in the aggregate, and thus ensuring that adjacent satellite networks are adequately protected.[74]

26. In contrast, Telesat asserts that specific NCMC capability requirements regarding aggregate off-axis EIRP spectral density limits are unnecessary and suggests that one possible approach for network operators to ensure compliance with aggregate off-axis EIRP spectral density limits is through the methodology in ITU Resolution 156.[75] Telesat argues that network designers and operators

[65] SES and O3b Reply Comments at 9-10.

[66] *Id*.

[67] 47 CFR 25.274(g).

[68] *NPRM*, 32 FCC Rcd at 4248-49, para. 31.

[69] The monitoring and control requirements were in paragraphs (a)(2)(iii) and (a)(3)(iii) of Sections 25.221, 25.222, 25.226, and 25.227; and 25.227(a)(10).

[70] *See NPRM*, 32 FCC Rcd at 4249, para. 33 (addressing cessation of uplink transmissions for VMES).

[71] *See, e.g.,* Hughes Comments at 2; Inmarsat Comments at 4; Telesat Comments at7; and ViaSat Comments at 7.

[72] ViaSat Reply Comments at 8.

[73] *Id*.

[74] ViaSat Reply Comments at 8.

[75] Telesat Comments at 7. Telesat states that under this methodology, compliance with the aggregate limit would be maintained by limiting the power density of each individual earth station by 10 log(N) dB, where N is the "number of earth stations in motion that are in the receive satellite beam of the associated satellite and that are expected to transmit simultaneously on the same frequency." *Id*.

should decide whether to monitor aggregate off-axis spectral density limits, but should not be required to do so.[76]

27. ViaSat asserts that Telesat's proposal is flawed due to the fact that Resolution 156 is premised on a requirement that an NCMC notify individual terminals to cease operations through "disable transmission" commands, and that means individual earth stations must be controlled by an NCMC in any event.[77] According to ViaSat, the mechanism for controlling individual earth stations to manage aggregate off-axis EIRP density still is necessary under Resolution 156, both to calculate the apportioned power levels based on the number of operating terminals and to monitor the aggregate of the apportioned values, and command earth stations to adjust their levels or cease transmitting as required."[78] We agree with ViaSat and further note that Note 4 of Annex 1 to ITU Resolution 156 explicitly addresses the need of controlling potential aggregate interference. ViaSat also states that the 10 log(N) approach, considered in Note 3 of Annex 1 to ITU Resolution 156 and not requiring controlling aggregate off-axis EIRP density is inappropriate for ESIMs using advanced modulation and coding techniques. We agree with ViaSat on this point. These techniques are intended to cope with propagation impairments specific to the location of each ESIM or for other network efficiency considerations. As a result, such ESIMs may intentionally transmit with different EIRP density levels.[79] For those reasons, we do not agree with Telesat's proposal to eliminate the need for monitoring the aggregate off-axis EIRP density.

28. We also agree with ViaSat, Hughes and others that retaining the monitoring and control requirements, consolidating them into the ESIM section and harmonizing them for all types of ESIMs does not increase the regulatory burden. We also agree with commenters that the capabilities provided by the NCMC per these requirements are essential for effective spectrum sharing. We therefore adopt the proposed incorporation of the requirements, including the 100 millisecond response time, into Section 25.228 and the application of those requirements to all types of ESIMs.

29. *Self-Monitoring Requirement*. Section 25.227(a)(11) requires that ESAA terminals be self-monitoring and capable of automatically ceasing transmission. Section 25.227 paragraphs (a)(1)(iii), (a)(2)(ii), and (a)(3)(ii), and corresponding paragraphs in Sections 25.221, 25.222, and 25.226 contain similar self-monitoring requirements. The Commission proposed to make this requirement generally applicable to all types of ESIMs and to codify it in Section 25.228(b).[80] Commenters are also supportive of extending this requirement to all ESIMs in the unified ESIM rule.[81] We adopt the proposal to codify the self-monitoring requirement in Section 25.228(b).

30. *Cessation of Uplink Transmissions Upon Loss of Downlink Signal*. Sections 25.226(a)(9) and 25.227(a)(9) state that each VMES or ESAA terminal must automatically cease transmitting within 5 seconds or 100 milliseconds, respectively, upon loss of reception of the satellite downlink signal or when it detects that unintended satellite tracking has happened or is about to happen. In the *ESIMs NPRM*, the Commission proposed to eliminate these rules as redundant[82] because Section 25.271(g) applies by its terms to all types of ESIMs, and its provision with regard to loss of synchronization to signals from the target satellite is general enough to cover all situations of interest. Boeing and other commenters support this proposal.[83] Specifically, Boeing states that the "Commission's recent adoption of Section 25.271(g)

[76] *Id*.

[77] ViaSat Reply Comments at 7.

[78] *Id*.

[79] *Id*.

[80] *NPRM*, 32 FCC Rcd at 4249, para. 32.

[81] *See, e.g.*, Hughes Comments at 2; Inmarsat Comments at 4; ViaSat Comments at 7.

[82] *NPRM*, 32 FCC Rcd at 4249, para. 33.

[83] Boeing Comments at 5; Inmarsat Comments at 4.

adequately addresses this requirement for all earth stations operating with FSS networks without imposing a potentially arbitrary time limit (i.e., five [seconds] or a tenth of a second) for meeting the requirement."[84] We affirm that Section 25.271(g) stands in the place of these vehicle-specific requirements, and delete Sections 25.226(a)(9) and 25.227(a)(9).

31. *ESIM Installation Requirement for Radiation Hazard Mitigation*. Our rules require that all VMES and ESAA licensees ensure installation of VMES or ESAA terminals on vehicles by qualified installers who have an understanding of the antenna's radiation environment and use those measures best suited to maximize protection of the general public and persons operating the vehicle and equipment.[85] The Commission proposed extending this requirement to ESVs operating in the C-, Ku- and Ka-bands, because the same basic rationale for the VMES and ESAA requirement appears to apply equally to ESVs – *i.e.*, to ensure protection of members of the public (including those manning the vessels and operating the equipment), who may be exposed to hazardous radiation environments on vessels as well as on or in the vicinity of land vehicles and aircraft.[86] Accordingly, the Commission proposed to consolidate the requirement into paragraph (d) of the proposed Section 25.228.[87] The Commission also proposed cross-referencing Section 1.1310 Table 1 of the Commission's rules, rather than specifying the maximum permitted radiation exposure level in Section 25.228(d).[88] As with other organizational changes, commenters are supportive.[89] We therefore adopt these proposals.

2. Reorganizing and Streamlining Footnotes to the Table of Frequency Allocations

32. In the *ESIMs NPRM*, we proposed to reorganize and consolidate the sections in Part 25 of the Commission's rules, including technical and operational as well as application rules, for the three types of ESIMs. This reorganization included updates to the Commission's Table of Frequency Allocations as necessary to reflect the changes we adopt in this Order. We find that this reorganization can better be accomplished with a few additional, non-substantive organizational changes in the non-Federal Government (NG) Footnotes to the Table of Frequency Allocations.[90]

33. Specifically, we combined the text of footnote NG55 with part of the text from footnote NG52 which addresses ESIM sub-bands. Based on the number of the international footnote for ESIMs, 5.527A, the resulting footnote is numbered as NG527A.[91] As a result of combining ESIM-related substantive issues in the new NG527A, we additionally move some text in NG52 to new footnote NG527A. Additionally, we combine the text of revised footnote NG180 with the existing text of NG181, and numbered the resulting footnote as NG457A.[92] Finally, based on these revisions, we remove footnotes NG55, NG180, and NG181. The substantive content in those footnotes is fully covered by the

---

[84] Boeing Comments at 6.

[85] The rules also require that a VMES or ESAA terminal exhibiting radiation exposure levels exceeding 1.0 mW/cm^2 in accessible areas, such as at the exterior surface of the radome, must have a label attached to the surface of the terminal warning about the radiation hazard and must include thereon a diagram showing the regions around the terminal where the radiation levels could exceed 1.0 mW/cm^2.

[86] *NPRM*, 32 FCC Rcd at 4249, para. 34.

[87] *Id*.

[88] *Id*.

[89] AC BidCo Comments at 3; Inmarsat Comments at 4.

[90] 47 CFR § 2.106. We note that these revisions are in addition to the changes proposed in the *NPRM*, such as to US133, and are adopted herein.

[91] *See* Appendix B – Final Rules.

[92] As with the new ESIM footnote, NG527A, the numbering for the ESV footnote, NG457A, is based on the number of the international footnote for ESVs in the 5925-6425 MHz band, 5.457A.

other revisions. We note below where these changes impact other revisions.

3. Vehicle-Type Specific Rules Applicable Across Multiple Frequency Bands

34. *ESV Requirements*. As explained in the *ESIMs NPRM*, there are two rule sections that address specific requirements for ESV operators that were adopted to codify Section 306 of the Communications Act.[93] Specifically, paragraphs (a)(6) and (a)(7) of Sections 25.221 and 25.222 require ESV operators, licensed by the FCC that are communicating with ESVs on vessels registered outside the United States to maintain detailed information on each vessel's country of registry and a point of contact within the foreign administration responsible for licensing the ESV, and to control ESVs using a hub earth station located in the United States. However, a U.S.-licensed ESV may operate under control of a hub earth station located outside the United States, provided that the ESV operator maintains a point of contact in the United States that can make the ESV cease transmitting if necessary. Because paragraphs (a)(6) and (a)(7) of Sections 25.221 and 25.222 are statutorily based, we retain these requirements in paragraph (e)(3) and paragraph (e)(1), respectively, of Section 25.228.

35. We also discontinued our use of the term "ESV hub operators" and "hub earth stations" for greater clarity. In their place, in our revised rules, we use the term "network control and monitoring center" (NCMC)[94] to better reflect the nature of the functions performed by such facilities. Commenters generally offer approval of this ministerial change.[95]

36. *VMES Requirements*. As the Commission noted in the *ESIMs NPRM*, there are currently no rules in Part 25 of the Commission's rules that apply to VMES terminals in more than one frequency band,[96] because VMES rules in Part 25 only apply to Ku-band VMESs. In keeping with our goal to streamline rules for all ESIM operators, we did not propose in the *NPRM*, and do not adopt here, any VMES-specific rules that would apply across all frequency bands.

37. *ESAA Requirements*. There are four sections of Section 25.227 that are specific to ESAA operators in the Ku-band. There are no objections to our proposal to reorganize these ESAA requirements, either by eliminating redundant sections or incorporating them into Section 25.228.[97]

38. First, Section 25.227(a)(12) provides that ESAA applicants that comply with the established off-axis EIRP spectral-density limits may request Permitted List authority. We adopt the proposal to eliminate this rule section because this flexibility is already provided to applicants by Section 25.115(k)(1).[98]

39. Next, we adopt the proposal to keep the requirement that is currently in Section 25.227(a)(14) and move it into Section 25.228(g)(2).[99] This requirement states that all ESAA terminals operating in U.S. airspace, whether on U.S.-registered civil aircraft or non-U.S.-registered civil aircraft, must be licensed by the Commission. It further states that all ESAA terminals on U.S.-registered civil aircraft operating outside of U.S. airspace must be licensed by the Commission, except as provided by Section 303(t) of the Communications Act.[100] We also adopt the proposal to extend this requirement to

---

[93] *NPRM*, 32 FCC Rcd at 4250, para. 36. *See also* 47 USC § 306.

[94] As noted in paragraph 12 *supra*, we adopt the definition of network control and monitoring center (NCMC) in Section 25.103.

[95] Inmarsat Comments at 6.

[96] *NPRM*, 32 FCC Rcd at 4250, para. 39.

[97] Our decision to extend the requirements for ESAA operations to the conventional Ka-band is discussed further in the section on Ka-band ESIM rules.

[98] *NPRM*, 32 FCC Rcd at 4250, para. 40.

[99] *NPRM*, 32 FCC Rcd at 4250-51, para. 41.

[100] 47 U.S.C. § 303(t).

apply to all Ka-band ESAA terminals.

40. Section 25.227(a)(15) states that for ESAA systems operating over international waters, ESAA operators will certify that their target space station operators have confirmed that proposed ESAA operations are within coordinated parameters for adjacent satellites up to 6 degrees away on the geostationary arc. In the *ESIMs NPRM*, the Commission pointed out that the provisions of Section 25.140 and Section 25.220, which apply to U.S. satellites and earth stations, and Section 25.137, which also applies to foreign-licensed points of communication, make Section 25.227(a)(15) redundant.[101] As such, we eliminate this redundancy deleting this section and not bringing this requirement into the ESIM rule section.

41. Finally, we adopt the proposal to move the requirements of Section 25.227(a)(16) to new Section 25.228(g)(3), with a minor revision to make the requirement clearly imperative.[102] Specifically, the provision requires that prior to operations within the foreign nation's airspace, the ESAA operator must ascertain whether the relevant administration has operations that could be affected by ESAA terminals, and must determine whether that administration has adopted specific requirements concerning ESAA operations. Further, in moving these requirements to Section 25.228(g)(3), we extend the existing requirement to apply to Ka-band ESAA operators. Inmarsat argues that the provision in paragraph (g) of Section 25.228 that states that an ESAA terminal in foreign airspace must operate under the Commission's rules or those of the foreign operator, whichever are more constraining, should be eliminated.[103] We disagree. The Commission's rules are designed, *inter alia*, to protect adjacent satellites spaced two degrees apart from interference from earth stations communicating with other satellites. In some cases, the satellites protected from interference by these rules are U.S.-licensed satellites serving foreign territory, where the relevant administrations may not have comparable rules.

4. Frequency-Band Specific Status and Coordination Rules

42. As proposed in the NPRM and described in detail below, while moving the ESIM technical and operational requirements into a unified rule section, we eliminate redundancies and harmonize language whenever possible. In the separate ESIM sections, there are frequency-band specific rules for ESVs, VMESs and ESAAs in the conventional and extended Ku-bands.[104] The Commission proposed to eliminate some of these requirements, which were redundant with other provisions in Part 25.[105] The specific changes are explained below. We retain the provisions in paragraphs (c) and (d) of Sections 25.222, 25.226, and 25.227 which were not redundant and are now included in Section 25.228.

43. Specifically, we eliminate the provision included in both Sections 25.226(a)(8) and 25.227(a)(8), because this provision is redundant with the one in Section 25.209(c)(1). This requirement provides that in the relevant bands,[106] VMES and ESAA terminals receive protection from interference caused by space stations other than the target space station only to the degree to which harmful interference would not be expected to be caused to a hypothetical earth station employing an antenna conforming to the reference patterns defined in Sections 25.209(a) and (b) and stationary at the location at which any interference occurred.

---

[101] *NPRM*, 32 FCC Rcd at 4251, para. 42.

[102] *NPRM*, 32 FCC Rcd at 4251, para. 43.

[103] Inmarsat Comments at 7.

[104] Under the adopted Section 25.228, there are Commission rules for ESIMs operation in four bands: the conventional C-band and the conventional and extended Ku-bands and conventional Ka-band.

[105] *NPRM*, 32 FCC Rcd at 4251, para. 44.

[106] Specifically, VMES terminal receiving in the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth) and 11.7-12.2 GHz (space-to-Earth) bands, and ESAA terminal receiving in the 11.7-12.2 GHz (space-to-Earth) bands do not receive protection from interference.

44. Similarly, we eliminate the provision in Sections 25.222(a)(8), 25.226(a)(7) and 25.227(a)(7), which are redundant with new footnote NG527A to section 2.106 of the Commission's rules.[107] This footnote states that in the 10.95-11.2 GHz (space-to-Earth) and 11.45-11.7 GHz (space-to-Earth) frequency bands ESVs, VMESs and ESAAs must not claim protection from transmissions of non-Federal stations in the fixed service.

45. Finally, the Commission noted in the *ESIMs NPRM* that there are two sets of coordination requirements for Ku-band ESIMs, which are contained in paragraphs (c) and (d) of Sections 25.222, 25.226 and 25.227.[108] Paragraphs (c) in these rule sections address the coordination requirements related to the protection of the NASA Tracking and Data Relay Satellite System (TDRSS) in the 14.0-14.2 GHz frequency band. Paragraphs (d) address coordination requirements designed to protect the Radio Astronomy Service (RAS) in the 14.47-14.5 GHz frequency band. Paragraphs (c), as well as paragraphs (d), in different rule sections, while covering the same frequency bands and coordination requirements to protect TDRSS or RAS operations, as applicable, are worded slightly differently in each rule section. We move these requirements to Section 25.228(j), with non-substantive word changes to harmonize the language for the requirements.[109]

5. Vehicle- Type Specific Rules Applicable to a Single Frequency Band

46. Part 25 includes rules that are particular to the type of ESIM in a specific frequency band. For example, C-band ESVs and Ku-band ESAAs have requirements that are unique to the combination of type of earth station and the particular frequency band in which it operates. The Commission has never licensed C-band VMES and ESAA terminals, and did not propose to adopt rules for these terminals in this proceeding.

47. *C-band ESV Specific Requirements*. The Commission proposed to retain and move several requirements that are unique to ESVs operating in the C-band to Section 25.228(h).[110] Specifically, this proposal covered the provisions in paragraphs (a)(8), (a)(9), (a)(10), (a)(12), and (a)(13) of Section 25.221 as written. No commenter addressed this proposal, and we have relocated these provisions to Section 25.228 without changing the terms, as proposed.[111]

48. As noted in the *ESIMs NPRM*, rules were adopted in the *2005 ESV Order* to protect FS and FSS providers in the C-band while providing maximum flexibility to ESV operators.[112] Specifically, Section 25.221(a)(11) stated that ESVs while in motion do not receive interference protection from either terrestrial licensees or satellites. The Commission proposed to limit this provision only to terrestrial licensees. This updated provision is moved to Section 25.228(h)(4). No commenters object to the proposal, which we adopt, to amend the second sentence of Non-Federal Government footnote NG180 of Section 2.106 consistent with this change. As noted above, this amended footnote is combined with NG181 and moved to NG457A for better organization and consistency.[113]

---

[107] As noted above, we are moving the relevant text to NG527A from NG52 for organizational purposes.

[108] *NPRM*, 32 FCC Rcd at 4252, para. 47.

[109] 47 CFR § 25.228(j).

[110] *NPRM*, 32 FCC Rcd at 4252-53, para. 49-50. The Commission has an open proceeding exploring additional uses of "mid-band spectrum," including the 3700-4200 MHz portion of the C-band. *See Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373 (2017); *Expanding Flexible Use of the 3.7-4.2 GHz Band*, Order and Notice of Proposed Rulemaking, FCC 18-91 (rel. July 13, 2018) (*Mid-band Proceeding*). Operation of ESIMs will be subject to any changes to the Commission's rules made as a result of Commission action in the *Mid-Band Proceeding*.

[111] Section 25.228(h).

[112] *NPRM*, 32 FCC Rcd at 4252, fn 52.

[113] *See* Appendix B – Final Rules.

49. *Ku-Band ESAA Specific Requirements*. Section 25.227(a)(13) contains specific requirements for Ku-band ESAA providers operating in international airspace within line-of-sight of the territory of a foreign administration.[114] These requirements are moved to Section 25.228(i), with non-substantive word changes to harmonize the language to that of Section 25.228.

D. Technical and Operational Requirements for Ka-band ESIMs

50. The Commission did not propose any specific technical or operational requirements for ESVs, VMESs, or ESAAs operating in the conventional Ka-band. The Commission stated that such ESIMs would be authorized subject to the requirements in Sections 25.115(n), which includes the requirement to comply with the earth station off-axis EIRP density limits in new Section 25.218(i), unless the ESIM operations are coordinated under Section 25.220.[115] This is similar to the blanket-licensing provisions for conventional Ka-band earth stations in Section 25.138. The Commission proposed that conventional Ka-band ESVs would be required to comply with the requirements in new Section 25.228(e), conventional Ka-band VMESs would be required to comply with the requirement in new Section 25.228(f), and conventional Ka-band ESAAs would be required to comply with the requirements in new Section 25.228(g). The Commission sought comment on any additional provisions that should be adopted for the operation of ESVs, VMESs, or ESAAs in the conventional Ka-band, such as minimum separation distances to protect the fixed and mobile services from ESV emissions, and/or power flux-density limits to protect the fixed and mobile services from ESAA emissions.[116]

51. The Commission also proposed to amend an existing footnote to the Table of Allocations to recognize the operation of ESIMs as an application of the FSS with primary status in the conventional Ka-band.[117] The Commission sought comment on its belief that ESIMs operating in the conventional Ka-band in accordance with its proposed rules would not pose more of a risk of interference to, nor require more interference protection from, other radiocommunication systems than other earth stations operating in the frequency band on a primary basis today.[118] The Commission has taken similar steps to clarify the primary status of C-band and Ku-band ESIMs.[119] Specifically, the Commission proposed to amend footnote NG55, which authorizes ESV, VMES, and ESAA use in the Ku-band, to include a portion of the Ka-band and to use the term "ESIMs."[120] With the exception of the areas discussed below in the bands, 18.6-18.8 GHz, 29.25-29.3 GHz and 28.35-28.6, commenters generally supported these proposed changes.

52. *29.25-29.3 GHz Band*. In the 29.25-29.5 GHz band, GSO FSS operations and feeder links for the NGSO Mobile Satellite Service (MSS systems) are designated for co-primary usage. Iridium operates feeder links for its NGSO MSS system in the 29.1-29.3 GHz band.[121] Iridium urges the Commission not to authorize ESIMs operations in the 29.25-29.3 GHz band that is shared with Iridium

[114] 47 CFR § 25.227(a)(13).

[115] *NPRM*, 32 FCC Rcd at 4253, para. 52.

[116] *Id.*

[117] *NPRM*, 32 FCC Rcd at 4253, para. 53.

[118] As stated in the *NPRM*, the Commission already blanket licenses ubiquitously-deployed fixed earth stations in the conventional Ka-band under Section 25.138; under the proposed rules ESIMs would have to comply with regulations designed to ensure that they do not cause more interference than fixed earth stations. *Id.* at 4253, fn 54.

[119] *See, e.g.,* 47 CFR § 2.106, footnotes NG55, NG180, and NG181. As noted above, for better organization, NG180 and NG181 are now combined into NG457A.

[120] *See NPRM,* 32 FCC Rcd at 4253, para. 53.

[121] *Iridium Satellite LLC,* IBFS File No. SES-MOD-20060907-01680 (granted Mar. 29, 2007).

feeder links.[122] Iridium claims that the addition of ESIM operations with GSO FSS space stations in this band segment "would create an impractically complex sharing environment" with its NGSO-MSS feeder link operations.[123] Iridium also argues that the satellite industry has not developed a method for determining appropriate exclusion zones around Iridium feeder-link earth stations, outside of which ESIM operations in the band segment will not cause harmful interference to Iridium satellite reception of feeder link uplink transmissions.[124] Iridium has three such feeder-link earth stations in the United States that are currently authorized to operate in the 29.25-29.3 GHz band: one in Tempe, Arizona; one in Fairbanks, Alaska; and one in Wahiawa, Hawaii.[125]

53. In response to Iridium's proposal to bar ESIM operations in the 29.25-29.3 GHz band, Inmarsat and ViaSat provided technical analyses of ESIM interference into Iridium feeder links that propose other approaches ESIM operators could take to coexist with Iridium in the subject band.[126] These analyses are designed to demonstrate how ESIMs transmitting in the 29.25-29.3 GHz band would not exceed the Iridium feeder link interference protection criteria even while operating in the vicinity of Iridium feeder link earth stations. ViaSat's analysis considers six ESAAs operating at distances of 0 and 100 kilometers from an Iridium feeder link earth station, and claims that the carrier-to-interference ratio of the Iridium feeder link signal is more than 30 dB for all but 0.0001 percent of the time.[127] Inmarsat's analysis computes an exclusion zone around an Iridium feeder link earth station within which ESIMs would not be allowed to operate in the 29.25-29.3 GHz band in order to avoid causing unacceptable interference to Iridium's feeder links.[128] Iridium challenged the analyses conducted by ViaSat and Inmarsat, claiming that some of the underlying assumptions are incorrect, and insisted that ESIM operation in the 29.25-29.3 GHz frequency band should not be allowed.[129] In response, ViaSat refined its analysis referred to in the Inmarsat and ViaSat Nov. 6 *Ex Parte* Letter, and claimed that, even under more conservative assumptions, no unacceptable interference would be caused to Iridium feeder links.[130] Similarly, Inmarsat opposed Iridium's arguments and insisted that its previous analysis was valid and

[122] Iridium Comments at 1-2. Iridium has since acknowledged that the Commission could allow ESVs and VMES in the band but requests that the Commission defer consideration of ESAAs operating in 29.25-29.3 GHz. Letters from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission at 2 (filed Sept. 12, 2018) (Iridium Sept. 12 *Ex Parte* Letters); Letter from Robert M. McDowell, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission at 1 (filed Sept. 19, 2018) (Iridium Sept. 19 Javed *Ex Parte* Letter) and Letter from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission at 2 (filed Sept. 20, 2018) (Iridium Sept. 20 Bender *Ex Parte* Letter) In response to Iridium's new proposal, Inmarsat, ViaSat and SES assert that there is no material difference in the potential impact from an aeronautical ESIM and other ESIMs on the ground. Letter from Jack Wengryniuk VP, Regulatory and Market Access Inmarsat, Inc., Christopher J. Murphy Associate General Counsel, Regulatory Affairs and Daryl T. Hunter Chief Technical Officer, Regulatory Affairs ViaSat, Inc., and Petra A. Vorwig Senior Legal and Regulatory Counsel SES Americom, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Sept. 18, 2018) (ESIM Operators Sept. 18 Joint *Ex Parte* Letter). *See also* Letter from John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Sept. 21, 2018) (ViaSat Sept. 21 *Ex Parte* Letter).

[123] Letter from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission, at 1 (filed Sept. 25, 2017) (Iridium September 25, 2017 *Ex Parte* Letter).

[124] *Id.*

[125] These earth stations are licensed by the Commission under call signs E960131 (Tempe, AZ), E050282 and E060300 (Fairbanks, AK), which are licensed to Iridium, and E980049 (Wahiawa, HI), which is licensed to General Dynamics Satellite Communication Services, LLC.

even conservative.[131]

54. Subsequently, Iridium argued that the 50 megahertz under discussion between 29.25-29.3 GHz corresponded only to 5% of the total 2,000 megahertz of the conventional Ka-band spectrum where ESIM operation would be allowed and repeated its argument "that the satellite industry has been unable to develop a method for coordinating NGSO feeder-links and ESIMs."[132] In response, ViaSat argued that channels commonly used to provide broadband service to aircraft have bandwidths of 80, 160 or 320 megahertz, and that a prohibition on using the 50 megahertz in 29.25-29.3 GHz would therefore have a disproportionate impact on the capacity of the satellite network.[133] In other words, according to ViaSat, decreasing the amount of spectrum available from 750 megahertz (in a 29.25-30 GHz band) to 700 megahertz (in a 29.3-30 GHz band) would preclude deployment of, for instance, a network that relies on two 320 megahertz channels and one 80 megahertz channel. Thus, ViaSat argues, the impact of not being able to use the band 29.25-29.3 GHz could be greater than simply reducing available spectrum by 50 megahertz, but could actually prevent providers from making full use of the conventional Ka-band. Later filings from Iridium and ViaSat further elaborated on their prior arguments.[134]

55. As an initial matter, coordination is required between GSO FSS and feeder links to MSS space stations that have co-primary status in the frequency band 29.25-29.3 GHz.[135] The Commission has previously stated that NGSO MSS applicants bear the burden of showing that a new NGSO MSS feeder-link facility can share with uplinks to GSO FSS space stations.[136] The Commission is committed to being as spectrally efficient as possible, and has stressed that NGSO MSS uplink applicants must demonstrate that coordination with GSO FSS operation in the 29.25-29.3 GHz band is feasible, as required by paragraph (c) of Section 25.258.[137] Based on the record before us, we do not believe that it is necessary to establish exclusion zones in order to protect Iridium space station feeder link reception. Iridium has previously acknowledged that the 29.25-29.3 GHz band is shared with GSO FSS networks.[138] Moreover, in a subsequent grant modifying Iridium's license, the International Bureau clearly restated Iridium's co-

(Continued from previous page)

[126] Letter from M. Ethan Lucarelli, Director, Regulatory and Public Policy, and Giselle Creeser, Director, Regulatory, Inmarsat, Inc., and John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Nov. 6, 2017) (Inmarsat and ViaSat Nov. 6 *Ex Parte* Letter).

[127] *Id.*

[128] *Id.*

[129] Letter from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Jan. 18, 2018) (Iridium Jan. 18 *Ex Parte* Letter).

[130] Letter from John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Feb. 5, 2018) (ViaSat Feb. 5 *Ex Parte* Letter).

[131] Letter from Giselle G. Creeser, Director, Regulatory, Inmarsat to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Feb. 16, 2018) (Inmarsat Feb. 16 *Ex Parte* Letter).

[132] Letter from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Mar. 22, 2018) (Iridium Mar. 22 *Ex Parte* Letter).

[133] Letter from John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Mar. 26, 2018) (ViaSat Mar. 26 *Ex Parte* Letter).

[134] Letter from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Apr. 11, 2018) (Iridium Apr. 11 *Ex Parte* Letter); Letter from John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Apr. 26, 2018) (ViaSat Apr. 6 *Ex Parte* Letter); Letter from Scott Blake Harris, Counsel to Iridium Communications, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Jun. 28, 2018); Letter from John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch,

(continued….)

primary status with respect to GSO FSS networks.[139] Iridium questions the feasibility of implementing exclusion zones in which ESIMs must not operate in the 29.25-29.3 GHz band as a method of protecting Iridium feeder links. Instead, we observe that the current coordination provisions of Section 25.258(a) of our rules would require ESIM operations in 29.25-29.3 GHz, like those of any other GSO FSS earth stations operating in the band, to engage in coordination with Iridium.[140]

56. We find that coordination under Section 25.258(a) will provide Iridium with sufficient interference protection. For example, ESIMs may seek to protect Iridium feeder link reception by not transmitting in the 29.25-29.3 GHz band when the transmission from the ESIM would pass through the region in space in which an Iridium satellite could be present at an elevation angle of five degrees or higher[141] as viewed from any Iridium feeder link earth station transmitting in the band,[142] and such transmission would exceed the interference protection criteria of the Iridium space station feeder link receiver. An ESIM could calculate when this would occur if it was programmed with the location of all of the Iridium feeder link earth stations in the band.[143] More specifically, with this information programmed into an ESIM, along with the information and skills that an ESIM operator already possesses in order to correctly point its antenna (i.e., its own location, the location of the target GSO FSS space station, and the requisite computing ability), the ESIM operator could determine with sufficient precision when to cut off transmissions in order to comply with these interference protection criteria.[144] Moreover, this mechanism responds to a worst-case Iridium protection scenario. In a less than worst case scenario, an ESIM would only need to avoid transmitting in the 29.25-29.3 GHz band when its transmitted signal would exceed the Iridium satellite interference protection criteria at the actual location of any Iridium satellite that is within the region in space described above, which presents more limited circumstances. If the ESIM could calculate the precise locations of the Iridium satellites in real time, rather than simply the region in space where the Iridium satellite could be present, it would only need to avoid transmitting in the band when its antenna beam would pass sufficiently near the specific Iridium satellite location as to interfere with Iridium satellite reception.[145] While this is a more burdensome calculation for the ESIM to

(Continued from previous page)
Secretary, Federal Communications Commission (filed Aug. 29, 2018) (ViaSat Aug. 29 *Ex Parte Letter*); Iridium Sept. 12 *Ex Parte* Letters; ESIM Operators Sept. 18 Joint *Ex Parte* Letter; Iridium Sept. 19 Javed *Ex Parte* Letter and Iridium Sept. 20 Bender *Ex Parte* Letter.

[135] While allocation of a given frequency band to a particular service on a "primary" basis entitles that service to protection against harmful interference from stations of a "secondary" service, "co-primary" services such as the NGSO MSS and GSO FSS in the 29.25-29.5 GHz band share that band on an equal basis and may not cause harmful interference to each other. *See* 47 CFR §§ 2.104(d), 2.105(c).

[136] *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Service*, First Report and Order, 11 FCC Rcd 19005, 19024, para. 42 (1996). In designating the 29.25-29.5 GHz bands for feeder links for NGSO MSS systems and GSO FSS uplinks, the Commission adopted specific provisions for licensing and coordination of NGSO MSS feeder links in the 29.25-29.5 GHz band. *See* 47 CFR § 25.258 ("Operators of NGSO MSS feeder link earth stations and GSO FSS earth stations in the band 29.25 to 29.5 GHz where both services have a co-primary allocation shall cooperate fully in order to coordinate their systems").

[137] *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Service*, Memorandum Opinion and Order, 16 FCC Rcd. 11436, 11438-39, para. 7 (2001).

[138] Opposition of Iridium Constellation LLC, IBFS File No. SAT-MOD-20120813-00128 (filed Oct. 19, 2013), at 1 (stating that the modification Iridium seeks "will not require additional bandwidth in the 29.25-29.3 GHz band shared with GSO FSS networks such as Hughes").

perform and requires the transmission of information about the Iridium satellite orbits, it would afford the ESIM more opportunities to transmit in the 29.25-29.3 GHz band than the worst-case approach described above, if the ESIM licensee chose to implement it. While the Commission acknowledges these potential methods for accomplishing coordination as plausible options, the Commission does not specifically endorse either method, and ESIMs operators and Iridium are free to explore other coordination mechanisms.[146] If either ESIM operators or Iridium have concerns that coordination is not proceeding in good faith, or fail to come to an agreement, the matter can be brought to the attention of the Commission.

57. We recognize that coordination between ESIMs and NGSO space stations is more complex than coordination in static situations. However, as described in the paragraph above, we are of the view that coordination is feasible. In addition, any concerns about aggregate effect for interference generated by large numbers of ESIMs can be addressed during coordination.[147] Finally, we encourage the parties to act in good faith, consistent with our overall goal of promoting efficient use of spectrum.

58. Iridium asserts that "coordination with blanket-licensed fixed terminals has hardly been common, has been challenging to the limited extent that it has occurred, becomes increasingly complex with each additional system, and would make sharing with ESIMs even more difficult."[148] However, the Commission has already granted blanket licenses for over five million earth stations to operate in the 29.25-29.3 GHz band, each of which was required, pursuant to Section 25.258 of our rules, to coordinate with Iridium.[149] These earth stations are not individually licensed and can be ubiquitously deployed. We are not persuaded that the relatively small increase in total number of earth stations licensed in the band that we expect will result from authorizing ESIM operations will lead to a significant increase in the use of the 29.25-29.3 GHz band, or will make coordination exceedingly difficult.[150] Moreover, while interference into the Iridium feeder link receivers depends in part upon the number of simultaneously transmitting earth stations in the band, this number is determined primarily by the number of uplink spot beams on each GSO FSS satellite, not by the number of authorized earth stations. Thus, we will permit ESIMs to operate within the FSS in the 29.25-29.3 GHz band on a co-primary basis, and without

(Continued from previous page)

[139] *See Iridium Constellation LLC, Application for Modification of License to Authorize a Second-Generation NGSO MSS Constellation*, 31 FCC Rcd 8675, 8676, para. 3 ("Iridium shares the 29.25-29.3 GHz feeder uplink band on a co-primary basis with geostationary-satellite orbit (GSO) space stations in the fixed-satellite service (FSS).").

[140] *See also* 47 CFR § 25.203(h).

[141] We choose that elevation angle to be five degrees or higher as viewed from any Iridium feeder link earth station transmitting in the band noting that the Iridium feeder link earth stations in the 29.25-29.3 GHz band are authorized to communicate with Iridium space stations only when the Iridium satellites are at an elevation angle of five degrees or more above the local horizontal plane, as viewed from the earth station. *See, e.g. Iridium Satellite LLC,* IBFS File No. SES-MOD-20060907-01680 (granted Mar. 29, 2007).

[142] The region in space in which an Iridium satellite could be present at an elevation angle of five degrees or higher as viewed from a particular Iridium feeder link earth station is a segment of the surface of a sphere, or "cap," at the altitude of the Iridium satellites, which is approximately 780 kilometers. The size of this cap is such that the arc length from the point directly above the Iridium feeder link earth station to the edge of the cap is approximately 2800 kilometers. The interference threshold is calculated assuming a worst-case situation in which the Iridium space station receiving antenna has maximum gain towards the ESIM location.

[143] This information could be programmed into the ESIM software and updated as necessary by the ESIM's Network Control and Monitoring Center (NCMC).

[144] The calculations could take place in two steps. The first step would be to identify the point (point A) at which the direction of an ESIM transmission capable of causing interference intersects a sphere that is centered on the center of the Earth and having a radius equal to the radius of the Earth plus the altitude of the Iridium satellites. The second step would be to determine whether the distance from point A to the point on the same sphere (point B) that is directly over the Iridium feeder link earth station is less than approximately 2800 kilometers in arc length. As mentioned *supra*, 2800 kilometers is the arc length from point B to the boundary on the sphere beyond which the Iridium satellites are below five degrees elevation angle as viewed from the feeder link earth station. If the distance (continued….)

protection zones for MSS feeder link operations.[151]

59. With respect to the conditions for authorizing operations in this band, SES Americom and its affiliate O3b, ViaSat and Inmarsat "recommend that the Commission adopt a policy statement acknowledging that it can license ESIM operations … where an ESIM applicant demonstrates that its operations will not have a significant impact on Iridium's licensed and actual feeder link operations."[152] We decline to adopt such an approach, as the coordination requirement that currently applies to the operation of fixed earth stations is also applicable to ESIM operations. Therefore, as provided above, ESIM operations in 29.25-29.3 GHz will be subject to coordination with Iridium, under Section 25.258(a) of our rules, just like those of any other GSO FSS earth stations operating in the band.[153] Because GSO FSS uplinks are co-primary with NGSO MSS feeder link uplinks in the 29.25-29.3 GHz band, we expect both Iridium and the licensees of ESIM operations to coordinate with each other in good faith.

60. *ESIMs in the 28.35-28.6 GHz Band*. In the *NPRM*, the Commission also asked for comment on any possible effects that these proposed rules may have on existing or future services in adjacent frequency bands, such as the UMFUS operations in the 27.5-28.35 GHz bands.[154] CTIA asserts that the Commission needs to ensure that adjacent terrestrial systems are protected from interference and that we confirm that ESIM out of band emission limits are governed by Section 25.202(f).[155] The Global Mobile Suppliers Association (GSA) presented an analyses of interference caused by ESIM transmissions in the 28.35-28.6 GHz band into mobile service (MS) receivers operating below 28.35 GHz. GSA analyzed potential interference from ESIMs into MS receivers for all three types of ESIMs (VMES, ESV, and ESAA) for scenarios in which the ESIM is stationary and in motion, at various separation distances.[156] GSA acknowledged that some of its assumptions result in worst-case interference scenarios.[157] GSA computed both the interference-to-noise ratio at the MS receivers and the combined frequency dependent rejection required by the combined ESIM transmitters and MS receivers to mitigate the interference. GSA states its calculations show that adjacent band interference above the limits it deems acceptable would occur in many of the scenarios it analyzed. In a later submission, GSA questioned the modeling used in the ViaSat analysis.[158]

(Continued from previous page)
between points A and B is less than 2800 kilometers, the ESIM emission could interfere with reception of the Iridium feeder uplink by an Iridium satellite located at point A.

[145] The ESIM operator's Network Control and Monitoring Center (NCMC) could periodically transmit the ephemeris data of the Iridium satellites to the ESIMs in the network to enable each ESIM to accurately calculate the locations of the Iridium satellites. Alternatively, it could transmit other data describing the Iridium satellite orbits that would reduce the computational load on the ESIMs.

[146] Iridium recommends that the Commission require ESIMs to comply with this specific coordination mechanism. Iridium Sept. 12 *Ex Parte* Letters at 2; Sept. 18 Javed *Ex Parte* Letter at 2, and Iridium Sept. 20 Bender *Ex Parte* Letter at 2. While Inmarsat, ViaSat and SES, urge the Commission to maintain flexibility with respect to possible coordination mechanisms. ESIM Operators Sept. 18 Joint *Ex Parte* Letter at 3. *See also* ViaSat Sept. 21 *Ex Parte* Letter.

[147] With respect to long term interference, only one ESIM will be transmitting to a satellite receive beam in the same frequency band and polarization at any given time. With respect to short term interference, no "time aggregation" occurs if no ESIM is allowed to ever exceed the acceptable interference level associated with small percentages of time. *See also* ViaSat Aug. 29 *Ex Parte* Letter.

[148] Iridium Sept. 25, 2017 *Ex Parte* Letter at 2.

[149] *See*, *e.g.*, HNS License Sub, LLC, *Satellite Policy Branch Information: Action Taken*, Public Notice, Report No. SAT-00905 (rel. Feb. 28, 2007) (IBFS File No. SES-LIC-20061226-02232).

[150] Compared to the small consumer earth stations with fixed antennas sold for satellite broadband access by companies such as Hughes Network Systems and ViaSat, ESIMs are several times more expensive, because they need a tracking antenna, and are therefore unlikely to be deployed in quantities remotely approaching the quantities in which those consumer earth stations have been and will continue to be deployed.

61. ViaSat characterized GSA's analysis as "a static analysis that was based on unrealistic worst-case assumptions and modeling" and claimed that it would be preferable to rely on "a statistical approach including Monte Carlo simulations and dynamic movement of stations, both 5G and ESIM, as well as realistic emission mask data for the ESIM."[159] According to ViaSat's analysis, "an earth station in motion (ESIM) operating at the lower end of the 28.35-28.6 GHz band with emissions complying with the FCC's 25.202(f) out-of-band emissions (OOBE) mask does not cause unacceptable interference to 5G systems operating at the upper edge of the adjacent 27.5-28.35 GHz band." ViaSat further states that "GSA's reliance on a deterministic method, rather than dynamic scenarios, is contrary to the approach supported by its own members."[160]

62. We do not express a view here about the relative merits of a deterministic and a dynamic approach. However, as noted above, the Commission has already blanket-licensed over five million fixed earth stations in the 28.35-28.6 GHz band, which can be ubiquitously deployed at unspecified locations anywhere within the United States. ESIMs in this band, like these existing fixed earth stations will be subject to the same out-of-band emission limits in Section 25.202(f) of our rules.[161] Despite the large number of operating fixed earth stations, no commenter has challenged the adequacy of these OOBE limits to protect mobile services from interference from fixed earth stations. The number of ESIMs we expect to be deployed in the 28.35-28.6 GHz band is a smaller than the number of consumer earth stations with fixed antennas. Moreover, as noted above, a single ESIM will be transmitting to a satellite receive beam in the same frequency band and polarization at any given time and therefore the number of interference sources that might cause aggregation is also limited by this fact. GSA has not made any concrete proposals for out-of-band emission limits specific to ESIMs. Nor did the Commission propose such limits. We therefore decline to adopt any out-of-band emission limits that would be specifically applicable to ESIMs at this time. ESIMs must comply with the out-of-band emission limits specified in Section 25.202(f).

63. *18.6-18.8 GHz Bands.* The National Academy of Sciences, through its Committee on Radio Frequencies (CORF), expresses concern that ESIMs operating in the 18.6-18.8 GHz band could cause harmful interference to earth exploration satellite service (EESS) systems operating around 18.7

(Continued from previous page)

[151] Iridium also questions whether ESIMs should be recognized as an application of the FSS in the 29.25-29.3 GHz band. Iridium Sept. 12 *Ex Parte* Letter at 3 and Iridium Sept. 12 Bender *Ex Parte* Letter at 3. ESIMs are currently operating in several frequency bands where they have been treated as applications of the FSS (see NG55, NG180, NG 181) and have been able to do so maintaining the same interference environment created by the operation of fixed earth stations. Operation of ESIMs in the band 29.25-29.3 GHz is not any different than the operation in these other frequency bands.

[152] SES, O3b, Inmarsat, ViaSat *Ex Parte* Letter (filed Apr. 3, 2018).

[153] *See also* 47 CFR § 25.203(h).

[154] *NPRM*, 32 FCC Rcd at 4254, para 55.

[155] CTIA Reply Comments at 2 and 4.

[156] GSA Reply Comments at 2.

[157] GSA Reply Comments at 4.

[158] Letter from Reza Arefi, Chair, GSA Spectrum Group for North American Region, to Marlene H. Dortch, Secretary, Federal Communications Commission (filed June 11, 1018) (GSA June 11 *Ex Parte* Letter).

[159] ViaSat Mar. 26 *Ex Parte* Letter.

[160] *Id*. at 2. In a later submission, ViaSat addresses *GSA's June 11 Ex Parte Letter*. *See* Letter from John P. Janka and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Aug. 29, 2018) (ViaSat Aug. 29 GSA *Ex Parte* Letter).

[161] 47 CFR § 25.202(f).

GHz.[162] CORF suggests that ESIMs might cause interference to EESS satellite receivers by transmitting upward toward EESS satellites in that range.[163] CORF also suggests that the introduction of ESIMs could lead to increased use of the 18.6-18.8 GHz band by FSS networks for downlink transmissions to ESIM terminals, potentially resulting in increased reflections of satellite signals off the surface of the Earth and into EESS satellite receivers.[164] In its reply comments, Boeing states that it reached out to CORF representatives to discuss possible misunderstandings regarding the nature of operations in the 18.6-18.8 GHz band.[165] Specifically, Boeing notes that given the fact that the 18.3-18.8 GHz band is authorized for downlink transmissions from FSS satellites, there is no potential for ESIMs to transmit in an upward direction in this frequency segment.[166] Second, Boeing pointed out, that the introduction of ESIMs in the 18.3-18.8 GHz band would not result in additional satellite downlink transmissions in this spectrum, it would just increase the number of fixed and mobile earth stations that would receive those signals on Earth.[167] Further, as Boeing states, "[t]he total number of FSS networks operating in the Ka-band using geostationary satellites has been governed primarily by the number of space stations that can successfully operate in a two-degree spacing environment, not any limits on end user demand for such capacity."[168] We agree and will continue to be mindful of the need to protect the interests of the passive scientific users of the radio spectrum, including users of the Radio Astronomy Service (RAS) and EESS bands, as observed by CORF.[169]

64. CORF further suggests that the Commission should clarify the proper meaning of "radio line of sight."[170] Specifically, CORF states it is particularly important to note that in general, the radio and geometric horizons are different because of atmospheric refraction.[171] Thus, for an atmosphere having a standard refractivity gradient, the effective radius of Earth is about four-thirds that of the actual radius, which corresponds to approximately 8,500 km.[172] This increases the radio horizon by about 15 percent compared to the geometric horizon.[173] Although we do not incorporate a definition of "radio line of sight" in the rules we adopt here, we note that CORF's interpretation of radio line of sight is widely accepted.

65. *Stratospheric Platforms*. The Elefante Group asks the Commission to ensure that its stratospheric platforms would be considered ESAA to enable GSO satellite communications with its platforms.[174] We note that our ESAA definition does not set an upper limit on the altitude of the aircraft communicating with a geostationary satellite. In addition, setting such a limit was not proposed or addressed in this proceeding. We therefore decline to generally state that stratospheric platforms are included in the definition of ESAA. Proposals for using FSS frequencies for communications between

[162] CORF Comments at 6-10.

[163] CORF Comments at 9.

[164] *Id*. *See also* Boeing Reply Comments at 5.

[165] Boeing Reply Comments at 5-6.

[166] *Id.* at 5.

[167] *Id.* at 5-6.

[168] *Id*. at 6.

[169] CORF Comments at 1.

[170] CORF Comments at 5.

[171] *Id*.

[172] *Id*. at 5-6.

[173] *Id*. at 6.

[174] Elefante Group Comments at 3. We also decline Elefante Group's request that the term "aircraft" as used within the definition of ESAA be interpreted broadly to include stratospheric platforms. *Id*. at 5.

such platforms and geostationary satellites will be examined taking into consideration their specific characteristics.

66. Having addressed the concerns raised in the record regarding the expansion of ESIMs to the conventional Ka-band frequency bands, we find it in the public interest to adopt rule changes as proposed in the *ESIM NPRM*. Accordingly, we combine footnote NG55 with the relevant portion of NG52 into NG527A, and state: "In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites in the fixed-satellite service on a primary basis." We also amend Section 25.202(a)(8), (a)(10), and (a)(11) consistent with these changes to reflect all frequency bands.[175]

E. ESIMs Application Requirements

67. In the *ESIMs NPRM*, the Commission proposed significant reorganization of the Part 25 rules governing all types of ESIMs. As explained in the *ESIMs NPRM*, application requirements for FSS earth station authorizations at fixed and temporary-fixed locations are in Section 25.115. However, the earth station license application requirements for ESVs, VMESs, and ESAAs are contained in paragraph (b) of Sections 25.221, 25.222, 25.226, and 25.227. The Commission proposed to move the ESIM application requirements into Section 25.115 for better integration of the rules, and we adopt this proposal. Specifically, the application requirements for a particular frequency band for all types of ESIM platforms will be contained in paragraphs (l) (for C-band), (m) (for Ku-band), and (n) (for Ka-band) of Section 25.115. This restructuring is globally supported by the commenters.[176]

68. *Overview of Earth Station Licensing Rules*. As explained in detail in the *ESIMs NPRM*, the Part 25 licensing rules for FSS earth stations transmitting digital emissions to GSO FSS space stations provide two main options for obtaining a license for an earth station at a fixed location. The first option for obtaining such a license is to demonstrate compliance (in one of two ways) with default limits on emissions in directions other than toward the target satellite, which are referred to as off-axis EIRP density limits.[177] These limits were developed to implement the Commission's GSO FSS space station two-degree orbital spacing policy. They ensure earth station compatibility with networks using adjacent satellites in a two-degree orbital spacing environment by controlling the level of emissions from an earth station that can be transmitted toward adjacent satellite orbital locations. Under this option, there are, as indicated, two ways to show compliance. One alternative is to demonstrate that the earth station antenna gain pattern comports with the off-axis gain limits in Section 25.209, and that the antenna input power density comports with limits in Section 25.212. The Commission proposed to extend this option to ESIM applications. The other alternative, already available to ESIM applicants, is to demonstrate that the off-axis EIRP density of the earth station emissions comports with the applicable off-axis EIRP density limits in our ESIM rules.[178] The second option to obtain a license is to demonstrate that the operations of the earth stations in the satellite network have been coordinated with operators of networks using adjacent satellites that would be affected by emissions of the earth stations that exceed the default off-axis EIRP density limits, under the coordination requirements of Section 25.220.

69. Commenters support the proposals that both of these licensing mechanisms be available

[175] *See* Appendix B.

[176] AC BidCo Comments at 1; Boeing Comments at 3; Inmarsat Comments at 2; Joint Commenters Comments at 1; ViaSat Comments at 4-5.

[177] The off-axis EIRP density limits are set forth in 47 CFR § 25.218 for the C- and Ku-bands and in 47 CFR § 25.138 for the Ka-band.

[178] These provisions are set forth in paragraphs (b)(1) of Sections 25.221, 25.222, 25.226, and 25.227.

to ESIM operators.[179] Regarding the alternative of certifying compliance with the antenna pattern specifications in Section 25.209 and the antenna input power density requirements in Section 25.212, in addition to the current option of showing that the Section 25.218 off-axis EIRP density limits are met, AC BidCo states that there is consensus in favor of the Commission's plan to give ESIM applicants this flexibility.[180] As explained in more detail below, we adopt the plan to continue to make both options for obtaining a license available for ESIMs and revise our rules to allow ESIM applicants to use both alternatives for showing compliance under the first option.[181]

70. As discussed above,[182] we are eliminating antenna pointing accuracy requirements for ESIMs. Therefore, the showings regarding antenna pointing accuracy in paragraphs (b)(1) of Sections 25.221, 25.222, 25.226, and 25.227 will no longer be required. Similarly, the ESIM application showing required for applicants proposing to meet the 0.2 degree antenna pointing accuracy requirement in paragraphs (b)(1)(iii) of Sections 25.221, 25.222, 25.226, and 25.227 is no longer relevant. Again, because we are eliminating the antenna pointing accuracy requirement, the requirement in the existing ESIM rules that an applicant proposing to operate with a maximum pointing error greater than 0.2 degrees must declare its maximum pointing error and show that at the maximum mispointing, the EIRP density limits are still met, is no longer necessary. Once our new rules go into effect, applicants will have two options to qualify for a license: either comply with the off-axis EIRP density limits, and provide the information required by Sections 25.115(l)-(n)(1), or coordinate, and provide the information required by Sections 25.115(l)-(n)(2). Additionally, we eliminate the pointing accuracy certification requirements of Sections 25.221(b)(1)(iii), 25.222(b)(1)(iii), 25.226(b)(1)(iii), and 25.227(b)(1)(iii), subparagraphs (A) and (B). We also eliminate the maximum mispointing declaration requirements that were in paragraphs (b)(1)(iv)(A) and the cessation of transmissions upon mispointing demonstration requirements in paragraphs (b)(1)(iv)(B) in Sections 25.221, 25.222, 25.226, and 25.227.

71. We adopt, without commenter objection, the proposal to retain the requirement to provide the off-axis EIRP density showing required by Section 25.115(g)(1), and the coordination certifications required by Section 25.220(d), for applicants that will not meet the off-axis EIRP density limits. Paragraphs (b)(2), (b)(2)(i) and (b)(2)(ii) of Sections 25.221, 25.222, 25.226, and 25.227 apply to an applicant proposing to operate with off-axis EIRP density in excess of the levels in paragraph (a)(1)(i) or (a)(3)(i) of these sections. Such an applicant will apply under the provisions in subparagraphs (a)(2) of Sections 25.115(l)-(n), which contain substantially the same requirements for exhibits to its earth station application.

72. The Commission further proposed to allow ESIM applicants the option of certifying compliance with the antenna pattern requirements of Section 25.209 and the antenna input power density requirements of Section 25.212, in lieu of the off-axis EIRP density limits in Section 25.218.[183] This is not a substantive change, because the off-axis EIRP density limits in Section 25.218, and those resulting from the summing of the antenna input power density limits in Section 25.212 and the antenna off-axis gain limits in Section 25.209 are the same as the off-axis EIRP density limits in the individual ESIM

[179] AC BidCo Comments at 3; Joint Commenters Comments at 3; AC BidCo Reply Comments at 2; ViaSat Reply Comments at 4.

[180] AC BidCo Reply Comments at 4.

[181] The Joint Commenters support the proposal to permit applicants to demonstrate technical compliance by either certifying compliance with (1) the off-axis antenna gain limits in Section 25.209 and the antenna input power density limits in Section 25.212 or (2) the off-axis EIRP density limits set forth in Section 25.218. Joint Commenters at 3. *See also* AC BidCo at 3.

[182] *See* para. 18 *supra*.

[183] *NPRM*, 32 FCC Rcd at 4254, para. 58. For completeness, we note that cross-references in Section 25.212 are revised to reflect the changes to Sections 25.138, 25.221, 25.222, 25.226, and 25.227.

Sections 25.221, 25.222, 25.226, and 25.227.[184] No commenters disagree with this proposal.[185] For example, the Joint Commenters note that giving applicants the option of how to certify off-axis performance provides regulatory flexibility without sacrificing protection from harmful interference.[186]

73. Paragraphs (b)(2)(iii) and (b)(2)(iv) of Sections 25.221, 25.222, 25.226, and 25.227 require detailed showings that each ESAA transmitter in the system will automatically cease or reduce emissions within 100 milliseconds after generating EIRP density exceeding the applicable limits. In the rules proposed in the *ESIMs NPRM* in Sections 25.115(l)-(n)(3)(i), the applicant would have been required to show how the transmitter will detect exceedance of the off-axis EIRP density mask and reduce the power of or shut down one or more transmitters within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off-axis EIRP spectral-densities of the transmitter or transmitters exceed the relevant off-axis EIRP spectral-density limits.

74. Many commenters argue against the demonstration requirement in our proposal. For example, Inmarsat argues that such demonstration at the application phase that would produce the necessary "detailed showings" would be impractical and burdensome.[187] Inmarsat submits that applicants should be able to certify compliance in their applications, just like the requirements of Section 25.227.[188] Similarly, the Joint Commenters state they cannot support the proposal, as written, to include a requirement to demonstrate how the cessation requirement will be met.[189] Boeing also states that it concurs with Intelsat and Inmarsat's explanation that it would be appropriate for the Commission to permit ESIMs applicants to certify that their earth station terminals will comply with the Commission's shut down requirements to ensure compliance with the off-axis power spectral density limits, rather than require a "demonstration" of such compliance.[190] Such a certification requirement would be consistent with the Commission's existing rules regarding antenna pointing and cessation requirements and therefore should be adopted.[191] Hughes provides suggested text for certification rather than demonstration.[192]

75. After further consideration, we agree with commenters that a certification is sufficient for the purposes of this application requirement. We have used a certification process elsewhere in our rules and it has proven effective at ensuring that licensees satisfy the technical requirements of our rules.[193] Thus, Sections 25.115(l)-(n)(3)(i) will require all applicants to: "provide a *certification* that the ESIM system is capable of detecting and automatically ceasing emissions when an individual ESIM transmitter exceeds the relevant off-axis EIRP spectral density limits specified in § 25.218, or the limits provided to the target satellite operator for operation under § 25.220."

76. The certification for a C-band ESV system in Section 25.221(b)(3)(v) regarding

---

[184] In the *2015 Second Report and Order*, the Commission adopted the same definition of θ as described in the preceding paragraph in Section 25.209, the off-axis antenna gain limits rule. *2015 Second Report and Order*, 30 FCC Rcd 14713.

[185] *See, e.g.,* AC BidCo Comments at 3; Boeing Comments at 4; Joint Commenter Comments at 3; ViaSat Comments at 8.

[186] Joint Commenter Comments at 3.

[187] Inmarsat Comments at 4.

[188] *Id*.

[189] Joint Commenters at 4.

[190] Boeing Comments at 2.

[191] *Id*.

[192] Hughes Comments at 4-5.

[193] S*ee e.g.,* 47 CFR § 25.140(a) (requiring GSO FSS space station applications to contain certifications of compliance with certain technical requirements, without submission of any backup evidence or demonstrations).

compliance with the power limits in Section 25.204(h) is eliminated as no longer necessary. However, we retain a technical and operational requirement to meet the power limits in Section 25.204(h) in redesignated Section 25.228(h)(7).

77. As proposed, we note that the requirements that were in paragraphs (b)(5) of Sections 25.226 and 25.227 that any VMES or ESAA applicant filing for a terminal or system and planning to use a contention protocol must include in its application a certification that its contention protocol use will be reasonable is substantially the same as the requirement in Section 25.115(i), which we construe as applying to applications for ESIMs.[194] Therefore, we will not duplicate the language from Sections 25.226(b)(5) and 25.227(b)(5) in the ESIM rules brought into Section 25.115.

78. Further, as proposed, we delete the requirements that were in paragraphs (b)(8) of Sections 25.226 and 25.227 that VMES and ESAA applicants must submit a radio frequency hazard analysis determining via calculation, simulation, or field measurement, whether ESAA terminals, or classes of terminals, will produce power densities that will exceed the Commission's radio frequency exposure criteria as duplicative of Section 1.1307(b) of the Commission's rules.[195] Similarly, we delete paragraphs (b)(7) of Sections 25.221 and 25.222 and Section 25.226(b)(9) as duplicative of 25.115(k)(1), which we construe as applicable to ESIM applications.[196]

79. Paragraphs (b)(7) of Sections 25.226 and 25.227 require that any VMES or ESAA applicant must include in its application a certification that it will comply with the requirements of paragraphs (a)(6) of those sections, and paragraphs (a)(9), (a)(10), and (a)(11) of Section 25.227. The Commission invited comment as to whether the certification requirement serves a useful purpose, or whether the Commission should eliminate it, because Commission licensees are required to comply with all applicable Commission rules. AC BidCo comments that "eliminating this certification requirement will have no effect on the substantive technical and operational standards that an ESIM operator must meet."[197] Because licensees will be required to comply with these provisions even without the certification requirement, we agree, and will no longer require such a certification.

80. We proposed to remove Section 25.226(b)(8), which states, in part, that all VMES applicants must demonstrate that their VMES terminals are capable of automatically ceasing transmissions upon the loss of synchronization or within 5 seconds upon loss of reception of the satellite downlink signal, whichever is the shorter timeframe. This is redundant with Section 25.271(g), which applies by its terms to all transmitting earth stations. It is not necessary to duplicate the provisions in Section 25.271(g) in a rule intended specifically for ESIMs. Additionally, the requirement for radiation hazard mitigation that had been included in Section 25.226(b)(8) is incorporated into Section 25.228(d), as explained above.

81. Finally, as proposed, we retain the requirements in paragraphs (b)(4) of Sections 25.221, 25.222, 25.222, 25.226, and 25.227, in paragraphs (b)(5) of Sections 25.221 and 25.222 and (b)(6) of Sections 25.226 and 25.227, and in paragraphs (b)(6) of Sections 25.221 and 25.222 and (b)(8) of Sections 25.226 and 25.227, and move those requirements into paragraphs (l)-(n) of Section 25.115.[198] Inmarsat supports this proposal as promoting uniformity and efficiency.[199]

---

[194] *NPRM*, 32 FCC Rcd at 4356, para. 65.

[195] 47 CFR §1.1307(b).

[196] *NPRM*, 32 FCC Rcd at 4256, para. 66.

[197] AC BidCo Comments at 4.

[198] *NPRM*, 32 FCC Rcd at 4256-57, para. 69.

[199] Inmarsat Comments at 4.

F. Merging Sections 25.130 and 25.131 into Section 25.115

82. We adopt the Commission's proposals to move the requirements in Section 25.130 into Section 25.115(a)(5)-(10).[200] We note that there is a difference between what the Commission proposed in the *ESIMs NPRM* and the version that we adopt in this Report and Order because Section 25.130 was updated by the *Spectrum Frontiers Second Report and Order*.[201] The changes to Section 25.130(b) are brought into Section 25.115(a)(6)(i)-(iv), and the Note to paragraph (g) is now incorporated as a Note to (a)(10). Further, the Note is revised to eliminate cross-references to the individual ESIM Sections 25.221, 25.222, 25.226, and 25.227, and is revised to cross-reference the appropriate paragraphs of Section 25.115.

83. Further, the last sentence of Section 25.130(a) previously stated that "applicants that are not required to submit applications on Form 312EZ" must submit the information in subparagraphs (1)-(5) of Section 25.130(a) as an attachment to their applications. The use of Form 312EZ is not mandatory, but rather, use is an option available to applicants under some circumstances. Therefore, as proposed, we change the word "required" to "permitted". We reserve Section 25.130. Cross-references to this section are redirected to the appropriate paragraphs in Section 25.115.

84. Similarly, we move all requirements regarding receive-only earth stations, with minor revisions, from Section 25.131 into Section 25.115(b).[202] We reserve Section 25.131, and redirect any cross-references to this section to the appropriate paragraphs in Section 25.115.

G. Other Miscellaneous Changes to Section 25.115

85. We adopt the proposals to reorganize and remove sections that are redundant or better included elsewhere in the reorganized sections.[203] Specifically, we incorporate the language regarding instructions for electronically filing from Section 25.115(a)(4), into Section 25.115(a)(1). We revise the cross-references in Section 25.115(k)(1) to Sections 25.221, 25.226, and 25.227 to refer instead to the proposed paragraphs (l)-(n) of Section 25.115, consistent with the unifying of the application requirements into Section 25.115. Similarly, we adopt non-substantive changes to Section 25.115(k)(2). The proposed changes to 25.115(c)(1) discussed in the *ESIMs NPRM* were previously adopted in the *NGSO FSS Report and Order*.[204]

H. Changes Required in Additional Sections of the Commission's Rules: Sections 25.129, 25.133, 25.140, 25.202, 25.204, 25.209, and 25.258 and notes to the Table of Frequency Allocations

86. The Commission proposed several additional changes in other sections of Part 25 to harmonize the various rule sections involving ESIMs. We are updating cross-references to sections which are being eliminated or reorganized accordingly. Specifically, we eliminate references to Sections 25.221, 25.222, 25.226 and 25.227 in Sections 25.202(a)(8) and 25.140(d)(1). Section 25.140(d)(1) also has an updated reference to Section 25.218. Additionally, we update the cross-reference to Section

---

[200] A list of the existing paragraphs in Section 25.130 and the corresponding proposed paragraphs in Section 25.115 appears in Table 1 of Appendix C.

[201] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.,* Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988 (2017).

[202] A list of the existing paragraphs in Section 25.131 and the corresponding proposed paragraphs in Section 25.115 appears in Table 2 of Appendix C.

[203] *NPRM*, 32 FCC Rcd at 4257, para. 72.

[204] *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters,* Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809, Appendix A (2017) (*NGSO FSS Order* or *NGSO FSS FNPRM*).

25.138(a) in Section 25.140(a)(3)(iii) to point to Section 25.218(i), which will contain the off-axis EIRP density limits contained in Section 25.138(a). Similarly, we revise the cross-reference to Section 25.138(a) in Section 25.258(b) regarding operation of ubiquitously deployed GSO FSS earth stations in the 29.25-29.5 GHz frequency band to point to Section 25.218(i). We are also eliminating cross-references to Sections 25.221, 25.222, 25.226, and 25.227 in Sections 25.115(g)(1)(iv) and (vii). Further, we are eliminating cross-references to Section 25.138, *e.g.* from Sections 25.115(c)(3)(i)(B), (c)(3)(ii), and 25.132(d). In Section 25.133(d), the reference to Section 25.131 is updated to reflect the requirement being reorganized into Section 25.115(b).

87. Because Section 25.138 is being removed and reserved, we remove the reference to it in Section 25.129(c).[205] For the same reasons, we remove references to Section 25.221 in Section 25.140(a)(3)(i), and to Sections 25.222, 25.226, and 25.227 in Section 25.140(a)(3)(ii).[206] For completeness, we also note that we eliminate similar obsolete cross-references in Section 25.220(a).

88. We revise the cross-references to Sections 25.130 and 25.131 in Section 25.209(c)(1) to reflect the move of the particular requirements to Sections 25.115(b)(2) and (b)(4). Similarly, we revise Section 25.209(f) to eliminate the reference to Sections 25.138, 25.221, 25.222, 25.226, and 25.227, and to refer instead to Section 25.218, as well as other clarifying changes. These changes are necessary to reflect the changes to requirements for demonstrations for a non-conforming antenna. We also consolidate the requirements in paragraphs (i)-(k) of Section 25.204 into Section 25.228(j)(2).[207]

89. In addition to moving the ESIM-related sentence of footnote NG52 of the Table of Frequency Allocations into NG527A[208] that language in footnote NG52 is also revised to refer to ESIMs rather than ESVs, VMESs, and ESAAs to be consistent with the terminology adopted in this Report and Order.[209] Finally, footnote US133 of the Table of Frequency Allocation contained cross-references to sub-paragraphs of Sections 25.226 and 25.227 that are updated to point to the appropriate sub-paragraphs of Section 25.228.[210]

IV. FURTHER NOTICE OF PROPOSED RULEMAKING

90. In this Further Notice of Proposed Rulemaking, in an effort to provide additional flexibility to the growing ESIMs market, we seek comment on expanding the frequencies available to ESIMs communicating with GSO FSS satellite networks. SES and O3b requested that the Commission consider expanding GSO ESIMs into additional bands.[211] Specifically, SES and O3b suggested that ESIM operations should also be allowed in the FSS downlink frequency bands 10.7-10.95 GHz, 11.2-11.45 GHz, and 17.8-18.3 GHz.[212] AC BidCo support this proposal.[213] SES and O3b also requested that

[205] *See* Appendix B.

[206] *Id*.

[207] A list of the existing paragraphs in Section 25.204 and the corresponding proposed paragraphs in Section 25.228 appears in Table 6 of Appendix C.

[208] 47 CFR § 2.106.

[209] *See* Appendix B – Final Rules.

[210] We also adopt the proposal to add footnotes 5.484B and 5.527A, which relate to ESIM use and were adopted in WRC-15, to the International Table.

[211] SES and O3b Comments at 6-8; SES and O3b Reply Comments at 3-4; SES and O3b *Ex Parte* Letter (filed Feb. 14, 2018).

[212] *Id*.

[213] AC BidCo Reply Comments at 3.

the Commission propose rules for ESIM operations communicating with NGSO FSS systems.[214] The Commission may address the ESIM operation with NGSO FSS systems in a separate NPRM.

91. We seek comment on allowing ESIMs to operate in all of the frequency bands in which earth stations at fixed locations operating in GSO FSS satellite networks can be blanket-licensed because in this situation operation of earth stations in motion should not introduce a material change to the interference environment created or to the protection required. Consistent with the revisions to the Table of Frequency Allocations the Commission adopted in the *NGSO FSS Report and Order*,[215] we seek comment on expanding the Ku-band space-to-Earth frequency ranges in which ESIMs can be authorized to receive transmissions from GSO FSS space stations[216] to also include the ranges 10.7-10.95 GHz and 11.2-11.45 GHz.[217] We seek comment on whether these operations would be on an unprotected basis with respect to other services. In the Ka-band, we seek comment on allowing ESIMs to receive signals from GSO FSS satellite space stations on a secondary basis in the 17.8-18.3 GHz band and, on a primary basis, in the 19.3-19.4 and 19.6-19.7 GHz band. Can FSS operators design their systems such that widely deployed ESIMs can avoid interference from widely deployed FS (*e.g.* by switching to other frequencies when interference occurs)? What, if any impact will there be on customers if an ESIMs encounters interference in frequency bands where FSS earth stations are not entitled to protection? We also seek comment on whether to allow ESIMs to operate in GSO FSS satellite networks in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) frequency bands on an unprotected, non-interference basis with respect to NGSO FSS satellite systems. Finally, we seek comment on any possible effects expanding the frequencies available to ESIMs communicating with GSO FSS satellite networks may have on existing or future services in these bands or adjacent frequency bands and on any necessary changes to our rules that may be appropriate to accommodate them.

V. PROCEDURAL MATTERS

92. *Ex Parte Procedures*. The proceeding this Further Notice initiates shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules.[218] 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

[214] SES and O3b Comments at 3-6. Letter from Petra A. Vorwig, Senior Legal and Regulatory Counsel, SES Americom, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Feb. 16, 2018) (SES Feb. 14 *Ex Parte* Letter). Telesat supports this proposal. Telesat Reply Comments at 3. *See also* Letter from Suzanne Malloy, Vice President, Regulatory Affairs, O3b Limited, to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Sept. 21, 2018).

[215] *See NGSO FSS Report and Order*, 32 FCC Rcd at 7817, para. 25 and Appendix A at 4.

[216] *See* footnote NG52 of 47 CFR § 2.106.

[217] We note that EchoStar/Hughes filed an *ex parte* letter on Mar. 8, 2018, in which, among other matters, it opposes the SES proposal for allowing ESIM operations in the 10.7-10.95 GHz and 11.2-11.45 GHz frequency bands, on the grounds that such proposal was not in the original *NPRM*. Letter from Jodi Goldberg, Associate Corporate Counsel, EchoStar Corporation to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Mar. 8, 2018). We agree with EchoStar/Hughes in this respect, but we understood the SES proposal to request consideration of these bands in a new NPRM and, accordingly, we are addressing the matter in this *FNPRM*. We also note that the Commission's Part 25 rules currently allow for blanket licensing in the 10.7-10.95 GHz, 11.2-11.45 GHz, and 17.8-18.3 GHz on an unprotected basis with respect to the fixed service. 47 CFR § 25.225(f)(2).

[218] 47 CFR §§ 1.1200 *et seq.*

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 rule 1.1206(b). In proceedings governed by rule 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.

93. *Comment Period and Procedures*. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 CFR §§ 1.415, 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 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: http://apps.fcc.gov/ecfs/.

- 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.

  - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.

  - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

94. 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).

95. *Regulatory Flexibility Act*: *Final Regulatory Flexibility Analysis*. Pursuant to the Regulatory Flexibility Act of 1980, as amended, 5 U.S.C. § 601 *et seq.* (RFA), the Commission's Final Regulatory Flexibility Analysis (FRFA) on the possible significant economic impact on small entities of the policies and rules addressed in this Report and Order, is attached as Appendix D. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this *Report and Order*, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).

96. *Initial Regulatory Flexibility Analysis.* In addition, as required by the RFA, we have prepared an Initial Regulatory Flexibility Analysis (IRFA) regarding the possible significant economic

impact on small entities of the policies and rules adopted in the Further Notice of Proposed Rulemaking, which is found in Appendix F.[219] We request written public comment on the IRFA. Comments must be filed in accordance with the same deadlines as comments filed in response to the FNPRM and must 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 FNPRM, including the IRFA, to the Chief Counsel for Advocacy of the SBA.

97. *Paperwork Reduction Act*. This document contains modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, other Federal agencies, and the general public are invited to comment on the modified information collection requirements contained in this document. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

98. In this document, we have assessed the effects of reducing the application burdens of GSO FSS ESIM applicants, and find that doing so will serve the public interest and is unlikely to directly affect businesses with fewer than 25 employees.

99. In addition, this document contains proposed modified 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 to comment on the information collection requirements contained in this document, 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, *see* 44 U.S.C. 3506(c)(4), we seek specific comment on how we might further reduce the information collection burden for small business concerns with fewer than 25 employees.

100. *Congressional Review Act*. The Commission will send a copy of this Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A).

VI. CONCLUSION AND ORDERING CLAUSES

101. IT IS ORDERED, pursuant to Sections 4(i), 7(a), 303, 308(b), and 316 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 303, 308(b), 316, that this Report and Order IS ADOPTED, the policies, rules, and requirements discussed herein ARE ADOPTED, Parts 2 and 25 of the Commission's rules ARE AMENDED as set forth in Appendix B, and this Further Notice of Proposed Rulemaking IS ADOPTED.

102. IT IS FURTHER ORDERED that the rules and requirements adopted in the Report and Order WILL BECOME EFFECTIVE [30 days from the date of publication in the Federal Register], except for those rules and requirements containing new or modified information collection requirements that require review by the OMB under the PRA, which WILL BECOME EFFECTIVE after OMB review and approval, on the effective date specified in a notice that International Bureau will publish in the Federal Register announcing such approval and effective date.

103. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Report and Order and Further Notice of Proposed Rulemaking, including the Initial and Final Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

104. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Report and Order to

[219] *See* 5 U.S.C. § 603.

Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

List of Commenters

Commenters

AC BidCo LLC (AC BidCo)
The Boeing Company (Boeing)
Elefante Group, Inc. (Elefante Group)
The Global Mobiles Suppliers Association (GSA)
Hughes Network Systems, LLC (Hughes)
Inmarsat Inc. (Inmarsat)
Iridium Satellite LLC (Iridium)
Kymeta Corporation and Intelsat License LLC (Joint Commenters)
National Academy of Sciences' Committee on Radio Frequencies (CORF)
SES S.A. and O3b Limited (filing jointly) (SES and O3b)
Telesat Canada (Telesat)
ViaSat, Inc.

Reply Commenters

AC BidCo LLC (AC BidCo)
The Boeing Company (Boeing)
CTIA
The Global Mobiles Suppliers Association (GSA)
Inmarsat Inc. (Inmarsat)
Iridium Satellite LLC (Iridium)
National Radio Astronomy Observatory (NRAO)
SES S.A. and O3b Limited (filing jointly) (SES and O3b)
Telesat Canada (Telesat)
ViaSat, Inc.

APPENDIX B

Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR parts 2 and 25 as follows:

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. Pages 41, 44, 48, 49, 50, 52, and 55 are revised.

b. In the list of International Footnotes, footnotes 5.484B and 5.527A are added.

c. In the list of United States (US) Footnotes, footnote US133 is revised.

d. In the list of non-Federal Government (NG) Footnotes, footnote NG52 is revised; footnotes NG55, NG180, and NG181 are removed; and footnotes NG457A and NG527A are added.

The revisions and additions read as follows:

§ 2.106 Table of Frequency Allocations.

* * * * *

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
(See previous page)	3500-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.433	3500-3600 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.433A Radiolocation 5.433	3500-3550 RADIOLOCATION G59 AERONAUTICAL RADIONAVIGATION (ground-based) G110	3500-3550 Radiolocation	Private Land Mobile (90)
			3550-3650 RADIOLOCATION G59 AERONAUTICAL RADIONAVIGATION (ground-based) G110	3550-3600 FIXED MOBILE except aeronautical mobile US105 US433	Citizens Broadband (96)
3600-4200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile		3600-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.433	US105 US107 US245 US433	3600-3650 FIXED FIXED-SATELLITE (space-to-Earth) US107 US245 MOBILE except aeronautical mobile US105 US433	Satellite Communications (25) Citizens Broadband (96)
			3650-3700 US109 US349	3650-3700 FIXED FIXED-SATELLITE (space-to-Earth) NG169 NG185 MOBILE except aeronautical mobile US109 US349	
		5.435			
	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		3700-4200	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) NG457A	Satellite Communications (25) Fixed Microwave (10
4200-4400 AERONAUTICAL RADIONAVIGATION 5.438 5.439 5.440			4200-4400 AERONAUTICAL RADIONAVIGATION 5.440 US261		Aviation (87)
4400-4500 FIXED MOBILE 5.440A			4400-4940 FIXED MOBILE	4400-4500	
4500-4800 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE 5.440A				4500-4800 FIXED-SATELLITE (space-to-Earth) 5.441 US245	
4800-4990 FIXED MOBILE 5.440A 5.442 Radio astronomy 5.149 5.339 5.443			US113 US245 US342	4800-4940 US113 US342	
4990-5000 FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY			4940-4990 5.339 US342 US385 G122	4940-4990 FIXED MOBILE except aeronautical mobile 5.339 US342 US385	Public Safety Land Mobile (90Y)

Space research (passive) 5.149			4990-5000 RADIO ASTRONOMY US74 Space research (passive) US246		
5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 5.150	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation 5.150	 5.150 US245	5850-5925 FIXED-SATELLITE (Earth-to-space) US245 MOBILE NG160 Amateur 5.150	ISM Equipment (18) Private Land Mobile (90) Personal Radio (95) Amateur Radio (97)
5925-6700 FIXED 5.457 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C			5925-6425	5925-6425 FIXED FIXED-SATELLITE (Earth-to-space) NG457A	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
			6425-6525 5.440 5.458	6425-6525 FIXED-SATELLITE (Earth-to-space) MOBILE 5.440 5.458	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
			6525-6700 5.458 US342	6525-6700 FIXED FIXED-SATELLITE (Earth-to-space) 5.458 US342	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
5.149 5.440 5.458					
6700-7075 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE			6700-7125	6700-6875 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 5.458 5.458A 5.458B	
				6875-7025 FIXED NG118 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE NG171 5.458 5.458A 5.458B	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
				7025-7075 FIXED NG118 FIXED-SATELLITE (Earth-to-space) NG172 MOBILE NG171	RF Devices (15) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
5.458 5.458A 5.458B 5.458C			5.458	5.458 5.458A 5.458B	

7075-7145 FIXED MOBILE 5.458 5.459			7075-7125 FIXED NG118 MOBILE NG171 5.458 7125-7145 FIXED 5.458 G116	7075-7125 FIXED NG118 MOBILE NG171 5.458 7125-7145 5.458	RF Devices (15)
9.9-10 RADIOLOCATION Fixed 5.477 5.478 5.479			9.9-10 RADIOLOCATION 5.479	9.9-10 Radiolocation 5.479	
10-10.45 FIXED MOBILE RADIOLOCATION Amateur 5.479	10-10.45 RADIOLOCATION Amateur 5.479 5.480	10-10.45 FIXED MOBILE RADIOLOCATION Amateur 5.479	10-10.5 RADIOLOCATION US108 G32	10-10.45 Amateur Radiolocation US108 5.479 US128 NG50	Private Land Mobile (90) Amateur Radio (97)
10.45-10.5 RADIOLOCATION Amateur Amateur-satellite 5.481			5.479 US128	10.45-10.5 Amateur Amateur-satellite Radiolocation US108 US128 NG50	
10.5-10.55 FIXED MOBILE Radiolocation	10.5-10.55 FIXED MOBILE RADIOLOCATION		10.5-10.55 RADIOLOCATION US59		Private Land Mobile (90)
10.55-10.6 FIXED MOBILE except aeronautical mobile Radiolocation			10.55-10.6	10.55-10.6 FIXED	Fixed Microwave (101)
10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) Radiolocation 5.149 5.482 5.482A			10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) US130 US131 US482	10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) FIXED US482 SPACE RESEARCH (passive) US130 US131	
10.68-10.7 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.483			10.68-10.7 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) US131 US246		
10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 5.484B (Earth-to-space) 5.484 MOBILE except aeronautical mobile	10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 5.484B MOBILE except aeronautical mobile		10.7-11.7 US131 US211	10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 US131 US211 NG52	Satellite Communications (25) Fixed Microwave (101)

11.7-12.5 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492	11.7-12.1 FIXED 5.486 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488 Mobile except aeronautical mobile 5.485 12.1-12.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.488 5.485 5.489	11.7-12.2 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492 5.487 5.487A	11.7-12.2	11.7-12.2 FIXED-SATELLITE (space-to-Earth) 5.485 5.488 NG143 NG527A	Satellite Communications (25)
5.487 5.487A					

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
(See previous page)	12.2-12.7 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492	12.2-12.5 FIXED FIXED-SATELLITE (space-to-Earth) 5.484B MOBILE except aeronautical mobile BROADCASTING 5.484A 5.487	12.2-12.75	12.2-12.7 FIXED BROADCASTING-SATELLITE	Satellite Communications (25) Fixed Microwave (101)
12.5-12.75 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B (Earth-to-space)	5.487A 5.488 5.490 12.7-12.75 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE except aeronautical mobile	12.5-12.75 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B MOBILE except aeronautical mobile BROADCASTING-SATELLITE 5.493		5.487A 5.488 5.490 12.7-12.75 FIXED NG118 FIXED-SATELLITE (Earth-to-space) MOBILE	TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
5.494 5.495 5.496					
12.75-13.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.441 MOBILE Space research (deep space) (space-to-Earth)			12.75-13.25 US251	12.75-13.25 FIXED NG118 FIXED-SATELLITE (Earth-to-space) 5.441 NG52 NG57 MOBILE US251 NG53	Satellite Communications (25) TV Broadcast Auxiliar (74F) Cable TV Relay (78) Fixed Microwave (101)
13.25-13.4 EARTH EXPLORATION-SATELLITE (active) AERONAUTICAL RADIONAVIGATION 5.497 SPACE RESEARCH (active)			13.25-13.4 EARTH EXPLORATION-SATELLITE (active) AERONAUTICAL RADIONAVIGATION 5.497 SPACE RESEARCH (active)	13.25-13.4 AERONAUTICAL RADIONAVIGATION 5.497 Earth exploration-satellite (active) Space research (active)	Aviation (87)
5.498A 5.499			5.498A		

13.4-13.75 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH 5.501A Standard frequency and time signal-satellite (Earth-to-space) 5.499 5.500 5.501 5.501B			13.4-13.75 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G59 SPACE RESEARCH 5.501A Standard frequency and time signal-satellite (Earth-to-space) 5.501B	13.4-13.75 Earth exploration-satellite (active) Radiolocation Space research Standard frequency and time signal-satellite (Earth-to-space)	Private Land Mobile (90)
13.75-14 FIXED-SATELLITE (Earth-to-space) 5.484A RADIOLOCATION Earth exploration-satellite Standard frequency and time signal-satellite (Earth-to-space) Space research 5.499 5.500 5.501 5.502 5.503			13.75-14 RADIOLOCATION G59 Standard frequency and time signal-satellite (Earth-to-space) Space research US337 US356 US357	13.75-14 FIXED-SATELLITE (Earth-to-space) US337 Standard frequency and time signal-satellite (Earth-to-space) Space research Radiolocation US356 US357	Satellite Communications (25) Private Land Mobile (90)
14-14.25 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.484B 5.506 5.506B RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.504C 5.506A Space research 5.504A 5.505			14-14.2 Space research US133	14-14.2 FIXED-SATELLITE (Earth-to-space) NG527A Mobile-satellite (Earth-to-space) Space research US133	Satellite Communications (25)
14.25-14.3 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.484B 5.506 5.506B RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.508A Space research 5.504A 5.505 5.508			14.2-14.4	14.2-14.47 FIXED-SATELLITE (Earth-to-space) NG527A Mobile-satellite (Earth-to-space)	
14.3-14.4 FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.484B 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A	14.3-14.4 FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.484B 5.506 5.506B Mobile-satellite (Earth-to-space) 5.506A Radionavigation-satellite 5.504A	14.3-14.4 FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.484B 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A			
14.4-14.47 FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.484B 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A			14.4-14.47 Fixed Mobile		

Space research (space-to-Earth) 5.504A			
14.47-14.5 FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radio astronomy 5.149 5.504A	14.47-14.5 Fixed Mobile US113 US133 US342	14.47-14.5 FIXED-SATELLITE (Earth-to-space) NG527A Mobile-satellite (Earth-to-space) US113 US133 US342	
14.5-14.8 FIXED FIXED-SATELLITE (Earth-to-space) 5.510 MOBILE Space research	14.5-14.7145 FIXED Mobile Space research 14.7145-14.8 MOBILE Fixed Space research	14.5-14.8	
14.8-15.35 FIXED MOBILE Space research 5.339	14.8-15.1365 MOBILE SPACE RESEARCH Fixed US310 15.1365-15.35 FIXED SPACE RESEARCH Mobile 5.339 US211	14.8-15.1365 US310 15.1365-15.35 5.339 US211	
15.35-15.4 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.511	15.35-15.4 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) US246		Page 50
17.8-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A (Earth-to-space) 5.516 MOBILE 5.519	17.8-18.3 FIXED-SATELLITE (space-to-Earth) US334 G117 US519	17.8-18.3 FIXED Fixed-satellite (space-to-Earth) US334 US519	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
18.1-18.4 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B (Earth-to-space) 5.520 MOBILE 5.519 5.521	18.3-18.6 FIXED-SATELLITE (space-to-Earth) US334 G117 US139	18.3-18.6 FIXED-SATELLITE (space-to-Earth) NG164 NG527A US139 US334	Satellite Communications (25)
18.4-18.6 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B			

International Table			United States Table		FCC Rule Part(s)
MOBILE					
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B MOBILE except aeronautical mobile Space research (passive) 5.522A 5.522C	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.522B MOBILE except aeronautical mobile SPACE RESEARCH (passive) 5.522A	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B MOBILE except aeronautical mobile Space research (passive) 5.522A	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) US255 US334 G117 SPACE RESEARCH (passive) US139 US254	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) US255 NG164 NG527A SPACE RESEARCH (passive) US139 US254 US334	
18.8-19.3 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.523A MOBILE			18.8-20.2 FIXED-SATELLITE (space-to-Earth) US334 G117	18.8-19.3 FIXED-SATELLITE (space-to-Earth) NG165 US139 US334	
19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.523B 5.523C 5.523D 5.523E MOBILE				19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) NG166 US334	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Mobile-satellite (space-to-Earth) 5.524	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 529	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Mobile-satellite (space-to-Earth) 5.524		19.7-20.2 FIXED-SATELLITE (space-to-Earth) NG527A MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25)
20.1-20.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528			US139	5.525 5.526 5.527 5.528 5.529 US334	
20.2-21.2 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) 5.524			20.2-21.2 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) G117	20.2-21.2 Standard frequency and time signal-satellite (space-to-Earth)	

Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE	27-27.5 FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE		27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE	27-27.5 Inter-satellite 5.536	RF Devices (15)
27.5-28.5 FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 MOBILE 5.538 5.540			27.5-30	27.5-28.35 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	RF Devices (15) Satellite Communications (25) Upper Microwave Flexible Use (30) Fixed Microwave (101)
				28.35-29.1 FIXED-SATELLITE (Earth-to-space) NG165 NG527A NG62	Satellite Communications (25)
28.5-29.1 FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540					
29.1-29.5 FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.523C 5.523E 5.535A 5.539 5.541A MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540				29.1-29.25 FIXED FIXED-SATELLITE (Earth-to-space) NG166 MOBILE	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
				29.25-29.5 FIXED-SATELLITE (Earth-to-space) NG527A NG535A NG62	Satellite Communications (25)
29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542	29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.525 5.526 5.527 5.529 5.540	29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542		29.5-30 FIXED-SATELLITE (Earth-to-space) NG527A MOBILE-SATELLITE (Earth-to-space) 5.525 5.526 5.527 5.529 5.543	
29.9-30 FIXED-SATELLITE (Earth-to-space) 5.484A 5.484B 5.516B 5.527A 5.539 MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543					

5.525 5.526 5.527 5.538 5.540 5.542			
30-31 FIXED-SATELLITE (Earth-to-space) 5.338A MOBILE-SATELLITE (Earth-to-space) Standard frequency and time signal-satellite (space-to-Earth) 5.542	30-31 FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) Standard frequency and time signal-satellite (space-to-Earth) G117	30-31 Standard frequency and time signal-satellite (space-to-Earth)	

* * * * *

INTERNATIONAL FOOTNOTES

* * * * *

5.484B Resolution 155 (WRC-15) shall apply. (WRC-15)

* * * * *

5.527A The operation of earth stations in motion communicating with the FSS is subject to Resolution 156 (WRC-15). (WRC-15)

* * * * *

UNITED STATES (US) FOOTNOTES

* * * * *

US133 In the bands 14-14.2 GHz and 14.47-14.5 GHz, the following provisions shall apply to the operations of Earth Stations Aboard Aircraft (ESAA):

(a) In the band 14-14.2 GHz, ESAA licensees proposing to operate within radio line-of-sight of the coordinates specified in 47 CFR 25.228(j)(1) are subject to prior coordination with NTIA in order to minimize harmful interference to the ground terminals of NASA's Tracking and Data Relay Satellite System (TDRSS).

(b) In the band 14.47-14.5 GHz, operations within radio line-of-sight of the radio astronomy stations specified in 47 CFR 25.228(j)(3) are subject to coordination with the National Science Foundation in accordance with the requirements set forth in that rule section.

* * * * *

NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

* * * * *

NG52 Except as provided for by NG527A, use of the bands 10.7-11.7 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary satellites in the fixed-satellite service shall be limited to international systems, i.e., other than domestic systems.

* * * * *

NG457A Earth stations on vessels (ESVs), as regulated under 47 CFR part 25, are an application of the fixed-satellite service and the following provisions shall apply:

(a) In the band 3700-4200 MHz (space-to-Earth), ESVs may be authorized to communicate with geostationary satellites and, while docked, may be coordinated for up to 180 days, renewable. ESVs in motion are subject to the condition that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed service.

(b) In the band 5925-6425 MHz (Earth-to-space), ESVs may be authorized to communicate with geostationary satellites on a primary basis.

* * * * *

NG527A Earth Stations in Motion (ESIMs), as regulated under 47 CFR part 25, are an application of the fixed-satellite service (FSS) and the following provisions shall apply:

(a) In the bands 10.95-11.2 GHz (space-to-Earth) and 11.45-11.7 GHz (space-to-Earth), ESIMs may be authorized to communicate with geostationary satellites, subject to the condition that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed service.

(b) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites on a primary basis.

* * * * *

PART 25 – SATELLITE COMMUNICATIONS

2. In § 25.103, revise the definitions of Blanket license, Earth Station Aboard Aircraft, Routine processing or licensing, Two-degree compliant space station, and Vehicle-Mounted Earth Station, and add definitions of Earth Station in Motion (ESIM) and Network Control and Monitoring Center, as shown below.

§ 25.103 Definitions.

* * * * *

Blanket license. A license for: (1) multiple earth stations in the FSS or MSS, or for SDARS terrestrial repeaters, that may be operated anywhere within a geographic area specified in the license, or (2) for multiple space stations in non-geostationary-orbit.

* * * * *

Earth Station Aboard Aircraft (ESAA). An earth station operating aboard an aircraft that receives from and transmits to geostationary-orbit Fixed-Satellite Service space stations.

* * * * *

Earth Station in Motion (ESIM). A term that collectively designates ESV, VMES and ESAA earth stations, as defined in this section.

* * * * *

Network Control and Monitoring Center (NCMC). An NCMC, as used in Part 25, is a facility that has the capability to remotely control earth stations operating as part of a satellite network or system.

* * * * *

Routine processing or licensing. Expedited processing of unopposed applications for earth stations in the FSS communicating with GSO space stations that satisfy the criteria in § 25.211(d), § 25.212(c), § 25.212(d), § 25.212(e), § 25.212(f), § 25.218, or § 25.223(b), include all required information, are consistent with all Commission rules, and do not raise any policy issues. Some, but not all, routine earth station applications are eligible for an autogrant procedure under § 25.115(a)(3).

* * * * *

Two-degree-compliant space station. A GSO FSS space station operating in the conventional or extended C-bands, the conventional or extended Ku-bands, or the conventional Ka-band within the limits on downlink EIRP density or PFD specified in § 25.140(a)(3) and communicating only with earth stations operating in conformance with routine uplink parameters specified in § 25.211(d), § 25.212(c), (d), (e), or (f), or § 25.218.

Vehicle-Mounted Earth Station (VMES). An earth station, operating from a motorized vehicle that travels primarily on land, that receives from and transmits to geostationary orbit Fixed-Satellite Service space stations and operates within the United States.

3. In § 25.115, revise paragraphs (a)(1) and (a)(2)(iii), remove and reserve paragraph (a)(4), add paragraphs (a)(5) - (a)(10), revise paragraph (b) and add paragraphs (b)(1) – (b)(9), revise paragraphs (c)(1), (c)(1)(i)(A), (c)(3)(i)(B), (c)(3)(ii), (e), (g)(1)(vii), (k)(1), and (k)(2), and add paragraphs (l), (m), and (n) to read as follows:

§ 25.115 Applications for earth station authorizations.

(a)(1) *Transmitting earth stations.* Commission authorization must be obtained for authority to operate a transmitting earth station. Applications for transmitting earth stations must be filed electronically through the International Bureau Filing System (IBFS) in accordance with the applicable provisions of part 1, subpart Y of this chapter. Applications must be filed electronically on FCC Form 312, Main Form and Schedule B, and include the information specified in this section, except as set forth in paragraph (a)(2) of this section.

(2) * * *

(iii) The application meets all relevant criteria in § 25.211 or § 25.212 or includes information filed pursuant to paragraph (g)(1) of this section indicating that off-axis EIRP density from the proposed earth stations will not exceed relevant levels specified in § 25.218; and

* * * * *

(4) [Reserved]

(5) Applicants that are not permitted to submit applications under paragraph (a)(2) of this section on Form 312EZ, must submit, as an attachment to their application, the following information to be used as an "informative" in the public notice issued under § 25.151:

(i) A detailed description of the service to be provided, including frequency bands and satellites to be used. The applicant must identify either the specific satellite(s) with which it plans to operate, or the eastern and western boundaries of the arc it plans to coordinate.

(ii) The diameter or equivalent diameter of the antenna.

(iii) Proposed power and power density levels.

(iv) Identification of any random access technique, if applicable.

(v) Identification of a specific rule or rules for which a waiver is requested.

(6)(i) Applicants for earth stations transmitting in frequency bands shared with equal rights between terrestrial and space services must provide a frequency coordination analysis in accordance with § 25.203(b) and must include any notification or demonstration required by any other relevant provision in § 25.203.

(ii) Applicants for user transceiver units associated with the NVNG MSS must provide the information required by § 25.135.

(iii) Applicants for 1.6/2.4 GHz MSS user transceivers must demonstrate that the transceivers will operate in compliance with relevant requirements in § 25.213.

(iv) Applicants for earth stations licensed in accordance with § 25.136 must demonstrate that the transmitting earth stations will meet the relevant criteria specified in that section, including any showings required under § 25.136(a)(4), (c), and/or (d)(4).

(7) In those cases where an applicant is filing a number of essentially similar applications, showings of a general nature applicable to all of the proposed stations may be submitted in the initial application and incorporated by reference in subsequent applications.

(8) Transmissions of signals or programming to non-U.S. licensed satellites, and to and/or from foreign points by means of U.S.-licensed fixed satellites may be subject to restrictions as a result of international agreements or treaties. The Commission will maintain public information on the status of any such agreements.

(9) Applicants seeking to operate in a shared government/non-government band must provide the half-power beam width of their proposed earth station antenna, as an attachment to their applications.

(10) With the exception of applications for blanket-licensed earth station networks filed pursuant to § 25.115(c) or § 25.218; applications for conventional Ka-band hub stations filed pursuant to § 25.115(e); applications for NGSO FSS gateway earth stations filed pursuant to § 25.115(f); applications for individually licensed earth stations filed pursuant to § 25.136; applications for ESIMs filed pursuant to § 25.115(l), § 25.115(m), or § 25.115(n); or applications for 29 GHz NGSO MSS feeder-link stations in a complex as defined in § 25.257, parties may apply, either in an initial application or an application for modification of license, for operating authority for multiple transmitting FSS earth stations that are not eligible for blanket or network licensing under another section of this part in the following circumstances:

(i) The antennas would transmit in frequency bands shared with terrestrial services on a co-primary basis and the antennas would be sited within an area bounded by 1 second of latitude and 1 second of longitude.

(ii) The antennas would transmit in frequency bands allocated to FSS on a primary basis and there is no co-primary allocation for terrestrial services, and the antennas would be sited within an area bounded by 10 seconds of latitude and 10 seconds of longitude.

(b) *Receive-only earth stations*. Except as provided in paragraphs (b)(1) and (8) of this section, applications for licenses for receive-only earth stations must be submitted on FCC Form 312, Main Form and Schedule B, accompanied by any required exhibits and the information described in paragraphs (a)(5)(i)-(v) of this section. Such applications must be filed electronically through the International Bureau Filing System (IBFS) in accordance with the applicable provisions of part 1, subpart Y of this chapter.

(1) Receive-only earth stations in the FSS that operate with U.S.-licensed space stations, or with non-U.S.-licensed space stations that have been duly approved for U.S. market access, may be registered with the Commission in order to protect them from interference from terrestrial microwave stations in bands shared co-equally with the Fixed Service in accordance with the procedures of §§ 25.203 and 25.251, subject to the stricture in § 25.209(c).

(2) Licensing or registration of receive-only earth stations with the Commission confers no authority to receive and use signals or programming received from satellites. *See* Section 705 of the Communications Act. 47 U.S.C. 605.

(3) Applications for registration must be accompanied by the coordination exhibit required by § 25.203 and any other required exhibits.

(4) Complete applications for registration will be placed on public notice for 30 days and automatically granted if no objection is submitted to the Commission and served on the applicant. Additional pleadings are authorized in accordance with § 1.45 of this chapter.

(5) The registration of a receive-only earth station results in the listing of an authorized frequency band at the location specified in the registration. Interference protection levels are those agreed to during coordination.

(6) Reception of signals or programming from non-U.S. satellites may be subject to restrictions as a result of international agreements or treaties. The Commission will maintain public information on the status of any such agreements.

(7) Registration term: Registrations for receive-only earth stations governed by this section will be issued for a period of 15 years from the date on which the application was filed. Applications for renewals of registrations must be submitted on FCC Form 312R (Application for Renewal of Radio Station License in Specified Services) no earlier than 90 days and no later than 30 days before the expiration date of the registration.

(8) Applications for modification of license or registration of receive-only earth stations must be made in conformance with §§ 25.117 and 25.118. In addition, registrants are required to notify the Commission when a receive-only earth station is no longer operational or when it has not been used to provide any service during any 6-month period.

(9)(i) Except as set forth in paragraph (9)(ii) of this section, receive-only earth stations operating with non-U.S. licensed space stations must file an FCC Form 312 requesting a license or modification to operate such station.

(ii) Operators of receive-only earth stations need not apply for a license to receive transmissions from non-U.S.-licensed space stations that have been duly approved for U.S. market access, provided the space station operator and earth station operator comply with all applicable rules in this chapter and with applicable conditions in the Permitted Space Station List or market-access grant.

(c) * * *

(i) * * *

(A) No more than three geostationary satellites to be accessed;

* * * * *

(3) * * *

(i) * * *

(B) The application includes information filed pursuant to paragraph (g)(1) of this section indicating that off-axis EIRP density from the proposed earth stations will not exceed relevant routine levels specified in § 25.218(i).

(ii) Applications to license networks of earth stations operating in the 28.35-28.6 GHz and/or 29.25-30.0 GHz bands under blanket operating authority that do not meet the requirements of § 25.212(e) or § 25.218(i) must comply with the requirements in § 25.220 and must be filed on FCC Form 312 with a Schedule B for each large (5 meters or larger) hub station antenna and each representative type of small antenna (less than 5 meters) operating within the network.

* * * * *

(e)(1) An application for a GSO FSS earth station license in the 17.8-19.4 GHz, 19.6-20.2 GHz, 27.5-29.1 GHz, or 29.25-30 GHz bands not filed on FCC Form 312EZ pursuant to paragraph (a)(2) of this section must be filed on FCC Form 312, Main Form and Schedule B, and must include any information required by paragraphs (a)(5)-(10) or (g) or (j) of this section.

* * * * *

(g) * * *

(1) * * *

(vii) The relevant off-axis EIRP density envelopes in § 25.218 or § 25.223 must be superimposed on plots submitted pursuant to paragraphs (g)(1)(i) through (vi) of this section.

* * * * *

(k)(1) Applicants for FSS earth stations that qualify for routine processing in the conventional or extended C-bands, the conventional or extended Ku-bands, the conventional Ka-band, or the 24.75-25.25 GHz band, including ESV applications filed pursuant to paragraph (m)(1) or (n)(1) of this section, VMES applications filed pursuant to paragraph (m)(1) or (n)(1) of this section, and ESAA applications filed pursuant to paragraph (m)(1) or (n)(1) of this section, may designate the Permitted Space Station List as a point of communication. Once such an application is granted, the earth station operator may communicate with any space station on the Permitted Space Station List, provided that the operation is consistent with the technical parameters and conditions in the earth station license and any limitations placed on the space station authorization or noted in the Permitted Space Station List.

(2) Notwithstanding paragraph (k)(1) of this section, an earth station that would receive signals in the 17.8-20.2 GHz band may not communicate with a space station on the Permitted Space Station List in that band until the space station operator has completed coordination under Footnote US334 to § 2.106 of this chapter.

(l) The requirements of this paragraph apply to applications for ESV operation in the 5925-6425 MHz (Earth-to-space) band with GSO satellites in the Fixed-Satellite Service, in addition to the requirements in paragraphs (a)(1), (a)(5), (a)(6), and (i) of this section:

(1) Applications where any necessary frequency coordination has been satisfactorily completed, and the proposed earth station transmissions comport with the applicable provisions in § 25.212(d) or the applicable off-axis EIRP density limits in § 25.218(d) will be routinely processed. Such applications must include the relevant information specified by paragraph (g) of this section. Applicants for ESIMs operating in a network using variable power density control of earth stations transmitting simultaneously in shared frequencies to the same target satellite receiving beam must also provide the certification required by § 25.212(g) or § 25.218(d)(4), whichever is applicable.

(2) Applications where the proposed earth station transmissions do not comport with the applicable provisions in § 25.212(d) or the applicable off-axis EIRP density limits in § 25.218(d) must include the information specified by paragraph (g)(1) of this section, and are subject to the requirements of § 25.220.

(3) Applications must include the following information:

(i) ESIM applicants that meet the relevant off-axis EIRP density mask must certify that an individual ESIM terminal is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. ESIM applicants that do not meet the relevant off-axis EIRP density mask must provide a detailed showing that an individual ESIM terminal is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. Variable-power ESIM applicants must certify that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off axis EIRP densities of the transmitter or transmitters exceed the relevant off-axis EIRP density limits.

(ii) An exhibit describing the geographic area(s) in which the ESV s will operate.

(iii) The point of contact information referred to in § 25.228(e)(2).

(iv) Applicants for ESVs that will exceed the guidelines in § 1.1310 of this chapter for radio frequency radiation exposure must provide, with their environmental assessment, a plan for mitigation of radiation exposure to the extent required to meet those guidelines.

(m) The requirements of this paragraph apply to applications for ESIM operation in the 14.0-14.5 GHz (Earth-to-space) band with GSO satellites in the Fixed-Satellite Service, in addition to the requirements in paragraphs (a)(1), (a)(5), and (i) of this section:

(1) Applications where any necessary frequency coordination has been satisfactorily completed, and the proposed earth station transmissions comport with the applicable provisions in § 25.212(c)(2) or the applicable off-axis EIRP density limits in § 25.218(f) will be routinely processed. Such applications must include the relevant information specified by paragraph (g) of this section. Applicants for ESIMs operating in a network using variable power density control of earth stations transmitting simultaneously in shared frequencies to the same target satellite receiving beam must also provide the certification required by § 25.212(g) or § 25.218(f)(4), whichever is applicable.

(2) Applications where the proposed earth station transmissions do not comport with the applicable provisions in § 25.212(c)(2) or the applicable off-axis EIRP density limits in § 25.218(f) must include the information specified by paragraph (g)(1) of this section, and are subject to the requirements of § 25.220.

(3) Applications must include the following information:

(i) ESIM applicants that meet the relevant off-axis EIRP density mask must certify that an individual ESIM terminal is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. ESIM applicants that do not meet the relevant off-axis EIRP density mask must provide a detailed showing that an individual ESIM terminal is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. Variable-power ESIM applicants must certify that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off axis EIRP densities of the transmitter or transmitters exceed the relevant off-axis EIRP density limits.

(ii) An exhibit describing the geographic area(s) in which the ESIMs will operate.

(iii) The point of contact information referred to in § 25.228(e)(2), (f), or (g)(1) as appropriate.

(iv) Applicants for ESIMs that will exceed the guidelines in § 1.1310 of this chapter for radio frequency radiation exposure must provide, with their environmental assessment, a plan for mitigation of radiation exposure to the extent required to meet those guidelines.

(n) The requirements of this paragraph apply to applications for ESIM operation in the 28.35-28.6 GHz or 29.25-30.0 GHz (Earth-to-space) band with GSO satellites in the Fixed-Satellite Service, in addition to the requirements in paragraphs (a)(1), (a)(5), and (i) of this section:

(1) Applications where any necessary frequency coordination has been satisfactorily completed, and the proposed earth station transmissions comport with the applicable provisions in § 25.212(e) or the applicable off-axis EIRP density limits in § 25.218(i) will be routinely processed. Such applications must include the relevant information specified by paragraph (g) of this section. Applicants for ESIMs operating in a network using variable power density control of earth stations transmitting simultaneously in shared frequencies to the same target satellite receiving beam must also provide the certification required by § 25.212(g) or § 25.218(i)(5), whichever is applicable.

(2) Applications where the proposed earth station transmissions do not comport with the applicable provisions in § 25.212(e) or the applicable off-axis EIRP density limits in § 25.218(i) must include the information specified by paragraph (g)(1) of this section, and are subject to the requirements of § 25.220.

(3) Applications must include the following information:

(i) ESIM applicants that meet the relevant off-axis EIRP density mask must certify that an individual ESIM terminal is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. ESIM applicants that do not meet the relevant off-axis EIRP density mask must provide a detailed showing that an individual ESIM terminal is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. Variable-power ESIM applicants must certify that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off axis EIRP densities of the transmitter or transmitters exceed the relevant off-axis EIRP density limits.

(ii) An exhibit describing the geographic area(s) in which the ESIM s will operate.

(iii) The point of contact information referred to in § 25.228(e)(2), (f), or (g)(1) as appropriate.

(iv) Applicants for ESIMs that will exceed the guidelines in § 1.1310 of this chapter for radio frequency radiation exposure must provide, with their environmental assessment, a plan for mitigation of radiation exposure to the extent required to meet those guidelines.

4. In § 25.129, revise paragraph (c) to read:

* * * * *

(c) In addition to the information required by §§1.1307(b) and 2.1033(c) of this chapter, applicants for certification required by this section must submit any additional equipment test data necessary to demonstrate compliance with pertinent standards for transmitter performance prescribed in §§ 25.202(f), and 25.216, must submit the statements required by § 2.1093(c) of this chapter, and must demonstrate compliance with the labeling requirement in § 25.285(b).

* * * * *

5. Reserve § 25.130.

§ 25.130 [Reserved]

6. Reserve § 25.131.

§ 25.131 [Reserved]

7. In § 25.132, revise paragraph (d) to read as follows:

§ 25.132 Verification of earth station antenna performance.

* * * * *

(d) For each new or modified transmitting antenna over 3 meters in diameter, the following on-site verification measurements must be completed at one frequency on an available transponder in each frequency band of interest and submitted to the Commission.

* * * * *

8. In § 25.133, revise paragraph (d) to read as follows:

§ 25.133 Period of construction; certification of commencement of operation.

* * * * *

(d) Each receiving earth station licensed or registered pursuant to § 25.115(b) must be constructed and placed into service within 6 months after coordination has been completed. Each licensee or registrant must file with the Commission a certification that the facility is completed and operating as provided in paragraph (b) of this section, with the exception of certification of antenna patterns.

9. Reserve § 25.138.

§ 25.138 [Reserved]

10. In § 25.140, revise paragraphs (a)(3)(i), (ii), and (iii) and (d)(1) to read as follows:

§ 25.140 Further requirements for license applications for GSO space station operation in the FSS and the 17/24 GHz BSS.

(a) * * *

(3) * * *

(i) With respect to proposed operation in the conventional or extended C-bands, a certification that downlink EIRP density will not exceed 3 dBW/4kHz for digital transmissions or 8 dBW/4kHz for analog transmissions and that associated uplink operation will not exceed applicable EIRP density envelopes in § 25.218 unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the orbital location of the proposed space station and except as provided in paragraph (d) of this section.

(ii) With respect to proposed operation in the conventional or extended Ku-bands, a certification that downlink EIRP density will not exceed 14 dBW/4kHz for digital transmissions or 17 dBW/4kHz for analog transmissions and that associated uplink operation will not exceed applicable EIRP density envelopes in § 25.218 unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the orbital location of the proposed space station and except as provided in paragraph (d) of this section.

(iii) With respect to proposed operation in the conventional Ka-band, a certification that the proposed space station will not generate power flux-density at the Earth's surface in excess of −118 dBW/m^2/MHz and that associated uplink operation will not exceed applicable EIRP density envelopes in § 25.218(i) unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the orbital location and except as provided in paragraph (d) of this section.

* * * * *

(d) * * *

(1) The letter notification must include the downlink off-axis EIRP density levels or power flux density levels and/or uplink off-axis EIRP density levels, specified per frequency range and space station antenna beam, that exceed the relevant routine limits set forth in paragraphs (a)(3)(i) through (iii) of this section and § 25.218.

* * * * *

11. In § 25.202, remove paragraphs (a)(10)(ii) and (a)(11)(ii), redesignate paragraphs (a)(10)(i) and (a)(11)(i) as (a)(10) and (a)(11) respectively, and revise paragraph (a)(8) and redesignated paragraphs (a)(10) and (a)(11) to read as follows:

§ 25.202 Frequencies, frequency tolerance, and emission limits.

(a) * * *

(8) The following frequencies are available for use by ESVs:

3700-4200 MHz (space-to-Earth)

5925-6425 MHz (Earth-to-space)

10.95-11.2 GHz (space-to-Earth)

11.45-11.7 GHz (space-to-Earth)

11.7-12.2 GHz (space-to-Earth)

14.0-14.5 GHz (Earth-to-space)

18.3-18.8 GHz (space-to-Earth)

19.7-20.2 GHz (space-to-Earth)

28.35-28.6 GHz (Earth-to-space)

29.25-30.0 GHz (Earth-to-space)

* * * * *

(10) The following frequencies are available for use by Vehicle-Mounted Earth Stations (VMESs):

10.95-11.2 GHz (space-to-Earth)

11.45-11.7 GHz (space-to-Earth)

11.7-12.2 GHz (space-to-Earth)

14.0-14.5 GHz (Earth-to-space)

18.3-18.8 GHz (space-to-Earth)

19.7-20.2 GHz (space-to-Earth)

28.35-28.6 GHz (Earth-to-space)

29.25-30.0 GHz (Earth-to-space)

(11) The following frequencies are available for use by Earth Stations Aboard Aircraft (ESAAs):

10.95-11.2 GHz (space-to-Earth)

11.45-11.7 GHz (space-to-Earth)

11.7-12.2 GHz (space-to-Earth)

14.0-14.5 GHz (Earth-to-space)

18.3-18.8 GHz (space-to-Earth)

19.7-20.2 GHz (space-to-Earth)

28.35-28.6 GHz (Earth-to-space)

29.25-30.0 GHz (Earth-to-space)

* * * * *

12. In § 25.204, revise paragraph (e)(3) to read as follows, and remove paragraphs (h) – (k):

§ 25.204 Power limits for earth stations.

* * * * *

(e) * * *

(3) FSS earth stations transmitting to geostationary space stations in the 28.35-28.6 GHz and/or 29.25-30.0 GHz bands may employ uplink adaptive power control or other methods of fade compensation. For stations employing uplink power control, the values in paragraphs (i)(1), (i)(2), and (i)(4) of § 25.218 may be exceeded by up to 20 dB under conditions of uplink fading due to precipitation. The amount of such increase in excess of the actual amount of monitored excess attenuation over clear sky propagation conditions must not exceed 1.5 dB or 15 percent of the actual amount of monitored excess attenuation in dB, whichever is larger, with a confidence level of 90 percent except over transient periods accounting for no more than 0.5 percent of the time during which the excess is no more than 4.0 dB.

* * * * *

13. In section 25.209, revise paragraphs (c)(1) and (f) to read as follows:

§ 25.209 Earth station antenna performance standards.

* * * * *

(c)(1) An earth station licensed for operation with a GSO FSS space station or registered for reception of transmissions from such a space station pursuant to §§ 25.115(b)(1) and (b)(3) is not entitled to protection from interference from authorized operation of other stations that would not cause harmful interference to that earth station if it were using an antenna with receive-band gain patterns conforming to the levels specified in paragraphs (a) and (b) of this section.

* * * * *

(f) A GSO FSS earth station with an antenna that does not conform to the applicable standards in paragraphs (a) and (b) of this section will be authorized only if the applicant demonstrates that the antenna will not cause unacceptable interference. This demonstration must show that the transmissions of the earth station comport with the requirements in § 25.218 or § 25.223, or the applicant must demonstrate that the operations of the earth station have been coordinated under § 25.220.

14. In § 25.212, revise paragraphs (c)(1), (c)(2), (d), (g), and (h) to read as follows:

§ 25.212 Narrowband analog transmissions and digital transmissions in the GSO Fixed Satellite Service.

* * * * *

(c)(1) An earth station, other than an ESIM, may be routinely licensed for analog transmissions in the conventional Ku-band or the extended Ku-band with bandwidths up to 200 kHz (or up to 1 MHz for command carriers at the band edge) if the input power spectral density into the antenna will not exceed -8 dBW/4 kHz, and the application includes certification pursuant to § 25.132(a)(1) of conformance with the antenna gain performance requirements in § 25.209(a) and (b).

(2) An earth station may be routinely licensed for digital transmission, including digital video transmission, in the conventional Ku-band, or, except for an ESIM, in the extended Ku-band, if input power spectral density into the antenna will not exceed -14 dBW/4 kHz and the application includes certification pursuant to § 25.132(a)(1) of conformance with the antenna gain performance requirements in § 25.209(a) and (b).

(d) An individual earth station may be routinely licensed for digital transmission in the conventional C-band or, except for an ESIM, in the extended C-band, if the applicant certifies conformance with relevant antenna performance standards in § 25.209(a) and (b), and power density into the antenna will not exceed -2.7 dBW/4 kHz. An individual earth station, other than an ESIM, may be routinely licensed for analog transmission with carrier bandwidths up to 200 kHz (or up to 1 MHz for command carriers at the band edge) in the conventional C-band or the extended C-band, if the applicant certifies conformance with relevant antenna performance standards in § 25.209(a) and (b), and power density into the antenna will not exceed +0.5 dBW/4 kHz.

* * * * *

(g) A license application for earth station operation in a network using variable power density control of earth stations transmitting simultaneously in shared frequencies to the same target satellite receiving beam may be routinely processed if the applicant certifies that the aggregate off-axis EIRP density from all co-frequency earth stations transmitting simultaneously to the same target satellite receiving beam, not resulting from colliding data bursts transmitted pursuant to a contention protocol, will not exceed the applicable off-axis EIRP density limits permissible for a single earth station, as specified in § 25.218.

(h) Applications for authority for fixed earth station operation in the conventional C-band, the extended C-band, the conventional Ku-band, the extended Ku-band or the conventional Ka-band that do

not qualify for routine processing under relevant criteria in this section, § 25.211, or § 25.218 are subject to the requirements in § 25.220.

15. In § 25.218, revise paragraphs (a) and (b) introductory text, and remove paragraphs (a)(1) and (a)(2), revise paragraph (i), and add paragraph (j) to read as follows:

§ 25.218 Off-axis EIRP density envelopes for FSS earth stations transmitting in certain frequency bands.

(a) This section applies to applications for fixed and temporary-fixed FSS earth stations transmitting to geostationary space stations in the conventional C-band, extended C-band, conventional Ku-band, extended Ku-band, or conventional Ka-band, and applications for ESIMs transmitting in the conventional C-band, conventional Ku-band, or conventional Ka-band, except for applications proposing transmission of analog command signals at a band edge with bandwidths greater than 1 MHz or transmission of any other type of analog signal with bandwidths greater than 200 kHz.

(b) Earth station applications subject to this section may be routinely processed if they meet the applicable off-axis EIRP density envelopes set forth in this section.

* * * * *

(i) Digital earth station operation in the conventional Ka-band.

(1) For co-polarized transmissions in the plane tangent to the GSO arc:

32.5 - 25log(θ)	dBW/MHz	for	$2.0° \leq \theta \leq 7°$
11.5	dBW/MHz	for	$7° \leq \theta \leq 9.2°$
35.5 - 25log(θ)	dBW/MHz	for	$9.2° \leq \theta \leq 19.1°$
3.5	dBW/MHz	for	$19.1° < \theta \leq 180°$

where θ is as defined in paragraph (c)(1) of this section.

(2) For co-polarized transmissions in the plane perpendicular to the GSO arc:

35.5 - 25log(θ)	dBW/MHz	for	$3.5° \leq \theta \leq 7°$
14.4	dBW/MHz	for	$7° < \theta \leq 9.2°$
38.5 - 25log(θ)	dBW/MHz	for	$9.2° < \theta \leq 19.1°$
6.5	dBW/MHz	for	$19.1° < \theta \leq 180°$

where θ is as defined in paragraph (c)(1) of this section.

(3) The EIRP density levels specified in paragraphs (i)(1) and (2) of this section may be exceeded by up to 3 dB, for values of $\theta > 7°$, over 10% of the range of theta (θ) angles from 7-180º on each side of the line from the earth station to the target satellite.

(4) For cross-polarized transmissions in the plane tangent to the GSO arc and in the plane perpendicular to the GSO arc:

22.5 - 25log(θ)	dBW/MHz	for	$2.0° < \theta \leq 7.0°$

where θ is as defined in paragraph (c)(1) of this section.

(5) A license application for earth station operation in a network using variable power density control of earth stations transmitting simultaneously in shared frequencies to the same target satellite receiving beam may be routinely processed if the applicant certifies that the aggregate off-axis EIRP density from all co-frequency earth stations transmitting simultaneously to the same target satellite receiving beam, not resulting from colliding data bursts transmitted pursuant to a contention protocol, will not exceed the off-axis EIRP density limits permissible for a single earth station, as specified in paragraphs (i)(1)-(i)(4) of this section.

(j) Applications for authority for fixed earth station operation in the conventional C-band, extended C-band, conventional Ku-band, extended Ku-band, or conventional Ka-band that do not qualify for routine processing under relevant criteria in this section, § 25.211, or § 25.212 are subject to the requirements in § 25.220.

16. In § 25.220, revise paragraph (a) to read as follows:

§ 25.220 Non-conforming transmit/receive earth station operations.

(a) The requirements in this section apply to applications for, and operation of, earth stations transmitting in the conventional or extended C-bands, the conventional or extended Ku-bands, or the conventional Ka-band that do not qualify for routine licensing under relevant criteria in §§ 25.211, 25.212, or 25.218.

* * * * *

17. Remove § 25.221.

§ 25.221 [Removed]

18. Remove § 25.222.

§ 25.222 [Removed]

19. Remove § 25.226.

§ 25.226 [Removed]

20. Remove § 25.227.

§ 25.227 [Removed]

21. Add § 25.228 to read as follows:

§ 25.228 Operating and coordination requirements for earth stations in motion (ESIMs).

(a) ESIM transmissions must comport with the applicable EIRP density limits in § 25.218, unless coordinated pursuant to the requirements in § 25.220.

(b) Each ESIM must be self-monitoring and, should a condition occur that would cause the ESIM to exceed its authorized off-axis EIRP density limits, the ESIM must automatically cease transmissions within 100 milliseconds, and not resume transmissions until the condition that caused the ESIM to exceed those limits is corrected.

(c) Each ESIM must be monitored and controlled by a network control and monitoring center (NCMC) or equivalent facility. Each ESIM must comply with a "disable transmission" command from the NCMC within 100 milliseconds of receiving the command. In addition, the NCMC must monitor the operation of each ESIM in its network, and transmit a "disable transmission" command to any ESIM that operates in such a way as to exceed the authorized off-axis EIRP density limit for that ESIM or for all ESIMs that simultaneously transmit on the same frequency to the same target satellite receiving beam. The NCMC must not allow the ESIM(s) under its control to resume transmissions until the condition that caused the ESIM(s) to exceed the authorized EIRP density limits is corrected.

(d) ESIM licensees must ensure installation of ESIM terminals on vehicles by qualified installers who have an understanding of the antenna's radiation environment and the measures best suited to maximize protection of the general public and persons operating the vehicle and equipment. An ESIM terminal exhibiting radiation exposure levels exceeding 1.0 mW/cm^2 in accessible areas, such as at the exterior surface of the radome, must have a label attached to the surface of the terminal warning about the radiation hazard and must include thereon a diagram showing the regions around the terminal where the radiation levels could exceed the maximum radiation exposure limit specified in 47 CFR §1.1310 Table 1.

(e) The following requirements govern all ESV operations.

(1) ESV operators must control all ESVs by a NCMC located in the United States, except that an ESV on U.S.-registered vessels may operate under control of a NCMC location outside the United States provided the ESV operator maintains a point of contact within the United States that will have the capability and authority to cause an ESV on a U.S.-registered vessel to cease transmitting if necessary.

(2) There must be a point of contact in the United States, with phone number and address, available 24 hours a day, seven days a week, with authority and ability to cease all emissions from the ESVs, either directly or through the facilities of a U.S. NCMC or a NCMC located in another country with which the United States has a bilateral agreement that enables such cessation of emissions.

(3) ESV NCMC operators communicating with ESVs on vessels of foreign registry must maintain detailed information on each such vessel's country of registry and a point of contact for the relevant administration responsible for licensing those ESVs.

(f) For all VMES operations, there must be a point of contact in the United States, with phone number and address, available 24 hours a day, seven days a week, with authority and ability to cease all emissions from the VMESs.

(g) The following requirements govern all ESAA operations.

(1) There must be a point of contact in the United States, with phone number and address, available 24 hours a day, seven days a week, with authority and ability to cease all emissions from the ESAAs.

(2) All ESAA terminals operated in U.S. airspace, whether on U.S.-registered civil aircraft or non-U.S.-registered civil aircraft, must be licensed by the Commission. All ESAA terminals on U.S.-registered civil aircraft operating outside of U.S. airspace must be licensed by the Commission, except as provided by section 303(t) of the Communications Act.

(3) Prior to operations within a foreign nation's airspace, the ESAA operator must ascertain whether the relevant administration has operations that could be affected by ESAA terminals, and must determine whether that administration has adopted specific requirements concerning ESAA operations. When the aircraft enters foreign airspace, the ESAA terminal must operate under the Commission's rules, or those of the foreign administration, whichever is more constraining. To the extent that all relevant administrations have identified geographic areas from which ESAA operations would not affect their radio operations, ESAA operators may operate within those identified areas without further action. To

the extent that the foreign administration has not adopted requirements regarding ESAA operations, ESAA operators must coordinate their operations with any potentially affected operations.

(h) The following requirements govern all operations in the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) frequency bands of ESVs receiving from or transmitting to GSO satellites in the Fixed-Satellite Service.

(1) ESVs must not operate in the 5925-6425 MHz (Earth-to-space) and 3700-4200 MHz (space-to-Earth) frequency bands on vessels smaller than 300 gross tons.

(2) ESV operators transmitting in the 5925-6425 MHz (Earth-to-space) frequency band to GSO satellites in the Fixed-Satellite Service (FSS) must not seek to coordinate, in any geographic location, more than 36 megahertz of uplink bandwidth on each of no more than two GSO FSS satellites.

(3) ESVs, operating while docked, for which coordination with terrestrial stations in the 3700-4200 MHz band is completed in accordance with § 25.251, will receive protection from such terrestrial stations in accordance with the coordination agreements, for 180 days, renewable for 180 days.

(4) ESVs in motion must not claim protection from harmful interference from any authorized terrestrial stations to which frequencies are already assigned, or any authorized terrestrial station to which frequencies may be assigned in the future in the 3700-4200 MHz (space-to-Earth) frequency band.

(5) ESVs operating within 200 km from the baseline of the United States, or within 200 km from a U.S.-licensed fixed service offshore installation, must complete coordination with potentially affected U.S.-licensed fixed service operators prior to operation. The coordination method and the interference criteria objective will be determined by the frequency coordinator. The details of the coordination must be maintained and available at the frequency coordinator, and must be filed with the Commission electronically via the International Bureau Filing System (*http://licensing.fcc.gov/myibfs/*) to be placed on public notice. The coordination notifications must be filed in the form of a statement referencing the relevant call signs and file numbers. Operation of each individual ESV may commence immediately after the public notice that identifies the notification sent to the Commission is released. Continuance of operation of that ESV for the duration of the coordination term must be dependent upon successful completion of the normal public notice process. If, prior to the end of the 30-day comment period of the public notice, any objections are received from U.S.-licensed Fixed Service operators that have been excluded from coordination, the ESV licensee must immediately cease operation of that particular station on frequencies used by the affected U.S.-licensed Fixed Service station until the coordination dispute is resolved and the ESV licensee informs the Commission of the resolution. As used in this section, "baseline" means the line from which maritime zones are measured. The baseline is a combination of the low-water line and closing lines across the mouths of inland water bodies and is defined by a series of baseline points that include islands and "low-water elevations," as determined by the U.S. Department of State's Baseline Committee.

(6) An ESV must automatically cease transmission if the ESV operates in violation of the terms of its coordination agreement, including, but not limited to, conditions related to speed of the vessel or if the ESV travels outside the coordinated area, if within 200 km from the baseline of the United States, or within 200 km from a U.S.-licensed fixed service offshore installation. Transmissions may be controlled by the ESV network control and monitoring center. The frequency coordinator may decide whether ESV operators should automatically cease transmissions if the vessel falls below a prescribed speed within a prescribed geographic area.

(7) ESV transmissions in the 5925-6425 MHz (Earth-to-space) band shall not exceed an EIRP spectral density towards the radio-horizon of 17 dBW/MHz, and shall not exceed an EIRP towards the radio-horizon of 20.8 dBW. The ESV network shall shut-off the ESV transmitter if either the EIRP spectral density towards the radio-horizon or the EIRP towards the radio-horizon is exceeded.

(i) For ESAA transmissions in the 14.0-14.5 GHz band from international airspace within line-of-sight of the territory of a foreign administration where fixed service networks have primary allocation in this band, the maximum power flux density (pfd) produced at the surface of the Earth by emissions from a single aircraft carrying an ESAA terminal must not exceed the following values unless the foreign Administration has imposed other conditions for protecting its fixed service stations:

$-132 + 0.5 \cdot \theta$	dB(W/(m^2 · MHz))	For	$\theta \leq 40°$
-112	dB(W/(m^2 · MHz))	For	$40° < \theta \leq 90°$

Where: θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal) and the aforementioned limits relate to the pfd under free-space propagation conditions.

(j) The following requirements govern all ESIMs transmitting to GSO satellites in the Fixed-Satellite Service in the 14.0-14.5 GHz band.

(1) Operations of ESIMs in the 14.0-14.2 GHz (Earth-to-space) frequency band within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the NASA TDRSS facilities on Guam (latitude 13°36′55″ N, longitude 144°51′22″ E), White Sands, New Mexico (latitude 32°20′59″ N, longitude 106°36′31″ W and latitude 32°32′40″ N, longitude 106°36′48″ W), or Blossom Point, Maryland (latitude 38°25′44″ N, longitude 77°05′02″ W) are subject to coordination with the National Aeronautics and Space Administration (NASA) through the National Telecommunications and Information Administration (NTIA) Interdepartment Radio Advisory Committee (IRAC). Licensees must notify the International Bureau once they have completed coordination. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. When NTIA seeks to provide similar protection to future TDRSS sites that have been coordinated through the IRAC Frequency Assignment Subcommittee process, NTIA will notify the Commission's International Bureau that the site is nearing operational status. Upon public notice from the International Bureau, all Ku-band ESIM licensees must cease operations in the 14.0-14.2 GHz band within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the new TDRSS site until the licensees complete coordination with NTIA/IRAC for the new TDRSS facility. Licensees must notify the International Bureau once they have completed coordination for the new TDRSS site. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. The ESIM licensee then will be permitted to commence operations in the 14.0-14.2 GHz band within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the new TDRSS site, subject to any operational constraints developed in the coordination process.

(2) Within 125 km (for ESVs and VMESs) or within radio line of sight (for ESAAs) of the NASA TDRSS facilities identified in paragraph (j)(1) of this section, ESIM transmissions in the 14.0-14.2 GHz (Earth-to-space) band shall not exceed an EIRP spectral density towards the horizon of 12.5 dBW/MHz, and shall not exceed an EIRP towards the horizon of 16.3 dBW.

(3) Operations of ESIMs in the 14.47-14.5 GHz (Earth-to-space) frequency band in the vicinity (for ESVs and VMESs) or within radio line of sight (for ESAAs) of radio astronomy service (RAS) observatories observing in the 14.47-14.5 GHz band are subject to coordination with the National Science Foundation (NSF). The appropriate NSF contact point to initiate coordination is Electromagnetic Spectrum Management Unit, NSF, Division of Astronomical Sciences, 2415 Eisenhower Avenue, Arlington VA 22314; Email: *esm@nsf.gov*. Licensees must notify the International Bureau once they have completed coordination. Upon receipt of the coordination agreement from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. Table 1 provides a list of each applicable RAS site, its location, and the applicable coordination zone.

Table 1—Applicable Radio Astronomy Service (RAS) Facilities and Associated Coordination Distances

Observatory	Latitude (north)	Longitude (west)	Radius (km) of coordination zone
Arecibo, Observatory, Arecibo, PR	18°20′37″	66°45′11″	Island of Puerto Rico.
Green Bank, WV	38°25′59″	79°50′23″	160.
Very Large Array, near Socorro, NM	34°04′44″	107°37′06″	160.
Pisgah Astronomical Research Institute, Rosman, NC	35°11′59″	82°52′19″	160.
U of Michigan Radio Astronomy Observatory, Stinchfield Woods, MI	42°23′56″	83°56′11″	160.
Very Long Baseline Array (VLBA) stations:			
Owens Valley, CA	37°13′54″	118°16′37″	160*.
Mauna Kea, HI	19°48′05″	155°27′20″	50.
Brewster, WA	48°07′52″	119°41′00″	50.
Kitt Peak, AZ	31°57′23″	111°36′45″	50.
Pie Town, NM	34°18′04″	108°07′09″	50.
Los Alamos, NM	35°46′30″	106°14′44″	50.
Fort Davis, TX	30°38′06″	103°56′41″	50.
North Liberty, IA	41°46′17″	91°34′27″	50.
Hancock, NH	42°56′01″	71°59′12″	50.
St. Croix, VI	17°45′24″	64°35′01″	50.

*Owens Valley, CA operates both a VLBA station and single-dish telescopes.

When NTIA seeks to provide similar protection to future RAS sites that have been coordinated through the IRAC Frequency Assignment Subcommittee process, NTIA will notify the Commission's International Bureau that the site is nearing operational status. Upon public notice from the International Bureau, all Ku-band ESIMs licensees must cease operations in the 14.47-14.5 GHz band within the relevant geographic zone (160 kms for single-dish radio observatories and Very Large Array antenna systems and 50 kms for Very Long Baseline Array antenna systems for ESVs and VMESs, radio line of sight for ESAAs) of the new RAS site until the licensees complete coordination for the new RAS facility. Licensees must notify the International Bureau once they have completed coordination for the new RAS site and must submit the coordination agreement to the Commission. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party opposed the operations. The ESIMs licensee then will be permitted to commence operations in the 14.47-14.5 GHz band within the relevant coordination distance around the new RAS site, subject to any operational constraints developed in the coordination process.

(4) ESIMs licensees must use Global Positioning Satellite-related or other similar position location technology to ensure compliance with the provisions of subparagraphs 1-3 of this paragraph.

22. In § 25.258, revise paragraph (b) to read as follows:

§ 25.258 Sharing between NGSO MSS feeder-link stations and GSO FSS services in the 29.25-29.5 GHz band.

* * * * *

(b) Licensed GSO FSS earth stations in the vicinity of operational NGSO MSS feeder-link earth station complexes must, to the maximum extent possible, operate with frequency/polarization selections that will minimize unacceptable interference with reception of GSO FSS and NGSO MSS uplink transmissions in the 29.25-29.5 GHz band. Earth station licensees operating with GSO FSS systems shall

be capable of providing earth station locations to support coordination of NGSO MSS feeder link stations under paragraphs (a) and (c) of this section. Operation of ubiquitously deployed GSO FSS earth stations in the 29.25-29.5 GHz frequency band must conform to the rules contained in § 25.218(i).

* * * * *

23. In § 25.287, remove paragraph (d):

§ 25.287 Requirements pertaining to operation of mobile stations in the NVNG, 1.5/1.6 GHz, 1.6/2.4 GHz, and 2 GHz Mobile-Satellite Service bands.

* * * * *

(d) [Removed]

24. Add § 25.290 to read as follows:

§ 25.290 Responsibility of licensee for blanket-licensed earth station operation.

The holder of an FCC blanket earth station license is responsible for operation of any earth station under that license. Operators of satellite networks and systems must not transmit communications to or from such earth stations in the United States unless such communications are authorized under a service contract with the holder of a pertinent FCC blanket earth station license or under a service contract with another party with authority for such operation delegated by such a blanket licensee.

APPENDIX C

REDESIGNATION TABLES

Table 1 Redesignation of Paragraphs in Section 25.130 to Paragraphs in Section 25.115

Existing Paragraph in Section 25.130	Revised Paragraph in Section 25.115
(a)(1)	(a)(5)(i)
(a)(2)	(a)(5)(ii)
(a)(3)	(a)(5)(iii)
(a)(4)	(a)(5)(iv)
(a)(5)	(a)(5)(v)
(b)	(a)(6)
(c)	(a)(7)
(d)	(a)(8)
(f)	(a)(9)
(g)	(a)(10)
(g)(1)	(a)(10)(i)
(g)(2)	(a)(10)(ii)
Note to (g)	Note to (a)(1)

Table 2: Redesignation of Paragraphs in Section 25.131 to Paragraphs in Section 25.115

Existing Paragraph in Section 25.131	Revised Paragraph in Section 25.115
(a)	(b)
(b)	(b)(1)
(c)	(b)(2)
(d)	(b)(3)
(e)	(b)(4)
(f)	(b)(5)
(g)	(b)(6)
(h)	(b)(7)
(i)	(b)(8)
(j)(1)	(b)(9)(i)
(j)(2)	(b)(9)(ii)

Table 3: Redesignation of Paragraphs in Section 25.138 to Paragraphs in Section 25.218

Existing Paragraph in Section 25.138	Revised Paragraph in Section 25.218
(a)(8)	(h)(2)
(a)(9)	(h)(1)
(a)(10)	(h)(3)
(a)(12)	(h)(5)
(a)(13)	(h)(6)

Table 4: Redesignation of Paragraphs in Section 25.221 to Paragraphs in Section 25.228

Existing Paragraph in Section 25.221	Revised Paragraph in Section 25.228
(a)(9)	(h)(1)
(a)(8)	(h)(2)
(a)(10)	(h)(3)

(a)(11)	(h)(4)
(a)(12)	(h)(5)
(a)(13)	(h)(6)

Table 5: Redesignation of Paragraphs in Sections 25.221, 25.222, 25.226, and 25.227 to Paragraphs in Section 25.115

Existing Paragraph in Sections				
25.221	**25.222**	**25.226**	**25.227**	**Revised Paragraph in Section 25.115**
(a)(4)	(a)(4)			(e)(2)
		(a)(5)		(f)
			(a)(6)	(g)(1)
(b)(2)	(b)(2)	(b)(2)	(b)(2)	(l)(2), (m)(2), (n)(2)
(b)(2)(i)	(b)(2)(i)	(b)(2)(i)	(b)(2)(i)	(l)(2), (m)(2), (n)(2)
(b)(2)(ii)	(b)(2)(ii)	(b)(2)(ii)	(b)(2)(ii)	(l)(2), (m)(2), (n)(2)
(b)(4)	(b)(4)	(b)(4)	(b)(4)	(l)(3)(ii), (m)(3)(ii), (n)(3)(ii)
(b)(5)	(b)(5)	(b)(6)	(b)(6)	(l)(3)(iii), (m)(3)(iii), (n)(3)(iii)
(b)(6)	(b)(6)	(b)(8)	(b)(8)	(l)(3)(iv), (m)(3)(iv), (n)(3)(iv)

Table 6: Redesignation of Paragraphs in Section 25.204 to Paragraphs in Section 25.228

Existing Paragraph in Section 25.204	**Revised Paragraph in Section 25.228**
(h)	(h)(7)
(i)	(j)(2)
(j)	(j)(2)
(k)	(j)(2)

APPENDIX D

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Further Notice of Proposed Rulemaking in the Matter of Comprehensive Review of Licensing and Operating Rules for Satellite Services.[2] The Commission sought written public comment on the proposals in the *Further Notice*, including comment on the IRFA. No comments were received on the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for, and Objectives of, the Rules

2. This Order adopts changes to Part 25 of the Commission's rules, which governs licensing and operation of space stations and earth stations for the provision of satellite communication services.[4] We revise the rules to, among other things, facilitate the deployment of Earth Stations in Motion (ESIMs) and reduce the regulatory burdens on those ESIMs by streamlining the rules governing ESIMs, eliminating redundant and unnecessary regulations, expanding the frequency bands licensed by ESIMs regulations, and consolidating regulations where possible.

3. This Order revises multiple sections of Part 25 of the rules. Specifically, it revises the rules to:

1) Expand the frequency bands for which routine licensing of ESIMs is available to include the 18.3-18.8 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz, and 29.25-30 GHz frequency bands;
2) Eliminate the antenna pointing accuracy requirement for ESIMs;
3) Allow ESIM applicants to certify compliance with the antenna gain pattern masks in Section 25.209 and the antenna input power density limits in Section 25.212 in lieu of providing off-axis EIRP data;
4) Consolidate the technical and operational rules for all types of ESIMs that are spread over four rule sections, into one rule section;
5) Consolidate the application rules for all types of ESIMs that are spread over four rule sections, into Section 25.115, the general earth station application rule section;
6) Cross-reference certain rules governing the application, technical, or operating requirements for all GSO FSS earth stations instead of duplicating those provisions in the rules pertaining specifically to ESIMs;
7) Clarify the requirements for blanket-licensed earth station licensees to be responsible for the operation of all earth stations operating under their licenses;
8) Update and improve definitions.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

4. No party filing comments in this proceeding responded to the IRFA, and no party filing comments in this proceeding otherwise argued that the policies and rules proposed in this proceeding

[1] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996) (CWAAA).

[2] *Further NPRM*, 29 FCC Rcd at 12230-34, Appendix D.

[3] *See* 5 U.S.C. § 604.

[4] 47 CFR Part 25, Satellite Communications.

would have a significant economic impact on a substantial number of small entities. The Commission has, nonetheless, considered any potential significant economic impact that the rule changes may have on the small entities which are impacted. On balance, the Commission believes that the economic impact on small entities will be positive rather than negative, and that the rule changes move to streamline the Part 25 requirements.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

5. Pursuant to the Small Business Jobs Act of 2010, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration, and to provide a detailed statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules May Apply

6. The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the rules adopted herein.[5] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[6] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[7] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).[8] Below, we describe and estimate the number of small entity licensees that may be affected by the adopted rules.

Satellite Telecommunications and All Other Telecommunications

7. The rules adopted in this Order will affect some providers of satellite telecommunications services. Satellite telecommunications service providers include satellite and earth station operators. Since 2007, the SBA has recognized two census categories for satellite telecommunications firms: "Satellite Telecommunications" and "Other Telecommunications." Under the "Satellite Telecommunications" category, a business is considered small if it had $32.5 million or less in annual receipts.[9] Under the "Other Telecommunications" category, a business is considered small if it had $32.5 million or less in annual receipts.[10]

8. The first category of Satellite Telecommunications "comprises establishments primarily engaged in providing point-to-point telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications."[11] For this category, Census Bureau data

---

[5] 5 U.S.C. § 604(a)(3).

[6] 5 U.S.C. § 601(6).

[7] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

[8] Small Business Act, 15 U.S.C. § 632 (1996).

[9] *See* 13 CFR § 121.201, NAICS code 517410.

[10] *See* 13 CFR § 121.201, NAICS code 517919.

[11] U.S. Census Bureau, 2007 NAICS Definitions, "517410 Satellite Telecommunications."

for 2007 show that there were a total of 512 satellite communications firms that operated for the entire year.[12] Of this total, 482 firms had annual receipts of under $25 million.[13]

9. The second category of Other Telecommunications is comprised of entities "primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry."[14] For this category, Census Bureau data for 2007 show that there were a total of 2,383 firms that operated for the entire year.[15] Of this total, 2,346 firms had annual receipts of under $25 million.[16] We anticipate that some of these "Other Telecommunications firms," which are small entities, are earth station applicants/licensees that will be affected by our adopted rule changes.

10. We anticipate that our rule changes will have an impact on earth and space station applicants and licensees. Space station applicants and licensees, however, rarely qualify under the definition of a small entity. Generally, space stations cost hundreds of millions of dollars to construct, launch and operate. Consequently, we do not anticipate that any space station operators are small entities that would be affected by our actions.

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

11. The Order adopts a number of rule changes that will affect reporting, recordkeeping and other compliance requirements for earth and space station operators. Most changes, as described below, will decrease the burden for all businesses operators, especially firms that hold licenses to operate earth stations.

12. We streamline and reorganize the rules to facilitate improved compliance. First, the Order simplifies information collections in applications for earth station licenses. Specifically, the Order eliminates reporting requirements that are more burdensome than necessary. For example, under Section 25.115, applicants may provide certification rather than a detailed showing to meet the burden to prove that the ESIM system is capable of detecting and automatically ceasing emissions when an individual ESIM transmitter exceeds the relevant off-axis EIRP spectral density limits specified in Section 25.218, or the limits provided to the target satellite operator for operation under Section 25.220.

13. Another example is that we see no reason to continue to require earth station to provide logs for the vehicle location, transmit frequency, channel bandwidth, and target satellite of ESIM transmissions from an ESIM operator. The Order also expands routine licensing eligibility for ESIMs operations to include conventional Ka-band frequencies.

14. We amend the rules to eliminate the antenna pointing requirement which gives ESIM operators more flexibility in anomalous situations. Additionally, by eliminating the antenna pointing requirement, the showings regarding antenna pointing accuracy in paragraphs (b)(1) of Sections 25.221,

---

[12] *See* http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-_skip=900&-ds_name=EC0751SSSZ4&-_lang=en.

[13] *Id*.

[14] U.S. Census Bureau, 2007 NAICS Definitions, "517919 Other Telecommunications," http://www.census.gov/naics/2007/def/ND517919.HTM.

[15] *See* 13 CFR § 121.201, NAICS code 517919.

[16] U.S. Census Bureau, 2007 Economic Census, Subject Series: Information, Table 5, "Establishment and Firm Size: Employment Size of Firms for the United States: 2007 NAICS Code 517919" (issued Nov. 2010).

25.222, 25.226, and 25.227 will no longer be required. Thus, we eliminate that requirement as well. We also delete requirements for VMES and ESAA applicants to certify that they will comply with certain rule sections.

F. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

15. The RFA requires an agency to describe any significant, specifically small business, alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rules for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."[17]

16. The Commission is aware that some of the revisions may impact small entities. The *NPRM* sought comment from all interested parties, and small entities were encouraged to bring to the Commission's attention any specific concerns they may have with the proposals outlined in the *NPRM*. No commenters raised any specific concerns about the impact of the revisions on small entities. The revisions eliminate unnecessary requirements and expand routine processing to applications in additional frequency bands, among other changes. Together, the revisions in this Order lessen the burden of compliance on small entities with more limited resources than larger entities.

17. The adopted changes for earth station licensing clarify requirements for routine licensing and expand applicability of routine licensing standards. Each of these changes will lessen the burden in the licensing process. Specifically, this Order adopts revisions eliminates some filing requirements, and eliminates the antenna pointing accuracy requirements in such a way that applicant burden will be reduced. Thus, the revisions will ultimately lead to benefits for small earth station operators in the long-term.

G. Report to Congress

18. The Commission will send a copy of this Second Report and Order, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act.[18] In addition, the Commission will send a copy of this Order, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of this Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.[19]

H. Legal Basis

19. The action is authorized under Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 161, 303(c), 303(f), 303(g), and 303(r).

[17] 5 U.S.C. § 603(c)(1)-(c)(4).

[18] *See* 5 U.S.C. § 801(a)(1)(A).

[19] *See* 5 U.S.C. § 604(b).

APPENDIX E

Proposed Rules

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 CFR parts 2 and 25 as follows:

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation for part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. Page 52 is revised.

b. In the list of non-Federal Government (NG) Footnotes, footnoteNG527A is revised.

The revisions and additions read as follows:

§ 2.106 Table of Frequency Allocations.

* * * * *

	17.8-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A (Earth-to-space) 5.516 MOBILE 5.519		17.8-18.3 FIXED-SATELLITE (space-to-Earth) US334 G117 US519	17.8-18.3 FIXED Fixed-satellite (space-to-Earth) NG527A US334 US519	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
18.1-18.4 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B (Earth-to-space) 5.520 MOBILE 5.519 5.521			18.3-18.6 FIXED-SATELLITE (space-to-Earth) US334 G117 US139	18.3-18.6 FIXED-SATELLITE (space-to-Earth) NG164 NG527A US139 US334	Satellite Communications (25)
18.4-18.6 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B MOBILE					
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B MOBILE except aeronautical mobile Space research (passive) 5.522A 5.522C	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.522B MOBILE except aeronautical mobile SPACE RESEARCH (passive) 5.522A	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B MOBILE except aeronautical mobile Space research (passive) 5.522A	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) US255 US334 G117 SPACE RESEARCH (passive) US139 US254	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) US255 NG164 NG527A SPACE RESEARCH (passive) US139 US254 US334	
18.8-19.3 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.523A MOBILE			18.8-20.2 FIXED-SATELLITE (space-to-Earth) US334 G117	18.8-19.3 FIXED-SATELLITE (space-to-Earth) NG165 NG527A US139 US334	
19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.523B 5.523C 5.523D 5.523E MOBILE				19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) NG166 NG527A US334	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Mobile-satellite (space-to-Earth) 5.524	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 5.529	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Mobile-satellite (space-to-Earth) 5.524		19.7-20.2 FIXED-SATELLITE (space-to-Earth) NG527A MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25)

20.1-20.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528	US139	5.525 5.526 5.527 5.528 5.529 US334	
20.2-21.2 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) 5.524	20.2-21.2 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) G117	20.2-21.2 Standard frequency and time signal-satellite (space-to-Earth)	Page 52

* * * * *

NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

* * * * *

NG527A Earth Stations in Motion (ESIMs), as regulated under 47 CFR part 25, are an application of the fixed-satellite service and the following provisions shall apply:

(a) In the band 10.7-11.7 GHz (space-to-Earth), ESIMs may be authorized to communicate with geostationary satellites, subject to the condition that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed service.

(b) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth), 19.3-19.4 GHz (space-to-Earth, 19.6-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites on a primary basis.

(c) In the band 17.8-18.3 GHz (space-to-Earth), ESIMs may be authorized to communicate with geostationary satellites on a secondary basis.

(d) In the bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites, subject to the condition that these earth stations may not cause harmful interference to, or claim protection from, non-geostationary-satellite systems in the fixed-satellite service.

* * * * *

PART 25 – SATELLITE COMMUNICATIONS

The Federal Communications Commission proposes to amend title 47, part 25 of the Code of Federal Regulations as follows:

1. The authority citation for part 25 continues to read as follows:

Authority: 47 U.S.C. 154, 301, 302, 303, 307, 309, 310, 319, 332, 605, and 721, unless otherwise noted.

2. In § 25.202, revise paragraphs (a)(8) and (a)(10) to read as follows and remove and reserve paragraph (a)(11):

§ 25.202 Frequencies, frequency tolerance, and emission limits.

(a) * * *

(8) The following frequencies are available for use by Earth Stations on Vessels (ESVs) communicating with GSO FSS space stations, subject to the provisions in § 2.106 of this chapter:

3700-4200 MHz (space-to-Earth)

5925-6425 MHz (Earth-to-space)

* * * * *

(10) The following frequencies are available for use by Earth Stations in Motion (ESIMs) communicating with GSO FSS space stations, subject to the provisions in § 2.106 of this chapter:

10.7-11.7 GHz (space-to-Earth)
11.7-12.2 GHz (space-to-Earth)
14.0-14.5 GHz (Earth-to-space)
17.8-18.3 GHz (space-to-Earth)
18.3-18.8 GHz (space-to-Earth)
18.8-19.3 GHz (space-to-Earth)
19.3-19.4 GHz (space-to-Earth)
19.6-19.7 GHz (space-to-Earth)
19.7-20.2 GHz (space-to-Earth)
28.35-28.6 GHz (Earth-to-space)
28.6-29.1 GHz (Earth-to-space)
29.25-30.0 GHz (Earth-to-space)

APPENDIX F

Initial Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act (RFA),[1] the Commission has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules that we seek comment on in this Notice. We request written public comments on this IRFA. Commenters must identify their comments as responses to the IRFA and must file the comments by the deadlines for comments on the Notice provided above in Section V.B. The Commission will send a copy of the Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.[2] In addition, the Notice and IRFA (or summaries thereof) will be published in the Federal Register.[3]

A. Need for, and Objectives of, the Proposed Rules

2. The Further Notice of Proposed Rulemaking seeks comment on extending the use of other frequency bands in which blanket-licensed FSS earth stations are permitted for ESIMs communicating with GSO FSS space stations.

B. Legal Basis

3. The action would be authorized under Sections 4(i), 7(a), 10, 303, 308(b), and 316 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 160, 303,308(b), 316.

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules May Apply

4. The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the proposed rules, if adopted.[4] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[5] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[6] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).[7]

5. **Satellite Telecommunications.** This category comprises firms "primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or

[1] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq.*, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[2] *See* 5 U.S.C. § 603(a).

[3] *Id.*

[4] 5 U.S.C. § 603(b)(3).

[5] 5 U.S.C. § 601(6).

[6] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

[7] Small Business Act, 15 U.S.C. § 632 (1996).

reselling satellite telecommunications."[8] The category has a small business size standard of $32.5 million or less in average annual receipts, under SBA rules.[9] For this category, Census Bureau data for 2012 show that there were a total of 333 firms that operated for the entire year.[10] Of this total, 299 firms had annual receipts of less than $25 million.[11] Consequently, we estimate that the majority of satellite telecommunications providers are small entities.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

6. The FNPRM seeks comment on extending the use of other frequency bands in which blanket-licensed FSS earth stations are permitted for ESIMs communicating with GSO FSS space stations. This would reduce paperwork costs for such satellite operators who would no longer need to file separate application materials for these systems. Operators will also no longer need to request waivers for operations that would be covered under specific regulations.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

7. The RFA requires an agency to describe any significant, specifically small business, alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rules for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities."[12]

8. The NPRM seeks comments on extending the use of other frequency bands in which blanket-licensed FSS earth stations are permitted for ESIMs communicating with GSO FSS space stations. This would reduce the economic and other impacts for these service providers by reducing the regulatory burden. Specifically, providers would no longer have to file applications that are outside of the standard rule provisions. However, the Commission invites comment on this change and any alternatives.

F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rules

9. None.

---

[8] U.S. Census Bureau, 2012 NAICS Definitions, "517410 Satellite Telecommunications"; http://www.census.gov/naics/2007/def/ND517410.HTM.

[9] 13 CFR § 121.201, NAICS code 517410.

[10] U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ4, Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the United States: 2012, NAICS code 517410 http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ4&prodType=table.

[11] *Id.*

[12] 5 U.S.C. § 603(c)(1)-(c)(4).

STATEMENT OF
CHAIRMAN AJIT PAI

Re: *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 17-95.

During a recent visit to Moab, Utah, I held a videoconference with the school superintendent of a fairly remote district in the state. He told me that district's student-athletes often had to travel several hours in order to play away games. Fortunately, some of their school buses had connectivity, which enabled them to do homework on long drives.

That vignette got me thinking about on-the-road connectivity, including the need to promote satellite-related earth stations in motion (or "ESIMs," for those who are more acronym-inclined). ESIMs are used to deliver broadband to ships, vehicles, and aircraft—basically, any non-stationary platform, especially those that can't be served using other communications technologies.

Today, the FCC advances the use of ESIMs in several ways. First, we allow ESIMs to operate in more satellite frequencies than they can currently use. We aim to spark innovation and investment, encourage deployment, and hopefully connect even more consumers in this fast-growing segment of the satellite marketplace. Second, we explore whether to add even more spectrum bands to the ESIMs-approved list. And third, we simplify the three sets of rules for the three different kinds of ESIMs by establishing a single, unified regulatory framework. This will provide certainty for ESIM operators and their customers.

Our forward-thinking approach to ESIMs reflects our overall strategy for closing the digital divide: to encourage any and all technologies that can connect those for whom Internet access is more aspiration than reality—including many other students on many long bus rides in Utah.

Many thanks to those who worked on this item. In particular, thanks to Jose Albuquerque, Paul Blais, Stephen Duall, Chip Fleming, Cindy Spiers, Jennifer Gilsenan, Walt Strack, Tom Sullivan, and Troy Tanner from the International Bureau; Julie Knapp, Nicholas Oros, Aspasia Paroutsas, and Jamison Prime in the Office of Engineering and Technology; Steve Buenzow from the Wireless Telecommunications Bureau; and Deborah Broderson, David Horowitz, and Bill Richardson from the Office of General Counsel.

STATEMENT OF
COMMISSIONER MICHAEL O'RIELLY

Re: *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service,* IB Docket No. 17-95.

Having been a recent cross-country traveler on an older airplane without any entertainment system, my appreciation of adequate broadband on moving vehicles has only increased. As any frequent flyer – or not-so-frequent flyer – knows, the Wi-Fi on airplanes is generally lacking. However, this shortcoming doesn't have to be the case.

With the fairly technical item before us today, the Commission streamlines and consolidates the rules for Earth Stations in Motion, commonly referred to as just ESIMs; permits operations in additional spectrum bands to facilitate communications with GSO satellites; and seeks comment on future frequencies for ESIMs. Hopefully, our actions will facilitate and improve satellite broadband on ships, planes, trains and automobiles, not only to provide access to Americans as they travel, but also for the benefit of commerce and other uses.

I approve.

STATEMENT OF
COMMISSIONER BRENDAN CARR

Re: *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 17-95.

It often takes the modern-day version of duct tape and bailing wire to deploy broadband in the hardest-to-serve parts of the country. This work is done by people with names like Bear, who works in the Nevada desert bringing broadband to a community that did not even see telephone service until the 1960s. People like Blake, who strings aerial fiber on utility poles hundreds of miles above the Arctic circle. And people like Darren and Matt, who worked in the 106 degree Arizona heat two weeks ago to deploy a provider's first 5G small cell in the state. These are tough jobs, and right now we have the best crews in the world working to get more broadband into more communities. Today's decision aims to make it a little easier to serve rural and remote parts of the country. We do this by proposing to give satellite providers greater flexibility in reaching consumers who often cannot be served using other technologies. I am glad that we are looking to promote new services and innovations in these satellite bands. So the item has my support.

STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL

Re: *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service,* IB Docket No. 17-95.

There's no denying the dramatic way that mobile broadband has changed the world. It's a part of how we live, work, learn, and play. Yet we are still in the early stages of our always-on, always-connected future.

That means the true potential for mobile broadband is not fully realized. So today, we take action to start to change that. We make it possible for some of the most modern satellite technologies to expand the reach of our networks to some of the most challenging environments—our planes, ships, and vehicles. We do this by facilitating the operation of Earth Stations in Motion with Fixed-Satellite Service geostationary-orbit satellites in the Ka-band and by simplifying our rules to facilitate investment and reduce the regulatory burden. A fresh look at our rules is warranted because new capabilities have allowed the development of more spectrally efficient, ultra-small terminals that can provide broadband communications to support voice, video, and high-speed data. That means these satellite systems can support a whole new range of global connectivity for more efficient and effective transportation systems. This is exciting—and I support today's action.