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

In the Matter of	)	
	)	
Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands	)	IB Docket No. 12-376
	)	
Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service	)	IB Docket No. 05-20 (proceeding terminated)

NOTICE OF PROPOSED RULEMAKING AND REPORT AND ORDER

Adopted: December 20, 2012 **Released: December 28, 2012**

Comment Date: [75 days after date of publication in the Federal Register]
Reply Comment Date: [105 days after date of publication in the Federal Register]

By the Commission: Chairman Genachowski issuing a statement.

TABLE OF CONTENTS

Heading Paragraph #

I. INTRODUCTION 1
II. EXECUTIVE SUMMARY 2
III. BACKGROUND 6
IV. DISCUSSION 11
A. ESAA Allocation 12
1. Operations on a Primary Basis in the 11.7-12.2 GHz (space-to-Earth) Band 13
2. Operations on an Unprotected Basis in the 10.95-11.2 GHz and 11.45-11.7 GHz Bands (space-to-Earth) Within the United States 18
3. Operations on a Secondary Basis in the 14.0-14.5 GHz Band (Earth-to-Space) 22
B. Coordination 25
1. Coordination with the Space Research Service in the 14.0-14.2 GHz Band 25
2. Coordination with Radioastronomy Service Stations in the 14.47-14.5 GHz Band 30
a. Coordination Procedure 31
b. Relevant RAS Facilities 36
c. Future RAS Facilities 39
C. Technical Rules 41

1. Introduction 41
2. Off-Axis EIRP Density Limits Along the GSO Arc 44
3. Off-Axis EIRP Density in Directions Other than Along the GSO ARC 54
4. Variations in Antenna Gain Pattern and Transmit EIRP Density 57
5. Antenna Pointing Accuracy Requirement Adopted 62
6. Shut-off Capability 67
7. Dynamic EIRP Density Systems 72
8. Higher EIRP Density Levels Permitted if Coordinated 79
9. Antenna Performance Standards for Receive Terminals in the 11.7-12.2 GHz (space-to-Earth) Band 84
10. Tracking/Data Logging Requirements 86
11. Contention Protocols 90
12. Protection of Terrestrial Systems 94
a. Power-flux Density Limits to Protect FS 94
b. Minimum Elevation Angle 99
D. Licensing Considerations 101
1. Blanket and Individual Terminal Licensing 102
2. License Term 105
3. Network Control and Monitoring Center Requirements 106
4. ALSAT and the Permitted List Point of Communication Designations 109
5. Information Requirements 113
6. Procedures for Conforming Amendments/Modification Applications 114
E. Regulation of ESAA Operations on U.S.-Registered and Non-U.S.-Registered Aircraft 119
1. U.S.-Registered Aircraft 120
a. Operations In or Near Foreign Nations. 121
b. Operations Over International Waters. 123
2. Non-U.S.-Registered Aircraft Operating in U.S. Airspace 125
F. Law Enforcement 132
G. Aeronautical Mobile Satellite (Route) Service 139
H. Conclusion 141
V. NOTICE OF PROPOSED RULEMAKING 142
A. Allocations 142
VI. PROCEDURAL MATTERS 143
A. Regulatory Flexibility Act 143
B. Paperwork Reduction Act of 1995 145
C. Congressional Review Act 147
D. *Ex Parte* Rules 148
E. Filing Requirements 149
VII. ORDERING CLAUSES 153
APPENDIX A – Final Regulatory Flexibility Analysis
APPENDIX B – Initial Regulatory Flexibility Analysis
APPENDIX C - Final Rules
APPENDIX D - Proposed Rules
APPENDIX E - List of Commenters

I. INTRODUCTION

1. In this *Report and Order*, we provide for the efficient licensing of two-way in-flight broadband services, including Internet access, to passengers and flight crews aboard commercial airliners and private aircraft. These rules will enhance competition in an important sector of the mobile telecommunications market in the United States and promote the widespread availability of Internet

access to aircraft passengers. The *Report and Order* establishes technical and licensing rules for Earth Stations Aboard Aircraft (ESAA), *i.e.*, earth stations on aircraft communicating with Fixed-Satellite Service (FSS) geostationary-orbit (GSO) space stations operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz (space-to-Earth or downlink) and 14.0-14.5 GHz (Earth-to-space or uplink) frequency bands. Installed on the exterior of the aircraft, the earth stations provide a satellite-based communications link between the airborne commercial and private aircraft and terrestrial communications systems. Adopting these rules will reduce the administrative burdens on both applicants and the Commission, should allow the Commission to process ESAA applications up to 50 percent faster, and will speed the deployment of ubiquitous broadband service aboard commercial and private aircraft.

II. EXECUTIVE SUMMARY

2. This *Report and Order* implements ESAA as an application of the FSS. The FSS involves communication between satellites in orbit and earth stations in fixed locations. Advancing technology, however, has made it possible for mobile platforms to maintain antenna pointing accuracy sufficient to keep an earth station antenna focused on a satellite while maintaining communications and preventing interference with adjacent satellites. There are currently two mobile applications in the FSS: Earth Stations on board Vessels (ESV) and Vehicle-Mounted Earth Stations (VMES), which provide satellite communications with vessels and land vehicles respectively. ESAA is the "third leg" of mobile applications in the FSS. By means of satellite antennas mounted on the exterior of aircraft, satellites will be able to communicate with mobile devices used by passengers and crew of those aircraft. The satellite antenna will carry the signal to and from the aircraft, and mobile technologies such as Wi-Fi will provide communications within the aircraft's hull.

3. Since 2001, we have authorized, on an *ad hoc* basis, the use of GSO FSS space stations to provide wireless connectivity to airborne aircraft. These authorizations allow the provision of broadband services to passengers on a non-harmful interference basis, and several airlines are operating under the terms of those authorizations.

4. This *Report and Order* formalizes ESAA as a licensed application in the FSS by:

- Allocating ESAA on a primary basis in the 11.7-12.2 GHz (space-to-Earth) band,
- Allocating ESAA on an unprotected basis in the 10.95-11.2 GHz and 11.45-11.7 GHz (space-to-Earth) bands,
- Allocating ESAA on a secondary basis in the 14.0-14.5 GHz band (Earth-to-space),
- Requiring ESAA licensees to coordinate their operations with stations in the Space Research Service and the Radioastronomy Service to prevent interference,
- Adopting technical rules for the operation of ESAA systems to ensure that ESAA systems do not interfere with other FSS users or terrestrial Fixed Service (FS) users,
- Adopting licensing requirements and operational requirements for ESAA for both U.S.-registered aircraft and for non-U.S.-registered aircraft operating in U.S. airspace,
- Requiring ESAA licensees to operate consistently with the Communications Assistance to Law Enforcement Act (CALEA), and
- Declining at this time to extend certain requirements concerning 1.5/1.6 GHz safety services to other frequency bands, including those used by ESAA.

5. This *Notice of Proposed Rulemaking* requests comment on a proposal to elevate the allocation status of ESAA in the 14.0-14.5 GHz band from secondary to primary, which would make the ESAA allocation equal to the allocations of ESV and VMES. This *Notice of Proposed Rulemaking and Report and Order* implements ESAA as an application whose allocation status and technical and

licensing rules are consistent with those of ESV and VMES. ESAA will allow licensees to bring broadband service to an underserved sector: passengers and crew aboard aircraft in flight.

III. BACKGROUND

6. Historically, FSS has been a service involving communications between earth stations at given positions communicating with one or more space stations. Typically, the given positions of an earth station may be specified fixed points or fixed points within a specified area.[1] Most FSS services are provided by space stations operating in GSO approximately 22,000 miles above the Earth's equator maintaining the same position relative to given location on the Earth's equator. Generally, U.S.-licensed GSO FSS space stations operating in the bands at issue in this proceeding are spaced approximately two degrees apart along the geostationary orbit.[2] Two-degree spacing required the adoption of stringent limits on the off-axis gain, or off-axis equivalent isotropically radiated power (EIRP) density, of an earth station antenna pointed toward space stations other than the target space station. Traditionally, to meet the technical constraints necessary in a two-degree orbital spacing environment, earth stations utilized narrow beam transmissions using high gain parabolic antennas sited in a single place and carefully pointed at the space stations with which they are to communicate.

7. Technological advances have made it feasible for companies to employ antenna configurations and tracking systems that allow the transmissions from an earth station to remain centered on the desired GSO FSS space station, while the platform upon which the transmitting earth station antenna is mounted moves. Recognizing these advances in antenna system design, in 2005, we adopted licensing and technical rules for ESV to communicate with GSO FSS space stations while in motion, and defined ESV as a primary application of the FSS with mobile capabilities.[3] In 2009, we similarly adopted licensing and technical rules for VMES.[4] Like ESVs, VMES are mobile earth stations that communicate with GSO FSS space stations, and like ESVs, we defined VMES as a mobile application of the FSS. Collectively, although mounted on mobile platforms, the ability of these new antenna systems to satisfy stringent technical criteria allows us to treat these systems, in many respects, as if they were communicating with GSO FSS space stations from a fixed position. This *Report and Order* completes the land, sea, air triad of satellite mobile broadband services, setting forth the technical and licensing rules

[1] FSS also includes satellite-to-satellite links and feeder links for other radiocommunication services. 47 C.F.R. § 2.1(c).

[2] *See generally Licensing of Space Stations in the Domestic Fixed-Satellite Service and Related Revisions of Part 25 of the Rules and Regulations*, CC Docket No. 81-704, Report and Order, 54 Rad. Reg. 2d (P&F) 577 (1983) (*Two-Degree Spacing Order*) (adopting 2º orbital spacing policy to maximize the number of in-orbit satellites operating in the Ku- and C-bands); *on reconsideration*, 99 F.C.C. 2d 737 (1985). *See also 2000 Biennial Regulatory Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage By, Satellite Network Earth Stations and Space Stations; Amendment of Part 25 of the Commission's Rules and Regulations to Reduce Alien Carrier Interference Between Fixed-Satellites at Reduced Orbital Spacings and to Revise Application Procedures for Satellite Communication Services*, IB Docket No. 00-248, CC Docket No. 86-496, Fifth Report and Order in IB Docket No. 00-248 and Third Report and Order in CC Docket No. 86-496, 20 FCC Rcd 5666, 5674, ¶ 17 (2005) *(Streamlining Fifth Report and Order)*.

[3] *Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, IB Docket No. 02-10, Report and Order, FCC 04-286, 20 FCC Rcd 674 (2005) (*ESV Order*); Order on Reconsideration, 24 FCC Rcd 10369 (2009); Second Order on Reconsideration, 27 FCC Rcd 8555 (2012) (*ESV Second Reconsideration Order*).

[4] *Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum and Adopt Service Rules and Procedures to Govern the Use of Vehicle-Mounted Earth Stations in Certain Frequency Bands Allocated to the Fixed-Satellite Service,* IB Docket No. 07-101, Report and Order, 24 FCC Rcd 10414 (2009) *(VMES Order)*, *recon. pending*.

for satellite delivery of advanced communication services, including two-way broadband data services, to be delivered to passengers in-flight. In today's decision, we name this air-based mobile application of the FSS "earth stations aboard aircraft (ESAA)."

8. The three types of mobile platform two-way terminals operating in FSS frequency bands (ESV, VMES, and ESAA) are technically similar to Very Small Aperture Terminals (VSATs). A VSAT uses a transmitter and small antenna, at a fixed location and pointed precisely at its target satellite, to transmit customer information to the satellite. The satellite relays the customer information, through a downlink earth station, to a data center which routes the information to the intended recipient. In a like manner, passengers onboard a mobile platform such as a ship, land vehicle or airplane, will connect their laptop computer, or other broadband device, to an Internet router located within the platform – a connection that is *not* governed by the rules addressed in this proceeding. The router passes the customer's information to a transmitter and small antenna located on the outside of the platform. An antenna tracking system compensates for the motion of the platform and keeps the antenna pointed precisely at the target satellite so that potential interference to adjacent satellites is minimized. The target satellite receives the customer information and transmits it, through a downlink earth station, to a Network Control and Monitoring Center (NCMC). The NCMC connects the customer to the Internet.[5] In the reverse direction the NCMC relays information from the Internet to an uplink earth station and from there to the target satellite. The signal from the target satellite is received by the tracking antenna on the platform and is passed along to the passenger through the Internet router in the platform. The NCMC is responsible for controlling all aspects of the mobile platform FSS system and for ensuring that any interference to an adjacent satellite is minimized and eliminated. Because of the technical similarity to VSAT systems, the rules governing the operations of mobile FSS applications are similar to those that govern the operation of VSATs. Differences in the operating rules between each of the three mobile FSS applications and VSAT systems are due primarily to the different characteristics of the mobile platforms.

9. Airborne aircraft in the United States and around the world have installed systems that provide passengers with onboard connectivity for data services.[6] There are two satellite-based services that are used to provide such wireless connectivity. Starting in the 1990s, the L-band Mobile Satellite Service (MSS) has been used to provide connectivity to airborne aircraft.[7] Since 2001, the Commission also has authorized, on an *ad hoc* basis, the use of GSO FSS space stations operating in the 10.95-11.2

[5] In some ESAA implementations, each ESAA terminal will operate in its own frequency channel. In other implementations, multiple ESAA transmitters will simultaneously transmit on the same frequency. In this latter situation, the NCMC is responsible for controlling the total aggregate power from all of the transmitters to ensure that no interference occurs to adjacent satellites.

[6] The most deployed terrestrial-based system used to provide Internet service to passengers on airborne aircraft in the United States is the 800 MHz Radiotelephone Service (Air-Ground). Originally, Air-Ground licensees could provide only a limited range of narrowband voice and data services due to restrictive service rules and the use of 6 kHz narrowband channels. In 2005, the Commission revised its Air-Ground rules and band plan to accommodate the provision of a backhaul link capable of facilitating broadband offerings onboard airborne commercial aircraft. *Amendment of Part 22 of the Commission's Rules to Benefit the Consumers of Air-Ground Telecommunications Services, Biennial Regulatory Review --Amendment of Parts 1, 22, and 90 of the Commission's Rules*, Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd 4403 (2005), Report and Order, 20 FCC Rcd 19663 (2005) (collectively, the *Air-Ground Rulemaking*). In addition to the 800 MHz commercial Air-Ground spectrum, there is spectrum in the 454/459 MHz band allocated for general aviation air-ground stations. 47 C.F.R. § 22.805. The 454/459 MHz general aviation air-ground licensees currently provide narrowband (low capacity) voice and data services. We also note that Qualcomm, Inc. has filed a Petition for Rulemaking (RM-11640) proposing that the Commission initiate a proceeding to establish allocation and service rules for an Air-Ground service to be operated on a secondary basis in the 14.0-14.5 GHz band.

[7] The "L-Band" is generically denoted as 1 to 2 GHz.

GHz, 11.45-11.7 GHz, 11.7-12.2 GHz (space-to-Earth or downlink) and 14.0-14.5 GHz (Earth-to-space or uplink) frequency bands to provide wireless connectivity to airborne aircraft.[8] These *ad hoc* authorizations allow provision of broadband services to passengers on a non-harmful interference basis, and several airlines are operating under the terms of those authorizations.[9] The rules we adopt today provide for faster, more efficient licensing of these GSO FSS operations used to provide connectivity to airborne aircraft (as opposed to the *ad hoc* approach used to date), and set the stage for regulatory finality with regard to the allocation status of these applications.

10. The Commission released the *Notice of Proposed Rulemaking* in an earlier phase of the market for ESAA.[10] The *Notice* sought comment on concepts expressed in a Petition for Rulemaking filed by Boeing in 2003 requesting that the Commission adopt licensing and technical rules,[11] the *ESV Order* released a few months prior to the release the *Notice*, and technical recommendations adopted by the International Telecommunication Union (ITU) for this type of service.[12] The *Notice* recognized the emergence of the new market for GSO FSS satellite services by proposing more flexible use of the 11.7-12.2 GHz and 14.0-14.5 GHz bands while protecting existing terrestrial and satellite services from

[8] *Panasonic Avionics Corporation*, Order and Authorization, 26 FCC Rcd 12557 (Int'l Bur. and OET 2011) (blanket license for a network of up to 50 earth stations aboard foreign-flagged commercial aircraft operated by Lufthansa transmitting in the 14.0 GHz-14.5 GHz and receiving in the 11.7-12.2 GHz band); *Row 44, Inc*., Order and Authorization, 24 FCC Rcd 10223 (Int'l Bur. and OET 2009) (blanket license for a network with up to 1,000 technically identical earth stations aboard aircraft transmitting in the 14.05-14.47 GHz and receiving in 11.7-12.2 GHz); *ViaSat, Inc*., Order and Authorization, 22 FCC Rcd 19964 (Int'l Bur. and OET 2007) (blanket license for a network with up to 1,000 technically identical earth stations aboard aircraft transmitting in the 14.0-14.5 GHz and receiving in the 11.7-12.2 GHz); *ARINC Incorporated*, Order and Authorization, 20 FCC Rcd 7553 **(**Int'l Bur. and OET 2005) (blanket license for up to 1,000 technically identical earth stations aboard aircraft transmitting in the 14.0-14.5 GHz and receiving in the 11.7-12.2 GHz); and *Boeing Company*, Order and Authorization, 16 FCC Rcd 5864 (Int'l Bur. and OET 2001) (blanket license for up to 800 technically identical receive only earth stations aboard aircraft); Order and Authorization, 16 FCC Rcd 22645 (Int'l Bur. and OET 2001) (modifying prior receive only authorization to provide blanket license for up to 800 technically identical earth stations aboard aircraft transmitting in the 14.0-14.5 GHz and receiving in the 11.7-12.2 GHz). Most recently, Gogo LLC (Gogo) filed an application on June 19, 2012, for a blanket license for up to 1,000 technically identical earth stations aboard aircraft transmitting in the 14.0-14.5 GHz and receiving in 11.7-12.2 GHz. Gogo LLC, Application for Blanket Authority for Operation of 1,000 Technically Identical Ku-Band Transmit/Receive Earth Stations in the Aeronautical Mobile Satellite Service, IBFS File No. SES-LIC-20120619-00574 (Gogo Application). In its application, Gogo also proposes receiving in other bands. *Id.,* Narrative at 6. Gogo holds an authorization for the terrestrial-based Air-Ground network, Call Sign WQFX728 (granted on October 31, 2006).

[9] For example, in the United States, both Southwest Airlines and JetBlue Airways offer satellite-enabled Internet services to passengers. http://www.southwest.com/wifi/ (Southwest Webpage devoted to product) (last visited July 30, 2012); *see also* "Speedy In-Flight Wi-Fi, Even During a Wild Ride," New York Times, Oct. 17, 2011.

[10] *Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 05-20, Notice of Proposed Rulemaking, 20 FCC Rcd 2906 (2005) (*Notice*).

[11] Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum in the 14-14.5 GHz Band to the Aeronautical Mobile-Satellite Service ("AMSS") and to Adopt Licensing and Service Rules for AMSS Operations in the Ku-band, Petition for Rulemaking, filed on July 21, 2003 by the Boeing Company (Boeing 2003 Petition for Rulemaking). The Boeing 2003 Petition for Rulemaking was placed on public notice as RM-10800. Consumer and Governmental Affairs Bureau, Reference Information Center, Petition for Rulemaking filed, Report No. 2632 (rel. Oct. 2, 2003). The Boeing 2003 Petition for Rulemaking contained detailed proposals and draft rules, the contents of which, along with the comments filed in response, were discussed in detail in the Commission's *Notice* in IB Docket 05-20.

[12] *Notice*, 20 FCC Rcd at 2950-56 (Appendix C, reprinting ITU Recommendation ITU-R M.1643).

harmful interference.[13] The *Notice* proposed to allocate the 11.7-12.2 GHz (space-to-Earth) frequency band on a primary basis for transmissions to earth stations onboard airborne aircraft from GSO FSS space stations,[14] and the 14.0-14.5 GHz (Earth-to-space) frequency band on a secondary basis for transmissions to GSO FSS space stations from earth stations onboard airborne aircraft.[15] The *Notice* also proposed technical and licensing rules for these systems. Eleven parties filed comments in response to the *Notice*, and eight parties filed reply comments.[16]

IV. DISCUSSION

11. In this *Report and Order*, we adopt rules to provide for a mobile application of the FSS for communications between earth stations fixed to aircraft communicating with GSO satellites in the FSS in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz bands. The *Notice* refers to what was being proposed as part of the Aeronautical Mobile Satellite Service (AMSS), a mobile application of the MSS. Commenters advocated changing the name of the service to make it consistent with other mobile uses of FSS.[17] We concur. Accordingly, we will refer to the mobile application established in this proceeding as Earth Stations Aboard Aircraft or ESAA, and we will discuss all past filings using this term.[18] In using the new moniker ESAA, we effectively communicate that this is a mobile application of the FSS, and convey the technical and regulatory similarities to ESV and VMES, analogous mobile applications of the FSS.[19]

A. ESAA Allocation

12. As explained more fully below, in this *Report and Order*, we adopt three footnotes to the U.S. Table of Frequency Allocations (Table of Allocations) indicating that ESAA is an application of the FSS and may be authorized to communicate with GSO space stations of the FSS on a primary basis in the

[13] The *Notice* also acknowledges the *ad hoc* authorizations issued at the time of the *Notice* and then pending applications. *Notice*, 20 FCC Rcd at 2910-12, ¶¶ 5-6 (discussing the Boeing Connexion System and a pending ARINC application).

[14] *Notice*, 20 FCC Rcd at 2915-16, ¶ 15.

[15] *Id.* at 2918-19, ¶ 20. Space stations operating on a primary basis are protected against interference from stations of secondary services. Stations operating in a secondary service cannot cause harmful interference to or claim protection from harmful interference from stations of a primary service. 47 C.F.R. §§ 2.104(d) and 2.105(c). Non-conforming services may be provided only on a non-harmful interference basis to any authorized service and may not claim interference protection from those services.

[16] A complete list of parties who have filed in the proceeding is included in Appendix E. The parties to the proceeding include ESAA operators (ARINC, Boeing, ViaSat), operators of FSS space stations (Intelsat, PanAmSat, SES, Telesat Canada), the U.S. Government (Department of Justice), the scientific community (National Radio Astronomy Observatory, National Science Foundation, and the National Research Council's Committee on Radio Frequencies), and industry public interest groups (Satellite Users Interference Reduction Group, Center for Democracy & Technology and the Electronic Frontier Foundation).

[17] Letter from Bruce A. Olcott, Counsel, Boeing, to Mindel De La Torre, Chief, International Bureau, IB Docket No. 05-20 at 5 (dated Apr. 20, 2010) (Boeing Apr. 20, 2010 Ex Parte Letter). Boeing suggested the service name of "aircraft-mounted earth stations (AMES)." *Id*.

[18] Our action here does not affect existing AMSS allocations or the rules governing it, but classifies and regulates ESAA as an application of FSS rather than AMSS. At the same time, to avoid confusion in the future regarding the name of the service, we administratively close out the AMSS docket – IB Docket No. 05-20 – and open a new ESAA docket – IB Docket No. 12-376.

[19] The license to be issued to the satellite-based system that is the subject of this rulemaking is not an "aeronautical en route" or "aeronautical fixed radio station" license for purposes of Section 310(b) of the Communications Act. 47 U.S.C. § 310(b).

11.7-12.2 GHz band (space-to-Earth), on an unprotected basis in 10.95-11.2 GHz and 11.45-11.7 GHz bands (space-to-Earth), and on a secondary basis in the 14.0-14.5 GHz band (Earth-to-space). In doing so, we consider the following allocation issues.

1. Operations on a Primary Basis in the 11.7-12.2 GHz (space-to-Earth) Band

13. *Background*. GSO FSS systems operate on a primary basis in the 11.7-12.2 GHz (space-to-Earth) band.[20] In the *Notice*, the Commission proposed to establish a new non-Federal government footnote for the 11.7-12.2 GHz downlink band to indicate that ESAA may receive signals from GSO FSS space stations.[21] The Commission also asked whether reception by ESAA terminals in this band should be on a primary basis or on a secondary basis. The Commission explained that the band is used extensively by VSATs.[22] The Commission specifically asked whether ESAA terminals can maintain pointing accuracy toward GSO FSS space stations typically expected in a two-degree spacing environment. The Commission noted that if ESAA is allocated primary status in the 11.7-12.2 GHz downlink band, it would enjoy the protection level set forth in Section 25.209(c) of our rules for conforming earth station antennas.[23]

14. The Commission also sought comment, in the alternative, on Boeing's proposal that reception by ESAA terminals in the 11.7-12.2 GHz downlink band continue to be authorized on an unprotected basis as a non-conforming use of the band.[24] As explained in the *Notice*, Boeing argued in its Petition for Rulemaking in favor of conditions typically imposed when a use does not conform to the Table of Allocations, *e.g.*, unprotected, meaning not permitted to cause harmful interference and required to accept interference.[25] In its comments in response to the *Notice*, Boeing ultimately supported primary status for ESAA in the 11.7-12.2 GHz downlink band arguing that because the Commission designated ESV and VMES as applications of FSS allocated on a primary basis, ESAA should have a similar regulatory status.[26] ViaSat agrees, stating that ESAA should have the same allocation status as ESV, so long as ESAA neither interferes with other space stations nor is susceptible to interference to a greater extent than ESV.[27] ViaSat also argues that ESAA earth stations should receive the protection levels of Section 25.209(c) for conforming earth station antennas.[28]

---

[20] There are no co-primary users in the 11.7-12.2 GHz band. 47 C.F.R. § 2.106, Table of Frequency Allocations.

[21] *Notice*, 20 FCC Rcd at 2915-16, ¶ 15.

[22] *Id*. A VSAT network consists of a large number of technically identical small fixed-satellite earth stations that operate in the 11.7-12.2 GHz and 14.0-14.5 GHz band and meet specified technical requirements and communicate only with other earth stations in that network. *Routine Licensing of Large Networks of Small Antenna Earth Stations Operating in the 12/14 GHz Frequency Bands*, Report and Order, CC Docket No. 90-219, 6 FCC Rcd 7372 (1991). VSAT systems provide video and data communications. Historically, this technology has been used by business customers but more recently VSAT systems are also used to provide Internet service to residential consumers.

[23] Section 25.209(c)(1) of our rules states that earth station antennas licensed for reception of transmissions from a space station in the FSS are protected from interference caused by other space stations only to the degree to which harmful interference would not be expected to be caused to an earth station employing an antenna conforming to the referenced patterns defined in Section 25.209(a) and (b). 47 C.F.R. § 25.209(c)(1). In Section IV.C.9. below, we adopt receive antenna performance standards for ESAA aircraft terminals.

[24] *Notice*, 20 FCC Rcd at 2916, ¶ 17 (quoting Boeing 2003 Petition for Rulemaking at 11).

[25] *Id*.

[26] Letter from Boeing, dated April 20, 2010, 1-7; and Letter from Boeing, dated Aug. 17, 2007, 1-2.

[27] ViaSat Comments at 3.

[28] ViaSat Reply at 5-6.

15. Other commenters argue that ESAA does not need primary status to operate effectively, and that granting ESAA primary status would have a negative impact on the operations of other FSS licensees. Telesat states that ESAA downlinks in the 11.7-12.2 GHz band should operate on an unprotected, non-harmful interference basis, because there is no reason to grant primary status to earth stations that can operate on a secondary basis.[29] PanAmSat argues that granting ESAA primary status in the band would constrain the operations of adjacent space stations.[30] Intelsat agrees, arguing that Boeing has stated that ESAA operations can continue on an unprotected, non-harmful interference basis. Intelsat states that taking ESAA into account in future coordination would be an unnecessary burden on satellite operators.[31] PanAmSat concurs, and further contends that the technical standards supported by Boeing and ViaSat would be different from the standards for VSATs of the type used in ESV and VMES.[32]

16. *Discussion.* We find a primary allocation for ESAA as an application of the FSS in the 11.7-12.2 GHz (space-to-Earth) band to be in the public interest. We are unaware of any problems that have occurred as a result of the previously licensed operation of ESAA in the 11.7-12.2 GHz downlink band.[33] The transmission parameters of the GSO FSS space stations when transmitting in 11.7-12.2 GHz (space-to-Earth) band to ESAA terminals will be similar to the transmission parameters utilized by GSO FSS space stations transmitting to other FSS earth stations including ESV and VMES. This is true because an ESAA terminal on an airborne aircraft would appear almost fixed from the perspective of the GSO FSS space station. Further, under the rules adopted in this *Report and Order*, transmission to an ESAA terminal will be subject to the same rules that apply to all GSO FSS space station transmissions in the 11.7-12.2 GHz band.[34] Accordingly, transmissions from a GSO FSS space station to an earth station fixed to airborne aircraft are not materially different from any other transmission from a GSO FSS space station and would be unlikely to result in interference events to other co-primary services. Further, ESAA operations will be subject to the same limitations on interference protection that apply to typical fixed earth stations with respect to protection against interference. Specifically, ESAA are protected against interference only to the extent that the antenna conforms to established performance standards.[35]

17. Concerns that primary status for ESAA operations would constrain operation of adjacent space stations are unfounded. As such, transmissions from GSO FSS space stations in the 11.7-12.2 GHz (space-to-Earth) to earth stations fixed to airborne aircraft should receive comparable regulatory status with other GSO FSS uses. Primary status for ESAA as an application of the FSS also means that ESAA licensees can expect the same level of interference protection from adjacent satellite system operations as other primary FSS operators receive and, for coordination purposes, have the same status as other primary

[29] Telesat Comments at 2.

[30] PanAmSat Reply at 2. PanAmSat and Intelsat were separate entities at the time they filed pleadings in this proceeding, but subsequently Intelsat acquired PanAmSat, and PanAmSat became a wholly-owned subsidiary of Intelsat. *Constellation, LLC et al., Transferors, and Intelsat Holdings, Ltd., Transferee, Consolidated Application for Authority to Transfer Control of PanAmSat Licensee Corp. and PanAmSat H-2 Licensee Corp*., Memorandum Opinion and Order, FCC 06-85, 21 FCC Rcd 7368 (2006). In this document, we shall continue to refer to them as separate entities for ease of citation reference.

[31] Intelsat Comments at 2.

[32] PanAmSat Comments at 2.

[33] *See supra* n.8.

[34] 47 C.F.R. § 25.210 *et seq.*

[35] 47 C.F.R. § 25.209(c) and *infra* Section IV.C.9. We also note that treating ESAA operations like other FSS operations is warranted for purposes of interference protection because ESAA is not designed as a safety service meriting priority and preemption. *See infra* Section IV.G.

FSS systems.[36] Granting ESAA a definitive level of protection will provide certainty as to the technical requirements for ESAA systems. For these reasons, as the Commission proposed in the *Notice*, we will add a non-Federal government footnote to the Table of Allocations, providing ESAA primary status as an application of FSS in the 11.7-12.2 GHz downlink band. Specifically, we add the following footnote to the Table of Allocations:

> NG55 In the band 11.7-12.2 GHz , Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 are an application of the fixed-satellite service and may be authorized to communicate with geostationary satellites in the fixed-satellite service (space-to-Earth) on a primary basis.

2. Operations on an Unprotected Basis in the 10.95-11.2 GHz and 11.45-11.7 GHz Bands (space-to-Earth) Within the United States

18. *Background.* The 10.7-11.7 GHz band is allocated internationally for FSS on a primary basis.[37] Within the United States, FSS use of this band is reserved for international systems by footnote NG104 to the Table of Allocations and Section 25.202(a)(1) of our rules.[38] In the United States, these bands are also used by the FS for the Local Television Transmission Service, Microwave Business, Microwave Public Safety, and Common Carrier Fixed Point-to-Point.[39] Recognizing that ESAA terminals on U.S.-registered aircraft may operate over international waters (*i.e.*, "high seas," or regions beyond the territorial limits of any country) and in foreign countries and therefore may need to receive downlink signals in the 10.95-11.2 GHz and 11.45-11.7 GHz bands in certain circumstances, we sought comment on whether ESAA operations in the 10.95-11.2 GHz and 11.45-11.7 GHz bands should be permitted on a non-protected basis.

19. Commenters broadly support permitting ESAA to receive transmissions in the 10.95-11.2 GHz and 11.45-11.7 GHz bands, stating that it would facilitate ESAA communications and lead to more efficient use of the 10.95-11.2 GHz and 11.45-11.7 GHz downlink bands.[40] Commenters also generally support making these bands available to ESAA on an unprotected, non-harmful interference basis.[41] Boeing and ViaSat argue that such an allocation would not affect FS, and would benefit those flights over international waters where there may be incidental use of the 10.95-11.2 GHz and 11.45-11.7 GHz bands

---

[36] Co-primary systems generally are obligated to coordinate with each other on a first-come, first-served basis, whereas a system operating under a secondary allocation must not give interference to, and must accept interference from, systems operating with primary status. 47 C.F.R. § 2.105(c).

[37] 47 C.F.R. § 2.106, Table of Frequency Allocations.

[38] 47 C.F.R. § 2.106 NG 104 (stating that "[t]he use of the bands 10.7-11.7 GHz (Space to Earth)...by the fixed satellite service in the geostationary-satellite orbit shall be limited to international systems, *i.e.*, other than domestic systems"); 47 C.F.R. § 25.202(a)(1) n.2 (stating that "[u]se of this band by geostationary satellite orbit satellite systems in the fixed-satellite service is limited to international systems; *i.e.*, other than domestic systems"). The Commission determined that restricting FSS use in these frequency bands to international systems limits the number of FSS earth stations with which licensees of co-primary fixed stations would need to coordinate. *Satellite Services*, 26 RR 2d 1257, 1263-65 (1973), and *GWARC Inquiry*, 70 FCC 2d 1193, 1252 (1978). *See also Assignment of Orbital Locations to Space Stations in the Domestic Fixed Satellite Service and the Applications of GE American Communications, Inc.*, Order and Authorization, 15 FCC Rcd 3385 (Sat. & Radiocomm. Div. 1999). Under this limitation to international use, downlink service into the United States and its insular areas is permissible, if uplink originates outside the United States and its insular areas.

[39] 47 C.F.R. § 2.106.

[40] ARINC Comments at 25; PanAmSat Comments at 5; and Boeing Comments at 8.

[41] Telesat Comments at 2; SES Comments at 4; and Boeing Comments at 8.

when flying into or out of the United States.[42] Boeing maintains that ESAA downlinks in the 10.95-11.2 GHz and 11.45-11.7 GHz bands should have the same regulatory status as standard FSS downlinks in these bands.[43] ViaSat proposes, however, allowing ESAA terminals to receive in the 10.95-11.2 GHz and 11.45-11.7 GHz bands on a co-primary basis with FS where the uplink originates outside of the United States, and limiting the requirement to operate on a non-harmful interference, unprotected basis relative to FS to cases in which the uplink originates in the United States.[44] SES recommends waiving the domestic service prohibition in footnote NG104 for this purpose.[45] No commenter opposes authorizing ESAA downlinks in the 10.95-11.2 GHz and 11.45-11.7 GHz bands.

20. *Discussion.* Our regulatory treatment of ESV and VMES in the 10.95-11.2 GHz and 11.45-11.7 GHz bands requires ESV and VMES operators to accept interference from all current and future FS operations in these bands.[46] ESAA, like ESV and VMES, would use these bands for reception only from GSO FSS space stations. As discussed in the *Notice*, within the United States, we do not anticipate that unprotected receive-only operations in the 10.95-11.2 GHz and 11.45-11.7 GHz bands would interfere with or restrict other authorized operations in the band.[47]

21. Designating ESAA as an application of the FSS in the 10.95-11.2 GHz and 11.45-11.7 GHz downlink bands on an unprotected basis within the United States removes regulatory uncertainty regarding its status, and therefore, we do so. Because ESAA downlink operations in these bands will not interfere with or restrict current or future FS operations and because ESAA will not receive protection from the FS in these bands, we find, as we did for ESV and VMES, that the intent of NG104 and Section 25.202(a)(1) will not be undermined by allowing ESAA to operate domestically in these bands. At the same time, we decline to adopt ViaSat's suggestion that we elevate ESAA receive operations in these bands to co-primary status when the uplink signals originate outside the United States because our experience with ESV and VMES has not demonstrated that there is a need for this allocation status. No ESV or VMES operator has complained of interference or inability to receive in these bands, despite the fact that ESVs and VMES operate in these bands on an unprotected basis. We also note that the Table of Allocations currently contains three non-Federal government footnotes bearing upon mobile applications of FSS: footnotes NG104, limiting the 10.7-11.7 GHz and 12.75-13.25 GHz bands to international satellite systems; NG182, authorizing ESV; and NG186, authorizing VMES. The texts of NG182 and NG186 are effectively identical. Therefore, as a substantive matter, we adopt the following non-Federal government footnote authorizing ESAA operations in the 10.95-11.2 GHz and 11.45-11.7 GHz downlink bands. At the same time, as a ministerial matter of consolidating footnotes without changing their meanings, we replace footnotes NG104, NG182, and NG186 with the following footnote regarding mobile applications of FSS:

---

[42] Boeing Comments at 8 and ViaSat Reply at 7.

[43] Boeing Comments at 9. Boeing also mentions use of the 12.2-12.75 GHz band for downlink in its comments. Boeing Comments at 8. We did not seek comment on the use of this spectrum in the *Notice*. In the United States, the 12.25-12.70 GHz band is allocated to the FS and BSS and the 12.70-12.75 GHz band is allocated to the FS, MS, and FSS (Earth-to-space). Use of this band by ESAA terminals would be to receive communications from space stations whose coverage area is outside the United States or with very limited coverage within the United States. In the event an interest in providing ESAA develops and matures in this band, licensing of such services can be addressed on a case-by-case basis under Part 25 licensing rules, or through further rule making proceedings, as market developments warrant.

[44] ViaSat Comments at 7.

[45] SES Comments at 4 and SES Reply at 5.

[46] *ESV Order*, 20 FCC Rcd at 710-11, ¶ 86; *VMES Order*, 24 FCC Rcd at 10424, ¶ 31.

[47] *Notice*, 20 FCC Rcd at 2916-17, ¶ 18.

> NG52 Except as otherwise provided for herein, 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 (FSS) shall be limited to international systems, i.e., other than domestic systems. In the sub-bands 10.95-11.2 GHz and 11.45-11.7 GHz, Earth Stations on Vessels (ESV), Vehicle-Mounted Earth Stations (VMES), and Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 may be authorized for the reception of FSS emissions from geostationary satellites, subject to the condition that these earth stations shall not claim protection from transmissions of non-Federal stations in the fixed service.

We also make changes to Section 25.202 of our rules consistent with the change to the Table of Allocations. Finally, we note that reception in this band by U.S. authorized ESAA operations outside of U.S. airspace over international waters is fully consistent NG104 and is unlikely to cause interference to or restrict current or future FS operations in the United States.[48]

3. Operations on a Secondary Basis in the 14.0-14.5 GHz Band (Earth-to-Space)

22. *Background.* GSO FSS systems operate on a primary basis in the 14.0-14.5 GHz (Earth-to-space).[49] In the *Notice*, however, the Commission proposed ESAA operations on a secondary basis.[50] The Commission noted that the 14.0-14.5 GHz uplink band is used by VSATs to communicate with GSO FSS satellites, and is also allocated for use by non-GSO (NGSO) earth stations,[51] both gateway earth stations and user terminals. The band is also allocated to MSS on a secondary basis, including aeronautical MSS.

23. Boeing initially argued in favor of a secondary allocation for ESAA in the 14.0-14.5 GHz uplink band, quoting the Conference Preparatory Meeting Report for WRC-03, stating that "it has been demonstrated that it is feasible for appropriately designed . . . [ESAA] networks to be operated on a secondary basis in the band 14.0-14.5 GHz without causing harmful interference to primary services in the band."[52] ESAA operations in the 14.0-14.5 GHz uplink band have been ongoing with no reported instances of interference to other users.[53] Telesat agrees, stating that the ITU *Radio Regulations* provide clarity as to the relative status of primary and secondary services, and that authorizing ESAA to use the band on a secondary basis does not raise any issues.[54] In subsequent filings, Boeing changed its position and now favors making ESAA primary in the 14.0-14.5 GHz band, arguing that secondary status is inadequate because of the possibility of harmful interference to ESAA in the 14.0-14.5 GHz band from ESV, VMES, and other services. Boeing also points out that elevating ESAA to primary status in the 14.0-14.5 GHz band would put ESAA on an equal footing with ESV and VMES in coordination negotiations. For these reasons, Boeing requests that we give ESAA primary status in the 14.0-14.5

[48] Section IV.E.1. *infra* addresses regulatory issues relating to U.S.-licensed ESAA operations outside of U.S. airspace.

[49] 47 C.F.R. § 2.106, Table of Frequency Allocations.

[50] *Notice*, 20 FCC Rcd at 2918-19, ¶ 20.

[51] There are currently no planned NGSO FSS systems in these bands.

[52] Boeing Comments at 9-10 (quoting WRC-03 Document 03, *CPM Report to 2003 World Radiocommunication Conference* at 2.4.2).

[53] Boeing Comments at 9-10. *See* Letter from Bruce A. Olcott, Squire Sanders Dempsey (counsel to Boeing) to Marlene H. Dortch, Secretary, Federal Communications Commission, dated Jan. 27, 2011.

[54] Telesat Comments at 2.

GHz.[55] ViaSat contends that we should allocate ESAA on a primary basis in the 14.0-14.5 GHz uplink band, arguing that such an allocation would advance our goals of promoting efficient use of spectrum and meeting growing demand for broadband capability for airline passengers. ViaSat also states that ESAA is no more likely to cause or receive interference than any other VSAT terminal, and that appropriate technical rules and coordination would resolve potential problems, as it does for ESV.[56] While some commenters would prefer a primary allocation for reasons of regulatory parity, no party opposes a secondary allocation for ESAA in the 14.0-14.5 GHz uplink band on technical grounds.

24. *Discussion.* As commenters have explained, ESAA operations in this band, operating under technical constraints similar to those adopted in this order, have been ongoing for years with no reported instances of interference.[57] Thus, the record of ongoing operations coupled with the analysis of the commenters provides support for giving secondary status to ESAA as an application of the FSS, and potentially allocating ESAA on a primary basis in this band. The *Notice,* however, did not specifically seek comment on allocating the uplink to primary status, and the record, while strongly suggesting that primary status would be appropriate, is not sufficiently developed at this time to make such an allocation. Thus, we believe it would be premature to raise the status of the uplink to primary at this time. For these reasons, we grant ESAA a secondary allocation as an application of FSS in the 14.0-14.5 GHz uplink band, subject to the restrictions in our rules and this *Report and Order*.[58] At the same time, the public interest would be served by quickly developing a more complete record on Boeing's request for operations on a primary basis in this band. We will, therefore, consider Boeing's request in the *Notice of Proposed Rulemaking, infra*.

B. Coordination

1. Coordination with the Space Research Service in the 14.0-14.2 GHz Band

25. *Background*. In the *Notice*, the Commission noted that Space Research Services (SRS) have a secondary allocation in the 14.0-14.2 GHz sub-band. There are currently two authorized SRS facilities in the United States: the National Aeronautics and Space Administration (NASA) space research Tracking and Data Relay Satellite System (TDRSS) receive facilities located in Guam and White Sands, New Mexico, which operate with frequency assignments in the 14.0-14.05 GHz band.[59] In addition to the two existing facilities, NASA plans to establish another TDRSS receive facility at Blossom Point on the Eastern Shore of Maryland. In the *Notice*, the Commission proposed to require that, as a prerequisite to licensing, ESAA operations in the 14.0-14.5 GHz uplink band, in the vicinity (*i.e.*, within the radio line-of-sight) of TDRSS facilities, be coordinated with the National Telecommunications and Information Administration (NTIA) to resolve any potential concerns regarding space research facilities.[60] This would

[55] Letter from Bruce A. Olcott, Squire Sanders Dempsey (counsel to Boeing) to Marlene H. Dortch, Secretary, Federal Communications Commission, dated Jan. 7, 2011.

[56] ViaSat Comments at 3.

[57] *See* n.8 *supra* for list of authorizations granted.

[58] We also take this opportunity to update the Table of Allocations by removing footnote NG184. This footnote authorizes *existing* licensees of land mobile stations in the 11.7-12.2 GHz and 14.2-14.4 GHz bands and fixed stations in the 11.7-12.1 GHz band to continue to operate on a secondary basis until their license expired. Because all existing licenses have now expired, we remove footnote NG184 from the Table of Allocations.

[59] *Amendment of Parts 2, 25 and 73 of the Commission's Rules to Implement Decisions from the World Radiocommunication Conference (Geneva, 2003) (WRC-03) Concerning Frequency Bands Between 5900 KHz and 27.5 GHz and to Otherwise Update the Rules in this Frequency Range*, ET Docket No. 04-139, Notice of Proposed Rulemaking, 19 FCC Rcd 6592, 6609 n.74 (2004).

[60] *Notice*, 20 FCC Rcd at 2919-20, ¶¶ 22-23 & n.72 ("We understand that the 'vicinity of a TDRSS site' refers to the area where an [aircraft earth station] is in line-of-sight of the TDRSS site"). *But see* ARINC Comments at 26

(continued....)

parallel requirements for ESV and VMES, where, as a condition of licensing, all ESV and VMES earth stations operating in the 14.0-14.2 GHz sub-band within 125 km of a NASA TDRSS earth station site must coordinate through NTIA before beginning operations.[61]

26. Boeing suggests requiring coordination with TDRSS sites as a condition of, rather than a prerequisite to, licensing.[62] Boeing also argues that future TDRSS earth stations will probably be designed to reject out-of-band emissions, and that we should therefore require coordination only in the 14.0-14.2 GHz sub-band, rather than in the entire 14.0-14.5 GHz uplink band.[63]

27. *Discussion*. The importance of SRS is such that ensuring their protection from interference cannot wait until after a system is licensed. We note that we have established a licensing condition requiring coordination prior to operations for both ESV[64] and VMES.[65] We agree with Boeing that future TDRSS sites are likely to be designed to minimize the impact of other operations, but it is not clear that filtering and other measures will be sufficient to obviate the need for coordination with ESAA in the 14.0-14.5 GHz downlink band. We therefore adopt the Commission's proposal and will require that ESAA stations operating in the entire 14.0-14.2 GHz uplink sub-band within line-of-sight of TDRSS sites coordinate with NTIA as a prerequisite to operation.[66] Specifically, we require ESAA licensees proposing to operate in the 14.0-14.2 GHz sub-band within radio line-of-sight of the Guam and White Sands, New Mexico TDRSS receive facilities to coordinate through NTIA before beginning operations.[67] ESAA licensees shall notify the International Bureau once they have completed coordination.[68] Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that

(...continued from previous page)
("While ARINC acknowledges the need to protect currently operating TDRSS [ ] sites from interference through coordination with NTIA, a rigid 'vicinity of,' or 'line of sight,' rule would be too restrictive and should not be imposed").

[61] 47 C.F.R. §§ 25.222(c), 25.226(c)(2); *ESV Order*, 19 FCC Rcd at 712-13, ¶ 90; *VMES Order*, 24 FCC Rcd at 10422-23, ¶ 25.

[62] Boeing Comments at 10.

[63] Boeing Comments at 11.

[64] *ESV Order*, 19 FCC Rcd at 712-13, ¶¶ 90-91.

[65] *VMES Order*, 24 FCC Rcd at 10427-28, ¶¶ 41-43 ("We adopt the Commission's proposal to make SRS coordination a VMES licensing condition. We require VMES licensees proposing to operate in the 14.0-14.2 GHz sub-band within 125 kilometers of the Guam and White Sands, New Mexico TDRSS receive facilities to coordinate through NTIA before beginning operations.")

[66] Determination of the particular radio line-of-sight distance at which terminals must coordinate can be accomplished in a number of ways. For example, Section 25.213 uses a formula for determining the distance (d) at which airborne mobile earth stations in the 1.6/2.4 GHz band must coordinate with radio astronomy sites. That formula is d (km) = 4.1 square root of (h), where h is the altitude of the aircraft in meters above ground level. *See* 47 C.F.R. § 25.213(a)(1)(iv).

[67] NASA TDRSS facilities on Guam are at latitude 13°36'55" N, longitude 144°51'22" E, while the White Sands, New Mexico TDRSS facilities are located at latitude 32°20'59" N, longitude 106°36'31" W and latitude 32°32'40" N, longitude 106°36'48" W.

[68] Licensees should file these documents electronically via IBFS (http://licensing.fcc.gov/myibfs/). The notifications should be filed in the form of a statement referencing the relevant call signs and file numbers. Filers should upload the coordination notification into IBFS by selecting "Pleadings or Comments" from the IBFS main page. Under "Pleading Type," filers should select "Statement." The electronically-filed coordination notification will be reviewed for completeness and placed on the Satellite Division's SES weekly public notice under the heading "Informative."

the licensee may commence operations within the new coordination zone in 30 days if no party has opposed the operations.[69]

28. We observe that the International Bureau has notified ESV and VMES network operators in the 14.0-14.2 GHz sub-band that they will be required to cease operations within 125 kilometers of the new Blossom Point facilities, when these facilities have become operational, unless and until the operator has reached a coordination agreement with NASA that has been approved by both us and NTIA.[70] We adopt a similar rule for ESAA operators. Therefore, once NTIA notifies the International Bureau that these facilities are about to become operational, the International Bureau will issue a notice announcing the specific date for the commencement of operations of the Blossom Point facilities and requiring each ESAA operator in the 14.0-14.2 GHz sub-band to cease operations within radio line-of-sight of the new Blossom Point facilities until the ESAA operator has completed a coordination agreement with NASA, acceptable to both NTIA and the Commission, for the new TDRSS site.

29. We also observe that, in addition to the EIRP density mask requirements,[71] both ESVs and VMES must meet specific EIRP density requirements towards the horizon in the 14.0-14.2 GHz sub-band while within the coordination distance of a TRDSS site. These additional EIRP density requirements towards the horizon are intended to control potential interference to NASA's TDRSS earth stations and must be met regardless of the power transmitted in any other direction.[72] We place similar specific EIRP density requirements towards the horizon on ESAA systems.

2. Coordination with Radioastronomy Service Stations in the 14.47-14.5 GHz Band

30. As discussed below, we require ESAA licensees proposing to operate in the 14.47-14.5 GHz sub-band within line-of-sight of Radioastronomy Service (RAS) facilities to coordinate with the National Science Foundation (NSF) before beginning operations.

a. Coordination Procedure

31. *Background*. RAS operates in the 14.47-14.5 GHz sub-band on a permissive basis within the United States.[73] Our rules require ESV and VMES licensees planning to operate within the 14.47-14.5 GHz sub-band to coordinate their proposed operations with RAS facilities.[74] In the *Notice*, the Commission sought comment on the feasibility of similar coordination between ESAA and RAS

[69] This mirrors the procedure for ESV and VMES. *ESV Order*, 20 FCC Rcd at 713, ¶ 91, *VMES Order*, 24 FCC Rcd at 10427, ¶ 41.

[70] *International Bureau Announces New NASA TDRSS Earth Station Site, Report No. SPB-221*, Public Notice, DA 07-4028, 22 FCC Rcd 17321 (Int'l Bur. 2007) (*Blossom Point Notice*). *See also* 47 C.F.R. § 25.222(c) (formerly section 25.222(d), requiring all ESV networks operating in the 14.0-14.2 GHz band within 125 km of a new TDRSS earth station to cease operations upon commencement of the TDRSS operations, unless and until the ESV operator and NASA reach an agreement that both the Commission and NTIA approve).

[71] *See infra*. IV.C.2,3, 7, and 8.

[72] 47 C.F.R. § 25.204(i) (specific EIRP density requirements towards the horizon in the 14.0-14.2 GHz sub-band for ESV); 47 C.F.R. § 25.204(j) (specific EIRP density requirements towards the horizon in the 14.0-14.2 GHz sub-band for VMES).

[73] Internationally, the RAS is allocated on a secondary basis in the 14.47-14.5 GHz band. In the United States, Footnote US203 of the Table of Allocations permits RAS use of the 14.47-14.5 GHz frequencies at certain sites. 47 C.F.R. § 2.106 US203; *see also id.* US342.

[74] *ESV Order*, 20 FCC Rcd at 748, Appendix B, § 25.222(e); 47 C.F.R. § 25.222(d) (requiring coordination with RAS facilities at St. Croix, Mauna Kea, and Arecibo).

operations to preclude harmful interference to the RAS.[75] Specifically, the Commission proposed and requested comment on several measures to protect RAS in the 14.47-14.5 GHz sub-band from harmful interference. The Commission proposed to require that, as a prerequisite to licensing, ESAA operations in the 14.0 -14.5 GHz band be coordinated with the NTIA to resolve any potential concerns regarding radio astronomy facilities. The Commission also requested comment on the possibility of changing the status of RAS in the Table of Allocations to co-secondary with respect to ESAA only, retaining its permitted status with regard to other services in the 14.47-14.5 GHz sub-band.[76] In order to account for future RAS sites, the Commission requested comment on whether and how ESAA licensees should coordinate their operations with future RAS sites, noting that if we require ESAA licensees to coordinate only with sites currently listed in footnote US203 to the Table of Allocations, the addition of new RAS to footnote US203 would require a full rulemaking process. The Commission also requested comment on whether an *ad hoc* coordination process between future RAS sites and ESAA licensees could be effective in preventing harmful interference to RAS.[77] Finally, noting that RAS observations do not occur continually and are usually scheduled in advance, the Commission requested comment on whether we should require RAS observatories to provide advance notice to ESAA operators regarding their observations, where possible.[78] In order to implement these proposals and ensure proper coordination between ESAA and other users in the 11.7-12.2 GHz and 14.0-14.5 GHz bands, in the *Notice* the Commission proposed two footnotes to be added to the Table of Allocations.[79]

32. With regard to elevating RAS to secondary allocation status, the National Radio Astronomy Observatory (NRAO) argues that co-secondary status for RAS is unnecessary, provided that the footnote US203 requirement to protect RAS "to the extent practicable" remains in effect.[80] NRAO further contends that the necessary protection for RAS is already spelled out in agreements that NSF has with Boeing and ARINC.[81] Boeing and the National Research Council's Committee on Radio Frequencies (CORF) do not object to elevating the regulatory status of RAS to secondary relative to ESAA only,[82] but CORF contends that secondary status for RAS would be unnecessary if we adopt rules requiring compliance with ITU-R M.1643, Annex 1, Part C.[83]

33. With regard to coordination requirements, CORF supports the proposal to require ESAA to coordinate operations within line-of-sight of RAS sites.[84] ARINC disagrees, opposing any requirement for a shut-down of ESAA operations within line-of-sight of RAS sites, and arguing that protection of RAS sites should be coordinated on a case-by-case basis.[85]

34. *Discussion*. We will not change the allocation status of the RAS relative to ESAA. Commenters generally agree that the current allocation priority is appropriate, provided that reasonable

[75] *Notice*, 20 FCC Rcd at 2922-23, ¶¶ 28-29.

[76] *Id.* at 2922-23, ¶ 28.

[77] *Id.* at 2923, ¶ 29 (citing 47 C.F.R. § 2.106 US203).

[78] *Id.* at 2923, ¶ 30.

[79] *Id.* at 2923 ¶¶ 31-32.

[80] NRAO Comments at 3.

[81] *Id.* at 2-3.

[82] Boeing Comments at 13 and CORF Comments at 10.

[83] CORF Comments at 10.

[84] *Id.* at 4-5.

[85] ARINC Comments at 26-27, ARINC Reply at 11.

coordination procedures are in place. We will require ESAA licensees to coordinate with RAS sites whenever an ESAA earth station comes within radio line-of-sight of an RAS facility. At the same time, we conclude that a firm requirement that ESAA earth stations must cease transmissions in the 14.47-14.5 GHz sub-band whenever they are within line-of-sight of RAS facilities would be excessively burdensome on ESAA. We find that coordination on a case-by-case basis is both sufficient to protect RAS and consistent with Recommendation ITU-R M.1643, which addresses protection of RAS sites, requiring ESAA in the 14.47-14.5 GHz sub-band to either cease operations or comply with power limits when they are within line-of-sight of an RAS site. Accordingly, we adopt the proposed footnotes NG54 and US133, as modified to reflect the renamed mobile application of the FSS herein, and will add them to the Table of Allocations:

> NG54 In the band 14-14.5 GHz, Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 may be authorized to communicate with geostationary satellites in the fixed-satellite service (Earth-to-space), subject to the condition that ESAA shall not claim protection from, nor cause interference to, earth stations at given positions (where the given position may be a specified fixed point or any fixed point within specified areas)..
>
> 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 25.227(c) 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 25.226(d)(2) are subject to coordination with the National Science Foundation in accordance with 47 CFR 25.227(d).

35. Licensees currently authorized to provide ESAA shall submit the applicable NSF-licensee coordination agreement to the Commission by electronic means.[86] If an ESAA applicant submits the coordination agreement as part of its ESAA application, the 30-day public notice period for the application will provide opportunity for any public comment on the coordination agreement. Alternatively, upon receipt of coordination agreement from a licensee, the International Bureau will issue an information notice stating that the licensee may commence operations within the new coordination zone in 30 days if no party has opposed the operations.[87]

b. Relevant RAS Facilities

36. *Background*. In the *Notice*, the Commission sought comment on ESAA coordination obligations with respect to certain RAS facilities, including those listed in US203. Specifically, the Commission sought comment on requiring ESAA operators proposing operations in the 14.47-14.5 GHz sub-band and planning to travel within line- of-sight of the radio observatories listed in US203 to

[86] *Amendment of the Commission's Space Station Licensing Rules and Policies, 2000 Biennial Regulatory Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations*, Fourth Report and Order, 19 FCC Rcd 7419 (2004) (*Fourth Report and Order*); *Amendment of the Commission's Space Station Licensing Rules and Policies*, Declaratory Order, 19 FCC Rcd 19564 (Int'l Bur. 2004). *See also International Bureau Provides Guidance Concerning the Notice Requirement for C-Band Coordination by Earth Stations On Vessels*, Public Notice, DA 05-1671, 20 FCC Rcd 10748 (Int'l Bur. 2005).

[87] This notification procedure mirrors the procedure for ESV. *ESV Order*, 20 FCC Rcd at 715, ¶ 96.

coordinate their proposed operations to resolve any potential interference concerns.[88] In this regard, we also observe that footnote US342 of the Table of Allocations states that, in making assignments to stations in the 14.47-14.5 GHz sub-band, among other bands, we shall take all practicable steps to protect RAS from harmful interference.[89]

37. *Discussion*. We will require ESAA licensees to coordinate with the RAS facilities required by the VMES rules. We find that a similar circumstance exists for both ESAA and VMES terminals, which may operate in the vicinity of radio observatories anywhere within the United States. Given the potential ubiquity of ESAA terminals within the United States, we conclude that it is necessary to adopt a new rule section requiring ESAA coordination with certain RAS facilities – the same sites identified for VMES – to protect these important RAS sites from potential interference.

38. We note that this is not the appropriate proceeding in which to update US203. We do not have a full record on the issue of updating US203. As noted, US342 requires us, in making assignments in the 14.47-14.5 GHz band, among others, to take all practicable steps to protect RAS sites from harmful interference. We take cognizance of recent agreements between NSF and certain Commission licensees that include RAS facilities not listed in US203.[90] During the VMES proceeding, NTIA provided in an *ex parte* letter, the most recent list of RAS facilities making observations in the 14.47-14.5 GHz band and the contact information for initiating coordination with NSF.[91] We continue to believe that reliance on the sites listed in the NTIA Letter is a practicable approach to protecting RAS sites from potential ESAA interference. Thus, we will include a condition in ESAA licenses requiring the licensees to coordinate with NSF for the following operational RAS sites, as identified by NTIA: Kitt Peak, Arizona; Owens Valley, California; Mauna Kea, Hawaii; North Liberty, Iowa; Stinchfield Woods, Michigan; Hancock, New Hampshire; Los Alamos, New Mexico; Pie Town, New Mexico; Socorro, New Mexico; Rosman, North Carolina; Arecibo, Puerto Rico; Fort Davis, Texas; St. Croix, U.S. Virgin Islands; Brewster, Washington; and Green Bank, West Virginia.[92] This approach will ensure consistency with the mobile applications of the FSS operating in and over the United States.

c. Future RAS Facilities

39. *Background.* With regard to future RAS sites, ARINC recommends that we should limit coordination requirements to RAS sites listed in footnote US203, and that adding future RAS sites to

[88] *See Notice*, 20 FCC Rcd at 2922-23, ¶¶ 28-29.

[89] 47 C.F.R. § 2.106 US342.

[90] *See, e.g., Raysat LMSS Order*, 23 FCC Rcd at 1995-96, ¶¶ 30-31 (discussing coordination agreement between NSF and Raysat); Raysat, Inc., Application for Authority to Operate 4,000 In-Motion Mobile Satellite Antennas in the 14.0-14.5 GHz and 11.7-12.2 GHz Frequency Bands, File Nos. SES-LIC-20060629-01083 *et al*., Application, Exhibit 3, Technical Operational Coordination Agreement for the Joint Usage of the Band 14.0-14.5 GHz between the National Science Foundation and Land Mobile Satellite Service Earth Stations (LMSS) Operated by Raysat, Inc. (May 25, 2006) (NSF-Raysat Coordination Agreement) *available at* http://licensing.fcc.gov/ibfsweb/ib.page.FetchAttachment?attachment_key=-110808. The NSF-Raysat Coordination Agreement lists the following sites: Green Bank, West Virginia; Socorro, New Mexico; Brewster, Washington; Owens Valley, California; Kitt Peak, Arizona; Pie Town, New Mexico; Los Alamos, New Mexico; Fort Davis, Texas; North Liberty, Iowa; and Hancock, New Hampshire. NSF-Raysat Coordination Agreement at 3. Footnote US203 lists Green Bank and Socorro, plus additional sites not listed in the NSF-Raysat Coordination Agreement. 47 C.F.R. § 2.106 US203.

[91] Letter from Karl Nebbia, NTIA to Julius Knapp, Chief, Office of Engineering and Technology, IB Docket No. 07-101 (dated Dec. 1, 2008) (NTIA Letter) (listing RAS sites and proposed coordination zones and identifying NSF contact point).

[92] NTIA Letter at 1.

footnote US203 should only be done by a full rulemaking proceeding. ARINC opposes *ad hoc* coordination requirements, arguing that this could subject ESAA licensees to unreasonable demands from RAS operators.[93] NRAO, on the other hand, states that any list of RAS sites in the rules will become obsolete, and recommends creating a registry listing all RAS sites, along with the properties, frequency bands, and regulatory provisions relevant to each site.[94] CORF recommends an *ad hoc* coordination process until footnote US203 can be updated, and recommends that NTIA or NSF notify the Commission six months before a new RAS site becomes operational. The Commission would then issue a public notice informing ESAA licensees of the need to coordinate with the new RAS site prior to the beginning of operations at the RAS site.[95]

40. *Discussion.* We find that a process whereby NTIA would inform us six months before new RAS sites become operational, and ESAA licensees are required to coordinate with those RAS sites, best balances the need to protect future RAS facilities from interference while minimizing the need for the Commission to initiate a new rulemaking proceeding for each RAS facility. We adopted a similar procedure for coordination between ESV and VMES, and new TDRSS sites.[96] We also find that NRAO's suggestion of a publicly available database listing RAS sites along with their properties, frequency bands, and regulations applicable to those frequency bands, would facilitate coordination and make it unnecessary to engage in full rulemaking proceedings to add new RAS sites to our rules. For these reasons, we adopt the procedure used for future TDRSS sites for future RAS sites as well. That is, once NTIA notifies the International Bureau that these facilities are about to become operational, the International Bureau will issue a public notice requiring each ESAA operator in the 14.47-14.5 GHz sub-band to cease operations within line-of-sight of the new RAS facility until the ESAA operator has completed a coordination agreement with NSF for the new RAS site.[97] ESAA operators shall notify the International Bureau once they have completed coordination and shall submit the applicable coordination agreement to us. 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 new coordination zone in 30 days if no party has opposed the operations.

C. Technical Rules

1. Introduction

41. As stated above, ESAA networks are technically similar to VSAT networks, as well as other mobile FSS networks, *i.e.*, ESV and VMES. As a result, the technical rules for ESAA draw on those adopted for such systems. This is a logical step because from the point-of-view of a GSO satellite, in orbit some 22,000 miles above the equator, all of these "mobile" terminals appear to be virtually fixed FSS terminals. The relative motion of these terminals, while significantly different as viewed from the surface of the earth, is nonexistent when viewed from the target satellite. The equivalent nature of the three mobile terminals is reflected in the fact that the systems and antennas frequently share a common or identical design.[98] As the Commission recognized in the *Notice*, the sharing rules for ESVs have their genesis in the VSAT rules and the technical concepts embodied in the rules for both VSAT systems and

[93] ARINC Comments at 27, ARINC Reply at 11.

[94] NRAO Comments at 4.

[95] CORF Comments at 6-9.

[96] *ESV Order*, 20 FCC Rcd at 713, ¶ 91.

[97] *See infra* Section IV.B.2.a for a discussion of coordination procedure.

[98] The common nature of these services has become more obvious over time. More recently, there have been various international technical groups working towards common design standards for all three services using the designation Earth Stations on Mobile Platforms (ESOMPs).

ESVs can be extended to apply to ESAA.[99] While the VMES proceeding opened after both the ESAA and ESV proceedings, the VMES rules share the same basic framework.[100]

42. While the ESAA rules we adopt in this proceeding are based on our VSAT rules, and are very similar and in certain cases identical to the rules for ESV and VMES, they are not wholly identical to those rules. One of the differences between these different mobile terminals is the accelerations and changes in direction that the mobile vehicles undergo. The antenna pointing mechanism must compensate for any change in direction and must be capable of maintaining the accurate pointing of the antenna at the target satellite. Thus, differences in the rules for ESV, VMES and ESAA networks will reflect the different environments in which the terminals operate. We also note that our rules regarding VSATs will apply to ESAA, except where otherwise specified in the relevant rule section. In particular we note that ESAA are covered by the coordination and procedures to be followed in case of interference found in Sections 25.272-25.274 of our rules.[101]

43. The rules that we adopt reflect the technical innovations that enable earth stations mounted on mobile platforms to communicate with GSO FSS space stations in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz (space-to-Earth or downlink) and 14.0-14.5 GHz (Earth-to-space or uplink) frequency bands without causing harmful interference to other users of the band. As noted above, since the *Notice* was released, the Commission has adopted technical rules for two other mobile applications communicating with GSO FSS space stations in these bands – ESV and VMES.[102] In addition, the *Streamlining Eighth Report and Order* brought the GSO FSS rules up to date in a number of areas.[103] During the same time, our licensing experience with these mobile platforms using GSO FSS space stations in the 11.2-11.7 GHz and 14.0-14.5 GHz bands suggests that a number of different types of ESAA systems may apply for licensing.[104] Therefore, the rules we adopt here reflect the regulatory advances in FCC licensing and our experience with similar mobile platforms that operators currently use to communicate with GSO FSS space stations in these bands.[105] As a result, a few subtle aspects of the

[99] *Notice*, 20 FCC Rcd at 2932-33, ¶¶ 47-50 (seeking comment on licensing and technical rules for ESAA similar to those under which VSAT and ESV operate).

[100] The VMES docket opened in 2007. IB Docket No. 07-101.

[101] 47 C.F.R. §§ 25.272-25.274.

[102] *ESV Order*, 20 FCC Rcd at 705, ¶ 76; *VMES Order*, 24 FCC Rcd at 10423, ¶ 27.

[103] *See generally 2000 Biennial Regulatory Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage By, Satellite Network Earth Stations and Space Stations; Amendment of Part 25 of the Commission's Rules and Regulations to Reduce Alien Carrier Interference Between Fixed-Satellites at Reduced Orbital Spacings and to Revise Application Procedures for Satellite Communication Services*, IB Docket No. 00-248, Eighth Report and Order and Order on Reconsideration, 23 FCC Rcd 15099 (2008) (*Streamlining Eighth Report and Order*).

[104] Examples of the different types of systems that operators might employ include VSAT-like systems with a single carrier per channel; low EIRP density systems that use small antennas and spectrum spreading techniques to remain within the EIRP density limits and that may use multiple co-frequency terminals; higher EIRP density systems that operate on a non-conforming basis, but within the existing coordination agreements of affected FSS operators; and dynamic EIRP density systems that can assign a specific data rate to one of several terminals operating on the same frequencies.

[105] Commenters request that we adopt rules that reflect the concepts developed for ESV (the original rules adopted prior to our *Notice* and subsequent *ESV Order*) and VMES as well as the Part 25 Earth Station streamlining proceeding. *E.g.*, Boeing Comments at 15; Boeing Reply Comments at 2-3; ViaSat, Inc. Reply Comments (ESAA networks should have "the same regulatory status and treatment as VSAT terminals in an FSS network"); ARINC Comments at 2, 24; Boeing *ex parte* February 24, 2009 (requesting that the Commission adopt service rules that generally mirror those adopted for ESV, while taking into consideration the rules adopted in the Part 25 and VMES

(continued....)

technical rules we adopt below represent a logical outgrowth of the proposals contained in the *Notice*.[106] We conclude that providing a flexible regulatory structure that reflects the state of technology will facilitate economies of scale and also allow individual operators to tailor their systems to best meet their business plans.

2. Off-Axis EIRP Density Limits Along the GSO Arc

44. In the *Notice*, in order to protect existing FSS users of the band, the Commission requested comment on establishing an "envelope" of off-axis EIRP density limits for ESAA that were based on rules for FSS earth stations in a two-degree spacing environment. This envelope was recommended by Boeing in its petition.[107] This approach would limit the off-axis EIRP density of all transmitting earth stations in an ESAA system to the same levels generated by an ordinary FSS fixed earth station communicating with a GSO FSS space station. The Commission noted that, for earth stations on aircraft communicating with GSO FSS space stations, that fixed earth stations protect adjacent FSS networks by meeting Sections 25.134(a)(1) and 25.209 of our rules.[108] At the same time, we acknowledged that adopting an aggregate off-axis EIRP density limit would give more flexibility to NCMCs in assigning power limits to ESAA for simultaneous co-frequency transmissions, while satisfying the aggregate power flux density (PFD) value. Such an approach would permit ESAA airborne terminals to have different off-axis EIRP density values depending on the characteristics of each ESAA airborne terminal. Enforcement and control of off-axis EIRP density limits on individual airborne terminals, however, might be simpler for NCMCs than controlling an aggregate value. Therefore, alternatively, the Commission sought comment on controlling the aggregate off-axis EIRP density envelope from a number of co-frequency terminals as proposed by Boeing.[109] In this situation the off-axis EIRP density of all co-frequency ESAA transmissions would not exceed the levels generated by a routinely authorized VSAT under Section 25.134(a) (1) (maximum input power density of -14 dBW/4 kHz into an antenna with side lobes specified in Section 25.209(a) (1)) to protect satellite operations in a two-degree spacing environment.

(...continued from previous page)
proceedings); Boeing *ex parte* dated June 26, 2009 (noting that consistent treatment between VMES and ESAA is widely supported by ViaSat, ARINC and SIA in comments in the VMES proceeding). Although they may not provide the only basis upon which an agency claims to have satisfied the notice requirement, comments may be adduced as evidence of the adequacy of notice. *See National Mining Ass'n v. Mine Safety and Health Admin.*, 512 F.3d 696, 699 (D.C. Cir. 2008) (*National Mining*), *Horsehead Res. Dev. Co. v. Browner*, 16 F.3d 1246, 1268 (D.C. Cir. 1994) (*Horsehead*).

[106] *See, e.g.*, *Public Service Commission of the District of Columbia v. FCC*, 906 F.2d 713, 717 (D.C. Cir. 1990) (stating that "it is well established that the exact result reached after a notice and comment rulemaking need not be set out in the initial notice for the notice to be sufficient. Rather, the final rule must be 'a logical outgrowth' of the rule proposed"). The specific provisions that would be considered a logical outgrowth of our proposals contained in our *Notice* include (a) the provisions regarding off-axis EIRP density limits in direction other than along the GSO arc found in Section IV.C.3, (b) the limits placed on dynamic EIRP density systems found in Section IV.C.7 and (c) the rules adopted concerning the use of contention protocols found in Section IV.C.11. As detailed in the applicable section, the technical and spectrum management issues that give rise to these rules were discussed in the *Notice* and resulted in the filing of relevant comments.

[107] Boeing 2003 Petition for Rulemaking at 14-18.

[108] Section 25.134(a)(1) limits the maximum input power density for a Ku-band VSAT while Section 25.209 defines the minimum gain envelope for a VSAT Ku-band antenna. Combined together these two sections describe the maximum off-axis EIRP density envelope permitted to avoid interference to adjacent satellite within the two-degree spacing scheme we adopted.

[109] *See Notice*, 20 FCC Rcd at 2925-27, ¶¶ 34-36.

45. ARINC supports the aggregate approach to off-axis EIRP density limits, stating that this approach adequately protects other FSS uses from harmful interference, and pointing out that the aggregate off-axis EIRP density envelope is consistent with Recommendation ITU-R M.1643. ARINC also denies that individual limits would be simpler for NCMCs to control, due to the use of sophisticated computer algorithms by NCMCs.[110] Boeing also supports the aggregate approach to off-axis EIRP density limits, but suggests several changes in the values it presented in its petition.[111] Intelsat and SES also support the aggregate approach to off-axis EIRP density limits.[112] Telesat, however, doubts the practicality of NCMC control of aggregate EIRP density, and therefore supports imposing off-axis EIRP density limits to individual ESAA terminals.[113] ViaSat argues that ESAA operators should be free to determine for themselves whether off-axis EIRP density limits should be controlled on an individual or aggregate basis, stating that overall system design and network management system will determine whether the individual approach or aggregate approach is best for that ESAA system.[114]

46. We adopt rules for both the aggregate approach and individual system designs for off-axis EIRP density of earth stations in an ESAA licensee's network. This is the approach we took in establishing off-axis EIRP density limits for ESV[115] and VMES.[116] If an operator chooses to operate with a single terminal on a channel, the terminal must meet the EIRP density limits in a similar fashion to the ESV and VMES single channel systems. If an operator chooses a system that uses multiple co-frequency terminals, whether using dynamic data rates or fixed data rates, the system must meet the EIRP density limits in the aggregate. We find that this approach is the most technically neutral.

47. In the *Notice*, the Commission invited comment on basing the off-axis EIRP density envelopes for ESAA airborne terminals on the antenna gain pattern envelopes and power requirements in Part 25 applicable to FSS earth stations.[117] The requirements that were in effect at the time of the Notice are set forth below in Table 1.[118]

Table 1

Angle-off-axis	Maximum EIRP density in any 4 KHz band
$1.0^\circ \leq \theta \leq 7.0^\circ$	15-25 $\log_{10}$ dBW
$7.0^\circ < \theta \leq 9.2^\circ$	-6 dBW
$9.2^\circ < \theta \leq 48^\circ$	18-25 $\log_{10}$ dBW
$\theta > 48^\circ$	-24 dBW

48. A number of commenters support the Commission's proposal to make the off-axis EIRP density envelopes for ESAA airborne terminals consistent with the envelopes that apply to FSS earth stations, and argue that the revisions to those FSS envelopes, such as the revisions ultimately adopted for VSAT earth stations in the *Part 25 Earth Station Streamlining* proceeding, should also be incorporated

[110] ARINC Comments at 3-4.

[111] Boeing Comments at 15-18.

[112] Intelsat Comments at 3; SES Comments at 3-4.

[113] Telesat Comments at 3.

[114] ViaSat Comments at 6.

[115] *ESV Order*, 20 FCC Rcd at 716, ¶ 99.

[116] *VMES Order*, 24 FCC Rcd at 10439, ¶ 83.

[117] *Notice*, 20 FCC Rcd at 2926, ¶ 35.

[118] *Notice*, 20 FCC Rcd at 2926-27 ¶ 36.

into the envelopes for ESAA terminals.[119] The NPRM recognized that for Ku-band ESAA terminals communicating with FSS satellites, the starting point for protecting adjacent FSS networks is contained in 47 C.F.R. §§ 25.134(a)(1) and 25.209, *i.e.*, the same off-axis EIRP density rules consistent with the off-axis EIRP density rules for FSS earth stations.[120] For example, Boeing contends that the off-axis EIRP density envelope based on the *Part 25 Earth Station Streamlining* proposal would give ESAA airborne terminal operators greater flexibility without increasing the potential for harmful interference to GSO FSS operations.[121]

49. Alternatively, PanAmSat and SES assert that the off-axis EIRP density envelope for ESAA airborne terminals must start at one degree off-axis to provide adequate protection to adjacent space stations.[122] According to PanAmSat, supporters of a 1.5 degree off-axis starting point overlook "critical distinctions" between ESAA airborne terminals and VSATs, such as the fact that VSATs are fixed whereas ESAA airborne terminals are mobile, and that VSATs have an established track record whereas ESAA is "new and untested."[123] Boeing says that PanAmSat provides no analysis to support its conclusion that a one degree starting angle is necessary for FSS protection and that it should be rejected.[124]

50. We are persuaded by the reasoning in favor of starting the off-axis EIRP density envelope at 1.5 degrees off-axis. Subsequent to the adoption of the *Notice*, in the *Streamlining Eighth Report and Order*, the Commission revised the antenna gain pattern envelope for FSS earth stations operating in the C-band and in the 11.2-11.7 GHz and 14.0-14.5 GHz bands. Specifically, the Commission decided to start the antenna gain pattern envelope at 1.5 degrees off-axis, instead of 1.25 degrees off-axis for earth stations in the 14.0-14.5 GHz band.[125] The Commission also relaxed the backlobe gain limits for earth stations in the 14.0-14.5 GHz band for angles greater than 85 degrees off-axis.[126] Concurrently with these revisions, the Commission proposed the off-axis EIRP density envelope set forth below for digital FSS earth stations in the 14.0-14.5 GHz band based on the revised antenna gain pattern envelope.[127] The Commission adopted the off-axis EIRP density envelope proposal for FSS earth stations in the *Streamlining Eighth Report and Order* as shown in Table 2 below.[128]

Table 2

$15 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
$-6 - 10\log_{10}(N)$	dBW/4 kHz	For	$7° < \theta \leq 9.2°$

[119] ViaSat Comments at 4-5, SES Comments at 3, Intelsat Comments at 3-4, Boeing Comments at 16-18; Boeing Reply at 8-9; SES Reply at 2-3.

[120] *Notice*, 20 FCC Rcd at 2926-27 ¶ 36.

[121] Boeing Comments at 16 (citing *In re 2000 Biennial Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage By, Satellite Network Earth Stations and Space Stations; Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures*, Sixth Report and Order and Third Notice of Proposed Rulemaking, IB Docket No. 00-248, 20 FCC Rcd 5593 (2005) (*Streamlining Sixth Report and Order*)).

[122] PanAmSat Comments at 3, SES Comments at 3, PanAmSat Reply at 3.

[123] PanAmSat Reply at 3.

[124] Boeing Reply at 9.

[125] *Streamlining Sixth Report and Order*, 20 FCC Rcd at 5604, ¶¶ 22-25.

[126] *Id*. at 5611, ¶¶ 40-41.

[127] *Id*. at 5622, ¶¶ 77-78.

[128] *Streamlining Eighth Report and Order*, 23 FCC Rcd 15099, 15109 at ¶¶ 18-24.

$18 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$
$- 24 - 10\log_{10}(N)$	dBW/4 kHz	For	$48° < \theta \leq 85°$
$- 14 - 10\log_{10}(N)$	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ is the angle in degrees from the line connecting the focal point of the antenna to the target satellite, within the plane determined by the focal point of the antenna and the line tangent to the arc of the geostationary satellite orbit at the position of the target satellite.

51. We have found that the reasoning underlying the VSAT off-axis EIRP density envelope above is also applicable to both the ESV and VMES terminals, and we conclude that these findings are equally applicable to ESAA airborne terminals. Like the ESAA terminals, the ESV and VMES terminals operate on a mobile basis in this fixed satellite band. While the speed of the airborne ESAA terminals will, undoubtedly, be greater than that of an ESV or VMES terminal, from the point of view of the satellite, some 22,000 miles above the Earth, this difference in speed is inconsequential. The important aspect of the terminal motion is that the tracking system compensate for any rapid rotations in pitch or roll of the moving platform. By utilizing this off-axis EIRP density envelope, we are implementing a coherent and consistent set of rules for the mobile applications of the FSS operating in the 14.0-14.5 GHz band including ESV, VMES and ESAA terminals.

52. In adopting this EIRP density envelope in Table 2, we include a term "N" to account for the number of terminals operating co-frequency in the same satellite antenna beam when each of the "N" terminals has the same EIRP density.[129] For a system that uses co-frequency terminals with dynamic EIRP density, N is to be taken as one, meaning that the aggregate EIRP density from all co-frequency terminals in the same satellite receive beam is the quantity being regulated. Accordingly, the off-axis EIRP density envelopes that we adopt for ESAAs in order to protect primary FSS operations are based on the power limits and gain requirements that the Commission adopted for VSAT earth stations in the *Streamlining Sixth Report and Order*. Those off-axis EIRP density envelopes are set forth in Appendix C to this Order. This EIRP density envelope applies where satellites are operating in a two-degree environment, that is, typically with FSS systems licensed for operation over the United States. Operation over international waters, or near and over other administrations, is discussed *infra*.

53. As regards minor exceedances of the off-axis EIRP density envelopes, in the *Notice*, the Commission proposed that the EIRP density of an individual sidelobe may not exceed the envelope defined above for θ between 1.0 and 7.0 degrees. For θ greater than 7.0 degrees, the Commission proposed that the envelope may be exceeded by no more than 10 percent of the sidelobes, provided no individual sidelobe exceeds the EIRP density envelope given above by more than 3 dB.[130] A number of commenters support the proposal to permit minor exceedances of the off-axis density envelope in the *Notice*.[131] ARINC emphasizes that such treatment would be consistent with our regulation of VSAT and ESV networks.[132] We also note that the Commission recently adopted a similar rule in the VMES

[129] For digital Single Channel per Carrier using frequency division multiple access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For terminals using spectrum spreading techniques with the same EIRP density per terminal, N is the expected maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam. Systems using dynamic EIRP density are discussed in more detail below.

[130] *Notice*, 20 FCC Rcd at 2927-28, ¶ 38.

[131] Intelsat Comments at 4; ViaSat Comments at 14; ARINC Comments at 5-6; Boeing Comments at 18; Boeing Reply at 10; ARINC Reply at 5.

[132] ARINC Comments at 6; ARINC Reply at 5.

proceeding.[133] No party opposes this proposal. Accordingly, we adopt our proposal to make ESAA regulations consistent with VSAT and ESV regulations.

3. Off-Axis EIRP Density in Directions Other than Along the GSO ARC

54. As mentioned above, the *Notice* requested comment on basing the off-axis EIRP density envelopes for ESAA terminals on the envelopes applicable to FSS earth stations, including envelopes applicable to antenna patterns of their terminals in both the elevation and the azimuth planes.[134] The *Notice* noted the existence of an FSS NGSO allocation in the 14.0-14.5 GHz band but also explained that no licenses had been issued for such systems.[135] ViaSat supports the Commission's proposal to address antenna performance in the elevation plane, particularly in the 14.0-14.5 GHz band, in which ESAA operations might affect NGSO satellites in the 14.0-14.5 GHz band.[136] ViaSat points out that existing GSO FSS antenna rules cover the gain pattern envelope in the GSO and elevation planes.[137] ViaSat observes that ESAA airborne terminal operators can reduce input power density to meet the proposed off-axis EIRP density limits in the elevation plane, but contends that this results in a lower system capacity.[138] ViaSat argues that, because no commercial NGSO systems are operating or planned in the band, the Commission should amend its rules to allow greater power in the elevation plane for ESAA airborne terminals.[139] PanAmSat disagrees with ViaSat's proposal and instead notes that Boeing's comments indicate that the alignment of the major axis of the antenna with respect to the tangent to the geostationary satellite orbit arc at the target satellite into account when determining whether ESAA terminals are in compliance with the off-axis EIRP density envelope,[140] PanAmSat construes this as a "commitment" to align the major axis of its antenna to a line tangent to the GSO arc at the longitude of the target satellite, and asserts that this commitment is essential to protect traditional FSS satellite users from sub-performing antennas.

55. We find ViaSat persuasive on this issue and disagree with PanAmSat. FSS earth station operators are allowed to meet less strict antenna gain pattern requirements outside of the GSO orbital plane.[141] Further, the Commission has established less strict requirements for VMES, which are based on the *Streamlining Eighth Report and Order*.[142] To be consistent with those FSS requirements, we find that ESAA airborne terminal operators should be allowed to meet a less strict off-axis EIRP density envelope

[133] *VMES Order*, 24 FCC Rcd 10441, ¶ 90.

[134] *See Notice*, 20 FCC Rcd at 2926, ¶ 35, citing Section 25.209 of the Commission's rules, 47 C.F.R. § 25.209. The antenna gain pattern envelope applicable to FSS earth stations in the elevation plane is in Section 25.209(a)(3) of the Commission's rules.

[135] *Notice*, 20 FCC Rcd at 2919 ¶ 20. There are no pending applications or existing authorizations to operate an NGSO FSS Ku-band network. The Commission granted one authorization to SkyBridge LLC, but the applicant surrendered the license. *Policy Branch Information, Actions Taken*, Public Notice, DA 05-2327 (rel. Aug. 19, 2005).

[136] ViaSat Comments at 14-15.

[137] *Id.* at 15.

[138] ViaSat Comments at 16.

[139] *Id*. at 16-17.

[140] PanAmSat Reply at 4 (citing Boeing at 50).

[141] 47 C.F.R. § 25.209(a)(2). *See also Streamlining Sixth Report and Order*, 20 FCC Rcd at 5610, ¶¶ 37-41 (adopting revisions to, among other rules, the Ku-band antenna gain pattern envelope).

[142] *VMES Order*, 24 FCC Rcd at 10444, ¶ 95.

outside of the GSO orbital plane.[143] Accordingly, we adopt an off-axis EIRP density envelope outside of the GSO orbital plane, based on the 14.0-14.5 GHz antenna gain pattern envelope outside the GSO orbital plane, revised as set forth in the *Streamlining Eighth Report and Order*, and as set forth in Table 3 below:

Table 3

$18 - 10\log_{10}(N) - 25\log_{10}\theta$	dBW/4 kHz	For	$3° \leq \theta \leq 48°$
$-24 - 10\log_{10}(N)$	dBW/4 kHz	For	$48° < \theta \leq 85°$
$-14 - 10\log_{10}(N)$	dBW/4 kHz	For	$85° < \theta \leq 180°$

where θ is the angle in degrees from the line connecting the focal point of the antenna to the target satellite, within any plane that includes that line, with the exception of the plane determined by the focal point of the antenna and the line tangent to the arc of the geostationary satellite orbit at the position of the target satellite and N is defined as in Table 2.[144]

Regardless of whether the ESAA airborne antenna is aligned with the GSO orbital arc, it will not cause harmful interference to adjacent satellite operators if the ESAA airborne terminal antenna is in compliance with off-axis EIRP density limits adopted here – inclusive of both those along the GSO arc and also in directions other than along the GSO arc.

56. As regards minor exceedances of the off-axis EIRP density envelope in Table 3 we will adopt the allowable exceedances in Section 25.209(a)(3) dealing with the antenna envelope exceedances for the 14.0-14.5 GHz band in directions other than along the GSO. Specifically, the envelope in Table 3 shall be exceeded by no more than 10 percent of the sidelobes provided no individual sidelobe exceeds the gain envelope given above by more than 6 dB. The region of the main reflector spillover energy is to be interpreted as a single lobe and shall not exceed the envelope by more than 6 dB.

4. Variations in Antenna Gain Pattern and Transmit EIRP Density

57. *Background.* Unlike the initial ESV communication systems that used VSAT-like FDMA or TDMA techniques, many ESAA systems are expected to operate using multiple, co-frequency terminals. These terminals will be controlled by a NCMC that may be capable of assigning a specific data rate with a specific power level to a particular terminal as required by the communication load at the terminal. In general, the EIRP density of the ESAA terminals will be a function of the data rate carried by the terminal. Alternatively, in some ESAA systems the NCMC may control the number of simultaneous active, co-frequency terminals each of which will have a fixed data rate. These ESAA systems are more complex than the VSAT-like ESV systems, with the NCMC having to predict the EIRP density on a dynamic basis and control the ESAA through an FSS communication link with a built in time-delay. There are a number of factors that affect the operation of the NCMC as discussed directly below. The simpler single channel per-carrier systems are also permitted to operate as ESAA systems and will be addressed *infra*.

58. In the *Notice,* the Commission noted that a number of factors including variations in antenna gain could vary the off-axis EIRP density levels generated by the ESAA. Variations in antenna gain pattern can include the effects caused by manufacturing tolerances, aging of the antenna,

[143] *See also* Boeing Comments at 15; Boeing Reply Comments at 2-3; ViaSat, Inc. Reply Comments; ARINC Comments at 2, 24; Boeing *ex parte* February 24, 2009; Boeing *ex parte* dated June 26, 2009 (noting that consistent treatment between VMES and ESAA is widely supported by ViaSat, ARINC and SIA in comments in the VMES proceeding).

[144] *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15117-18, ¶¶ 37-41.

environmental effects, and in ESAA networks by the use of certain types of airborne terminal antennas, such as phased arrays. Additionally, the *Notice* stated that other effects such as measurement error, control error, and latency for closed-loop power control systems can cause variations in the off-axis EIRP density. Accordingly, the Commission sought comment on requiring NCMCs that calculate the EIRP density of ESAA airborne terminals based on the received signal to take into account error sources and latency in this calculation. We also proposed requiring NCMCs that calculate the EIRP density of ESAA airborne terminals based on input power to account for measurement error and reporting latency.[145]

59. Boeing and PanAmSat support requiring new ESAA licensees to submit ESAA system performance verification reports prior to commencing commercial operations.[146] Such reports would ensure that operations adequately account for all factors affecting off-axis EIRP density, according to Boeing.[147] Intelsat also supports requiring ESAA applicants to demonstrate how variation in antenna patterns and transmit EIRP density are accounted for in the design, coordination, and operation of an ESAA.[148]

60. ViaSat counters that Boeing's proposed testing requirement is unnecessary and administratively burdensome, because the rules already require earth station licensees to certify within one year of grant that the licensed facilities have been built and are operating in accordance with the license term.[149] ViaSat further argues that the Commission does not need applicant information regarding variations in EIRP density due to manufacturing, aging, and environmental effects, claiming that ESAA airborne terminals are more precise and robust than other blanket-licensed fixed earth stations.[150] PanAmSat contends that VSAT terminals are required to individually meet the input power and performance criteria of Sections 25.134 and 25.209, while no such requirement has been proposed for ESAA.[151]

61. *Discussion*. We decline to adopt Boeing's proposal to require new ESAA licensees to submit ESAA system performance verification reports prior to commencing commercial operations. We disagree with Boeing and PanAmSat that this report is needed to ensure that our EIRP density envelope is met. We find that the technical information required to apply for and obtain ESAA licenses ensures that we have accounted for variations in the antenna pattern and the transmit EIRP. For example, we require applicants to submit detailed system descriptions, along with applications, that demonstrate how systems will meet the EIRP density envelope.[152] Further, operations under any ESAA authorization must be in accordance with the technical parameters of the application. Therefore, given that applicants will be filing detailed technical information requested as part of the ESAA license application process, and any authorization will be conditioned on compliance with such technical information, we conclude that such a report would not be necessary.

[145] *Notice*, 20 FCC Rcd at 2929-30, ¶ 41.

[146] Boeing Comments at 29-30; PanAmSat Reply at 6-7.

[147] Boeing Comments at 29.

[148] Intelsat Comments at 6.

[149] ViaSat Reply at 21-22.

[150] ViaSat Comments at 19-20.

[151] PanAmSat Reply at 4.

[152] *See infra* Section IV.D.5. (Information Requirements).

5. Antenna Pointing Accuracy Requirement Adopted

62. *Background*. In the *Notice*, the Commission proposed requiring ESAA applicants to demonstrate that they have accounted for potential antenna mispointing in the design, coordination and operation of their ESAA airborne terminals. Specifically, the Commission proposed requiring ESAA system operators to maintain an antenna pointing accuracy of 0.2 degrees with a high degree of confidence.[153]

63. ViaSat maintains that an antenna accuracy requirement would add needless expense to ESAA systems.[154] ARINC argues that there is no basis for the proposal. ARINC states that antenna mispointing is accounted for in the application of the off-axis EIRP density envelope, and it is therefore unnecessary to apply pointing accuracy requirements.[155] Further, ARINC asserts that antenna mispointing is likely to have little or no effect on other satellites, and attaches a technical analysis that purports to demonstrate that even an antenna mispointing of four degrees does not violate the off-axis EIRP density limits.[156] ARINC also claims that we recognized in the ESV context that off-axis EIRP density limits alone provide sufficient interference protection to other satellites.[157] ARINC also argues that while WRC-03 Resolution 902 suggests a peak tracking accuracy for ESV antennas of 0.2 degrees, the guidelines in ITU-R Recommendation M.1643 specify no similar tracking or pointing accuracy requirements.[158] Finally, ARINC asserts that pointing accuracy requirements could stifle innovation in an environment where interference protection is a matter of both antenna power and beamwidth, both of which are covered by specifying off-axis EIRP density limits.[159] ARINC and ViaSat maintain that a pointing error requirement applicable to individual ESAA airborne antennas is unnecessary because there is very little power supplied to an individual ESAA airborne antenna, and therefore little potential for harmful interference.[160] Moreover, ViaSat argues that the likelihood of many ESAA airborne antennas all mispointing at once at the same satellite is low due to the random nature of mispointing errors.[161] Telesat supports a requirement that ESAA applications provide a technical showing that off-axis EIRP density limits will not be exceeded.[162] Other commenters support our proposal. [163]

64. *Discussion*. We find that in order to adequately protect the existing primary FSS service from potential harmful interference resulting from vibration and rapid movement ESAA antennas, time-lag or insensitivity of ESAA antenna tracking mechanisms, there must be a level of assurance with respect to these anomalies. As previously mentioned, we expect a number of different types of ESAA systems to be licensed. For systems that have multiple co-frequency terminals and use very low EIRP density transmissions, such as ARINC describes, we agree that the mispointing of any single antenna does not pose a threat of interference. For terminals that use higher EIRP density transmissions, however,

[153] *Notice*, 20 FCC Rcd at 2929-30, ¶ 41.

[154] ViaSat Comments at 18-19.

[155] ARINC Comments at 9-10.

[156] *Id.* at 10-11.

[157] *Id.* at 10.

[158] *Id.* at 9.

[159] *Id.* at 12.

[160] *Id.* at 10-11; ViaSat Comments at 18-19; ViaSat Reply at 12.

[161] ViaSat Reply at 12-13, and Exhibit A.

[162] Telesat Comments at 3.

[163] PanAmSat Comments at 3; Intelsat Comments at 6; SUIRG Comments at 2.

there is a real danger of interference to existing FSS service. Therefore, we will distinguish between high EIRP density terminals operating near the EIRP density envelope limit and systems that use spectrum spreading techniques to operate terminals with low EIRP densities.

65. Antenna pointing error is dynamic in nature. Therefore, we require ESAA operators to maintain a 0.2 degree antenna pointing accuracy. All ESAA license applicants should demonstrate, through engineering analysis, that the total tracking error budget of their antenna is within 0.2 degrees of the three sigma (б)[164] value as part of the ESAA system license application. In particular, the applicant must show that the antenna pointing error is within three б from the mean value (*i.e.*, that the antenna maintains a pointing error within 0.2 degrees for 99.7 percent of the time). We disagree with commenters that antenna pointing accuracy has no impact on the off-axis EIRP density limits. Indeed, the applicant's off-axis EIRP density estimation should depend mainly on the antenna pointing error budget. The transmit power, the antenna gain, and the beamwidth are predictable and remain as constants throughout the operation.

66. We will, however, allow systems to avoid the 0.2 degree requirement by disclosing the antenna pointing accuracy that will be maintained and demonstrating and certifying that aggregate off-axis EIRP density will be below the levels set forth above for all angles. For systems that meet the 0.2 degree antenna pointing accuracy a certification from the antenna/tracking system manufacturer that the system meets this value under the expected operational environment will suffice along with a description of the expected operational environment. A demonstration attempting to show that the aggregate off-axis EIRP density from a number of co-frequency ESAA terminals will meet the off-axis EIRP density envelope should take into account, among other factors, the expected antenna mispointing statistics, the maximum number of co-frequency terminals and the expected range of EIRP densities from each terminal, and must show, convincingly, that aggregate EIRP density from all of the co-frequency ESAA terminals will be less than the EIRP density envelope.

6. Shut-off Capability

67. *Background*. In the *Notice*, the Commission sought comment on several rule revisions designed to prevent ESAAs from transmitting in unintended directions. First, the Commission proposed requiring ESAA operators to monitor and control their airborne terminals through a NCMC or equivalent facility located within the United States. ESAA airborne terminals would, at a minimum, receive "enable transmission" and "disable transmission" commands from the NCMC.[165] Airborne terminals would have to automatically cease transmissions immediately upon receiving any "parameter change" command, which may cause harmful interference during the change, until the airborne terminal receives an "enable transmission" command from its NCMC. In addition, the NCMC would be capable of monitoring the operation of each airborne terminal to determine if it is malfunctioning.[166]

68. In addition, the Commission proposed requiring ESAA airborne terminals to be self-monitoring, and to mute their transmissions automatically until the cause of harmful interference has been remedied.[167] Finally, the Commission proposed requiring ESAA airborne terminals that use closed-loop tracking of the satellite signal to employ an algorithm that is resistant to capturing and tracking adjacent

[164] Sigma is a standard deviation in a normal distribution.

[165] "Enable transmission" and "disable transmission" commands from the NCMC are instructions to the ESAA terminal to permit it to transmit or prevent it from transmitting.

[166] *Notice*, 20 FCC Rcd at 2930, ¶ 43.

[167] *See Notice*, 20 FCC Rcd at 2930, ¶ 44.

satellite signals.[168] ESAA airborne terminals would be required to immediately inhibit transmission when they detect that unintended satellite tracking has happened or is imminent.[169]

69. Several parties support requiring ESAA airborne terminals to cease transmissions when they are not pointed toward their intended satellites.[170] ARINC notes, however, that not all ESAA systems will use closed-loop tracking, noting that ARINC itself uses an open-loop algorithm. In an open-loop system the terminal antenna intentionally points away from the target satellite, in a small, programmed manner, and uses the information gained to estimate the actual position of the satellite with respect to the terminal antenna. ARINC contends that the Commission should not mandate a particular method of preventing unintended satellite tracking, as that would be picking one technology over another.[171]

70. *Discussion*. We conclude that ESAA operators should be required to shut off their transmissions automatically and immediately if at any time the ESAA airborne terminal is not tracking its intended satellite properly. We would consider an open-loop system to be properly tracking the intended satellite while it is operating within the bounds of its normal operation. This is necessary to ensure that ESAA airborne terminal transmissions do not cause harmful interference to other licensed facilities. We also agree with ARINC, however, that this requirement should not be designed to promote one particular methodology for ceasing ESAA airborne terminal transmissions. Accordingly, we will not limit this shut-off requirement to ESAA airborne terminals that use closed-loop tracking. Instead, we will make this requirement applicable to all ESAA operators. For ESAA systems that use multiple co-frequency terminals where the aggregate EIRP density is within the EIRP density envelope the amount of allowable pointing error will be stated in the demonstration submitted with the application. The demonstration will show how the expected mispointing, including that from an open-loop tracking system if it is used, will affect the aggregate EIRP density envelope. For ESAA systems that use FDMA or TDMA techniques, and operate close to the EIRP density envelop limits, we will use the limits adopted by the *ESV* and *VMES Orders*, that is, an antenna mispointing error budget of 0.2 degrees and a shut off requirement upon mispointing by 0.5 degrees.

71. Boeing and Telesat support requiring central control of ESAA airborne terminals through an NCMC.[172] ViaSat agrees, but asserts that ESAA airborne terminals should be able to resume transmissions automatically without an "enable transmission" command from the NCMC.[173] As an initial matter, we adopt our proposal to require central control of ESAA airborne terminals through an NCMC or similar facilities. We have imposed a similar requirement on ESV terminals,[174] and that has been useful in preventing harmful interference in that context. We will not adopt ViaSat's suggestion to allow ESAA airborne terminals to resume transmissions automatically after a forced shutdown without an "enable transmission" command from the NCMC. Requiring an "enable transmission" command provides greater assurance that the problem that caused the cessation of transmissions has been resolved. Because such a measure imposes few costs to ESAA licensees and their customers, in that the enable transmission

[168] Closed-loop logic is deployed to overcome various faults that may cause unintended satellite tracking. In closed-loop systems, a feedback is used to see if the desired tracking has taken place by measuring the difference between the input and output signals and the corrective action takes place as the result of comparison.

[169] *Notice*, 20 FCC Rcd at 2930, ¶ 42.

[170] ViaSat Comments at 21; Telesat Comments at 3; SUIRG Comments at 2; Boeing Comments at 28.

[171] ARINC Comments at 29.

[172] Boeing Comments at 28; Telesat Comments at 3.

[173] *See* ViaSat Comments at 21.

[174] *See ESV Order*, 19 FCC Rcd 696, ¶ 51.

command from the NCMC should not delay resumption of service by more than a second, we find that the benefits of the requirement outweigh possible costs.

7. Dynamic EIRP Density Systems

72. *Background*. In the *Notice*, in order to protect existing FSS users of the band, the Commission invited comment on proposals for off-axis EIRP density envelopes that that were based on rules for FSS earth stations operating in a two-degree spacing environment. The Commission proposed both aggregate and individuals off-axis EIRP density limits.[175] In this Order above, we adopt aggregate off-axis EIRP density limits that will allow operators flexibility in assigning power values to ESAA airborne terminals depending on the characteristics of each terminal instead of requiring each transmitter within the system to use the same EIRP density.[176] In light of that decision, we must also evaluate the use of dynamic (or variable) power control to manage aggregate off-axis EIRP density limits for multiple co-frequency terminals through variations in the power level required to support the rate of data transmission, and therefore EIRP density, from individual terminals.

73. A dynamic power control system requires the NCMC to manage a large number of factors including any inherent time delay in relaying commands through the satellite system to the terminals and monitoring signals from the terminals.[177] Recognizing the utility of dynamic power control systems, balanced against the complexity of such systems and the challenging environment of mobile applications operating in a FSS frequency band, the Commission decided to adopt a modest cautionary measure for dynamic power systems in both the VMES and ESV proceedings.[178] Specifically, the Commission required dynamic power ESV and VMES systems to operate with an aggregate EIRP density one-dB below the EIRP density envelope of the other systems. This same approach has been used in the *ad hoc* ESAA authorizations issued by the Commission.[179]

74. In its original petition for rulemaking in this proceeding, Boeing states that variable power networks have operated in the United States for several years without complaints of harmful interference.[180] More recently, in *ex parte* statements, Boeing advocated ESAA rules that would permit dynamic power control, based on the Commission's VMES rules, but excluding the modest one-dB reduction in the off-axis EIRP density envelope.[181]

---

[175] *Notice*, 20 FCC Rcd at 2926-27 ¶¶ 36-37.

[176] *See* Section IV.C.2., *supra*.

[177] *See VMES Order*, 24 FCC Rcd at 10450, ¶ 115.

[178] *VMES Order*, 24 FCC Rcd at 10447, 10450, ¶¶ 102, 115-117. More recently, the Commission adopted a substantially similar requirement for ESV systems. *ESV Second Reconsideration Order*, 22 FCC Rcd at 8561 - 8565, ¶¶ 17-25.

[179] *E.g., ARINC Order*, 20 FCC Rcd at 7563, ¶ 32 (noting ARINC's commitment to operating one-dB below standard VSAT off-axis EIRP density limits and requiring compliance with the same commitment as a condition of license).

[180] *See* Boeing 2003 Petition for Rulemaking at 4. *See also* ViaSat Reply Comments at 15 ("Dynamic power control technology is a proven technology…").

[181] Boeing Jan. 27, 2011, *Ex Parte* Statement at 2; Boeing Sept. 4, 2007, *Ex Parte* Statement at 5; Boeing Aug. 17, 2007, *Ex Parte* Statement at 21.

75. *Discussion*. Commenters advocate that the Commission permit the use of dynamic power control for ESAA systems.[182] We agree. There would be no public interest served by prohibiting the use of this technique. Accordingly, we adopt the commenters' proposal.

76. We reject, however, Boeing's suggestion that the use of dynamic power control be subject to a different interference framework than adopted by the Commission in the VMES and ESV proceedings. In the VMES and ESV proceedings, the Commission recognized that this one-dB constraint may result in a potential reduction of system capacity.[183] The Commission, however, concluded that the costs of this constraint were outweighed by the benefits of protecting against interference to adjacent space stations. Thus, unless a particular operator can demonstrate otherwise, a slightly lower power limit is needed to ensure that such systems do not cause harmful interference to other licensed operations.[184] Moreover, the market for mobile terminals communicating with Ku-band GSO space stations has grown significantly since the commencement of this proceeding. Given this growth in use and the complexity of dynamic control systems, at this time, it is reasonable to adopt the same modest cautionary measure for ESAA terminals as those adopted for ESV and VMES terminals. Accordingly, we require ESAA systems that utilize dynamic power control to operate with an aggregate EIRP density one-dB below the EIRP density envelope applicable to other ESAA systems.

77. We believe, however, that certain variable power ESAA systems may be capable of operating at the maximum EIRP spectral density limits while preventing interference and, therefore, may regain the system capacity that Boeing claims is lost due to the one-dB reduction. As a result, those ESAA operators that believe that they are capable of operating without the one-dB and without causing harmful interference should file a request to waive the one-dB requirement. We require the waiver request to be accompanied by a report demonstrating that the system has operated without providing interference to adjacent satellites.[185] In order to help ensure that the report includes sufficient technical information, we strongly encourage ESAA operators to refrain from filing a waiver request until its system is operating at or above 50 percent of its capacity.[186] Thus, operators utilizing variable power ESAAs will have the opportunity to demonstrate that they may simultaneously operate without the one-dB restriction and without causing harmful interference to FSS.[187]

78. Finally, we adopt rules requiring dynamic power ESAA systems to cease emissions under two scenarios. First, if the power-density from an individual transmitter exceeds the applicable[188] power-

[182] Boeing Comments at 22 (indicating that Connexion system uses dynamic power control to assign available off-axis EIRP density among multiple terminals); ViaSat Reply Comments at 15.

[183] *VMES Order*, 24 FCC Rcd at 10451, ¶ 118; *ESV Second Reconsideration Order*, 22 FCC Rcd 8561-8562, ¶ 18.

[184] *VMES Order*, 24 FCC Rcd at 10450, ¶¶ 115-16; *ESV Second Reconsideration Order* 22 FCC Rcd at 8562, ¶ 19.

[185] At a minimum, the report should evaluate, through the use of operational statistics, actual measurements or a combination thereof, the aggregate power density at the GSO from all simultaneously active co-frequency transmitters. The report should include information on the average and maximum number of simultaneous co-frequency transmitters, an analysis of the EIRP spectral density at the GSO, and a discussion of the factors taken into account at the NCMC to manage the aggregate power density of the system.

[186] We note that the one-dB reduction in EIRP spectral density is equivalent to a capacity reduction of about 20% over operations at the maximum permitted EIRP spectral density. If the system is designed to operate at the maximum EIRP spectral density, notifying the Commission when it has reached 50% of peak capacity allows for a further 30% growth during the year following notification without exceeding the minus one dB limit.

[187] Such waiver requests should be filed in the context of a modification of an ESAA license and would be subject to standard public notice and comment process.

[188] By "applicable" we mean that, for dynamic power ESAA systems that do not request, or request, but do not obtain a waiver of the one-dB requirement, the applicable power-density limits would be the off-axis EIRP density

(continued....)

density limit, then that transmitter must cease emissions automatically within 100 milliseconds of detecting this violation. Under this scenario, the individual transmitter must be self-monitoring and capable of shutting itself off. Second, if the power of one or more transmitters causes the aggregate off-axis EIRP densities to exceed the applicable power-density limit, then the transmitter or transmitters must cease or reduce emissions within 100 milliseconds of receiving the appropriate command from the system's NCMC. In its license application, the ESAA applicant should describe how the system will respond if the power-density in excess of the applicable off-axis EIRP density limits is detected.

8. Higher EIRP Density Levels Permitted if Coordinated

79. *Background*. In addition to allowing minor exceedance of the off-axis EIRP density envelope, as discussed above, in the *Notice* the Commission invited comment on whether it should consider any application for an ESAA network proposing to exceed the off-axis EIRP density envelope by more than the minor levels addressed above. The Commission proposed considering such applications under a certification procedure such as the one we adopted for "non-routine" FSS earth stations.[189]

80. A number of parties argue that ESAA network operators should be permitted to exceed the off-axis EIRP density envelope if the target satellite operator has coordinated those higher EIRP density levels with adjacent satellite operators.[190] In particular, ARINC contends that there should not be any interference concerns if the adjacent operators agree to emissions that exceed the envelope.[191] Boeing and ViaSat assert that, if U.S.-licensed ESAA operators were not allowed to coordinate EIRP density levels that exceed the envelope, they would be placed at a competitive disadvantage relative to other ESAA operators in other regions of the world.[192] As noted above, in the *Streamlining Fifth Report and Order*, the Commission allowed FSS earth station operators to exceed mandated power levels or to use smaller-than-routine antennas if the target satellite operators coordinate the non-routine earth station operations with adjacent satellite operators.[193] This procedure was extended to EIRP limits for FSS earth stations in the *Streamlining Eighth Report and Order*.[194] We find that it would be reasonable to use the same procedure for ESAA networks that exceed the off-axis EIRP density envelope.

81. Intelsat asserts that both the target satellite operator and the adjacent satellite operator should be required to sign the certification that coordination of the higher EIRP density levels has been completed.[195] Similarly, PanAmSat asserts that we should require signatures from both the target and the adjacent satellite operator unless one of the operators is not U.S.-licensed, because ESAA networks operating at higher EIRP density levels might not be contemplated in coordination agreements between

---

(...continued from previous page)
limits minus 1 dB in section 25.227(a)(3)(i). For dynamic power ESAA systems that obtain Commission approval to waive the 1 dB requirement, the applicable power-density limits would be the off-axis EIRP density limits set forth in section 25.227(a)(1)(i).

[189] *See Notice*, 20 FCC Rcd at 2928-29, ¶ 40. At the time of the *Notice*, the Commission had not adopted this certification procedure. The Commission adopted this certification procedure in the *Streamlining Fifth Report and Order*, 20 FCC Rcd at 5674, ¶ 17.

[190] Intelsat Comments at 3, ARINC Comments at 6-7, SES Comments at 4, SES Reply at 5-6, ARINC Reply at 5-6.

[191] ARINC Comments at 7.

[192] Boeing Comments at 23-24, Boeing Reply at 6-7, ViaSat Reply at 16-17.

[193] *Streamlining Fifth Report and Order*, 20 FCC Rcd at 5687-88, ¶¶ 50-52.

[194] *Streamlining Eighth Report and Order*, 23 FCC Rcd at 15120-21, ¶¶ 47-48.

[195] Intelsat Comments at 5.

U.S.-licensed satellite operators made before the ESAA network was licensed.[196] Boeing and ARINC, on the other hand, contend that a signature from the target satellite operator is sufficient, claiming that this is consistent with the rules adopted for VSAT networks adopted in the *Part 25 Earth Station Streamlining* proceeding.[197] Boeing responds further that single-party certifications would be submitted in licensing proceedings that are subject to notice and comment, and thus subject to challenge.[198]

82. *Discussion*. In the *Streamlining Fifth Report and Order*, the Commission noted that it has historically relied on satellite operators to work together cooperatively to reach coordination agreements.[199] The Commission has allowed earth station operators to exceed its earth station technical requirements, provided that they can show that they will not cause harmful interference to other licensed operations.[200] We formalized this procedure in the *Streamlining Fifth Report and Order*. Under this procedure, an applicant must obtain certifications from the operators of satellites with which the earth station operator plans to communicate, showing that those satellite operators have coordinated with the operators of satellites located within six degrees of the target satellite.[201] There was no basis in that proceeding to conclude that satellite operators would cease working cooperatively in the context of non-routine FSS earth stations.[202] Similarly, none of the parties in this proceeding advocating multiple signatures on certifications have explained why coordination of ESAA operations that exceed the off-axis EIRP density envelope would be different from any other coordination between satellite operators, such that we could not rely on a certification from the target satellite operator to reflect the coordination agreement accurately. For these reasons, we will permit ESAA operators, including dynamic power ESAA operators[203] to exceed the off-axis EIRP density envelope upon certification by the ESAA operator in question that the operator of the satellite(s) with which the ESAA system will communicate has coordinated the exceedance of the ESAA system with the operators of adjacent satellites.

83. Telesat maintains that the Commission should allow EIRP density levels to exceed the mandated values only upon evidence of coordination with all networks within nine degrees of the target

[196] PanAmSat Comments at 3-4.

[197] Boeing Comments at 24-25 and n.76; ARINC Reply at 6.

[198] Boeing Reply at 7.

[199] *Streamlining Fifth Report and Order*, 20 FCC Rcd at 5687-88, ¶ 50; *Streamlining Eighth Report and Order*, 23 FCC Rcd at 15122, ¶ 50.

[200] *Streamlining Fifth Report and Order*, 20 FCC Rcd at 5675, ¶ 18.

[201] *Id.* at 5688-89 ¶ 52, 5699 ¶ 84. The Commission also noted that the streamlined procedure it adopted in the *Streamlining Fifth Report and Order* includes a "backstop" coordination procedure, in which potentially affected parties have an opportunity to raise coordination issues after the earth station application is filed. *Third Further Notice*, 20 FCC Rcd at 5627, ¶ 93 (citing *Streamlining Fifth Report and Order*, 20 FCC Rcd at 5694-97, ¶¶ 70-79). In particular, the Commission observed that terrestrial wireless operators are free to raise issues regarding non-routine earth stations operating in shared bands. *Fifth Report and Order*, 20 FCC Rcd at 5695, ¶ 72. The Commission did not adopt any new procedures specifically for pre-application coordination of non-routine earth stations with terrestrial wireless operators in shared bands. This is because, when it proposed the streamlined procedure, it tentatively concluded that the existing pre-application procedures would continue to be sufficient. *See Part 25 Earth Station Streamlining Notice*, 15 FCC Rcd at 25131, ¶ 5; *Part 25 Earth Station Streamlining Further Notice*, 17 FCC Rcd at 18592, ¶ 12. None of the commenters questioned those tentative conclusions.

[202] *Streamlining Fifth Report and Order*, 20 FCC Rcd at 5687-88, ¶ 50; *Streamlining Eighth Report and Order*, 23 FCC Rcd at 15122, ¶ 50.

[203] The rules for allowing dynamic power ESAA systems to apply for and operate at higher power levels are in sections 25.227(a)(3)(ii) and (b)(3)(ii) in Appendix C.

satellite.[204] In the *Streamlining Fifth Report and Order*, the Commission adopted a six degree coordination requirement for FSS earth stations,[205] and we find that Telesat has not provided any basis for concluding that a greater margin is required for ESAA networks.

9. Antenna Performance Standards for Receive Terminals in the 11.7-12.2 GHz (space-to-Earth) Band

84. *Background*. In the *Notice*, the Commission invited parties to comment on the technical standards (*e.g.*, antenna performance standards) that should be applicable to operations of ESAA terminals in the 11.7-12.2 GHz band. In particular, the Commission sought comment on the relationship between allocation status and antenna performance standards. The Commission explained in the *Notice* that Boeing took the position that it was unnecessary to specify antenna performance requirements in the 11.7-12.2 GHz band because Boeing anticipated that the ESAA receive operations would be on an unprotected basis.[206] The Commission also explained in the *Notice* that others parties, in contrast to Boeing, believed antenna performance standards were necessary even in the event operations were on an unprotected basis.[207] In response to the *Notice*, several commenters assert that, as long as ESAA downlink operations are on an unprotected basis in the 11.7-12.2 GHz band, there is no need for ESAA downlink antenna gain standards.[208]

85. *Discussion*. In this *Report and Order*, we conclude that ESAA operations in this downlink band should be on a primary basis rather than an unprotected basis.[209] As a result of that allocation decision, we also conclude here that it is necessary to specify some antenna performance standards in this band to qualify for protection from other FSS space stations. Therefore, we apply the receive antenna performance standards applicable to FSS earth stations in this band to ESAA terminals. In the *Streamlining Eighth Report and Order*, the Commission adopted an off-axis EIRP density approach to reviewing earth station applications which specified that FSS earth stations in an off-axis EIRP density regime should still be protected from interference pursuant to Section 25.209(c) of the Commission's rules.[210] The Commission also concluded that this approach conforms with its historical practice of protecting earth stations from interference to the extent that a routine earth station would be expected to receive interference.[211] We believe that we should apply similar treatment to ESAA stations. Specifically, because ESAA is now co-primary in the 11.7-12.2 GHz (Earth-to-space) band, ESAA operations will be protected from interference by other operations in this band to the extent specified in Section 25.209(c).

10. Tracking/Data Logging Requirements

86. *Background*. In the *Notice*, the Commission invited comment on requiring ESAA operators to log airborne terminal operation parameters, including aircraft location, and provide us, NTIA, or other interested parties such data for airborne terminals on a particular air route within 24 hours, upon request.[212] Because making aircraft location information publicly available might create a security risk

[204] *See* Telesat Comments at 3.

[205] *See Streamlining Fifth Report and Order*, 20 FCC Rcd at 5686-88, ¶¶ 48-52.

[206] *Notice*, 20 FCC Rcd at 2928, ¶ 39.

[207] *Notice*, 20 FCC Rcd at 2928, ¶ 39.

[208] *See* Intelsat Comments at 4, SES Comments at 4, Telesat Comments at 3.

[209] *See supra* section IV.A.1, entitled "Operations on a Primary Basis in the 11.7-12.2 GHz (space-to-Earth) Band."

[210] *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15116-17, ¶¶ 34-35, citing 47 C.F.R. § 25.209(c).

[211] *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15117, ¶ 35.

[212] *See Notice*, 20 FCC Rcd at 2934-35, ¶ 54.

for aircraft, we stated that we would not make the information public.[213] We stated that we would consider alternate methods for identifying harmful interference sources in a secure and controlled environment.[214]

87. Several parties support requiring ESAA operators to maintain aircraft tracking data, to help resolve instances of harmful interference.[215] Other commenters oppose disclosure of any data that could be used to make flights and routes identifiable because of security concerns.[216] ARINC maintains that tracking information is not necessary to remedy interference, because operators can resolve interference events among themselves.[217] Boeing and ViaSat note that we found it unnecessary for real-time tracking data to be made available to third parties in the ESV context, because we adopted a point-of-contact and one-year data holding period requirement. They argue that we should do the same for ESAA.[218] However, Boeing and ARINC further recommend that, if we adopt a tracking requirement, the data should be disclosed only to us, NTIA, or frequency coordinators for purposes of resolving harmful interference events.[219]

88. Telesat and CORF support requiring ESAA operators to retain tracking data for one year, arguing that shorter periods would not be sufficient for an affected party to determine whether it has experienced harmful interference.[220] Boeing would require ESAA licensees to maintain ESAA location information only for 90 days, rather than for one year.[221] ARINC proposes requiring operators to hold tracking information for 30 days.[222] Both ESV and VMES systems are required to maintain tracking data for a one year period.[223]

89. *Discussion*. We agree with parties who recommend requiring ESAA operators to log and maintain location information and other data pertaining to operation of their ESAA terminals. It would be at best difficult to determine whether an ESAA airborne terminal was the source of a harmful interference event unless this information was maintained by the ESAA operators. Therefore, we require ESAA airborne terminal operators to log and retain location information regarding their terminals. We note that ESAA operators will only be required to disclose tracking data to the Commission, NTIA, or frequency coordinators, and only for purposes of resolving claims of harmful interference.[224] Balancing the interests

[213] *See Notice*, 20 FCC Rcd at 2934-35, ¶ 54.

[214] *Notice*, 20 FCC Rcd at 2935, ¶ 55.

[215] Telesat Comments at 4; Intelsat Comments at 6; PanAmSat Comments at 5-6; PanAmSat Reply at 6-7.

[216] Boeing Comments at 37, Boeing Reply at 16; ARINC Comments at 14-15, 17; ARINC Reply at 8-9; ViaSat Comments at 22;ViaSat Reply at 20.

[217] *See* ARINC Comments at 16; ARINC Reply at 8.

[218] *See* Boeing Comments at 37; Boeing Reply at 16; ViaSat Reply at 19-20.

[219] *See* Boeing Comments at 37; ARINC Reply at 8-9.

[220] *See* Telesat Reply at 2; CORF Comments at 7.

[221] *See* Boeing Comments at 37.

[222] *See* ARINC Comments at 18.

[223] *See ESV Order*, 20 FCC Rcd at 721, ¶ 112; *VMES Order*, 24 FCC Rcd at 10459-60, ¶ 146.

[224] PanAmSat and Telesat recommend creating a database of all installed ESAA airborne terminals, whether or not they are in active use, for fear that some ESAA operators might lose track of terminals when not in use, perhaps when an airline sells an ESAA-equipped plane to an another airline that does not subscribe to ESAA. *See* PanAmSat Comments at 5-6; PanAmSat Reply at 7; Telesat Reply at 2. SUIRG supports the Commission's database proposals, recommends designating a third party to maintain such a database, and volunteers its services "if provided with the relevant necessary funding." *See* SUIRG Comments at 2-3. ViaSat and Boeing oppose one or

(continued....)

of the various users of the spectrum, we agree with Telesat and CORF that requiring ESAA licensees to retain this data for one year is reasonable, which matches the data retention requirement for ESV and VMES.[225] Given the rapid rate at which motion and direction could change within the ESAA systems, ESAA licensees will be required to collect this data on one minute time intervals.[226] The information collected will consist of the aircraft location (latitude, longitude and altitude), the transmit frequency, channel bandwidth, and the satellite used. The information will be time annotated and will be made available in the form of a comma delimited electronic spreadsheet. This information may be maintained at a central location or in the individual terminal as long as it can be made available to the Commission, NTIA or a frequency coordinator, for purposes of resolving a harmful interference event, within 24 hours of the request.

11. Contention Protocols

90. *Background*. Contention protocols are a standard and longstanding technique used in both satellite and terrestrial networks,[227] to allow multiple users to share the same spectrum by defining the events that must occur when two or more transmitters attempt to simultaneously access the same channel and establishing rules by which a transmitter provides reasonable opportunities for other transmitters to operate. In satellite networks, transmissions from different VSAT remote earth stations compete or "contend" for the same resource, which could be a frequency, a time slot, or a hub earth station receiver. One example of a contention protocol is the "slotted Aloha" protocol. In this technique, the hub earth station synchronizes all remote VSAT stations so that they transmit only in discrete time slots, typically tens of milliseconds in duration.[228] Two or more remote earth stations are permitted to transmit in the same time slot in slotted Aloha. Slotted Aloha relies on the statistical characteristics of unrelated transmissions from different earth stations to limit the number and duration of transmissions that occur from more than one VSAT remote earth station in the same time slot. When two or more remote earth stations using a contention protocol transmit simultaneously using the maximum allowed EIRP density per carrier, those transmissions can "collide." The resulting power level caused by these collisions exceeds the level specified in our rules during the time period of simultaneous transmission, although for no more than tens of milliseconds.[229]

(...continued from previous page)
both of these proposals. *See* ViaSat Reply at 19-20; Boeing Reply at 16-17. Because we have decided not to require ESAA operators to maintain a database that is accessible by third parties, we need not address these issues further.

[225] *See ESV Order*, 19 FCC Rcd at 721, ¶¶ 112-113; *VMES Order*, 24 FCC Rcd at 10459-60, ¶¶ 146.

[226] ESVs are required to meet a 20 minute interval data logging requirement and VMES have a 5 minute interval data logging requirement. 47 C.F.R. §§ 25.222(a)(4) and 25.226(a)(6).

[227] *See*, *e.g.,* 47 C.F.R. § 90.7 (defining contention protocol)

[228] *See* Petition of Spacenet, Inc. for a Declaratory Ruling that Section 25.134 of the Commission's Rules Permits VSAT Remote Stations in the Fixed Satellite Service to Use Network Access Schemes that Allow Statistically Infrequent Overlapping Transmissions of Short Duration, or, in the Alternative, For Rulemaking to Amend that Section, *Order*, 15 FCC Rcd 23712, 23713, ¶ 3 (Int'l Bur., 2000) (*Spacenet Order*) (remote earth stations transmit in specific time slots, which means that the transmissions are synchronized but not coordinated). In comparison, with the "unslotted Aloha" technique, remote earth stations in the VSAT network can transmit randomly at any time, meaning that the transmissions are not synchronized in time or duration. G. Maral, *VSAT Networks* at 144-45 (John Wiley and Sons, ed. 1995).

[229] Spacenet maintained that the duration of an inbound transmission is typically between 15 and 50 milliseconds. *See Spacenet Order,* 15 FCC Rcd at 23713, ¶ 3.

91. The Commission adopted a specific rule to cover the use of contention protocols in VSAT systems in the *Streamlining Eighth Report and Order*.[230] In that Order, the Commission observed that use of contention protocols can increase the efficiency of VSAT networks, and that the VSAT network operators should be allowed to take advantage of those efficiencies.[231] The Commission also found that use of contention protocols tends to *decrease* the likelihood of harmful interference in almost all cases.[232] Therefore, rather than adopt rigid, inflexible rules for contention protocols, the *Streamlining Eighth Report and Order* requires only that contention protocol usage be reasonable.[233] The Commission reached a similar conclusion in the *VMES Order*.[234]

92. In response to the *Notice*, several commenters recommended that ESAA airborne terminal operators use contention protocols. ViaSat and ARINC recommend applying the contention protocol rule proposed in the *Streamlining Third Further NPRM* to ESAA networks, arguing that this would give ESAA flexibility and allow greater efficiency in spectrum usage.[235] In addition, Boeing advocates using this approach for all types of multiple access schemes, and not just contention protocols, arguing that the effect of the variations is independent of the reasons for them.[236] Conversely, Telesat opposes use of contention protocols in ESAA, arguing that ESAA is secondary and relatively new, and so does not yet need the flexibility afforded by contention protocols.[237]

93. *Discussion*. In the *Notice*, as noted above, the Commission invited comment on making the ESAA technical requirements consistent with the requirements for FSS earth stations.[238] As we did with other similar FSS systems, we find that the use of contention protocols can increase the efficiency of ESAA networks and tends to *decrease* the likelihood of harmful interference. Accordingly, we conclude here that we do not need to adopt rigid, inflexible rules for contention protocols used in ESAA networks, and instead we require such contention protocol usage to be reasonable. While we recognize that we did not specifically seek comment on contention protocols in the *Notice*, the possibility that we would adopt rules for using these protocols that are consistent with requirements we have established for other FSS earth stations is a logical outgrowth of the proposals in the *Notice*. Moreover, there is nothing in the *Notice* to suggest that we would preclude use of this longstanding and widely used technique. Further,

[230] *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15134, ¶¶ 80-81. Prior to adoption of the rule, the International Bureau authorized use of the contention protocols via waiver. *Id*. at 15127, ¶ 64.

[231] *See id.* at 15132, ¶ 76, citing *Streamlining Further Notice*, 17 FCC Rcd at 18618, ¶ 85.

[232] *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15132-33 ¶¶ 77-79.

[233] The Commission did not prescribe any particular method for demonstrating that a licensee's contention protocol usage is reasonable, but suggested that one possible method would be to show that the licensee was using a contention protocol in a manner that does not result in an increase in unavailability relative to a static system throughout most of its service area, that any increases in unavailability occur only in limited areas, and such increases are fairly small. *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15134, ¶ 81.

[234] *See VMES Order* at 10452, ¶ 120. *See also* Boeing Reply at 11 (noting that the Commission has adopted contention protocols for VSATs and arguing that "there is no rational basis" to preclude the use of contention protocols for ESAA).

[235] *See* ViaSat Comments at 14; ViaSat Reply at 10, 13-14. *See also* Boeing Comments at 18-19, 26; Boeing Reply at 10-11.

[236] *See* Boeing Comments at 19. Boeing also provides a table of figures for maximum off-axis envelope exceedance for certain time periods, calculated over the course of a month. Boeing Comments at 20.

[237] *See* Telesat Reply at 2.

[238] *Notice*, 20 FCC Rcd at 2926, ¶ 35.

the topic was fully briefed by the parties in the comments.[239] In light of these circumstances, and our decision above to adopt an aggregate off-axis EIRP spectral density envelope, we will require ESAA applicants planning to use contention protocol to certify that the contention protocol usage will be reasonable.

12. Protection of Terrestrial Systems

a. Power-flux Density Limits to Protect FS

94. In the *Notice*, the Commission invited comment on the following PFD limits, to be applicable to ESAA providers when they operate in the 14.0-14.5 GHz (Earth-to-space) frequency band in international airspace within line-of-sight of the territory of a foreign administration in which FS networks have primary allocation in this band:

$-132 + 0.5 \cdot \theta$	$dB(W/(m^2 \cdot MHz))$	for	$\Theta \leq 40^\circ$
-112	$dB(W/(m^2 \cdot MHz))$	for	$40^\circ < \Theta \leq 90^\circ$

Where: θ is the angle of arrival of the radio-frequency wave in degrees above the horizon. These limits would be applied to the PFD and angles of arrival that would be obtained under free-space propagation conditions.[240]

95. As an alternative, the Commission invited comment on applying these PFD limits only in the absence of an adoption of different conditions by a foreign administration.[241] The Commission also proposed that, in cases where ESAA operations may affect FS operations in more than one country simultaneously, the protection requirement to be applied "should be the most stringent requirement needed to protect a FS station within the jurisdiction of a potentially affected administration."[242]

96. Boeing and SES support the adoption of PFD limits for ESAA airborne terminal transmissions to protect FS operations in foreign countries.[243] Boeing recommends, however, not applying the proposed PFD limits in countries that have adopted or agreed to higher PFD limits.[244] Boeing maintains that, when two countries are in line-of-sight of an ESAA airborne terminal, each country should be protected pursuant to its own requirements, and the ESAA operator should not have to identify which country has stricter requirements.[245]

97. *Discussion*. We adopt the PFD limits proposed in the *Notice*, in order to protect fixed operations in foreign administrations. We are also extending this limit to protect mobile services in foreign administrations, given that the band is also allocated to the fixed and mobile services internationally. We agree with Boeing, however, that the PFD limits should apply wherever an ESAA airborne terminal is within the line-of-sight of a foreign administration's territory, not just when it is in

[239] *See DCPSC v. FCC*, 906 F.2d 713 (D.C. Cir. 1990) (explaining that it is reasonable to attempt to accommodate commentators by responding to their suggestions and that it is expected that final rules will differ from proposed rules when the evidence in the record supports such changes. A contrary view would lead to the absurdity that in rule-making under the APA "the agency can learn from the comments on its proposals only at the peril of starting a new procedural round of commentary") (citations omitted).

[240] *Notice*, 20 FCC Rcd at 2931, ¶ 46.

[241] *Id.*

[242] *Id.*

[243] Boeing Comments at 30-31; SES Comments at 5.

[244] Boeing Comments at 31.

[245] *Id.*

international airspace. We also agree with Boeing that ESAA operators should be allowed to exceed the PFD limits adopted here in countries that have adopted higher PFD limits, or have negotiated higher PFD limits with ESAA operators. We see no reason to require ESAA operators to meet a more restrictive PFD limit in another administration's territory than is required by that administration.

98. Further, we are persuaded by Boeing's contention that, in cases in which the ESAA is within the line-of-sight of two or more countries, the operator should comply with the requirements of each administration within each of those countries. In other words, we will not require the operator to comply with the "most stringent requirement" in both jurisdictions. As we concluded above, there is no reason to require ESAA operators to meet a more restrictive PFD limit in another administration's territory than is required by that administration.

b. Minimum Elevation Angle

99. *Background.* Boeing asserts that the Commission should adopt a five degree minimum elevation angle requirement for ESAA terminals operating on the ground, and no minimum elevation angle for ESAA terminals operating in flight. Boeing argues that this requirement would protect terrestrial services and limit protection required by the ESAA terminals. Boeing notes that a five degree minimum elevation angle is also applicable to FSS earth stations.[246]

100. *Discussion.* No commenter has opposed Boeing's recommendation. We agree with Boeing that a five degree minimum elevation angle requirement applicable when the ESAA terminal is operated on the ground would protect other terrestrial operators in the 14.0-14.5 GHz band. Accordingly, we adopt this proposal.

D. Licensing Considerations

101. In establishing a regulatory framework for ESAA, the Commission sought comment on rules that would minimize regulatory burden while still addressing the core regulatory concern with avoiding harmful interference.

1. Blanket and Individual Terminal Licensing

102. *Background*. In the *Notice*, the Commission invited comment on a blanket licensing approach for ESAA airborne terminals under rules similar to those under which ESVs and VSATs operate, where applicants would be required to file a narrative describing the overall system operation as well as specific information on the antennas, power density, and emission characteristics for each class of ESAA airborne terminals and earth station comprising the network. The Commission also sought comment on whether it should provide for the licensing of individual ESAA airborne terminals, using the same technical criteria that are applied to the antennas in a blanket-licensed ESAA network. Finally, the Commission invited comment regarding any modifications to FCC Form 312 that might be necessary to accommodate applications for ESAA systems.[247]

103. Boeing and SES support blanket licensing for ESAA airborne terminals, contending that individual station licensing would be inefficient and costly for both operators and the Commission.[248] ViaSat supports both blanket and individual site licensing.[249] Telesat supports blanket licensing.[250]

---

[246] *See* Boeing Comments at 28-29.

[247] *Notice*, 20 FCC Rcd at 2933, ¶¶ 49-50.

[248] Boeing Comments at 32; SES Comments at 5; SES Reply at 6.

[249] ViaSat Comments at 20.

[250] Telesat Comments at 3.

104. *Discussion*. We conclude that we will allow ESAA applicants to request either blanket licensing or individual licensing, using the same technical criteria that are applied to the antennas in a blanket-licensed ESAA network. We adopted blanket licensing for ESV networks in 2005 and for VMES networks in 2009.[251] In those contexts, blanket licensing has proven to be a very efficient licensing procedure. We conclude that those efficiencies should be extended to ESAA applicants. At the same time, in the event that an ESAA applicant wishes to license only one ESAA airborne terminal, we know of no reason to preclude that applicant from doing so.

2. License Term

105. In the *Notice*, the Commission observed that most licensed networks of earth stations have 15-year license terms. The Commission tentatively concluded that 15-year license terms would be reasonable for ESAA networks, and sought comment on this tentative conclusion.[252] ARINC and Boeing support the tentative conclusion to have 15-year license terms for ESAA networks.[253] No one opposed this tentative conclusion. Accordingly, we adopt 15-year license terms for ESAA networks, to be consistent with other earth station license terms.[254]

3. Network Control and Monitoring Center Requirements

106. *Background*. In the *Notice*, the Commission proposed requiring ESAA networks to operate under the direct control of a NCMC located within the United States, and to maintain a 24 hours a day, seven days a week point of contact in the United States.[255] We explained that these requirements would ensure that the ESAA licensee is capable of controlling all aspects of its ESAA network, which in turn would allow us to ensure that other licensees are protected from harmful interference.[256]

107. Intelsat supports requiring ESAA blanket licensees to maintain both their NCMC and a 24-hour point of contact in the United States.[257] Boeing, however, proposes requiring only a 24-hour point of contact in the United States. Boeing argues that requiring multiple NCMCs to be located in the United States and every other nation in which the ESAA licensee provides service would be unduly burdensome, and notes that there are no location requirements for the control centers of traditional MSS systems and ESV networks.[258] Boeing further contends that maintaining NCMC facilities in the United States should not be necessary as long as the ESAA operator has a 24-hour point of contact in the United States with the ability to cause each ESAA aircraft terminal to stop operating.[259] PanAmSat also supports requiring ESAA operators on U.S.-registered aircraft to maintain a 24-hour point of contact in the United States who can cause the ESAA terminal to stop transmitting.[260]

108. *Discussion*. We conclude that ESAA licensees need not maintain NCMC facilities in the United States, provided that they have a 24-hour point of contact in the United States with the ability and

---

[251] *ESV Order*, 19 FCC Rcd at 722, ¶¶ 114-117; *VMES Order*, 24 FCC Rcd at 10463-64, ¶¶ 160-162.

[252] *Notice*, 20 FCC Rcd at 2934, ¶ 52.

[253] ARINC Comments at 28; Boeing Comments at 36.

[254] *ESV Order*, 19 FCC Rcd at 723, ¶ 118; *VMES Order*, 24 FCC Rcd at 10466-67, ¶¶ 169-171.

[255] *Notice*, 20 FCC Rcd at 2932, 2935-36, ¶¶ 48, 57.

[256] *Id.*

[257] Intelsat Comments at 6.

[258] Boeing Comments at 33.

[259] Boeing Comments at 34; Boeing Reply at 14.

[260] PanAmSat Comments at 6.

authority to cause each ESAA aircraft terminal to stop transmitting. The Commission proposed requiring NCMC facilities to be in the United States to ensure that it would be able to require ESAA airborne terminals to stop transmitting in the event of harmful interference. Maintaining a 24-hour point of contact in the United States accomplishes the same purpose in a less restrictive manner. Furthermore, this requirement is consistent with the Commission's treatment of VSAT networks.[261]

4. ALSAT and the Permitted List Point of Communication Designations

109. *Background*. In the *Notice*, the Commission requested comment on whether it should authorize ESAA to operate with individually designated space stations or if we should allow ESAA operators the flexibility of requesting ALSAT/Permitted List as a designated point of communication.[262] In the *Notice*, the Commission tentatively concluded that ALSAT/Permitted List authority should be granted to ESAA applicants but limited to those who propose operations that comply with the proposed off-axis EIRP density requirements.[263] In other words, ALSAT/Permitted List authority would not be available to those ESAA operators who propose operations in excess of off-axis EIRP density requirements because such operations require coordination with operators of space stations adjacent to the target space station.[264]

110. PanAmSat opposes ALSAT authority for ESAA, arguing that it is not clear what effect large numbers of ESAA airborne terminals will have on the interference environment.[265] On the other hand, ARINC supports ALSAT licensing, stating that if an ESAA system complies with the off-axis EIRP density envelope with regard to one space station in the Commission's two-degree spacing environment, it should comply with regard to all such space stations.[266] Boeing and ViaSat support ALSAT licensing for ESAA networks because it would provide greater flexibility and reduce administrative burdens for ESAA licensees.[267] ARINC notes that ALSAT is permitted for ESV, and contends that ALSAT should be permitted for ESAA for the same reasons.[268]

111. ARINC supports the Commission's tentative conclusion to refuse ALSAT authority to ESAA applicants that have power levels that exceed the off-axis EIRP density envelope.[269] Boeing, however, contends that the Commission should allow ESAA applicants to obtain ALSAT authority for compliant ESAA aircraft terminal operations even if they propose higher power operations than the emissions mask allows. Specifically, Boeing suggests that the Commission could issue ALSAT licenses

---

[261] 47 C.F.R. § 25.271(c)(5).

[262] *See Notice*, 20 FCC Rcd at 2934-35, ¶ 51. While the terms "ALSAT" (*i.e.*, all U.S. Licensed Space Stations) and "Permitted Space Station List" have been used synonymously, ALSAT is the first entry on the Permitted List, followed by individual non-U.S. licensed FSS space stations granted market access in the conventional C-and/or Ku-bands. *Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, IB Docket No. 96-111, First Order on Reconsideration, 15 FCC Rcd 7207, 7210-11, ¶ 6, 7214-16, ¶¶ 16-20 (1999). The current Permitted List is available at http://www.fcc.gov/ib/sd/se/permitted.html.

[263] *Notice*, 20 FCC Rcd at 2934-35, ¶ 51.

[264] *Id.*

[265] PanAmSat Comments at 4-5, PanAmSat Reply at 5.

[266] ARINC Comments at 22-23; Boeing Comments at 35; ARINC Reply at 9-10; ViaSat Reply at 22-23.

[267] Boeing Comments at 35; ViaSat Reply at 20-22.

[268] ARINC Comments at 23; Boeing Comments at 35.

[269] ARINC Comments at 23-24. *See also* Telesat Comments at 4 (supporting ALSAT for ESAA provided that the 2-degree rules are followed).

to ESAA network operators communicating with certain foreign satellites at coordinated power levels that exceed the off-axis EIRP density envelope.[270]

112. *Discussion.* We disagree with PanAmSat that a large number of ESAA airborne terminals with ALSAT/Permitted List authority will cause harmful interference to adjacent space stations in a two-degree spacing environment if those terminals are operated within the aggregate off-axis EIRP density envelope adopted in this *Report and Order*, which is based on our two-degree spacing rules for VSAT networks. It is for this reason, that we would reject Boeing's proposal to grant ALSAT/Permitted List authority to non-compliant ESAA terminals. The Commission may permit, however, an ESAA network operator to operate at power levels in excess of those allowed by the off-axis EIRP density envelope if the target satellite operator negotiates agreements with its adjacent satellite operators to permit such higher power levels. Such agreements are relevant only to operations at the target satellite operator's space station orbit location. There is no guarantee that other operators at different sections of the geostationary arc would necessarily agree to the higher levels. Therefore, we cannot allow an ESAA network operator that exceeds our off-axis EIRP density limits to add new space stations or change points of communication without further Commission action. For this reason, we will only grant ALSAT/Permitted List authority to ESAA operators that comply with the off-axis EIRP density envelope adopted in this *Report and Order*.[271]

5. Information Requirements

113. The *Notice* solicited comment on whether any modifications to the Commission's Part 25 licensing information requirements were necessary to accommodate ESAA applications.[272] ViaSat believes that ESAA applicants should make a technical showing demonstrating that they will comply with EIRP density limits and other applicable rules, and that the disclosure should include non-proprietary design information.[273] We agree, concluding that ESAA applicants should be required to provide information that is on the same level of detail as that adopted in the *Streamlining Eighth Report and Order*.[274] In the *Streamlining Eighth Report and Order*, the Commission delegated authority to the International Bureau to modify IBFS and FCC Form 312, Schedule B, to reflect this decision.[275] Until such time as this revision is available, we will require parties filing ESAA applications to include such information as attachments to their applications.

6. Procedures for Conforming Amendments/Modification Applications

114. As noted above, we have processed applications for earth stations aboard aircraft communicating with Ku-band GSO-FSS space stations since 2001.[276] In this *Report and Order*, we adopt technical rules and make allocation decisions to allow for the efficient licensing of ESAA systems. In the *Notice*, the Commission explained that the *ad hoc* approach used to process ESAA application and the

[270] Boeing Comments at 35-36.

[271] We note that the Permitted List designation does not apply to operations in the 10.95-11.2 GHz and 11.45-11.7 GHz bands. As a result, ESAA operators who seek to communicate in those bands will be required to individually designate the target satellite for those bands in its application.

[272] *Notice*, 20 FCC Rcd at 2932-33, ¶¶ 47-50 (explaining that the applicant would be required to file information describing the overall system operation as well as specific information on the antennas, power density, emission characteristics and other details of its system).

[273] *See* ViaSat Reply at 21.

[274] *See Streamlining Eighth Report and Order*, 23 FCC Rcd at 15124-25, ¶¶ 58-59.

[275] *See id*.

[276] *See* n.8 *supra* and accompanying text.

resulting limited non-conforming licenses placed an unnecessary administrative burden on operators and the Commission while at the same time casting regulatory uncertainty over ESAA operations.[277] In this section, we address how applicants and existing licensees can file new data to conform their authorizations and pending applications to these new rules.[278]

115. At the outset, we emphasize that the existence of pending applications is not a barrier to our adopting rules or requiring that applicants amend their applications to come into compliance with the new rules. We have the authority to apply new procedures to pending applications if doing so does not impair the rights an applicant possessed when it filed its application, increase an applicant's liability for past conduct, or impose new duties on applicants with respect to "transactions already completed."[279] Applicants do not gain any vested right merely by filing an application,[280] and the simple act of filing an application is not considered a "transaction already completed" for purposes of this analysis.[281]

116. The authorizations granted under the *ad hoc* process were heavily conditioned and had limited interference protections granted.[282] As a result, we anticipate that current authorization holders will be eager to file conforming modifications to demonstrate that they are entitled to interference protections afforded by the allocation decisions and the technical rules adopted in this *Report and Order*. While we do not require existing non-conforming authorization holders to file conforming modifications, we also note that they are not entitled to the benefits conferred by these new rules until such time as they file a conforming modification demonstrating compliance and such modification is granted.

---

[277] *Notice*, 20 FCC Rcd at 2914, ¶ 11.

[278] We are aware that operators are pursuing development of similar systems operating with Ka-band GSO FSS space stations. The technical and licensing rules we adopt here today do not address such operations.

[279] *Order and FNPRM*, 22 FCC Rcd at 8901, ¶ 144. *See also First Space Station Licensing Reform Order*, 18 FCC Rcd at 10865, ¶ 278 and n.673 (citing *Landgraf v. USI Film Prod*ucts, 511 U.S. 244, 269-70 (*Landgraf*); *DIRECTV v. FCC*, 110 F.3d 816, 825-2626 (citing *Bell Atlantic Telephone Cos. v. FCC*, 79 F.3d 1195, 1207 (D.C. Cir., 1996)); *Black Citizens for a Fair Media v. FCC*, 719 F.2d 407, 411 (D.C. Cir., 1983); *Celotronix Telemetry, Inc. v. FCC*, 272 F.3d 585, 588 (D.C. Cir. 2001) (citing *Landgraf*, 511 U.S. at 280).

[280] *Order and FNPRM*, 22 FCC Rcd at 8901, ¶ 144; *Chadmoore Communications, Inc. v. FCC*, 113 F.3d 235, 240-41 (D.C. Cir. 1997) ("In this case the Commission's action did not increase [the applicant's] liability for past conduct or impose new duties with respect to completed transactions. Nor could it have impaired a right possessed by [the applicant] because none vested on the filing of its application."); *Hispanic Info. & Telecomms. Network v. FCC*, 865 F.2d 1289, 1294-95 (D.C. Cir. 1989) ("The filing of an application creates no vested right to a hearing; if the substantive standards change so that the applicant is no longer qualified, the application may be dismissed."); *Schraier v. Hickel*, 419 F.2d 663, 667 (D.C. Cir.1969) (filing of application that has not been accepted does not create a legal interest that restricts discretion vested in agency). *See also United States v. Storer Broadcasting Co*., 351 U.S. 192 (1952) (pending application for new station dismissed due to rule change limiting the number of licenses that could be held by one owner); *Bachow Communications, Inc. v. FCC*, 237 F.3d 683, 686-88 (D.C. Cir. 2001) (upholding freeze on new applications and dismissal of pending applications in light of adoption of new licensing scheme); *PLMRS Narrowband Corp. v. FCC*, 182 F. 3d 995, 1000-01 (D.C. Cir. 1999) (applicant did not, by virtue of filing application, obtain the right to have it considered under the rules then applicable).

[281] ESAA applicants also recognize that they are subject to any rules adopted in this proceeding. *See, e.g*., Gogo Application, IBFS File No. SES-LIC-20120619-00574, Narrative at 9 (recognizing that any blanket authority it receives will be subject to the requirements that are ultimately adopted in this proceeding).

[282] For example, under the *ad hoc* process, operations were granted based on a waiver of the Table of Allocations on a non-harmful interference, non-protected basis in the 11.7-12.2 GHz band (space-to-Earth). In contrast, after the effective date of this order, new authorizations or modified authorizations demonstrating compliance with our rules are entitled to operate on a primary basis in the 11.7-12.2 GHz band (space-to-Earth).

117. The Commission may adopt rules that modify any station license of general applicability that affect a class of licensees,[283] "if in its judgment such action will promote the public interest, convenience and necessity" and the modification may be accomplished through notice and comment rulemaking.[284] The licensing and technical rules we are adopting in this order are a means of bringing current authorization holders and pending applicants into compliance with general operational requirements.[285] The purpose of our actions here is to establish revised technical rules that will foster the provision of new services without causing harmful interference to other authorized users of the bands.[286] Moreover, the ESAA operators could not have had any reasonable expectation that the Commission would refrain from exercising its regulatory power to change the operational requirements of a service in cases where the public interest is best served by such change. Commission action that upsets expectations held by current authorization holders based on existing rules is not impermissibly retroactive.[287]

118. While most of the new rules adopted here will become effective 30 days after Federal Register publication, the Paperwork Reduction Act (PRA) of 1995[288] requires certain additional approvals before new information requirements can come into effect. We direct the International Bureau to release a Public Notice after receiving PRA approval for the new information requirements inviting applicants to amend their pending applications consistent with the rules we adopt today. The Public Notice should include any guidance the International Bureau deems useful in assisting current and future applicants and existing authorization holders in complying with the new ESAA information requirements. Any application that is not amended by the date specified by the International Bureau will be dismissed as defective.[289] The International Bureau will review the amended applications to determine whether they are substantially complete and acceptable for filing. The International Bureau will return to the applicant as defective any amended applications that are not substantially complete.[290] Existing applicants and authorization holders filing amendments or modification applications, by the deadline specified by the

[283] 47 U.S.C. § 316. *See Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communication Services in the 2.3 GHz Band*, WT Docket No. 07-293, Report and Order and Second Report and Order, 25 FCC Rcd 11710, 11774-75, at ¶ 157 (2010) (*2.3 GHz Order*).

[284] *2.3 GHz Order,* at 11774-75, ¶ 157; *Committee for Effective Cellular Rules v. FCC,* 53 F.3d 1309 (D.C. Cir. 1995); *WBEN, Inc. v. FCC*, 396 F.2d 601, 618 (2nd Cir. 1968), *cert. denied*, 393 U.S. 914 (1968).

[285] *Mitigation of Orbital Debris*, Second Report and Order, IB Docket No. 02-54, 19 FCC Rcd 11567, 11598, ¶ 78 (2004) (*Second Orbital Debris Order*) (stating that the application of rules adopted in the order to existing spacecraft would not be impermissible under the Administrative Procedure Act or Commission precedent).

[286] In comparison, we are not altering the "past legal consequences of past actions" of operations in this band. *Second Orbital Debris Order*, 19 FCC Rcd at 11598, ¶ 78 (applying a rule to satellites that are currently on-orbit or under physical construction is impermissibly retroactive only when an agency "alter[s] the *past* legal consequences of past actions"); *Celotronix,* 272 F.3d at 588 (citing *Bowen v. Georgetown University Hospital*, 488 U.S. 204, 219 (1988)).

[287] 47 U.S.C. § 304. *See 2.3 GHz Order*, 25 FCC Rcd at 11774-75, ¶ 157.

[288] 44 U.S.C. § 3507.

[289] 47 C.F.R. § 25.112(a)(2).

[290] *See Amendment of the Commission's Space Station Licensing Rules and Policies and Mitigation of Orbital Debris*, First Report and Order and Further Notice of Proposed Rulemaking in IB Docket No. 02-34, and First Report and Order in IB Docket No. 02-54, IB Docket Nos. 02-34 and 02-54, 18 FCC Rcd 10760, 10852, ¶ 244 (2003) (*First Space Station Licensing Reform Order*). Applications of PanAmSat Licensee Corp. for Authority to Construct, Launch, and Operate a Hybrid Satellite System in its Separate International Communications Satellite System, *Order on Reconsideration*, 18 FCC Rcd 23916 (2003). We note that the Commission reserves the right to return an application which has been placed on Public Notice as acceptable for filing if, upon further examination, it is determined that the application is not in conformance with the Commission's rules.

International Bureau, solely for the purpose of conforming with the information and operational requirements in this *Report and Order* will not be required to pay a fee. All other ESAA applications will continue to pay applicable fees. Finally, we note that to the extent applicants or authorization holders wish to submit the new information requirements prior to conclusion of the PRA approval process, nothing precludes such early submissions.

E. Regulation of ESAA Operations on U.S.-Registered and Non-U.S.-Registered Aircraft

119. We must take into account the fact that aircraft routes are not confined within the borders of the United States. Both U.S. and non-U.S.-registered aircraft travel routes to, from, and within the United States. Even routes that commence and end in the United States may travel in or near other countries. In light of the international nature of aircraft travel, we must determine both the regulatory status of ESAA operations on U.S.-registered aircraft outside the United States and the regulatory status of ESAA operations on non-U.S.-registered aircraft within the United States. Our regulatory review of ESAA operations on U.S.-registered and non-U.S.-registered aircraft is guided by the Communications Act provisions and our international obligations.[291]

1. U.S.-Registered Aircraft

120. The Commission is responsible for licensing aircraft terminals on all U.S.-registered aircraft regardless of whether the aircraft is within or outside U.S. territory.[292] Accordingly, the *Notice* proposed rules to prevent interference that ESAA operations on U.S.-registered aircraft might cause to other services (i) in or near foreign airspace and (ii) over international waters (*i.e*., "high seas," or regions beyond the territorial limits of any country).[293]

a. Operations In or Near Foreign Nations.

121. *Background.* In the *Notice*, the Commission proposed that prior to operations within a foreign nation's airspace, an ESAA operator would have to ascertain whether the relevant administration has operations that could be affected by ESAA airborne terminals on board U.S.-registered aircraft, and determine whether that administration has adopted specific requirements concerning ESAA operations.[294] When the U.S.-registered aircraft enters foreign airspace, the ESAA airborne terminal would be required to operate under the Commission's technical rules, or those of the foreign administration, whichever is more constraining.[295] To the extent that all relevant administrations have identified geographic areas from which ESAA operations would not affect their radio operations, ESAA operators would be free to operate within those identified areas without further action. To the extent that the foreign administration has not adopted requirements regarding ESAA operations, the Commission proposed that ESAA operators would be required to coordinate their operations with any potentially affected operations.[296]

122. *Discussion.* The parties commenting on the Commission's proposals for ESAA operations on U.S.-registered aircraft in or near foreign airspace generally support those proposals.

---

[291] *See Notice*, 20 FCC Rcd at 2935, ¶ 56 (citing *ESV Order*, 20 FCC Rcd at 723-24, ¶ 119).

[292] *See Notice*, 20 FCC Rcd at 2936, ¶ 57 (citing 47 U.S.C. § 301(e) (no person shall engage in radio communication "upon any vessel or aircraft of the United States" without a Commission license). As explained in the Notice, the Act does not indicate, nor do we believe, that such jurisdiction is restricted to the location of vessels or aircraft. *Id*.

[293] *See Notice*, 20 FCC Rcd at 2936, ¶¶ 58-59.

[294] *Notice*, 20 FCC Rcd at 2936, ¶ 58 (citing *ESV Order*, 20 FCC Rcd at 724, ¶ 121).

[295] *Notice*, 20 FCC Rcd at 2936, ¶ 58.

[296] *Id.*, 20 FCC Rcd at 2936, ¶ 58.

Boeing supports our proposals with regard to licensing of U.S.-registered aircraft and their operations in or near foreign airspace.[297] With respect to U.S. aircraft in foreign airspace, Telesat states that ESAA operators should be required to ascertain and meet the requirements of the relevant foreign administration.[298] Accordingly, we find that our proposals are sufficient to prevent ESAA operations on U.S.-registered aircraft from causing harmful interference to other services in or near foreign airspace, without being unduly burdensome on ESAA operators. We note that in connection with the provision of service in foreign airspace, U.S.-licensed ESAA operators bear the responsibility of ascertaining and complying with the applicable laws, regulations, and rules of that country.

b. Operations Over International Waters.

123. *Background.* With regard to the authorization of ESAA operations of U.S.-registered aircraft flying over international waters, the Commission sought comment on whether the only issue presented was the protection of adjacent satellite operators. We also invited comment on whether to require any ESAA operator seeking to operate over international waters to certify that the operator(s) of all space stations with which an ESAA aircraft terminal would be communicating while over international waters have confirmed that the proposed ESAA operations would be within the coordinated parameters of the space station. In the alternative, the Commission requested comment on whether such confirmation is necessary for ESAA operators that comply with the off-axis EIRP density envelopes proposed in the *Notice*, and adopted in this *Report and Order*.[299]

124. *Discussion.* Several commenters agree that ESAA operators planning operations over international waters should certify that their target satellite operators have confirmed that proposed ESAA operations are within coordinated parameters.[300] Boeing notes that ESAA systems operating over international waters but near foreign airspace might affect other systems in the foreign territory.[301] That concern suggests that mere compliance with adopted off-axis EIRP density envelopes is not the preferred approach to approving operations over international waters. We conclude, accordingly, that an effective and minimally burdensome approach to regulating these operation over international waters is to require ESAA operators to certify that their target space station operators have confirmed that proposed ESAA operations are within coordinated parameters.

2. Non-U.S.-Registered Aircraft Operating in U.S. Airspace

125. *Background*. Foreign-registered aircraft equipped with ESAA terminals are just as likely to travel through U.S. airspace[302] as U.S.-registered aircraft. In the *Notice*, the Commission requested comment on our tentative conclusion that we should allow operation of ESAA terminals on aircraft of foreign registry when these ESAA aircraft terminals are traveling through U.S. airspace. We also sought comment on the regulatory framework for such operations.[303] In the *Notice*, the Commission sought

[297] Boeing Comments at 39-40.

[298] *See* Telesat Comments at 4.

[299] *See Notice*, 20 FCC Rcd at 2936, ¶ 59.

[300] *See* Boeing Comments at 40; Intelsat Comments at 6-7; Telesat Comments at 4.

[301] Boeing Comments at 40.

[302] U.S. airspace includes the airspace over territorial waters. Consistent with Presidential proclamation and the United Nations Convention on the Law of the Sea, the territorial waters would extend 12 nautical miles from the baselines of the geographic areas described in 47 U.S.C. § 153(51). *See, e.g.,* Presidential Proclamation No. 5928, 54 Fed. Reg. 777 (1988). *See* U.N. Convention on the Law of the Sea, 21 I.L.M. 1261, at Part II, Art. 2 (opened for signature 1982).

[303] *See Notice*, 20 FCC Rcd at 2936-37, ¶ 60.

comment on whether we should provide a means to recognize an ESAA authorization issued by another administration or whether the Commission should license these terminals directly.[304] We also sought comment on a variety of mechanisms that might allow for recognition of an ESAA authorization issued by another administration. For example, the Commission sought comment on whether it should consider ESAA under the Convention on International Civil Aviation (Chicago Convention), which provides a mechanism for recognizing foreign licenses. Specifically, under the Chicago Convention aircraft registered to a member country may use radio transmitter equipment over another country's territory provided that the transmitter is licensed by the country that registered the aircraft and that said use is in compliance with the regulations of the country over which the aircraft is flying.[305] The Chicago Convention also provides that licenses issued by member nations must be equal to or above the minimum standards adopted by the International Civil Aviation Organization (ICAO).[306] In the *Notice*, the Commission also discussed relying on bilateral agreements between the United States and the other administrations as a mechanism for eliminating the need for direct licensing.[307] The Commission explained, however, that the utility of such a mechanism would depend on the specific language in these bilateral agreements, which may not be adequate to protect U.S.-licensed services from interference from terminals licensed by other administrations. The Commission also proposed allowing operation of ESAA terminals on foreign-registered aircraft in U.S. airspace on an unprotected, non-harmful interference basis under Article 4.4 of the ITU's Radio Regulations.[308] Although the Commission noted that it based the ESV regulations on Article 4.4, the Commission was also concerned that it would not be well-suited to ESAA because airplanes generally move much faster than maritime vessels, and so the source of any transient interference could be more difficult to identify.[309] The Commission also sought comment on a coordination approach. Under this approach, foreign ESAA airborne terminal operations would be

[304] *Id*. Although Section 306 of the Act prohibits the Commission from licensing earth stations on foreign-registered ships, this section does not apply to aircraft. *See* 47 U.S.C. §§ 306, 3(39)(A) (definition of "ship" excludes aircraft).

[305] *See* Convention on International Civil Aviation, signed Dec. 7, 1944, Article 30, *cited in Notice*, 20 FCC Rcd at 2937, ¶ 61. By its terms, the Chicago Convention does not prohibit the nation over which the foreign-registered aircraft is flying from also issuing a license for the transmitter. Therefore, a single ESAA airborne terminal onboard a single aircraft could have a separate license for each nation through which it passes.

[306] ICAO is a specialized agency of the United Nations created in 1944 to promote the safe and orderly development of international civil aviation throughout the world. It sets standards and regulations necessary for safety, security, efficiency and regularity of flight, as well as for aviation environmental protection. Contracting States undertake to adopt and put into operation the standards and recommendations issued by ICAO. Mutual recognition of licenses by Contracting States is tied to the requirement that licenses be "equal to or above the minimum standards which may be established from time to time pursuant to this Convention." For more information on how ICAO adopts technical standards, go to http://www.icao.int/icao/en/anb/mais/index.html (last visited on Aug. 22, 2011).

[307] *Notice*, 20 FCC Rcd at 2938, ¶ 63.

[308] This suggestion in the *Notice*, however, was limited to the circumstances where an ESAA terminal on a non-U.S.-registered aircraft operating in U.S. airspace is communicating with an ESAA network licensed by another administration *Id*. at ¶ 65. Article 4 of the ITU Radio Regulations sets forth the general international principles and rules regarding the assignment and use of frequencies. ITU Radio Regulation 4.4 (ITU RR 4.4) permits licensing of services that do not otherwise conform to the Radio Regulations so long as those services do not cause interference to, or claim protection from interference by, other services licensed in compliance with the Radio Regulations. The full text of ITU RR 4.4 reads as follows: "Administrations of the Member States shall not assign a station to any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations." Some administrations may authorize AMSS operations for their registered aircraft based on ITU RR 4.4.

[309] *Notice*, 20 FCC Rcd at 2939, ¶ 66.

permitted in the vicinity of radio astronomy and TDRSS sites only after they have been coordinated with the Commission and NTIA, and we determined that operations satisfied the technical rules established for ESAA.[310] Finally, the Commission sought comment on how our technical rules would apply under these different frameworks.[311]

126. Boeing and PanAmSat both propose Commission licensing of ESAA operations in U.S. airspace, regardless of the aircraft's country of registry.[312] Boeing contends that Commission licensing of all ESAA terminals operating in U.S. airspace is necessary to protect against interference concerns and to ensure compliance with all Commission policies.[313] Boeing is particularly concerned that having a separate framework for non-U.S.-registered aircraft would be at odds with Commission goals of facilitating development of ESAA and minimizing regulatory burdens on operators.[314] ARINC and SITA oppose Commission licensing of ESAA airborne terminals on non-U.S.-registered aircraft operating in U.S. airspace, arguing that Commission licensing would be inconsistent with the Chicago Convention.[315] ARINC and SITA are further concerned that if the United States licenses ESAA terminals on foreign planes, reciprocal licensing demands of foreign countries would likely result.[316] Accordingly, ARINC and SITA recommend applying the Chicago Convention to ESAA airborne terminals on non-U.S.-registered aircraft operating in U.S. airspace.[317] Under this approach, SITA explains, operators of ESAA terminals on non-U.S.-registered aircraft would only be required to comply with the technical requirements adopted by the Commission.[318]

127. *Discussion*. No commenters opposed our tentative conclusion[319] that we should allow operation of ESAA terminals on aircraft of foreign registry when these ESAA aircraft terminals are traveling through U.S. airspace, and we hold there is no basis in the record for precluding such

[310] *Id.* at 2940, ¶ 67. *See also* ITU-R M.1643, Annex 1, Part D, which provides, in part, "Coordination agreements should be developed between [ESAA] and space research systems based on controlling the emissions levels of the [ESAA airborne terminal] in the frequency band used by the SRS systems, and, in severe cases, may require cessation of [ESAA airborne terminal] emissions on frequencies used by the SRS system when operating in the vicinity of the space research earth station."

[311] *See Notice*, 20 FCC Rcd at 2940, ¶ 67

[312] *See* PanAmSat Comments at 6; Boeing Reply at 14.

[313] Boeing Comments 41-42; Boeing Reply at 14.

[314] Boeing Comments at 38.

[315] *See* ARINC Comments at 18-22; SITA Reply at 1-6, 9-10. SITA points out that Section 301(e) of the Communications Act specifies that we have licensing authority "upon any vessel or aircraft of the United States," but does not make a reference to licensing authority over foreign aircraft.

[316] *See* ARINC Comments at 22; SITA Reply at 9-10.

[317] *See* ARINC Comments at 22; SITA Reply at 3-4.

[318] *See* SITA Reply at 4. To implement ARINC and SITA's recommendation, the parties recommend revising Sections 87.173 and 87.187 of the Commission's rules, which specify frequencies available for aviation services, so that aircraft radio licenses can be issued for operations in the 14.0-14.5 GHz band, subject to other rules to be adopted in Part 25. *See* ARINC Comments at 20. Inclusion of these bands in the Part 87 would suggest that the Chicago Convention is applicable to ESAA operations. *See* ARINC Comments at 22.

[319] Boeing 2003 Petition for Rulemaking at 22; Boeing Comments at 41; SITA Reply Comments; ARINC Comments at 19; PanAmSat Comments at 6-7. The comments from SITA, ARINC, and PanAmSat presumed that operations in the United States on non-U.S. registered aircraft would be approved and instead focused on the appropriate regulatory framework for such operations.

operations.[320] In light of that determination, we must adopt a regulatory framework for such operations. Our regulatory framework must provide clear guidance to operators under all of the potential operating scenarios including situations where an ESAA terminal on a non-U.S.-registered aircraft operating in U.S. airspace is communicating with a U.S.-licensed ESAA network and where an ESAA terminal on a non-U.S.-registered aircraft operating in U.S. airspace is communicating with an ESAA network licensed by another administration.[321]

128. As of the date of this *Report and Order*, there is nothing to suggest that ICAO has adopted or intends to adopt standards and recommended practices for ESAA pursuant to the Chicago Convention. In the absence of international standards, and the adoption by member states of such international standards, implementation of the Chicago Convention with respect to ESAA would be premature. Further, we are not aware of any bilateral agreements that would cover ESAA operations. While the Commission sought comment on allowing operation of non-U.S.-licensed ESAA networks in the United States pursuant to ITU RR 4.4 or through a coordination framework, the need to review the technical parameters of ESAA operations makes adopting a framework based on international standards more difficult.

129. Given the lack of any internationally recognized parameters for ESAA, we concur with Boeing and PanAmSat that in the absence of a licensing process at the Commission, the Commission would have difficulty meeting our obligation under the Communications Act to prevent harmful interference among radio stations operating within the United States.[322] This conclusion applies regardless of whether the ESAA terminals on the non-U.S.-registered aircraft are communicating with an ESAA system hub located in the United States or located outside the United States. As such, we will require U.S. licensure of any ESAA terminals aboard aircraft of foreign registry operating in the United States and its airspace on the same terms as applied to ESAA terminals aboard U.S.-registered aircraft. This license will apply to domestic operations within the United States. The Commission has successfully followed this practice while this proceeding has been pending.[323] Thus, ESAA operations on non-U.S.-registered aircraft operating within the U.S. will be subject to the same technical rules as those applicable to any other ESAA operator. Similarly, the same flexibility will be provided with respect to the location of the ESAA operator's network control and maintenance facilities outside the U.S. provided that the authorization holder has a 24-hour point of contact in the United States with the ability and authority to cause each ESAA aircraft terminal to stop transmitting. We note, however, that our decision to license commercial ESAA terminals operating in United States airspace on the same terms as applied to U.S.-registered aircraft does not preclude adjustments to our policy in the future to ensure compliance with our international commitments. We further note that it appears that most airlines have elected to procure these services from vendors rather than directly engaging in running ESAA networks.[324] As a

[320] We further note that we have issued licenses to cover such operations. *e.g.*, grant to Panasonic Avionics Corporation authority for domestic operation of up to 50 technically identical transmit/receive earth stations installed in foreign-flagged commercial aircraft operated by Lufthansa. *Panasonic Order*, 26 FCC Rcd 12557 (Narrative at page 8 for NCMC).

[321] In the *Notice*, we distinguished between a system where the hub or network control center is located outside of the United States or inside the United States. *See Notice*, 20 FCC Rcd at 2936-37, ¶ 60 n.154, and ¶¶ 65-66. Earlier in the *Report and Order*, however, we determined that the public interest did not require a U.S.-licensed system to maintain its hub or network control center in the U.S. so long as the operator has a 24-hour point of contact in the United States with the ability and authority to cause each ESAA aircraft terminal to stop transmitting. *See* Section IV.D.3, *supra*.

[322] *See* 47 U.S.C. § 303(f).

[323] *Panasonic Order*.

result, we suspect that few if any airlines – whether U.S.-registered or non-U.S.-registered - will directly seek an ESAA authorization. Nevertheless, we remind all aircraft operators that if they seek an authorization they should be mindful of the Commission's Section 310 obligations.[325]

130. As discussed above, SITA and ARINC suggest implementation of the Chicago Convention through modification of Part 87.[326] We note that while ESAA may be used by the aircraft crew, our service rules were not designed around safety and regularity of flight considerations mentioned in Part 87, nor have we adopted priority or preemption requirements for such communications.[327] As a result, inclusion in Part 87 could prompt confusion regarding the purpose and scope of ESAA operations. In light of our determination to directly license all ESAA terminals operating in the United States and its airspace, we decline to include ESAA in the bands governed by Part 87 of the Commission's rules.

131. *Individual and Blanket Licensing in the Context of Non-U.S.-Registered Aircraft.* Earlier in this *Report and Order*, we adopted both blanket licensing for ESAA networks and individual terminal licensing.[328] As a result, operators of non-U.S.-registered aircraft may seek blanket or individual terminal ESAA licenses. Given the inherently international nature of air travel, one additional issue the Commission raised in the *Notice* is whether individual ESAA terminals should be permitted to be temporarily added to blanket licenses following the example of MSS transceivers designed to operate with U.S.-licensed systems.[329] Specifically, the Commission considered the fact that the ESAA terminal could be considered part of the underlying U.S.-licensed ESAA network it is controlled by while it operates in the United States. This proposal provides operators flexibility to the extent that they design their networks to allow hand-off of a terminal to a U.S.-licensed ESAA network from another non-U.S.-licensed network. In other words, a terminal can be temporarily controlled by a U.S. network and treated as part of that network while in the United States and can also be part of a non-U.S.-licensed network when the terminal operates outside the United States. The U.S.-licensed ESAA operator would assume responsibility for the terminal on the non-U.S.-registered aircraft for as long as it operates as part of its U.S.-licensed network.[330] Under this approach, the ESAA terminal would be subject to all the same provisions as any other terminal operating on the U.S. ESAA blanket license.[331] Thus, any failure to comply with our rules could result in sanctions against the U.S. ESAA blanket licensee including possible

(...continued from previous page)

[324] *See, e.g.*, Panasonic granted a blanket license for a network aboard foreign-flagged commercial aircraft operated by Lufthansa. This is not surprising, as airlines frequently utilize vendors to provide services for their customers – *e.g.*, DIRECTV provides satellite television service on Jet Blue airlines, VIASAT and Row 44 provide ESAA service on Southwest airlines.

[325] 47 U.S.C. § 310. *See Review of Foreign Ownership Policies for Common Carrier and Aeronautical Radio Licensees under Section 310(b)(4) of the Communications Act, as Amended*, IB Docket No. 11-133, Notice of Proposed Rulemaking, 26 FCC Rcd 11703, 11708-10, ¶¶ 7-11 (2011) (general overview of foreign ownership restrictions under Section 310 of the Communications Act).

[326] *See supra* ¶ 126 and n. 321. Part 87 of our rules provide fleet licensing for aeronautical services.

[327] Where safety and regularity of flight communications are to be carried by a communications system, specific measures must be put in place to safeguard them (*e.g.*, high levels of availability, reliability, and continuity).

[328] *See supra* Section IV.D.1.

[329] *See Notice*, 20 FCC Rcd at 2938, ¶ 62, citing 47 C.F.R. §§ 25.136(c), 25.135(d), Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands, CC Docket No. 92-166, *Report and Order*, 9 FCC Rcd 5936, 6016, ¶ 208 (1995) (*Big LEO Order*).

[330] *See Notice*, 20 FCC Rcd at 2938, ¶ 62.

[331] *Id.* at 2937, ¶ 61.

license forfeiture.[332] Boeing supports adoption of the regulatory flexibility that would allow an ESAA terminal to be temporarily associated with and licensed to a U.S. ESAA licensee or operator-authorized service vendor.[333] Boeing notes that this policy will facilitate the provision of advanced services to U.S. consumers.[334] We concur and make it clear that such temporary inclusion on a blanket license is contemplated by the blanket licensing rules we adopt in this order.

F. Law Enforcement

132. *Background*. At the time the *Notice* was released, the Commission had an open rulemaking proceeding to resolve various outstanding issues associated with the implementation of the Communications Assistance for Law Enforcement Act (CALEA).[335] In particular, the CALEA proceeding examined issues relating to CALEA's applicability to packet-mode services, such as broadband Internet access, and implementation and enforcement issues. As a result, in the *Notice*, the Commission noted the existence of the proceeding and explained that it anticipated that ESAA operations would be subject to any CALEA obligations placed on Internet service providers.[336] Subsequently, the Commission released the *CALEA First Report and Order* concluding that that CALEA applies to facilities-based broadband Internet access providers and providers of interconnected voice over Internet Protocol (VoIP) service.[337] As a result, ESAA operators that provide such services are required to comply with CALEA.

133. In the ESAA proceeding, prior to the release of the *CALEA First Report and Order*, the Departments of Justice and Homeland Security (the Departments) raised two specific CALEA implementing issues in this proceeding. Specifically, the Departments state that CALEA itself does not prescribe a timeframe within which an intercept order must be provisioned, and that the Commission has previously stated only that carriers should promptly provision such orders and comply with any other relevant statutes related to carriers' duty to assist law enforcement in performing interceptions.[338] The Departments request that we specify that ESAA providers must provision an intercept order "promptly," defined for purposes of interception onboard aircraft as "forthwith, but in no circumstance more than 10 minutes' from the moment of notification to the telecommunications carrier of lawful authority to intercept or otherwise conduct lawful electronic surveillance to the moment of real-time transmission to law enforcement or other authorized government agents."[339] The Departments also ask the Commission to require that any satellite-based communications capability to or from an aircraft operating in United States' airspace or international airspace contiguous or attendant to the United States use ground stations located within the United States' borders.[340]

---

[332] *Id*. at 2938, ¶ 64.

[333] *See* Boeing Comments at 41; Boeing Reply at 15.

[334] *See* Boeing Comments at 41-42.

[335] Pub. L. No. 103-414, 108 Stat. 4279 (1994) (codified as amended in sections of 18 U.S.C. and 47 U.S.C.); *Communications Assistance for Law Enforcement Act and Broadband Access and Services*, ET Docket No. 04-295, Notice of Proposed Rulemaking and Declaratory Ruling, 19 FCC Rcd 15676 (2004) (*CALEA Notice*) .

[336] *See Notice*, 20 FCC Rcd at 2908, n.7 (citing *CALEA Notice*).

[337] *See Communications Assistance for Law Enforcement Act and Broadband Access and Services*, ET Docket No. 04-295, FCC 05-153, First Report and Order and Further Notice of Proposed Rulemaking, 20 FCC Rcd 14989, 15001 at ¶ 24 (2005).

[338] *See* the Departments' Comments at 7-8.

[339] *Id*. at 8-9.

[340] *Id*. at 9.

134. In addition to the CALEA-specific points raised, the Departments also request a number of non-CALEA operational requirements.[341] These requests include retention of non-content communication records; specific capabilities regarding identification of location of passengers on planes; identification and location of devices used by passengers; ability to identify all aircraft with ongoing passenger communications; ability to disrupt or conference into an ongoing communication; ability to redirect communications from an aircraft; ability to provide priority and preemption access for emergency law enforcement/public safety information to airborne and terrestrial resources, as appropriate; and assurance that technology is compatible with Wireless Priority Service to enable National Security/Emergency Preparedness (NS/EP) users connectivity in emergency situations.[342] The Departments also request that we impose various security protocols including passenger authentication and registration prior to using personal electronic devices on the network and that the satellite-based service providers and carriers design onboard communications systems in such a way that they will deny network access and connectivity to any device that is stored in the cargo hull.[343]

135. The Departments also note that the use of personal phones and broadband devices aboard aircraft might lead to increased incidence of "air rage," which could have serious implications for law enforcement personnel aboard aircraft. Accordingly, the Departments request that we, in consultation with airlines, establish rules and policies concerning in-flight use of broadband devices and related conduct in order to minimize any such incidents.[344]

136. While commenters agree with the need to comply with the requirements of CALEA and also work with law enforcement agencies on issues of particular concern, operators suggest that this proceeding is not the appropriate forum to adopt rules of general applicability concerning aeronautical communications. For example, ARINC explains that each ESAA system is different, and that rather than adopting rules of general applicability, we should allow each ESAA provider to work with the Departments and other law enforcement agencies to address their concerns.[345] Similarly, Boeing recommends that system-specific arrangements between satellite carriers and law enforcement agencies are the best ways to address public safety and national security concerns.[346] Boeing also cites numerous examples of the Commission relying on such agreements to address law enforcement concerns. ViaSat states that the purpose of the proceeding is to address technical issues relating to radio frequency interference and to develop service rules and licensing procedures for ESAA, and thus, law enforcement issues relating generally to aeronautical communications systems are not appropriate for this proceeding.[347]

137. The Center for Democracy & Technology and the Electronic Frontier Foundation (CDT/EFF) raise questions regarding the Commission's authority to impose the requirements suggested by the Departments.[348] Further, CDT/EFF states that the Departments' recommendations are not in keeping with an express prohibition in CALEA of law enforcement-imposed design mandates.[349]

---

[341] *See id.* at 10-15.

[342] *Id.* at 11-13.

[343] *Id.* at 14-15.

[344] *See id.* at 16-17.

[345] *See* ARINC Reply at 12.

[346] *See* Boeing Reply at 18-19.

[347] ViaSat Reply at 18-19.

[348] CDT/EFF Reply at 3-4.

[349] *Id.* at 6-7 (quoting 47 U.S.C. § 1002(b)(1)).

CDT/EFF also claims that imposing the Departments' recommended requirements would inhibit technical innovation and consumer choice in ESAA.[350]

138. *Discussion*. We decline to adopt the proposals made by the Departments concerning non-CALEA operational capabilities for ESAA service. Satellite providers have traditionally addressed specific public safety, law enforcement, and national security concerns through individual negotiations with law enforcement agencies.[351] ESAA operators granted authorizations under the *ad hoc* process previously described have advised us that they have followed this example.[352] Similarly, operators of other terrestrial-based services used to provide passenger communications to airborne aircraft have advised us that they have also relied upon direct arrangements with law enforcement.[353] We believe that adopting rules in this proceeding might have the unintended effect of undermining the efficacy and flexibility of such arrangements.[354] We expect ESAA operators will continue to follow the established process described above and work diligently with law enforcement agencies to address their public safety, law enforcement, and national security concerns through individual negotiations and agreements. We are also mindful of the fact that we did not seek comment on any CALEA implementation rules or other law enforcement policies in this proceeding. Accordingly, we decline to adopt the CALEA-related proposals made by the Departments. We expect ESAA operators, however, to work diligently to expeditiously provision intercept orders and otherwise comply with their duty to assist law enforcement in performing lawful interceptions. We note, however, as with any other satellite service application, the public notice period provides a useful opportunity to raise any law enforcement concerns – CALEA or non-CALEA-based – that were not addressed by the operator as part of its system design consultations with the law enforcement community. Although we decline to adopt any of the CALEA or non-CALEA proposals requested by the Departments in this proceeding, to the extent that the Departments' concerns are not able to be adequately addressed as we contemplate here, the Departments are free to raise their concerns with us though the Commission's available administrative processes.

[350] *Id.* at 7.

[351] *See* examples cited in Boeing Reply at 18-19. The negotiations we discuss here may be independent from those that typically occur in the context of applications involving foreign ownership.

[352] *E.g*., Panasonic Application Narrative at 19, IBFS File No. SES-LIC-20100805-00992 ("Panasonic is engaged in active discussions with U.S. law enforcement officials regarding lawful interception ("LI") and network security functionality to be deployed in the eXConnect System. Panasonic has engaged a CALEA-compliant equipment vendor to implement its LI solution, which will be in place before the commencement of commercial operations. In addition, Panasonic is implementing additional functionality subject to final agreement with U.S. law enforcement."); Letter from Carlos Nalda, Esq., Counsel to Panasonic Avionics Corporation to Marlene H. Dortch, Secretary, Federal Communications Commission, dated June 30, 2012 at 3 (Panasonic June 30 *Ex Parte*) (Operators "have uniformly engaged in direct consultations with law enforcement to develop appropriate capabilities consistent with their system characteristics and service offerings.").

[353] Letter from Karis Hastings, Esq., Counsel for Gogo LLC, to Marlene H. Dortch, Secretary, Federal Communications Commission, dated July 20, 2012 at 2 (Gogo July 20 *Ex Parte*)(noting that in designing its existing terrestrial-based Air-Ground network, Call Sign WQFX728 granted on October 31, 2006, Gogo worked closely with law enforcement to incorporate functionalities and protections that would serve the public interest and national security interests).

[354] In the Air-Ground service, a terrestrial-based service that is also used to provide Internet service to passengers on board airborne aircraft, licensees are not required to provide capabilities beyond those required under CALEA. *Air-Ground Rulemaking*, 20 FCC Rcd 4403, 20 FCC Rcd 19663. The issue was not presented in that proceeding. The rules for the Air-Ground service are found in 47 C.F.R. Part 22, Subpart G. *See* n. 6 above for more information on the service.

G. Aeronautical Mobile Satellite (Route) Service

139. The Aeronautical Mobile Satellite (Route) Service is a radio service providing communications via satellite between an aircraft earth station (AES)[355] and land stations or other AESs. This service is used for aeronautical communications related to the safety and regularity of flight communications to aircraft crew primarily along national and international civil air routes.[356] Part 87 of the Commission's rules includes provisions covering licensing of AMS(R)S AESs. The scope of the Part 87 rules for AMS(R)S is currently limited to operations with the Inmarsat system. In a separate proceeding, the Commission sought comment on whether the Part 87 rules should be broadened to include other systems, and to apply certain requirements in Part 87 to other systems.[357] After receiving comments, the Commission concluded that certain AMS(R)S issues would be appropriate for resolution in this proceeding in light of the fact that AMS(R)S is a type of AMSS.[358]

140. We decline at this time to extend the Part 87 rule provisions concerning AMS(R)S operations to frequency bands other than the 1.5/1.6 GHz bands currently covered by those rules. The primary objective of our ESAA rules is to facilitate non-safety applications, such as airline customer connectivity and routine crew communications, and this appears to be the primary focus of market activity. In the event an interest in providing safety services develops and matures either in the Ku-band, which is the primary focus of this proceeding, or in other frequency bands, licensing of such services can be addressed on a case-by-case basis under Part 25 licensing rules, or through further rule making proceedings, as market developments warrant.

H. Conclusion

141. In allocating these bands to ESAA as an application of the FSS and establishing licensing and technical rules for ESAA, we have provided an efficient framework for processing of ESAA applications while at that same time ensuring that other services in these bands are protected from harmful interference. Our action here removes regulatory barriers to the provision of two-way, in-flight broadband services, including Internet access, to passengers and flight crews aboard commercial airliners and private aircraft. The record shows convincing support for action and does not suggest any material costs resulting from this action. The rules adopted in this proceeding will provide the benefit of regulatory certainty and will enhance competition in an important sector of the mobile telecommunications market in the United States. Along with VMES and ESV, ESAA will extend the broadband internet services seamlessly throughout land, sea and air.

V. NOTICE OF PROPOSED RULEMAKING

A. Allocations

142. In the *Report and Order* above, we adopt a footnotes to the Table of Allocations indicating that ESAA is an application of the FSS and may be authorized to communicate with GSO space stations of the FSS on a primary basis in the 11.7-12.2 GHz band (space-to-Earth), on an unprotected basis in 10.95-11.2 GHz and 11.45-11.7 GHz (space-to-Earth), and on a secondary basis in

[355] An AES is defined as a mobile earth station in the AMSS located on board an aircraft. *See* 47 C.F.R. § 2.1.

[356] *See* 47 C.F.R. § 87.261(a).

[357] *See Review of Part 87 of the Commission's Rules Concerning the Aviation Radio Service*, WT Docket No. 01-289, Notice of Proposed Rulemaking, 16 FCC Rcd 19005 (2001); Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 21432 (2003); Second Report and Order and Second Further Notice of Proposed Rule Making, 21 FCC Rcd 11582 (2006).

[358] *Review of Part 87 of the Commission's Rules Concerning the Aviation Radio Service*, WT Docket No. 01-289, Third Report and Order, 25 FCC Rcd 7610, 7611 n.4 (2010).

the 14.0-14.5 GHz band (Earth-to-space). A number of parties argue, however, that regulatory parity between ESV, VMES and ESAA suggests that ESAA as an application of the FSS should also be authorized on a primary basis in the 14.0-14.5 GHz uplink band.[359] We believe that the technical rules adopted in the *Report and Order* would support such a regulatory change. Accordingly, we tentatively concur with this recommendation and seek comment on the proposal to elevate ESAA as an application of the FSS to primary status in the 14.0-14.5 GHz band (Earth-to-space) band. Specifically, we propose to revise footnote NG55 to include a primary allocation for ESAA in the 14.0-14.5 GHz (Earth-to-space) band.[360] The proposed footnote reads as follows:

> NG55 In the bands 11.7-12.2 GHz (space-to-Earth) and 14-14.5 GHz (Earth-to-space), Earth Stations on Vessels (ESV), Vehicle-Mounted Earth Stations (VMES), and Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 are applications of the fixed-satellite service and may be authorized to communicate with geostationary satellites in the fixed-satellite service on a primary basis.

This proposed footnote would grant primary status to ESAA in the 14.0-14.5 GHz band, and as a ministerial matter, would consolidate the text from footnotes NG54, NG183, and NG187, which we propose to eliminate. We request comment on these proposals, including on all costs and benefits. We also seek comment on whether changing ESAA operations in the uplink band from secondary status to primary status requires any adjustment to our technical rules.

VI. PROCEDURAL MATTERS

A. Regulatory Flexibility Act

143. As required by the Regulatory Flexibility Act, 5 U.S.C. § 604, the Commission has prepared a Final Regulatory Flexibility Analysis (FRFA) of the possible significant economic impact on small entities of the policies and rules addressed in this document. The FRFA is set forth in Appendix A.

144. As required by the Regulatory Flexibility Act, 5 U.S.C. § 603, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) regarding the possible significant economic impact on a substantial number of small entities of the proposals addressed in this *Notice of Proposed Rulemaking* (*Notice)*. The IRFA is set forth in Appendix B. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines for comments on the *Notice*, and they should have a separate and distinct heading designating them as responses to the IRFA.

B. Paperwork Reduction Act of 1995

145. This *Report and Order* contains new or 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, the general public, and other Federal agencies are invited to comment on the new or modified information collection requirements contained in this proceeding. 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 previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. In *Report and Order*, we have assessed the effects of the new rules that impose various requirements on ESAA providers, and find that the collection

[359] ViaSat Comments at 3; Letter from Bruce A. Olcott, Squire Sanders Dempsey (counsel to Boeing) to Marlene H. Dortch, Secretary, Federal Communications Commission (Jan. 7, 2011).

[360] *See supra* ¶ 13.

of information requirements will not have a significant impact on small business concerns with fewer than 25 employees.

146. The *Notice* contains no new or modified information collection requirements as it merely proposes a change to the Table of Allocations.

C. Congressional Review Act

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

D. *Ex Parte* Rules

148. This proceeding shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules. Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule Section 1.1206(b).[361] In proceedings governed by rule Section 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

E. Filing Requirements

149. *Comments and Replies*. Pursuant to Sections 1.415 and 1.419 of the Commission's rules,[362] 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).[363]

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: http://fjallfoss.fcc.gov/ecfs2/.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

[361] *See* 47 C.F.R. § 1.1206(b).

[362] *See id*. §§ 1.415, 1.419.

[363] *See Electronic Filing of Documents in Rulemaking Proceedings*, Report and Order, GC Docket No. 97-113, FCC 98-56, 13 FCC Rcd 11322 (1998).

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 9300 East Hampton Drive, Capitol Heights, MD 20743.

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

150. Written comments by the public on the proposed and/or modified information collections are due on or before 45 days after publication in the Federal Register. Written comments must be submitted by the Office of Management and Budget (OMB) on the proposed and/or modified information collections on or before 60 days after date of publication in the Federal Register. In addition to filing comments with the Secretary, a copy of any comments on the information collection(s) contained herein should be submitted to the Secretary, Federal Communications Commission, Room TW-A325, 445 12th Street, SW, Washington, DC 20554, or via the Internet to jboley@fcc.gov and to Virginia Huth, OMB Desk Officer, 10236 NEOB, 725 – 17th Street, N.W., Washington, DC 20503 or via the Internet to vhuth@omb.eop.gov.

151. *Availability of Documents*. Comments, reply comments, and *ex parte* submissions will be available for public inspection during regular business hours in the FCC Reference Center, Federal Communications Commission, 445 12th Street, S.W., CY-A257, Washington, D.C., 20554. These documents will also be available via ECFS. Documents will be available electronically in ASCII, Word 97, and/or Adobe Acrobat.

152. *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).

VII. ORDERING CLAUSES

153. Accordingly, IT IS ORDERED that, pursuant to the authority contained in Sections 4(i), 4(j), 7(a), 302(a), 303(c), 303(e), 303(f), 303(g), 303(j), 303(r), and 303(y) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 154(j), 157(a), 302(a), 303(c), 303(e), 303(f), 303(g), 303(j), 303(r), 303(y), this *Report and Order* in IB Docket No. 05-20 IS ADOPTED.

154. IT IS FURTHER ORDERED that Parts 2 and 25 of the Commission's rules ARE AMENDED as set forth in Appendix A, and such rule amendments SHALL BE EFFECTIVE 30 days after the date of publication in the Federal Register, except for Sections 25.132(b)(3), 25.227(b), and the notification provisions of 25.227 (c)(1)-(2), (d)(1)-(3), which contain new information collection requirements that require approval by the Office of Management and Budget (OMB) under the PRA. The Federal Communications Commission will publish a document in the Federal Register announcing such approval and the relevant effective date.

155. IT IS FURTHER ORDERED that the final regulatory flexibility analysis, as required by Section 604 of the Regulatory Flexibility Act, IS ADOPTED.

156. IT IS FURTHER ORDERED that the International Bureau is delegated authority to issue Public Notices consistent with this *Report and Order*.

157. IT IS FURTHER ORDERED that IB Docket No. 05-20 IS TERMINATED.

158. IT IS FURTHER ORDERED that pursuant to the authority contained in Sections 4(i), 303(j), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 154(j), 303(j), and 303(r) the *Notice of Proposed Rulemaking* in IB Docket No. 12-376 is ADOPTED.

159. 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 Notice of Proposed Rulemaking*, including the final regulatory flexibility analysis and initial regulatory flexibility analysis, to the Chief Counsel for Advocacy of the Small Business Administration, in accordance with Section 603(a) of the Regulatory Flexibility Act, 5 U.S.C. § 601, *et seq*.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[364] the Notice of Proposed Rulemaking (*Notice*) in this proceeding, *Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 05-20, Notice of Proposed Rulemaking, 20 FCC Rcd 2906 (2005), incorporated an Initial Regulatory Flexibility Analysis (IRFA).[365] The Commission sought written public comment on the proposals in the *Notice,* including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[366]

A. Need for, and Objectives of, the *Report and Order*

The *Notice* sought to promote innovative and flexible use of satellite technology to provide advanced communications capabilities from earth stations aboard aircraft that would operate as a licensed application of the Fixed-Satellite Service (FSS) in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz bands within the United States. It sought comment and developed a record on the capability of AMSS to meet the interference avoidance requirements of the FSS in these bands.

The objective of the *Report and Order* is to adopt domestic U.S. allocation, service and licensing rules for earth stations on aircraft communicating with Fixed-Satellite Service (FSS) geostationary-orbit (GSO) space stations operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz (space-to-Earth or downlink) and 14.0-14.5 GHz (Earth-to-space or uplink) frequency bands. Installed on the exterior of the aircraft, the earth stations provide a satellite based communications link between the airborne commercial and executive/private aircraft and terrestrial communications systems. The *Report and Order* designates Earth Stations Aboard Aircraft (ESAA) as an application of the FSS with operations on a primary basis in the 11.7-12.2 GHz band (space-to-Earth), on an unprotected basis in 10.95-11.2 GHz and 11.45-11.7 GHz bands (space-to-Earth), and on a secondary basis in the 14.0-14.5 GHz band (Earth-to-space). In the 10.95-11.2 and 11.45-11.7 GHz bands, these operations may be authorized to communicate with geostationary satellite orbit FSS space stations but must accept interference from stations of the Fixed Service (FS) operating in accordance with the Commission's rules. The rules promote spectrum sharing with certain secondary operations in the uplink bands, including government space research service and radio astronomy service stations.

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

There were no public comments filed that specifically addressed the rules and policies proposed in the IRFA.

[364] *See* 5 U.S.C. § 603. The RFA, see 5 U.S.C. §§ 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Public Law No. 104-121, Title II, 110 Stat. 857 (1996), and the Small Business Jobs Act of 2010, Public Law No. 111-240, 124 Stat. 2504 (2010).

[365] *See Notice*, 20 FCC Rcd at 2946-49 (Appendix B).

[366] *See* 5 U.S.C. § 604.

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

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 Rules Will Apply

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.[367] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[368] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[369] A small business concern is one that: (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).[370] Below, we further describe and estimate the number of small entity licensees that may be affected by the adopted rules.

Satellite Telecommunications. Two economic census categories address the satellite industry. The first category has a small business size standard of $15 million or less in average annual receipts, under SBA rules.[371] The second has a size standard of $25 million or less in annual receipts.[372]

The category of Satellite Telecommunications "comprises establishments 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 reselling satellite telecommunications."[373] Census Bureau data for 2007 show that 512 Satellite Telecommunications firms that operated for that entire year.[374] Of this total, 464 firms had annual receipts of under $10 million, and 18 firms had receipts of $10 million to $24,999,999.[375] Consequently,

[367] 5 U.S.C. § 604(a)(3).

[368] 5 U.S.C. § 601(6).

[369] 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 the 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).

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

[371] 13 C.F.R. § 121.201, NAICS code 517410.

[372] 13 C.F.R. § 121.201, NAICS code 517919.

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

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

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

the Commission estimates that the majority of Satellite Telecommunications firms are small entities that might be affected by our action.

The second category, *i.e.*, "All Other Telecommunications" comprises "establishments 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. For this category, Census Bureau data for 2007 show that there were a total of 2,383 firms that operated for the entire year.[376] Of this total, 2,347 firms had annual receipts of under $25 million and 12 firms had annual receipts of $25 million to $49,999,999.[377] Consequently, the Commission estimates that the majority of All Other Telecommunications firms are small entities that might be affected by our action.

Space Station Licensees (Geostationary). Commission records reveal that there are approximately 20 space station licensees and operators in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz frequency bands . We do not request or collect annual revenue information concerning such licensees and operators, and thus are unable to estimate the number of geostationary space station licensees and operators that would constitute a small business under the SBA definition cited above, or apply any rules providing special consideration for geostationary space station licensees and operators that are small businesses.

Fixed-Satellite Service Transmit/Receive Earth Stations. Currently there are approximately 2,879 operational Fixed-Satellite Service transmit/receive earth stations authorized for use in the band. The Commission does not request or collect annual revenue information, and thus is unable to estimate the number of earth stations that would constitute a small business under the SBA definition.

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

The *Notice* sought comment on whether we should require satellite operators to maintain tracking data on the location of airborne terminals. In this *Report and Order*, we require the maintenance of such tracking data for one year. This database will assist investigations of radio frequency interference claims. ESAA operators must name a point of contact to maintain information about location and frequencies used by ESAA terminals. Such information will assist in investigating radio frequency interference claims. The Commission does not expect significant costs associated with these proposals. Therefore, we do not anticipate that the burden of compliance will be greater for smaller entities.

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

The RFA requires that, to the extent consistent with the objectives of applicable statutes, the analysis shall discuss significant alternatives such as: (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 rule for

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

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

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 small entities.[378]

The *Notice* solicited comment on alternatives for more efficient processing of ESAA applications and simplification of ESAA procedures, for example, by migrating from non-conforming use licensing to a licensing method that would provide for licenses with terms of 15 years. The *Notice* also sought comment on streamlining the application process for ESAA operations by permitting blanket licensing of multiple ESAA terminals in a single application, as an alternative to requiring all ESAA terminals to be licensed individually. In adopting blanket licensing with 15-year terms for conforming ESAA terminals, the *Report and Order* simplifies the application process for ESAA and establishes licensing terms consistent with other satellite-based services, such as ESV and VMES. Thus, adoption of the rules should reduce the costs associated with obtaining and maintaining authority to operate an ESAA network.

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

None.

Report to Congress: The Commission will send a copy of the *Report and Order*, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act. In addition, the Commission will send a copy of the *Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Report and Order* and FRFA (or summaries thereof) also will be published in the Federal Register.[379]

[378] 5 U.S.C. § 603(c)(1), (c)(4).

[379] *See* 5 U.S.C. § 604(b).

APPENDIX B

Initial Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[380] the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in this *Notice of Proposed Rulemaking (NPRM*) in IB Docket No. 12-376. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines specified in the *NPRM* for comments. The Commission will send a copy of the *NPRM*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).[381] In addition, the *NPRM* and IRFA (or summaries thereof) will be published in the Federal Register.[382]

A. Need for, and Objectives of, the *Notice of Proposed Rulemaking*

The *NPRM* seeks to promote innovative and flexible use of satellite technology to provide advanced communications capabilities from earth stations that would operate on board aircraft as a licensed application of the Fixed-Satellite Service (FSS) in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz , and 14.0-14.5 GHz bands within the United States. This application is called Earth Stations Aboard Aircraft (ESAA). The *NPRM* seeks comment a proposal to elevate the allocation status of ESAA in the 14.0-14.5 GHz band from secondary to primary.

B. Legal Basis

The proposed action is authorized pursuant to Sections 1, 2, 4(i), 301, 302, 303, and 324 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 152, 154(i), 301, 302, 303, and 324.

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

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.[383] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[384] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[385] A small business concern is one that: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any

[380] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601-612, 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).

[381] *See* 5 U.S.C. § 603(a).

[382] *See* 5 U.S.C. § 603(a).

[383] 5 U.S.C. § 604(a)(3).

[384] 5 U.S.C. § 601(6).

[385] 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 the 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).

additional criteria established by the Small Business Administration (SBA).[386] Below, we further describe and estimate the number of small entity licensees that may be affected by the adopted rules.

Satellite Telecommunications. Two economic census categories address the satellite industry. The first category has a small business size standard of $15 million or less in average annual receipts, under SBA rules.[387] The second has a size standard of $25 million or less in annual receipts.[388]

The category of Satellite Telecommunications "comprises establishments 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 reselling satellite telecommunications."[389] Census Bureau data for 2007 show that 512 Satellite Telecommunications firms that operated for that entire year.[390] Of this total, 464 firms had annual receipts of under $10 million, and 18 firms had receipts of $10 million to $24,999,999.[391] Consequently, the Commission estimates that the majority of Satellite Telecommunications firms are small entities that might be affected by our action.

The second category, *i.e.*, "All Other Telecommunications" comprises "establishments 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. For this category, Census Bureau data for 2007 show that there were a total of 2,383 firms that operated for the entire year.[392] Of this total, 2,347 firms had annual receipts of under $25 million and 12 firms had annual receipts of $25 million to $49, 999,999.[393] Consequently, the Commission estimates that the majority of All Other Telecommunications firms are small entities that might be affected by our action.

Space Station Licensees (Geostationary). Commission records reveal that there are approximately 20 space station licensees and operators in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz bands. We do not request or collect annual revenue information concerning such licensees and operators, and thus are unable to estimate the number of geostationary space station licensees and operators that would constitute a small business under the SBA definition cited above, or apply any rules providing special consideration for geostationary space station licensees and operators that are small businesses.

---

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

[387] 13 C.F.R. § 121.201, NAICS code 517410.

[388] 13 C.F.R. § 121.201, NAICS code 517919.

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

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

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

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

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

Fixed-Satellite Service Transmit/Receive Earth Stations. Currently there are approximately 2,879 operational Fixed-Satellite Service transmit/receive earth stations authorized for use in the band. The Commission does not request or collect annual revenue information, and thus is unable to estimate the number of earth stations that would constitute a small business under the SBA definition.

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

The rules proposed here merely propose a change to the Table of Frequency Allocations, and therefore we do not project any new reporting, recordkeeping, or other compliance requirements for the licensees.

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

The RFA requires that, to the extent consistent with the objectives of applicable statutes, the analysis shall discuss significant alternatives such as: (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 rule for 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 small entities.[394]

The *NPRM* solicits comment on alternatives to elevation of the status of ESAA in the 14.0-14.5 GHz band to primary status.

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

None.

[394] 5 U.S.C. § 603(c)(1), (c)(4).

APPENDIX C

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. 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. Pages 47-49 are revised.

b. In the list of United States (US) Footnotes, footnote US133 is added.

c. In the list of non-Federal Government (NG) Footnotes, footnotes NG52, NG54, and NG55 are added and footnotes NG104, NG182, NG184, and NG186 are removed.

§ 2.106 Table of Frequency Allocations.

The revisions and additions read as follows:

* * * * *

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
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 5.479 US128	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				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 US265	10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) FIXED US265 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 (Earth-to-space) 5.484 MOBILE except aeronautical mobile	10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 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 5.488 Mobile except aeronautical mobile 5.485 12.1-12.2 FIXED-SATELLITE (space-to-Earth) 5.484A 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 NG55 NG143 NG183 NG187	Satellite Communications (25)

	12.2-12.7 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.492	12.2-12.5 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile BROADCASTING	12.2-12.75	12.2-12.7 FIXED BROADCASTING-SATELLITE	Satellite Communications (25) Fixed Microwave (101)
5.487 5.487A	5.487A 5.488 5.490	5.484A 5.487		5.487A 5.488 5.490	
12.5-12.75 FIXED-SATELLITE (space-to-Earth) 5.484A (Earth-to-space) 5.494 5.495 5.496	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 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 5.493		12.7-12.75 FIXED NG118 FIXED-SATELLITE (Earth-to-space) MOBILE	TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
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 MOBILE US251 NG53	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
13.25-13.4 EARTH EXPLORATION-SATELLITE (active) AERONAUTICAL RADIONAVIGATION 5.497 SPACE RESEARCH (active) 5.498A 5.499			13.25-13.4 EARTH EXPLORATION-SATELLITE (active) AERONAUTICAL RADIONAVIGATION 5.497 SPACE RESEARCH (active) 5.498A	13.25-13.4 AERONAUTICAL RADIONAVIGATION 5.497 Earth exploration-satellite (active) Space research (active)	Aviation (87)
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)

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
14-14.25 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 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) NG54 NG183 NG187 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 5.506 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) NG54 NG183 NG187 Mobile-satellite (Earth-to-space)	
14.3-14.4 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 Radionavigation-satellite 5.504A	14.3-14.4 FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 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 5.506 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 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Space research (space-to-Earth) 5.504A			14.4-14.47 Fixed Mobile		
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 US133 US203 US342	14.47-14.5 FIXED-SATELLITE (Earth-to-space) NG54 NG183 NG187 Mobile-satellite (Earth-to-space) US133 US203 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			14.8-15.1365 MOBILE SPACE RESEARCH Fixed US310	14.8-15.1365 US310	

* * * * *

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 25.227(c) 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 25.226(d)(2) are subject to coordination with the National Science Foundation in accordance with 47 CFR 25.227(d).

* * * * *

NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

* * * * *

NG52 Except as otherwise provided for herein, 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 (FSS) shall be limited to international systems, i.e., other than domestic systems. In the sub-bands 10.95-11.2 GHz and 11.45-11.7 GHz, Earth Stations on Vessels (ESV), Vehicle-Mounted Earth Stations (VMES), and Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 may be authorized for the reception of FSS emissions from geostationary satellites, subject to the condition that these earth stations shall not claim protection from transmissions of non-Federal stations in the fixed service.

* * * * *

NG54 In the band 14-14.5 GHz, Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 may be authorized to communicate with geostationary satellites in the fixed-satellite service (Earth-to-space), subject to the condition that ESAA shall not claim protection from, nor cause interference to, earth stations at given positions (where the given position may be a specified fixed point or any fixed point within specified areas).

NG55 In the band 11.7-12.2 GHz, Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 are an application of the fixed-satellite service and may be authorized to communicate with geostationary satellites in the fixed-satellite service (space-to-Earth) on a primary basis.

* * * * *

PART 25 – SATELLITE COMMUNICATIONS

3. The authority citation for Part 25 continues to read as follows:

AUTHORITY: Interprets or applies Sections 4, 301, 302, 303, 307, 309, 332, and 705 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309, 332, and 705, unless otherwise noted.

4. Part 25 is amended by adding new Section 25.227 to the Table of Contents to read as follows:

* * * * *

§ 25.227 Blanket licensing provisions for domestic, U.S. Earth Stations Aboard Aircraft (ESAAs) 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) frequency bands and transmitting in the 14.0-14.5 GHz (Earth-to-space) frequency band, operating with Geostationary Satellites in the Fixed-Satellite Service.

* * * * *

5. Section 25.115 is amended by revising paragraph (a)(2)(iii) to read as follows:

§ 25.115 Application for earth station authorizations.

* * * * *

(a)(2)(iii) The earth station is not an ESV, VMES or ESAA.

* * * * *

6. Section 25.130 is amended by revising paragraph (a) to read as follows:

§ 25.130 Filing requirements for transmitting earth stations.

(a) Applications for a new or modified transmitting earth station facility shall be submitted on FCC Form 312, and associated Schedule B, accompanied by any required exhibits, except for those earth station applications filed on FCC Form 312EZ pursuant to § 25.115(a). All such earth station license 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. Additional filing requirements for Earth Stations on Vessels are described in §§ 25.221 and 25.222 of this part. Additional filing requirements for Vehicle-Mounted Earth Stations are described in § 25.226 of this part. Additional filing requirements for Earth Stations Aboard Aircraft are described in § 25.227 of this part. In addition, applicants that are not required to submit applications on Form 312EZ, other than ESV, VMES or ESAA applicants, must submit the following information to be used as an "informative" in the public notice issued under § 25.151 as an attachment to their application:

* * * * *

7. Section 25.132 is amended by revising paragraph (b)(3) to read as follows:

§ 25.132 Verification of earth station antenna performance standards.

* * * * *

(b)(3) Applicants seeking authority to use an antenna that does not meet the standards set forth in §§ 25.209(a) and (b), pursuant to the procedure set forth in § 25.220, § 25.221, § 25.222, § 25.223, § 25.226 or § 25.227 of this part, are required to submit a copy of the manufacturer's range test plots of the antenna gain patterns specified in paragraph (b)(1) of this section.

* * * * *

8. Section 25.201 is amended by adding the following definition in alphabetical order to read as follows:

§ 25.201 Definitions.

* * * * *

Earth Stations Aboard Aircraft (ESAA). ESAA is an earth station or earth stations, operating from an aircraft, that receives from and transmits to geostationary satellite orbit Fixed-Satellite Service space stations and operates within the United States pursuant to the requirements set out § 25.227 of this part.

* * * * *

9. Section 25.202 is amended by adding paragraph (a)(11) to read as follows:

§ 25.202 Frequencies, frequency tolerance and emission limitations.

* * * * *

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

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)

(ii) ESAAs shall be authorized as set forth in § 25.227 of this chapter.

* * * * *

10. Section 25.203 is amended by revising paragraphs (d) and (k) and the introductory language in paragraph (c) to read as follows:

§ 25.203 Choice of sites and frequencies.

* * * * *

(c) Prior to the filing of its application, an applicant for operation of an earth station, other than an ESV, VMES or ESAA, shall coordinate the proposed frequency usage with existing terrestrial users and with applicants for terrestrial station authorizations with previously filed applications in accordance with the following procedure:

* * * * *

(d) An applicant for operation of an earth station, other than an ESV, VMES or an ESAA, shall also ascertain whether the great circle coordination distance contours and rain scatter coordination distance contours, computed for those values of parameters indicated in § 25.251 (Appendix 7 of the ITU RR) for international coordination, cross the boundaries of another Administration. In this case, the applicant shall furnish the Commission copies of these contours on maps drawn to appropriate scale for use by the Commission in effecting coordination of the proposed earth station with the Administration(s) affected.

* * * * *

(k) An applicant for operation of an earth station, other than an ESV, VMES or an ESAA, that will operate with a geostationary satellite or non-geostationary satellite in a shared frequency band in which the non-geostationary system is (or is proposed to be) licensed for feeder links, shall demonstrate in its applications that its proposed earth station will not cause unacceptable interference to any other satellite network that is authorized to operate in the same frequency band, or certify that the operations of its earth station shall conform to established coordination agreements between the operator(s) of the space station(s) with which the earth station is to communicate and the operator(s) of any other space station licensed to use the band.

* * * * *

11. Section 25.204 is amended by adding paragraph (j) to read as follows:

§ 25.204 Power limits.

* * * * *

(k) Within radio line-of-sight of the Tracking and Data Relay System Satellite (TDRSS) sites identified in § 25.227(c) of this chapter, ESAA transmissions in the 14.0-14.2 GHz (Earth-to-space) band shall not exceed an EIRP spectral density towards or below the horizon of 12.5 dBW/MHz, and shall not exceed an EIRP towards or below the horizon of 16.3 dBW.

12. Section 25.205 is amended by adding paragraph (d) to read as follows:

§ 25.205 Minimum angle of antenna elevation.

* * * * *

(d) While on the ground, ESAAs shall not be authorized for transmission at angles less than 5° measured from the plane of the horizon to the direction of maximum radiation. While in flight there is no minimum angle of antenna elevation.

13. Section 25.209(f) is amended to read as follows:

§ 25.209 Antenna performance standards.

* * * * *

(f) An earth station with an antenna not conforming to the standards of paragraphs (a) and (b) of this section will be authorized only if the applicant meets its burden of demonstrating that its antenna will not cause unacceptable interference. For ESVs in the C-band, this demonstration must comply with the procedures set forth in § 25.221. For ESVs in the Ku-band, this demonstration must comply with the procedures set forth in § 25.222. For VMES, this demonstration shall comply with the procedures set forth in § 25.226. For ESAAs, this demonstration shall comply with the procedures set forth in § 25.227. For feeder-link earth stations in the 17/24 GHz BSS, this demonstration must comply with the procedures set forth in § 25.223. For other FSS earth stations, this demonstration must comply with the procedures set forth in §§ 25.218 or 25.220. In any case, the Commission will impose appropriate terms and conditions in its authorization of such facilities and operations.

* * * * *

14. Section 25.218 is amended by modifying paragraph (a)(1) to read as follows:

§ 25.218 Off-Axis EIRP Density envelope for FSS earth station operators.

(a) * * *

(1) ESV, VMES and ESAA applications

* * * * *

15. Section 25.220 is amended by amending the introductory language to paragraph (a)(1) to read as follows:

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

* * * * *

(a)(1) This section applies to earth station applications other than ESV, VMES, ESAA and 17/24 GHz BSS feeder link applications in which the proposed earth station operations do not fall within the applicable off-axis EIRP density envelope specified in Section 25.218 of this Chapter.

* * * * *

16. Part 25 is amended by adding new Section 25.227 to read as follows:

§ 25.227 Blanket Licensing provisions for Earth Stations Aboard Aircraft (ESAAs) 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) frequency bands and transmitting in the 14.0-14.5 GHz (Earth-to-space) frequency band, operating with Geostationary Satellites in the Fixed-Satellite Service.

(a) The following ongoing requirements govern all ESAA licensees and operations in the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 GHz (Earth-to-space) frequency bands receiving from and transmitting to geostationary orbit satellites in the Fixed-Satellite Service. ESAA licensees shall comply with the requirements in either paragraph (a)(1), (a)(2) or (a)(3) of this section and all of the requirements set forth in paragraphs (a)(4)-(a)(16) and paragraphs (c), (d), and (e) of this section. Paragraph (b) of this section identifies items that shall be included in the application for ESAA operations to demonstrate that these ongoing requirements will be met.

(1) The following requirements shall apply to an ESAA that uses transmitters with off-axis EIRP spectral-densities lower than or equal to the levels in paragraph (a)(1)(i) of this subsection. ESAA licensees operating under this subsection shall provide a detailed demonstration as described in paragraph (b)(1) of this section. The ESAA transmitter also shall comply with the antenna pointing and cessation of emission requirements in paragraphs (a)(1)(ii) and (a)(1)(iii) of this subsection.

(i) An ESAA licensee shall not exceed the off-axis EIRP spectral-density limits and conditions defined in paragraphs (a)(1)(A)-(D) of this subsection.

(A) The off-axis EIRP spectral-density for co-polarized signals emitted from the ESAA, in the plane of the geostationary satellite orbit (GSO) as it appears at the particular earth station location, shall not exceed the following values:

$15 - 10 \log_{10} (N) - 25 \log_{10}\theta$	dBW/4 kHz	For	$1.5° \leq \theta \leq 7°$
$-6 - 10 \log_{10} (N)$	dBW/4 kHz	For	$7° < \theta \leq 9.2°$
$18 - 10 \log_{10} (N) - 25 \log_{10}\theta$	dBW/4 kHz	For	$9.2° < \theta \leq 48°$

$-24 - 10 \log_{10} (N)$	dBW/4 kHz	For	$48° < \theta \leq 85°$
$-14 - 10 \log_{10} (N)$	dBW/4 kHz	For	$85° < \theta \leq 180°$

where 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 in the plane of the GSO. The plane of the GSO is determined by the focal point of the antenna and the line tangent to the arc of the GSO at the orbital location of the target satellite. For ESAA networks using frequency division multiple access (FDMA) or time division multiple access (TDMA) techniques, N is equal to one. For ESAA networks using multiple co-frequency transmitters that have the same EIRP density, N is the maximum expected number of co-frequency simultaneously transmitting ESV earth stations in the same satellite receiving beam. For the purpose of this subsection, the peak EIRP density of an individual sidelobe shall not exceed the envelope defined above for θ between 1.5° and 7.0°. For θ greater than 7.0°, the envelope shall be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the envelope given above by more than 3 dB.

(B) In all directions other than along the GSO, the off-axis EIRP spectral-density for co-polarized signals emitted from the ESAA shall not exceed the following values:

$18 - 10 \log_{10} (N) - 25 \log \log_{10} \theta$	dBW/4 kHz	For	$3.0° \leq \theta \leq 48°$
$-24 - 10 \log_{10} (N)$	dBW/4 kHz	For	$48° < \theta \leq 85°$
$-14 - 10 \log_{10} (N)$	dBW/4kHz	For	$85° < \theta \leq 180°$

where θ and N are defined in (a)(1)(i)(A). This off-axis EIRP spectral-density applies in any plane that includes the line connecting the focal point of the antenna to the orbital location of the target satellite with the exception of the plane of the GSO as defined in paragraph (a)(1)(i)(A) of this section. For the purpose of this subsection, the envelope shall be exceeded by no more than 10% of the sidelobes provided no individual sidelobe exceeds the EIRP density envelope given above by more than 6 dB. The region of the main reflector spillover energy is to be interpreted as a single lobe and shall not exceed the envelope by more than 6 dB.

(C) The off-axis EIRP spectral-density for cross-polarized signals emitted from the ESAA shall not exceed the following values:

In the plane of the geostationary satellite orbit as it appears at the particular earth station location:

$5 - 10 \log_{10} (N) - 25 \log_{10} \theta$	dBW/4kHz	For	$1.8° < \theta \leq 7°$
$-16 - 10 \log_{10} (N)$	dBW/4kHz	For	$7° < \theta \leq 9.2°$

where θ and N are defined in (a)(1)(i)(A).

(ii) Each ESAA transmitter shall meet one of the following antenna pointing requirements:

(A) Each ESAA transmitter shall maintain a pointing error of less than or equal to 0.2° between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna; or

(B) Each ESAA transmitter shall declare a maximum antenna pointing error that may be greater than 0.2° provided that the ESAA does not exceed the off-axis EIRP spectral-density limits in paragraph (a)(1)(i) of this section, taking into account the antenna pointing error.

(iii) Each ESAA transmitter shall meet one of the following cessation of emission requirements:

(A) For ESAAs operating under paragraph (a)(1)(ii)(A) of this section, all emissions from the ESAA shall automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds 0.5°, and transmission shall not resume until such angle is less than or equal to 0.2°, or

(B) For ESAA transmitters operating under paragraph (a)(1)(ii)(B) of this section, all emissions from the ESAA shall automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds the declared maximum antenna pointing error and shall not resume transmissions until such angle is less than or equal to the declared maximum antenna pointing error.

(2) The following requirements shall apply to an ESAA, or ESAA system, that uses off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(1)(i) of this section. An ESAA, or ESAA network, operating under this subsection shall file certifications and provide a detailed demonstration as described in paragraph (b)(2) of this section.

(i) The ESAA shall transmit only to the target satellite system(s) referred to in the certifications required by paragraph (b)(2) of this section.

(ii) If a good faith agreement cannot be reached between the target satellite operator and the operator of a future satellite that is located within 6 degrees longitude of the target satellite, the ESAA operator shall accept the power-density levels that would accommodate that adjacent satellite.

(iii) The ESAA shall operate in accordance with the off-axis EIRP spectral-densities that the ESAA supplied to the target satellite operator in order to obtain the certifications listed in paragraph (b)(2) of this section. The ESAA shall automatically cease emissions within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator and transmission shall not resume until ESAA conforms to the off-axis EIRP spectral densities supplied to the target satellite operator.

(iv) In the event that a coordination agreement discussed in paragraph (b)(2)(ii) of this section is reached, but that coordination agreement does not address protection from interference for the earth station, that earth station will be protected from interference to the same extent that an earth station that meets the requirements of §25.209 of this title would be protected from interference.

(3) The following requirements shall apply to an ESAA system that uses variable power-density control of individual simultaneously transmitting co-frequency ESAA earth stations in the same satellite receiving beam. An ESAA system operating under this subsection shall provide a detailed demonstration as described in paragraph (b)(3) of this section.

(i) The effective aggregate EIRP density from all terminals shall be at least 1 dB below the off-axis EIRP density limits defined in paragraph (a)(1)(i)(A)-(C), with the value of N=1. In this context the term "effective" means that the resultant co-polarized and cross-polarized EIRP density experienced by any GSO or non-GSO satellite shall not exceed that produced by a single transmitter operating 1 dB below the limits defined in paragraph (a)(1)(i)(A)-(C). The individual ESAA transmitter shall automatically cease emissions within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP density limits minus 1 dB specified above. If one or more ESAA transmitters causes the aggregate off-axis EIRP-densities to exceed the off-axis EIRP density limits minus 1dB specified above, then the transmitter or transmitters shall cease or reduce emissions within 100 milliseconds of receiving a command from the system's network control and monitoring center. An ESAA system operating under this subsection shall provide a detailed demonstration as described in paragraph (b)(3)(i) of this section.

(ii) The following requirements shall apply to an ESAA that uses off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(3)(i) of this section. An ESAA system operating under this subsection shall file certifications and provide a detailed demonstration as described in paragraphs (b)(3)(ii) and (b)(3)(iii) of this section.

(A) If a good faith agreement cannot be reached between the target satellite operator and the operator of a future satellite that is located within 6 degrees longitude of the target satellite, the ESAA shall operate at an EIRP density defined in (a)(3)(i) of this section.

(B) The ESAA shall operate in accordance with the off-axis EIRP spectral-densities that the ESAA supplied to the target satellite operator in order to obtain the certifications listed in paragraph (b)(3)(ii) of this section. The individual ESAA terminals shall automatically cease emissions within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator. The overall system shall be capable of shutting off an individual transmitter or the entire system if the aggregate off-axis EIRP spectral-densities exceed those supplied to the target satellite operator.

(C) The ESAA shall transmit only to the target satellite system(s) referred to in the certifications required by paragraph (b)(3) of this section.

(4) An applicant filing to operate an ESAA terminal or system and planning to use a contention protocol shall certify that its contention protocol use will be reasonable.

(5) There shall 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 ESAA.

(6) For each ESAA transmitter, a record of the vehicle location (*i.e.,* latitude/longitude/altitude), transmit frequency, channel bandwidth and satellite used shall be time annotated and maintained for a period of not less than one year. Records shall be recorded at time intervals no greater than one (1) minute while the ESAA is transmitting. The ESAA operator shall make this data available, in the form of a comma delimited electronic spreadsheet, within 24 hours of a request

from the Commission, NTIA, or a frequency coordinator for purposes of resolving harmful interference events. A description of the units (*i.e.*, degrees, minutes, MHz ….) in which the records values are recorded will be supplied along with the records.

(7) In the 10.95-11.2 GHz (space-to-Earth) and 11.45-11.7 GHz (space-to-Earth) frequency bands ESAAs shall not claim protection from interference from any authorized terrestrial stations to which frequencies are either already assigned, or may be assigned in the future.

(8) An ESAA terminal receiving in the 11.7-12.2 GHz (space-to-Earth) bands shall 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 an earth station employing an antenna conforming to the referenced patterns defined in paragraphs (a) and (b) of section 25.209 and stationary at the location at which any interference occurred.

(9) Each ESAA terminal shall automatically cease transmitting within 100 milliseconds upon loss of reception of the satellite downlink signal or when it detects that unintended satellite tracking has happened or is about to happen.

(10) Each ESAA terminal should be subject to the monitoring and control by an NCMC or equivalent facility. Each terminal must be able to receive at least "enable transmission" and "disable transmission" commands from the NCMC and must automatically cease transmissions immediately on receiving any "parameter change command", which may cause harmful interference during the change, until it receives an "enable transmission" command from its NCMC. In addition, the NCMC must be able to monitor the operation of an ESAA terminal to determine if it is malfunctioning.

(11) Each ESAA terminal shall be self-monitoring and, should a fault which can cause harmful interference to FSS networks be detected, the terminal must automatically cease transmissions.

(12) Unless otherwise stated all ESAA system that comply with the off-axis EIRP spectral-density limits in (a)(1)(i) may request ALSAT authority.

(13) ESAA providers operating in the 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 should 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 and angles of arrival would be obtained under free-space propagation conditions.

(14) All ESAA terminals operated in U.S. airspace must be licensed by the Commission.

(15) 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.

(16) Prior to operations within the foreign nation's airspace, the ESAA operator will ascertain whether the relevant administration has operations that could be affected by ESAA terminals, and will determine whether that administration has adopted specific requirements concerning ESAA

operations. When the aircraft enters foreign airspace, the ESAA terminal would be required to 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 would be free to operate within those identified areas without further action. To the extent that the foreign administration has not adopted requirements regarding ESAA operations, ESAA operators would be required to coordinate their operations with any potentially affected operations.

(b) Applications for ESAA operation in the 14.0-14.5 GHz (Earth-to-space) band to GSO satellites in the Fixed-Satellite Service shall include, in addition to the particulars of operation identified on Form 312, and associated Schedule B, the applicable technical demonstrations in paragraphs (b)(1), (b)(2) or (b)(3) and the documentation identified in paragraphs (b)(4) through (b)(8) of this section.

(1) An ESAA applicant proposing to implement a transmitter under paragraph (a)(1) of this section shall demonstrate that the transmitter meets the off-axis EIRP spectral-density limits contained in paragraph (a)(1)(i) of this section. To provide this demonstration, the application shall include the tables described in paragraph (b)(1)(i) of this section or the certification described in paragraph (b)(1)(ii) of this section. The ESAA applicant also shall provide the value N described in paragraph (a)(1)(i)(A) of this section. An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(A) of this section shall provide the certifications identified in paragraph (b)(1)(iii) of this section. An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(B) of this section shall provide the demonstrations identified in paragraph (b)(1)(iv) of this section.

(i) Any ESAA applicant filing an application pursuant to paragraph (a)(1) of this section shall file three tables and/or graphs depicting off-axis EIRP density masks defined by 25.227(a) and measured off-axis EIRP density levels of the proposed earth station antenna in the direction of the plane of the GSO; the co-polarized EIRP density in the elevation plane, that is, the plane perpendicular to the plane of the GSO; and cross-polarized EIRP density. Each table shall provide the EIRP density level at increments of 0.1° for angles between 0° and 10° off-axis, and at increments of 5° for angles between 10° and 180° off-axis.

(A) For purposes of the off-axis EIRP density table in the plane of the GSO, the off-axis angle is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite, and the plane of the GSO is determined by the focal point of the antenna and the line tangent to the arc of the GSO at the orbital position of the target satellite.

(B) For purposes of the off-axis co-polarized EIRP density table in the elevation plane, the off-axis angle is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite, and the elevation plane is defined as the plane perpendicular to the plane of the GSO defined in paragraph (b)(1)(i)(A) of this section.

(C) For purposes of the cross-polarized EIRP density table, the off-axis angle is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite and the plane of the GSO as defined in paragraph (b)(1)(i)(A) of this section will be used.

(ii) An ESAA applicant shall include a certification, in Schedule B, that the ESAA antenna conforms to the gain pattern criteria of § 25.209(a) and (b), that, combined with

the maximum input power density calculated from the EIRP density less the antenna gain, which is entered in Schedule B, demonstrates that the off-axis EIRP spectral density envelope set forth in paragraphs (a)(1)(i)(A) through (a)(1)(i)(C) of this section will be met under the assumption that the antenna is pointed at the target satellite.

(iii) An ESAA applicant proposing to implement a transmitter under paragraphs (a)(1)(ii)(A) of this section shall:

(A) demonstrate that the total tracking error budget of their antenna is within 0.2° or less between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna. As part of the engineering analysis, the ESAA applicant must show that the antenna pointing error is within three sigma (б) from the mean value; and

(B) demonstrate that the antenna tracking system is capable of ceasing emissions within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds 0.5°.

(iv) An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(B) of this section shall:

(A) declare, in its application, a maximum antenna pointing error and demonstrate that the maximum antenna pointing error can be achieved without exceeding the off-axis EIRP spectral-density limits in paragraph (a)(1)(i) of this section; and

(B) demonstrate that the ESAA transmitter can detect if the transmitter exceeds the declared maximum antenna pointing error and can cease transmission within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds the declared maximum antenna pointing error, and will not resume transmissions until the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna is less than or equal to the declared maximum antenna pointing error.

(2) An ESAA applicant proposing to implement a transmitter under paragraph (a)(2) of this section and using off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(1)(i) of this section shall provide the following certifications and demonstration as exhibits to its earth station application:

(i) A statement from the target satellite operator certifying that the proposed operation of the ESAA has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable.

(ii) A statement from the target satellite operator certifying that the power density levels that the ESAA applicant provided to the target satellite operator are consistent with the existing coordination agreements between its satellite(s) and the adjacent satellite systems within 6° of orbital separation from its satellite(s).

(iii) A statement from the target satellite operator certifying that it will include the power-density levels of the ESAA applicant in all future coordination agreements.

(iv) A demonstration from the ESAA operator that the ESAA system will comply with all coordination agreements reached by the satellite operator and is capable of detecting and automatically ceasing emissions within 100 milliseconds when the transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator.

(3) An ESAA applicant proposing to implement an ESAA system under paragraph (a)(3) of this section and using variable power-density control of individual simultaneously transmitting co-frequency ESAA earth stations in the same satellite receiving beam shall provide the following certifications and demonstration as exhibits to its earth station application:

(i) The applicant shall make a detailed showing of the measures it intends to employ to maintain the effective aggregate EIRP density from all simultaneously transmitting co-frequency terminals operating with the same satellite transponder at least 1 dB below the off-axis EIRP density limits defined in paragraphs (a)(1)(i)(A)-(C) of this section. In this context the term "effective" means that the resultant co-polarized and cross-polarized EIRP density experienced by any GSO or non-GSO satellite shall not exceed that produced by a single ESAA transmitter operating at 1 dB below the limits defined in paragraphs (a)(1)(i)(A)-(C) of this section. The applicant also must demonstrate that an individual transmitter and the entire ESAA system is capable of automatically ceasing emissions within 100 milliseconds if the aggregate off-axis EIRP-densities exceed the off-axis EIRP density limits minus 1 dB, as set forth in paragraph (a)(3)(i) of this section. The International Bureau will place this showing on public notice along with the application.

(ii) An applicant proposing to implement an ESAA system under paragraph (a)(3)(ii) of this section that uses off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(3)(i) of this section shall provide the following certifications, demonstration and list of satellites as exhibits to its earth station application:

(A) A detailed showing of the measures the applicant intends to employ to maintain the effective aggregate EIRP density from all simultaneously transmitting co-frequency terminals operating with the same satellite transponder at the EIRP density limits supplied to the target satellite operator. The International Bureau will place this showing on Public Notice along with the application.

(B) A statement from the target satellite operator certifying that the proposed operation of the ESAA has the potential to create harmful interference to satellite networks adjacent to the target satellite(s) that may be unacceptable.

(C) A statement from the target satellite operator certifying that the aggregate power-density levels that the ESAA applicant provided to the target satellite operator are consistent with the existing coordination agreements between its satellite(s) and the adjacent satellite systems within 6° of orbital separation from its satellite(s).

(D) A statement from the target satellite operator certifying that it will include the aggregate power-density levels of the ESAA applicant in all future coordination agreements.

(E) A demonstration from the ESAA operator that the ESAA system is capable of detecting and automatically ceasing emissions within 100 milliseconds when

an individual transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator and that the overall system is capable of shutting off an individual transmitter or the entire system if the aggregate off-axis EIRP spectral-densities exceed those supplied to the target satellite operator.

(F) An identification of the specific satellite or satellites with which the ESAA system will operate.

(4) There shall be an exhibit included with the application describing the geographic area(s) in which the ESAA will operate.

(5) Any ESAA applicant filing for an ESAA terminal or system and planning to use a contention protocol shall include in its application a certification that will comply with the requirements of paragraph (a)(4) of this section.

(6) The point of contact referred to in paragraph (a)(5) of this section shall be included in the application.

(7) Any ESAA applicant filing for an ESAA terminal or system shall include in its application a certification that will comply with the requirements of paragraph (a)(6), (a)(9), (a)(10), (a)(11) of this section.

(8) All ESAA applicants shall 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. ESAA applicants with ESAA terminals that will exceed the guidelines in Section 1.1310 for radio frequency radiation exposure shall provide, with their environmental assessment, a plan for mitigation of radiation exposure to the extent required to meet those guidelines. All ESAA licensees shall ensure installation of ESAA terminals on aircraft 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 ESAA terminal exhibiting radiation exposure levels exceeding 1.0 mW/cm² in accessible areas, such as at the exterior surface of the radome, shall have a label attached to the surface of the terminal warning about the radiation hazard and shall include thereon a diagram showing the regions around the terminal where the radiation levels could exceed 1.0 mW/cm².

(c) (1) Operations of ESAAs in the 14.0-14.2 GHz (Earth-to-space) frequency band in the radio line-of-sight of the NASA TDRSS facilities on Guam (latitude 13° 36' 55" N, longitude 144° 51' 22" E) or 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) 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 shall 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.

(2) 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 ESAA licensees shall cease operations in the 14.0-14.2 GHz band within radio line-of-sight of the new TDRSS site until the licensees complete coordination with

NTIA/IRAC for the new TDRSS facility. Licensees shall 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 ESAA licensee then will be permitted to commence operations in the 14.0-14.2 GHz band within radio line-of-sight of the new TDRSS site, subject to any operational constraints developed in the coordination process.

(d) (1) Operations of ESAA in the 14.47-14.5 GHz (Earth-to-space) frequency band in the radio line-of-sight 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 Manager, NSF, 4201 Wilson Blvd., Suite 1045, Arlington VA 22203, fax 703-292-9034, email esm@nsf.gov. Licensees shall 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.

(2) A list of applicable RAS sites and their locations can be found in 25.226(d)(2) Table 1.

(3) 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 ESAA licensees shall cease operations in the 14.47-14.5 GHz band within the relevant geographic zone of the new RAS site until the licensees complete coordination for the new RAS facility. Licensees shall notify the International Bureau once they have completed coordination for the new RAS site and shall 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 has opposed the operations. The ESAA 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.

APPENDIX D

Proposed Rules

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 CFR part 2 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. Pages 47 and 49 are revised.

b. In the list of non-Federal Government (NG) Footnotes, footnote NG55 is revised and footnotes NG54, NG183 and NG187 are removed.

§ 2.106 Table of Frequency Allocations.

The revisions and additions read as follows:

* * * * *

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
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 5.479 US128	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				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 US265	10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) FIXED US265 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 (Earth-to-space) 5.484 MOBILE except aeronautical mobile	10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 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 5.488 Mobile except aeronautical mobile 5.485 12.1-12.2 FIXED-SATELLITE (space-to-Earth) 5.484A 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 NG55 NG143	Satellite Communications (25)

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
14-14.25 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 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) NG55 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 5.506 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) NG55 Mobile-satellite (Earth-to-space)	
14.3-14.4 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 Radionavigation-satellite 5.504A	14.3-14.4 FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 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 5.506 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 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Space research (space-to-Earth) 5.504A			14.4-14.47 Fixed Mobile		
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 US133 US203 US342	14.47-14.5 FIXED-SATELLITE (Earth-to-space) NG55 Mobile-satellite (Earth-to-space) US133 US203 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			14.8-15.1365 MOBILE SPACE RESEARCH Fixed US310	14.8-15.1365 US310	

* * * * *

NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

* * * * *

NG55 In the bands 11.7-12.2 GHz (space-to-Earth) and 14-14.5 GHz (Earth-to-space), Earth Stations on Vessels (ESV), Vehicle-Mounted Earth Stations (VMES), and Earth Stations Aboard Aircraft (ESAA) as regulated under 47 CFR part 25 are applications of the fixed-satellite service and may be authorized to communicate with geostationary satellites in the fixed-satellite service on a primary basis.

* * * * *

APPENDIX E

List of Commenters

Commenters

ARINC Inc. (ARINC)
The Boeing Company (Boeing)
The Department of Justice including the Federal Bureau of Investigation and the Department of Homeland Security (the Departments)
Intelsat, Ltd. (Intelsat)
The National Academy of Sciences' Committee on Radio Frequencies (CORF)
National Radio Astronomy Observatory (NRAO)
PanAmSat Corporation (PanAmSat)
The Satellite Users Interference Reduction Group, Inc. (SUIRG)
SES Americom, Inc. (SES)
Telesat Canada (Telesat)
ViaSat, Inc. (ViaSat)

Reply Commenters

ARINC
Boeing
The Center for Democracy and Technology and the Electronic Frontier Foundation (CDT)
PanAmSat
SES
The Société Internationale de Télécommunications Aéronautiques (SITA)
Telesat
ViaSat

Ex Parte Commenters

Boeing
The Departments
PanAmSat
Row 44, Inc. (Row 44)
ViaSat
Gogo LLC
Panasonic Avionics Corporation

STATEMENT OF
CHAIRMAN JULIUS GENACHOWSKI

Re: ***Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands, IB Docket No. 12-376***

Whether traveling for work or leisure, Americans increasingly expect broadband access everywhere they go. These new rules will help airlines and broadband providers offer high-speed Internet to passengers, including by accelerating by up to 50 percent the processing of applications to provide broadband on planes. This will enable providers to bring broadband to planes more efficiently, helping passengers connect with friends, family, or the office.