

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

In the Matter of
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 RULE MAKING

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## I. INTRODUCTION

1. In this Notice of Proposed Rulemaking (*Notice* or NPRM), we make proposals and seek comment on a regulatory framework for licensing the operation of Aeronautical Mobile Satellite Service (AMSS)<sup>1</sup> systems to communicate with fixed-satellite service (FSS) networks in the Ku-Band<sup>2</sup> frequencies. Aircraft Earth stations (AES)<sup>3</sup> in the AMSS can be used to provide broadband telecommunications services on passenger, government, and executive/private aircraft. Our goal is to promote more efficient use of the spectrum while protecting and providing regulatory certainty to the existing primary allocations, including the fixed satellite service (FSS) operators, and sharing spectrum with other secondary operations in these frequency bands, including government space research (SRS) stations. Our proposals would enable important new communications services to be provided to crew and consumers on board aircraft. They would also protect existing terrestrial FS and FSS operations from harmful interference from AMSS stations and allow for future growth of FS and FSS networks. With regard to the secondary government space research stations and radio astronomy operations in parts of the

<sup>1</sup> The Mobile Satellite Service (MSS) is a radio communication service between mobile earth stations and one or more space stations. *See* 47 C.F.R. § 2.1. A mobile earth station is an earth station intended for use while in motion or during halts at unspecified points. *See* 47 C.F.R. § 25.201. The Mobile Satellite Service encompasses the land mobile-satellite service, the maritime mobile-satellite service, and the aeronautical mobile-satellite service.

<sup>2</sup> For purposes of this *Notice*, the "conventional" Ku-band refers to frequencies in the 11.7-12.2 GHz (downlink) and 14.0-14.5 GHz (uplink) bands and excludes the so-called "extended Ku-band" at 12.75-13.25 GHz, 13.75-14.0 GHz, 10.7-10.95 GHz, 10.95-11.2 GHz, 11.2-11.45 GHz, and 11.45-11.7 GHz. The "conventional" Ku-bands are allocated on a primary basis to the FSS. *See generally* 47 C.F.R. § 2.106.

<sup>3</sup> The term "aircraft Earth station" refers to any mobile earth station in the aeronautical mobile-satellite service located on board an aircraft. *See, e.g.*, 47 C.F.R. § 87.5.

Ku-Band, our proposals would provide protection to existing and accommodate future stations of these national assets. Our proposals also seek to establish a regulatory scheme that could enable foreign-licensed AES terminals to operate in the United States airspace without causing harmful interference to domestic operations.

2. This Notice continues our efforts to meet the growing demand for two-way broadband data and communications capabilities for commercial aircraft passengers and crew. The 2003 World Radiocommunications Conference (WRC-03) added a worldwide secondary AMSS allocation in the 14.0-14.5 GHz band.<sup>4</sup> In 2003, the Commission conformed the U.S. Table of Frequency Allocations (“U.S. Table” or “Table”) to this international allocation, finding it desirable because it will facilitate an important new use of the 14.0-14.5 GHz band.<sup>5</sup> Examining alternative approaches for licensing AMSS in the Ku-band also advances the Commission’s goals and objectives for market-driven deployment of broadband technologies and efficient spectrum usage. Broadband technologies, which encompass all evolving high-speed digital technologies that provide consumers integrated access to e-mail, voice, high-speed data, video-on-demand, and interactive delivery services, are a fundamental component of modern communications.<sup>6</sup> Fully evolved digital broadband will virtually eliminate geographic distance as an obstacle to acquiring information, and dramatically reduce the time it takes to access information. Consumers benefit as broadband technologies are developed and deployed.<sup>7</sup> AMSS potentially offers consumers the benefits of broadband services while traveling by air, both domestically and

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<sup>4</sup> See *WRC-03 Provisional Final Acts* at 34-38. These pages show a new “Mobile-satellite (Earth-to-space)” allocation in this band in all three Regions, as well as new footnote 5.AA13 (since re-numbered as 5.504A), which reads: “In the band 14-14.5 GHz, aircraft earth stations in the secondary aeronautical mobile-satellite service may also communicate with space stations in the fixed-satellite service. The provisions of Nos. 5.29, 5.30 and 5.31 apply.” ITU Radio Regulation Nos. 5.29, 5.30, 5.31 state that stations of a secondary service:

5.29 a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

5.30 b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;

5.31 c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

<sup>5</sup> Amendment of Parts 2, 25, and 87 of the Commission’s Rules to Implement Decisions from the World Radiocommunications Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range, ET Docket No. 02-305, *Report and Order*, 18 FCC Rcd 23426 at para. 76 (2003) (“*Above 28 MHz Allocation Order*”).

<sup>6</sup> See Federal Communications Commission Strategic Plan FY 2003-FY 2008, page 10, Means and Strategies to meet Goal 1 - Broadband, <http://www.fcc.gov/omd/strategicplan/strategicplan2003-2008.pdf>.

<sup>7</sup> We note that in a separate proceeding, the Commission has launched an examination of the appropriate legal and policy framework of the Communications Assistance for Law Enforcement Act (CALEA), including the applicability of CALEA to broadband internet access services (including those delivered by satellite systems). See *Communications Assistance for Law Enforcement Act and Broadband Access and Services*, ET Docket No. 04-295, *Notice of Propose Rulemaking and Declaratory Ruling*, 19 FCC Rcd 15676 (2004). To the extent any rules are adopted in that proceeding regarding CALEA obligations of satellite-based providers of broadband internet access, we anticipate that AMSS operators might also be subject to such rules.

internationally.<sup>8</sup> Such service might be particularly attractive to passengers on long-haul flights. AMSS provides a means for passengers to access high-speed Internet and interactive entertainment, while broadband capability for crews could “enhance aircraft operations through real-time equipment and supply information, weather updates, [and] security monitoring.”<sup>9</sup> This *Notice* responds to an emerging marketplace need by potentially permitting more flexible use of the Ku-band while protecting existing services from harmful interference.<sup>10</sup>

3. In this *Notice*, we seek comment on methods for authorizing and licensing AMSS stations that are consistent with the WRC-03 outcome and that would also help ensure that AMSS operations would not cause harmful interference to terrestrial and satellite operations. First, we examine frequency allocation issues in the Ku-band, where AMSS will operate. Next, we discuss and seek comment on rules and procedures to license AMSS networks that consist of hub earth stations and/or aircraft earth stations (AESs) for operation over geostationary satellite orbit (GSO) FSS satellites in the Ku-band. The AMSS licensing procedure that we propose for the Ku-band would permit blanket licensing of an AMSS network similar to the licensing rules for very small aperture terminals (VSATs) that currently operate in the Ku-band.

4. This *Notice* seeks comment on licensing procedures for AMSS with a goal of maximizing the efficient use of Ku-band spectrum, and respecting the operational and protection expectations of incumbent licensees. Our proposals are designed to encourage AES terminals to utilize the Ku-band to the maximum extent possible. The *Notice* also seeks comments on licensing methods for AES terminals that will minimize the burdens upon applicants and licensees, while maintaining operational limitations necessary to avoid harmful interference. Finally, the *Notice* seeks comment on procedures to protect both space research service and radio astronomy service sites from AMSS operations in the 14.0-14.5 GHz

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<sup>8</sup> We note that AMSS is distinct from AMS(R)S. AMS(R)S is a radio service providing communications via satellite between an aircraft earth station (AES) and land stations or other AESs, regulated under Part 87 (Aviation Services) of our rules. *See* 47 C.F.R. Part 87. AMS(R)S is allocated to the 1549.5-1558.5 MHz and 1651-1660 MHz bands on a co-primary basis with the mobile satellite service and in the 1545-1549.5 MHz and 1646.5-1651 MHz bands on a primary basis. *See* 47 C.F.R. § 2.106. AMS(R)S was formerly referred to as AMSS(R). The “(R)” in both terms indicates that the spectrum is used for aeronautical communications related to the safety and regularity of flights primarily along national and international civil air routes. AMS(R)S provides communications supporting operational control of both domestic and international air traffic. Such communications are important to the safe, efficient and economical operation of aircraft, and may convey information critical to aviation, such as aircraft position reports, performance, essential services and supplies, and weather information. *See* 47 C.F.R. § 87.261(a). Public correspondence – private or personal messages of passengers or crew – is prohibited. By contrast, AMSS is a service for aircraft passengers that can also be used by crew, but is not necessarily intended to provide critical flight support. Because of this dual nature (*i.e.*, AMSS can be used by passengers and/or crew for personal use and/or flight support), we find that it is appropriate to consider AMSS within the scope of Part 25 (Satellite Communications) of our rules.

<sup>9</sup> 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, The Boeing Company, Petition for Rulemaking at 27, filed July 21, 2003 (“Boeing Petition” or “Petition”).

<sup>10</sup> *See* Federal Communications Commission Strategic Plan FY 2003-FY 2008, page 14, Means and Strategies to meet Goal 2 – Spectrum, <http://www.fcc.gov/omd/strategicplan/strategicplan2003-2008.pdf>.

band.<sup>11</sup>

## II. BACKGROUND

### A. Current AMSS Use

5. In December 2000, the Boeing Company (“Boeing”) filed an application for blanket authority to operate up to 800 transmit and receive earth stations aboard aircraft in the Ku-band (using the 12 GHz band for space-to-Earth transmissions and the 14 GHz band for Earth-to-space transmissions).<sup>12</sup> In April 2001, the International Bureau and the Office of Engineering and Technology granted a waiver to Boeing so that it could operate up to 800 receive-only mobile earth stations aboard aircraft in the 12 GHz band.<sup>13</sup> In December 2001, that waiver grant was expanded to include the operation of two-way mobile earth stations (in a phased array antenna design) aboard aircraft in the 14.0-14.5 GHz band (uplink) and the 11.7-12.2 GHz (downlink) band.<sup>14</sup> Boeing was initially authorized to communicate with the Telstar 6 satellite at 93° W.L., and later received authority to communicate with the Americom 4 satellite at 101° W.L. as well.<sup>15</sup> Under its current authorization, Boeing is not permitted to cause harmful interference to other allocated services in the 11.7-12.2 GHz and 14-14.5 GHz frequency bands, and must accept all interference from authorized users of these bands.<sup>16</sup> According to its authorization, Boeing is permitted to operate AES terminals on board U.S.-registered aircraft traveling through United States airspace,<sup>17</sup>

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<sup>11</sup> See “Memorandum of Understanding Between the Federal Communications Commission and the National Telecommunications and Information Administration Addressing the Aeronautical Mobile-Satellite Service In the 14.0-14.5 GHz Band,” July 8, 2002

<sup>12</sup> See Application of The Boeing Company for Blanket Authority to Operate up to Eight Hundred Technically-Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 11.7-12.2 and 14.0-14.5 GHz Frequency Bands, File No. SES-LIC-20001204-02300 (December 4, 2000, supplemented January 10, 2001) (“*Boeing Two-Way AMSS Application*”).

<sup>13</sup> Boeing Company Application for Blanket Authority to Operate Up to Eight Hundred Technically Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 14.0-14.5 GHz and 11.7-12.2 GHz Frequency Bands, *Order and Authorization*, 16 FCC Rcd 5864 (International Bureau and Office of Engineering and Technology, 2001).

<sup>14</sup> Boeing Company Application for Blanket Authority to Operate Up to Eight Hundred Technically Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 14.0-14.5 GHz and 11.7-12.2 GHz Frequency Bands, *Order and Authorization*, 16 FCC Rcd 22645 (International Bureau and Office of Engineering and Technology, 2001) (“*Boeing Transmit-Receive Order*”). A waiver of Section 2.106 of the Commission’s rules was necessary because at that time the U.S. Table of Allocations did not include an allocation for AMSS downlinks in the 12 GHz band, nor did it include an allocation for AMSS uplinks in the 14 GHz band. As noted above, the Commission has since added a secondary allocation for AMSS in the 14.0-14.5 GHz band. See *Above 28 MHz Allocation Order*, 18 FCC Rcd at 23454, para. 76.

<sup>15</sup> See Satellite Communications Services Information, *Public Notice*, Report No. SES-00421 (rel. Aug. 21, 2002) and Report No. SES-00433, license re-issued to correct typographical errors (rel. Oct. 2, 2002).

<sup>16</sup> *Boeing Transmit-Receive Order*, 16 FCC Rcd at 22653-54, para. 19.

<sup>17</sup> Currently pending before the Commission is an application in which Boeing seeks authority for AES terminals to communicate with foreign-licensed satellites from aircraft located over the high seas (*i.e.*, international waters) and additional satellites for use while an AES is over the United States. See The Boeing Company, Application to (continued....)

including airspace over United States territorial waters.<sup>18</sup> In 2003, the Commission authorized a number of changes to the Boeing's non-conforming use license, including authority for reflector antenna AES terminals in place of the initially licensed phased array antennas.<sup>19</sup> In 2004, Connexion by Boeing launched its satellite-based broadband in-flight Internet, data, and entertainment service on international flights.<sup>20</sup> Each plane equipped with the Connexion service offers either an Ethernet Local Area Network (LAN) connection or a wireless 802.11b network connection, or both.<sup>21</sup> The company has entered into agreements with numerous carriers<sup>22</sup> and expects to generate service revenues of \$500,000 per airplane per year and annual revenues of \$2 billion.<sup>23</sup> The Boeing service currently is available in the United States on government aircraft and executive jet platforms the size of a Boeing 737 and larger, including Airbus aircraft.<sup>24</sup> While Boeing's Connexion commercial service is currently available only on foreign airlines such as Lufthansa, Boeing has approached a number of U.S. airlines regarding installation of the

(Continued from previous page) \_\_\_\_\_

Modify Blanket AMSS Earth Station Authorization Call Sign E000723, File No. SES-MOD-20040301-00304 (filed March 1, 2004) ("Boeing International Waters Modification Application"). The Office of Engineering and Technology granted Boeing an experimental license to test 10 AES terminals over international waters. *See* Call Sign WC2XVE, File No. 0002-EX-ML-2004 (Jan. 13, 2004).

<sup>18</sup> 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* Presidential Proclamation No. 5928, 54 Fed. Reg. 777 (1988). This approach is consistent with the international law principle that each nation has exclusive jurisdiction over the airspace above its land territory and territorial waters. *See* U.N. Convention on the Law of the Sea, 21 I.L.M. 1261, at Part II, Art. 2 (opened for signature 1982).

<sup>19</sup> Boeing intended to keep 125 of its phased array antennas, while substituting 675 of them for reflector antennas, thereby maintaining a total of 800 AES terminals. *See* Boeing Modification Application, File No. SES-MOD-20030512-00639 and Satellite Communications Services Information re: Actions Taken, *Public Notice*, Report No. SES-00561, rel. Dec. 17, 2003.

<sup>20</sup> *See* "The New Era of Inflight Connectivity Is Here: Connexion by Boeing and Lufthansa Announce the World Premiere of Airborne Internet," Boeing Press Release, [http://www.boeing.com/news/releases/2004/q2/nr\\_040511j.html](http://www.boeing.com/news/releases/2004/q2/nr_040511j.html) (May 11, 2004).

<sup>21</sup> *See* Airline Advantages, <http://www.connexionbyboeing.com/index.cfm?p=cbb.airlinesolutions&l=en.US&ec=>. Boeing's website indicates that Connexion's "broadband speeds are comparable to land-based broadband networks such as cable or DSL." *Id.*

<sup>22</sup> Connexion had service agreements with Lufthansa, Scandinavian Airlines System (SAS), and Japan Airlines to equip their long-haul fleets with the Connexion service beginning in early 2004. In addition, British Airways has completed a successful service demonstration, and both All-Nippon Airways and Singapore Airlines have announced their intent to install the Connexion service on their long-range aircraft. *See* Boeing Petition at 2-3; "ANA and Connexion by Boeing Sign Definitive Internet Services Agreement," *Press Release*, [http://www.boeing.com/news/releases/2004/q1/nr\\_040115j.html](http://www.boeing.com/news/releases/2004/q1/nr_040115j.html) and "Singapore Airlines Selects Connexion by Boeing for In-Flight Connectivity," *Press Release*, [http://www.boeing.com/news/releases/2003/q4/nr\\_031111j.html](http://www.boeing.com/news/releases/2003/q4/nr_031111j.html).

<sup>23</sup> Coffee, Tea or Broadband, Quentin Hardy, *Forbes* (June 17, 2004), available at [http://www.forbes.com/technology/networks/2004/06/17/cz\\_qh\\_0617wifi.html](http://www.forbes.com/technology/networks/2004/06/17/cz_qh_0617wifi.html).

<sup>24</sup> *See* Connexion by Boeing Executive Services Information Page at <http://www.connexionbyboeing.com/index.cfm?p=cbb.executivejet&l=en.US&ec=> and Boeing Petition at 3.

Connexion service on their U.S.-registered aircraft.<sup>25</sup>

6. Aeronautical Radio Inc. (“ARINC”) has filed an application seeking authority to offer, on a non-interference basis, a service similar to Boeing’s Connexion.<sup>26</sup> While this application remains pending before the Commission, ARINC has begun testing its Ku-band AMSS system pursuant to a grant of experimental authority.<sup>27</sup> ARINC says that its SKYLink service can offer aircraft passengers uplink speeds between 512 kbps and 3 Mbps and downlink speeds up to 128 kbps.<sup>28</sup>

## B. Petition for Rulemaking

7. On July 21, 2003, Boeing filed a Petition for Rulemaking, requesting that the Commission amend its rules to allocate AMSS in the 14.0-14.5 GHz band on a secondary basis and to adopt licensing and service rules for AMSS in the Ku-band.<sup>29</sup> Boeing generally supports Recommendation ITU-R M.1643, the ITU’s recommended technical and operational requirements for AES terminals operating satellite uplinks in the 14.0-14.5 GHz band.<sup>30</sup> For example, Boeing recommends that to protect adjacent FSS networks in the Ku-band, the Commission should “ensure that the aggregate e.i.r.p. [effective isotropically radiated power] spectral density of all co-frequency AES transmissions will not exceed the levels generated by a routinely authorized VSAT under Section 25.134(a)(1) of the Rules. . . .”<sup>31</sup> Boeing also proposes that AMSS earth stations be subject to blanket licensing because AMSS systems “will employ large numbers of AES terminals operating on aircraft all over the world.”<sup>32</sup> On October 2, 2003, the Commission released a public notice seeking comment on the Boeing Petition.<sup>33</sup>

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<sup>25</sup> Boeing Petition at 2; *see also* Boeing International Waters Modification Application, Public Interest Statement at 5. Some routes of these foreign carriers cover United States territory. *Id.*

<sup>26</sup> Aeronautical Radio Inc., Application for Blanket Authority to Operate Aboard Aircraft up to 1000 Technically-Identical Transmit and Receive Mobile Earth Stations in the 11.7-12.2 and 14.0-14.5 GHz Frequency Bands, File No. SES-LIC-20030910-01261, filed Sept. 10, 2003, and Amendment, File No. SES-AMD-20031223-01860, filed Dec. 23, 2003.

<sup>27</sup> *See* File No. 0054-EX-PL-2001, modified by File No. 0029-EX-ML-2003 and File No. 0029-EX-ML-2004 (Call Sign WC2XPE). The Office of Engineering and Technology recently extended ARINC’s experimental authority to conduct a limited market study of its SKYLink service on 15 aircraft until May 1, 2006. *See* File No. 0130-EX-RR-2004.

<sup>28</sup> ARINC comments at 1-2.

<sup>29</sup> 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, The Boeing Company, Petition for Rulemaking filed July 21, 2003 (“Boeing Petition” or “Petition”).

<sup>30</sup> Boeing Petition at 15-20. Recommendation ITU-R M.1643 is reprinted in Appendix C.

<sup>31</sup> Boeing Petition at 15.

<sup>32</sup> Boeing Petition at 21.

<sup>33</sup> *See* Consumer and Governmental Affairs Bureau Reference Information Center, Petition for Rulemaking Filed, *Public Notice*, Report No. 2632, rel. Oct. 10, 2003.

8. The Commission received three comments and five reply comments, representing seven different parties, regarding the Boeing Petition.<sup>34</sup> The commenters generally supported the Boeing Petition, although PanAmSat Corporation objected to Boeing's proposals that AMSS license applications be subject to routine processing and that the Commission adopt a fixed effective isotropically radiated power ("e.i.r.p" or EIRP) density standard equivalent to that of VSAT power levels.<sup>35</sup> The portion of the Boeing Petition regarding a domestic secondary allocation for AMSS is now moot since the Commission has already made such an allocation.<sup>36</sup> The remainder of the issues raised in the petition are addressed in the relevant portions of the Discussion section below.

9. We recognize that AMSS operations on-board moving aircraft in the FSS spectrum present novel challenges to AMSS operators. The record established in this proceeding will allow the Commission to determine the effect of authorizing AES terminals and will facilitate the development of any future rules. Thus, in an effort to generate solutions to these novel challenges, throughout this proceeding we make proposals about the status of AMSS operations, and then we follow our proposals by seeking comment on alternatives to our proposals. Our goal is to develop approaches for licensing AES terminals that would maximize the efficient use of Ku-band spectrum while balancing the expectations of incumbent operators to operate free from harmful interference and to have growth potential in the bands.

### III. DISCUSSION

10. We seek comment on rules for allocation and procedures for licensing AES terminals in the AMSS. Authorizing secondary status AES terminals in the Ku-band presents the challenge of protecting adjacent, primary status FSS satellites from the AES's potential harmful interference. We intend that, if adopted, such a licensing program would support the deployment of AMSS networks to the benefit of the American public without adversely affecting the operation and continued growth of incumbent radio services. We also intend to create a licensing program that ensures incumbent radio services are protected against harmful interference. To that end, we seek comment from individual operators of incumbent radio services in the Ku-band, including both federal government and non-government users. We request comments on the proposals addressed in this *Notice*. Further, we encourage all commenters to address any other issues concerning AMSS operations in the Ku-band. The record established in this proceeding

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<sup>34</sup> See Appendix A for list of commenters.

<sup>35</sup> PanAmSat Corporation ("PanAmSat") comments at 1-3. PanAmSat argues that the Commission "has well-established procedures for processing of small diameter antennas, and has established a dividing line between those that are eligible for routine processing and those that are not." PanAmSat comments at 2. Further arguing that Ku-band AMSS systems "are anything but 'routine'," PanAmSat proposes that the Commission develop AMSS power limits on a case-by-case basis rather than adopt a fixed EIRP density standard. *Id.* In its reply comments, Boeing argues that "station parameters designed to provide interference protection are irrelevant to Ku-band AES operations." Boeing reply at 3. Boeing also says that development of case-by-case AMSS power limits reopens an issue already settled by the Commission in issuing Boeing's non-conforming use license to operate an AMSS system (*i.e.*, that routinely licensed VSAT power limits are appropriate for Ku-band operations), and moreover that such an approach would waste Commission resources. *Id.* at 3-5. These issues and arguments are addressed in greater detail in Section B (Technical and Operational Requirements for AES of AMSS networks in the band 14.0-14.5 GHz (Earth-to-space)), *infra*.

<sup>36</sup> See *Above 28 MHz Allocation Order*, 18 FCC Rcd at 23454, para. 76.



will allow the Commission to determine the impact of authorizing AMSS aircraft earth stations and will facilitate the development of any future rules. Establishing a licensing procedure for AMSS networks would advance our continuing effort to maximize the flexible use of the radiofrequency spectrum for earth station operations.<sup>37</sup>

11. Although the Commission adopted a secondary allocation for AMSS in the 14.0-14.5 GHz band in the *Above 28 MHz Order*, we propose to amend the U.S. Table of Frequency Allocations with the addition of a footnote regarding protection of co-secondary services. In this *Notice*, we also propose modifications of Part 25 of our rules to permit licensing of AES terminals in the Ku-band. We agree with the Boeing Petition commenters who state that the current system of granting AMSS operators non-conforming use licenses, on a non-interference basis, places an unnecessary administrative burden on operators and on the Commission, and casts too much regulatory uncertainty over AMSS providers.<sup>38</sup> We agree with Boeing and ARINC that non-conforming use licenses are not a long-term solution for addressing the licensing requirements of AMSS.<sup>39</sup> As explained below, a licensing procedure with established technical and operational requirements for AMSS network operations would provide a stable regulatory environment for AMSS operators, aircraft operators, service providers, and FSS licensees. Establishing a licensing procedure would also allow us to implement, in part, the decisions of the WRC-03.

#### A. Basis For AMSS Operations and U.S. Table of Frequency Allocations Issues

12. WRC-03 modified the International Table of Allocations to include a secondary allocation for AMSS in the 14.0-14.5 GHz band.<sup>40</sup> Following this action, the Commission amended the U.S. Table of

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<sup>37</sup> See Principles for Reallocation of Spectrum to Encourage the Development of Technologies Telecommunications for the New Millennium, *Policy Statement*, 14 FCC Rcd 19868, 19870, ¶9 (1999) (“In the majority of cases,” the Commission noted in 1999, “efficient spectrum markets will lead to use of spectrum for the highest value end use,” and “[f]lexible allocations may result in more efficient spectrum markets.”). See also *Amendment of the U.S. Table of Frequency Allocations to Designate the 2500-2520/2670-2690 MHz Frequency Bands for the Mobile-Satellite Service*, First Report and Order and Memorandum Opinion and Order, 16 FCC Rcd 17222, 17223, para. 2 (2001) (finding that investing incumbent licensees with more flexibility in the use of their assigned spectrum would foster the introduction of new services, promote competition, and permit market forces to determine the best use for the spectrum).

<sup>38</sup> Boeing Petition at 3; ARINC comments at 4; Rockwell Collins Corporation reply at 1-2.

<sup>39</sup> Boeing Petition at 3; ARINC comments at 4. However, we do seek comment below on whether to permit AMSS downlink operations in the 11.7-12.2 GHz on a non-conforming use basis. See para. 17, *infra*.

<sup>40</sup> ITU footnote 5.504A provides: “In the band 14-14.5 GHz, aircraft earth stations in the secondary aeronautical mobile-satellite service may also communicate with space stations in the fixed satellite service. The provisions of Nos. 5.29, 5.30 and 5.31 apply.” ITU Radio Regulation Nos. 5.29, 5.30, 5.31 state that stations of a secondary service:

5.29 a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

5.30 b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;

(continued....)

Frequency Allocations (“U.S. Allocations Table”) in Section 2.106 of the its Rules to include a secondary allocation for AMSS in the 14-14.5 GHz band.<sup>41</sup> However, the Commission did not make an allocation for AMSS in the 11.7-12.2 GHz band, which is used for satellite downlinks to AES terminals. We propose to adopt a footnote to the U.S. Table of Frequency Allocations to address this issue.

## 1. Ku-Band

### a. Downlink: 10.95-11.2 GHz & 11.45-12.2 GHz Bands

13. The allocations and operating conditions for portions of the Ku-band downlink spectrum will differ based on several factors, including the fact that commercial and government operations currently operate in portions of the Ku-downlink band. As such, we discuss each band separately below.

#### (i) 11.7-12.2 GHz

14. The 11.7-12.2 GHz band is allocated to the FSS for downlink operations on a primary basis and is extensively used for VSAT downlink operations.<sup>42</sup> In the *ESV Report and Order*, we added a footnote to the U.S. Table of Frequency Allocations stating that earth stations on board vessels (ESVs) are an application of the fixed-satellite service in the 11.7-12.2 GHz (space to Earth) and 14.0-14.5 GHz (Earth to space) bands.<sup>43</sup> In the *ESV Report and Order*, we also removed a secondary footnote allocation for Government and non-government fixed systems, and a secondary mobile (except aeronautical mobile) allocation in the 11.7-12.1 GHz band, under which the Local Television Transmission Service (LTTS) was licensed.<sup>44</sup> As of March 1, 2005, we will no longer consider LTTS license applications for the 11.7-12.1 GHz band, though we did “grandfather” pre-existing LTTS licensees to operate as a secondary mobile service in the 11.7-12.1 GHz band with the understanding that there will be no expectation of renewal.<sup>45</sup>

15. We propose to establish a new non-Federal government footnote for the 11.7-12.2 GHz band to indicate that AES terminals in the AMSS may operate with FSS space stations, so that parties are aware that mobile receivers may be operating in the band. This footnote would implement international footnote 5.504A, adopted at WRC-03. We believe our rules should clearly reflect the various types of operations that use a spectrum band. We also seek comment on whether AES terminals receiving in the 11.7-12.2 GHz band should be secondary to the FSS or, if they can maintain pointing accuracy toward geostationary satellite orbit (GSO) satellites, we should treat AES terminals the same as if they were earth

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5.31 c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

<sup>41</sup> See *Above 28 MHz Order*, 18 FCC Rcd at 23454, para. 76 and 47 C.F.R. § 2.106.

<sup>42</sup> See 47 C.F.R. § 2.106.

<sup>43</sup> 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 (rel. Jan. 6, 2005) at para. 79 (“*ESV Report and Order*”).

<sup>44</sup> *ESV Report and Order* at paras. 82-84.

<sup>45</sup> *ESV Report and Order* at para. 84.

stations in the FSS band (*i.e.*, as primary and, therefore, be subject to the receive antenna protection levels set forth in Section 25.209(c)<sup>46</sup>).

16. The ITU-R recognized that the use of the 14.0-14.5 GHz band for AMSS on a secondary basis was compatible with current FSS systems and was supported by studies leading up to WRC-03. Studies within the ITU-R assessed compatibility of the usage of the 11/12 GHz downlink band that is associated with the 14 GHz uplink band, and found that these downlink signals could co-exist with FSS systems. There is currently no domestic AMSS downlink allocation; thus domestic downlink signals currently operate under ITU Radio Regulation 4.4 in the 11/12 GHz band.<sup>47</sup> We tentatively conclude that matching the secondary AMSS uplink in the 14 GHz band with a secondary downlink allocation in the 11/12 GHz band would aid in the acceptance and standardization of these applications and we seek comment in this regard.

17. In the alternative, we seek comment on Boeing's argument that AMSS operations in the 11.7-12.2 GHz band continue to be authorized on a non-conforming use (*i.e.*, non-protected) basis.<sup>48</sup> Boeing argues that proposed AMSS operations use standard Ku-band FSS satellite transponders to provide service, and thus "[f]rom an interference perspective, there is no difference between an FSS transponder used for FSS downlink operations and the same FSS transponder used for AMSS downlink operations."<sup>49</sup> Boeing also argues that AMSS downlinks can operate effectively on an unprotected basis because "AES receivers must be designed to tolerate the 'noise' generated by other operations in the band."<sup>50</sup> Boeing also contends that authorizing AMSS downlinks as a non-conforming use provides AMSS systems with flexibility to operate in different frequency bands in different administrations.<sup>51</sup> We seek comment on these arguments.

**(ii) 10.95-11.2 GHz and 11.45-11.7 GHz**

18. The frequency band 10.7-11.7 GHz is allocated internationally for FSS on a primary basis.

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<sup>46</sup> See 47 C.F.R. § 25.209(c).

<sup>47</sup> See Draft Preliminary views of IWG-2 on WRC-07, Agenda Item 1.6. ITU Radio Regulation 4.4. permits operation in any band on a non-interference and non-protected basis. The full text of ITU Radio Regulation 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, as station operating in accordance with the provisions of the Constitution, the Convention and these Regulations." See ITU Radio Regulation 4.4.

<sup>48</sup> Boeing Petition at 11. As Boeing points out in its petition, non-conforming use requires that (i) operations shall not cause harmful interference to any authorized station operating in compliance with the U.S. Table of Allocations, either domestically or internationally; (ii) operations must immediately cease upon notification of such harmful interference resulting from operations; and (iii) the non-conforming user must accept any interference from any authorized station.

<sup>49</sup> Boeing Petition at 11.

<sup>50</sup> Boeing Petition at 12.

<sup>51</sup> Boeing Petition at 12.

Within the United States, this band is referred to as the “extended” Ku-band,<sup>52</sup> and FSS use of this band is reserved for international systems by footnote NG104.<sup>53</sup> In the United States, these bands are also used by the fixed service for LTTS, Microwave Business, Microwave Public Safety, and Common Carrier Fixed Point-to-Point.<sup>54</sup> Boeing notes that Ku-band FSS downlinks are not restricted to the 11.7-12.2 GHz outside the United States, causing Boeing to design its AES terminals to receive “throughout the entire 10.7-12.75 GHz band to facilitate operations outside the United States.”<sup>55</sup> Boeing suggests that “authorizing AMSS downlinks as a non-conforming use throughout internationally allocated FSS downlink spectrum” gives AMSS systems flexibility to operate globally and simultaneously protect other authorized band users.<sup>56</sup> We recognize that AES terminals on U.S.-registered aircraft may need to access foreign satellites while traveling outside of the United States (*e.g.*, over international waters), and therefore may need to downlink in the extended Ku-band in certain circumstances.<sup>57</sup> Within the United States, we do not anticipate that unprotected receive-only operations in the extended Ku-band would interfere with or restrict other authorized operations in the band. We seek comment whether AMSS operations in the 10.95-11.2 and 11.45-11.7 GHz bands should be permitted on a non-protected basis.<sup>58</sup> If not, we seek comment on alternative methods for permitting use of the extended Ku-band frequencies for AMSS downlinks.

#### **b. 14.0-14.5 GHz Band**

19. The U.S. Table of Frequency Allocations for the 14.0-14.5 GHz band includes a primary allocation for non-federal government FSS uplink operations.<sup>59</sup> This band is heavily used by Very Small Aperture Terminals (“VSATs”) for uplinking to geostationary satellites.<sup>60</sup> These VSAT systems provide

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<sup>52</sup> The so-called “extended Ku-band” includes allocations at 12.75-13.25 GHz, 13.75-14.0 GHz, 10.7-10.95 GHz, 10.95-11.2 GHz, 11.2-11.45 GHz, and 11.45-11.7 GHz. Within the “extended” Ku-band downlink, the 10.7-10.95 GHz and 11.2-11.45 GHz bands are authorized for use in accordance with ITU-R Appendix 30 B, which provides for the planned use of the GSO FSS. The rules we propose today would only apply to extended Ku-band downlink operations at 10.95-11.2 GHz and 11.45-11.7 GHz.

<sup>53</sup> See 47 C.F.R. § 2.106 n. 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.”).

<sup>54</sup> A search of the ULS database reveals that the majority of services using the band are Common Carrier Fixed Point-to-Point. There are a total of 2106 active Common Carrier Fixed Point to Point licensees, 164 active Microwave Business licensees, 410 active Microwave Public Safety licensees, and 73 active LTTS licensees.

<sup>55</sup> Boeing Petition at 12.

<sup>56</sup> Boeing Petition at 12.

<sup>57</sup> For example, Boeing requests authority to use extended Ku-band in its International Waters Modification Application. See Boeing International Waters Modification Application.

<sup>58</sup> Footnote NG 104 would not be applicable because the AES receivers would not need any coordination with fixed terrestrial services since they would operate on an unprotected basis.

<sup>59</sup> 47 C.F.R. § 2.106.

<sup>60</sup> Our database indicates that there are 2672 authorizations issued for GSO FSS earth stations in the 14.0-14.5 GHz band. The authorizations indicate the maximum number of earth stations or antennas that a licensee may deploy. For (continued....)

video and data communications and are widely deployed at business locations, ranging from the largest corporate headquarters to the smallest convenience stores. In 2001, the Commission also permitted NGSO FSS gateway and user terminal uplinks to operate in the 14.0-14.5 GHz band.<sup>61</sup> The 14.0-14.5 GHz is also allocated for MSS, including aeronautical MSS, uplinks on a secondary basis for non-Federal government use.<sup>62</sup> This MSS allocation is presently used by OmniTracs, a satellite-based land mobile communications and tracking system that provides real-time messaging and position reporting between fleets and their operations centers.<sup>63</sup> As noted above, in the *ESV Report and Order*, we added a footnote to the U.S. Table of Frequency Allocations stating that earth stations on board vessels (ESVs) are an application of the fixed-satellite service in the 14.0-14.5 GHz band (for satellite uplinks).<sup>64</sup>

20. With regard to these services that operate across the entire 14.0-14.5 GHz band, we propose applying the standard primary/secondary sharing environment. We seek comment whether the co-secondary operations of AMSS and other MSS present any protection issues, and if so, how we should address them. We seek comment on whether ESV operations, operating on a primary basis, present any issues for consideration in connection with the authorization of AES terminals in the 14.0-14.5 GHz portion of the Ku-band. We concluded in the *ESV Report and Order* that AMSS secondary operations do not pose a concern for ESV primary operations.<sup>65</sup> Regarding normal FSS operations, we believe that following our two-degree spacing policy will protect existing and future FSS operations from harmful interference.<sup>66</sup> Accordingly, we propose to allow AES terminals to communicate with FSS space stations in the 14.0-14.5 GHz band on a secondary basis. We request comments on this approach. It should be noted that there are no primary fixed service allocations in any portion of the 14.0-14.5 GHz band. Below, we will consider how AMSS will co-exist with the various operations in sub-bands of the 14.0-

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example, since this is a VSAT band, a single GSO FSS authorization could cover several thousand VSAT Earth terminals.

<sup>61</sup> See Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, ET Docket No. 98-206, *First Report and Order and Further Notice of Proposed Rule Making*, 16 FCC Rcd 4096 (2001). To date, the Commission has not issued any NGSO licenses in the 14.0-14.5 GHz band.

<sup>62</sup> See 47 C.F.R. § 2.106.

<sup>63</sup> Qualcomm's OmniTracs service processes more than six million transactions each day sent to and from a quarter-million trucks. See *Qualcomm Service Keeps on Trucking*, July 13, 2001 at <http://www.business2.com/articles/web/print/0,1650,16490,FF.html>.

<sup>64</sup> *ESV Report and Order* at para. 79.

<sup>65</sup> *ESV Report and Order* para. 88.

<sup>66</sup> In 1983, the Commission established a two-degree orbital spacing policy to maximize the number of in-orbit satellites serving the United States in either the C-band or the Ku-band. See *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, FCC 83-184, 54 Rad. Reg. 2d (P & F) 577 (1983); summary printed in *Licensing Space Stations in the Domestic Fixed-Satellite Service*, 48 Fed. Reg. 40,233 (Sept. 6, 1983), on reconsideration, *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, FCC 84-487, 99 FCC 2d 737 (1985). At that time, the Commission began assigning adjacent in-orbit satellites to orbit locations two degrees apart in longitude, rather than the three-to-four degrees longitude previously used.

14.5 band.

**(i) 14.0-14.2 GHz Band**

21. The 14.0-14.2 GHz portion of the Ku-band is allocated on a primary basis in the United States to FSS for non-Federal government operations and to radionavigation services for non-Federal government and Federal government operations. In WT Docket No. 01-289, the Commission has proposed to remove the radionavigation allocation from the 14.0-14.2 GHz band because it is not significantly used and could potentially conflict with various satellite operations in the band.<sup>67</sup> Therefore, we do not anticipate any interference conflicts between AES terminals and radionavigation operations, especially if the Commission adopts its proposal in WT Docket No. 01-289.

22. Space research services (for both Federal and non-Federal government use) are allocated to the 14.0-14.2 GHz sub-band on a secondary basis.<sup>68</sup> The only currently authorized non-FSS facilities in this portion of the Ku-band uplink are two 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.<sup>69</sup> We note that the interference rejection filtering associated with the existing TDRSS leaves them vulnerable to interference to varying degrees. The White Sands facility, for example, has only minimal interference rejection filtering across the entire 14.0-14.5 GHz band, while the Guam facility is somewhat better protected above 14.2 GHz.<sup>70</sup> We also note that NASA plans to establish another TDRSS receive facility on the east coast of the United States within 2-3 years, with several mid-Atlantic region sites under consideration. We would expect that any future NASA facilities operating in this band would be equipped with state-of-the-art interference rejection filtering.

23. We recognize the importance of protecting these space research facilities from receiving harmful interference. In the case of airborne transmitters which fly through the main beam or the near-in sidelobes of the TDRSS ground terminal, saturation may occur to current TDRSS receiver at frequencies throughout a significant portion of the 14.0-14.5 GHz band. With this in mind, we propose to require that, as a prerequisite to licensing, AMSS operations in the 14.0-14.5 GHz band be coordinated with the

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<sup>67</sup> See Review of Part 87 of the Commission's Rules Concerning the Aviation Radio Service, WT Docket No. 01-289, *Report and Order and Further Notice of Proposed Rule Making*, 18 FCC Rcd 21432, para. 85 (2003).

<sup>68</sup> See 47 C.F.R. § 2.106.

<sup>69</sup> See *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, FCC 04-74, 19 FCC Rcd 6592, 6609 n.74 (2004).

<sup>70</sup> The diplexer for the White Sands earth stations provides only 35 dB or less of interference attenuation from 14.35 to 14.5 GHz, while the diplexer at the Guam earth station provides little to no interference protection from 14.05 to 14.23 GHz, but provides 70 dB of attenuation at 14.48 GHz. See Letter from Robert E. Spearing, Deputy Associate Administrator for Space Communications, Office of Space Flight, NASA, to Craig Holman, Regulatory Counsel, The Boeing Company, at Figure 2 (December 18, 2001), *cited in* The Boeing Company, *Order and Authorization*, 16 FCC Rcd 22645, 22648 n.21 (Int'l Bur./OET 2001).

National Telecommunications and Information Administration (NTIA)<sup>71</sup> to resolve any potential concerns regarding space research facilities. We seek comment on this proposal. One option for completion of coordination may be an agreement on the part of the AES operator that it simply will not operate in the “vicinity of” the TDRSS station.<sup>72</sup>

24. With respect to future TDRSS sites, we also envision a coordination process. Under this process, NTIA would need to notify the Commission’s International Bureau at least six months prior to operational status of any such new site. The Bureau would then issue a notice requiring all Ku-Band AMSS operators to complete coordination of their operations in the 14.0-14.5 GHz band through the FCC with the NTIA for the new TDRSS site, prior to the planned start date for operation of the new TDRSS site.<sup>73</sup> Due to the wideband nature of the TDRSS downlink signal, coordination between AES and TDRSS operations in the 14.0-14.5 GHz band is desirable for future TDRSS earth stations. However, we anticipate that NASA would endeavor to design any future TDRSS earth stations to minimize the coordination impact on AESs from TDRSS operations. Prior to the initiation of operations of any new TDRSS sites, during the coordination process, AES stations will continue to operate throughout the 14.0-14.5 GHz band in the vicinity of the future TDRSS site. After NTIA coordination has been completed for the new TDRSS receive site and the TDRSS site has become operational, AMSS operations would be permitted to operate in the 14.0-14.5 GHz band in the vicinity of the new TDRSS site, subject to any operational constraints developed in the coordination process. During the coordination period after NTIA notification of a new TDRSS site, should either party feel that an acceptable coordination agreement cannot be reached, the FCC and the NTIA will jointly resolve the matter.<sup>74</sup> If necessary, the Commission may be required to invoke Section 316 of the Communications Act to modify an authorization in order to protect TDRSS stations.<sup>75</sup> We seek comment on these proposals for the protection of space research sites. Additionally, we seek comment on whether a footnote should be added to the U.S. Table of Allocations that states that AES terminals operating in the 14.0-14.5 GHz band must ensure the protection of the space research operations.

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<sup>71</sup> NTIA is responsible for managing the government portion of the Table of Frequency Allocations. In bands shared between Federal and non-Federal Government services, the Commission and NTIA operate under a long-standing coordination agreement. *See* NTIA Manual, Basic Coordination Arrangement Between IRAC and the FCC, [http://www.ntia.doc.gov/osmhome/redbook/NTIamanual\\_May2003.pdf](http://www.ntia.doc.gov/osmhome/redbook/NTIamanual_May2003.pdf) at Chapter 8.3.1.

<sup>72</sup> We understand that the “vicinity of a TDRSS site” refers to the area where an AES is in line-of-sight of the TDRSS site. Determination of the particular distance at which line-of-sight 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  $d \text{ (km)} = 4.1 \text{ square root of } (h)$ , where h is the altitude of the aircraft in meters above ground level. *See* 47 C.F.R. § 25.213(a)(1)(iv).

<sup>73</sup> This public notice would also indicate that the final operating parameters for the new site would be subject to coordination through the Frequency Assignment Subcommittee (“FAS”) of NTIA’s Interdepartment Radio Advisory Committee, if such coordination has not already been completed.

<sup>74</sup> We would expect that approximately three months prior to operation of the new TDRSS station, either party would, if circumstances require, notify the Commission and NTIA that a coordination agreement is not likely and Commission/NTIA decisions are necessary.

<sup>75</sup> *See* 47 U.S.C. § 316.

25. Since NASA will have a very limited number of space research Earth stations that will be receiving from the government data relay satellites, we believe that coordination between AMSS and TDRSS operations is possible and will not prove to be a burden for AMSS operators. In fact, Boeing has already provided us with evidence of a successful coordination with NASA regarding its TDRSS sites, including provision for future TDRSS sites.<sup>76</sup> In addition, the TDRSS sites provide an important service, and we do not anticipate that the number of TDRSS sites will increase significantly, and in any event, future expansion of the SRS could be severely curtailed if AMSS operators have no obligation to protect future TDRSS sites. For these reasons, we believe that protection of future co-secondary sites would be warranted. NTIA coordination should not unnecessarily delay Ku-band AMSS operators from initiating their licensed service in areas that may interfere with TDRSS sites. Indeed, Boeing and ARINC have already committed to protecting government users in this band.<sup>77</sup>

**(ii) 14.2-14.4 GHz Band**

26. Similar to the 11.7-12.2 GHz band, until recently, a secondary mobile allocation at 14.2-14.4 GHz was available for LTTS for television pickup and television non-broadcast pickup stations under Part 101 of our rules.<sup>78</sup> As of March 1, 2005, no new LTTS applications will be considered for this band, though pre-existing licensees have been grandfathered to operate as a secondary mobile service in the 14.2-14.4 GHz band with the understanding that there will be no expectation of renewal.<sup>79</sup> We propose making AMSS co-secondary with the grandfathered LTTS operations, and invite comment.

**(iii) 14.4-14.5 GHz Band**

27. In addition to the non-Federal government primary FSS and secondary MSS allocations in the 14.4-14.5 GHz segment, the Federal government has secondary FS and mobile allocations in the band. Our records indicate that there are several fixed point-to-point operations and a limited number of fixed stations used by the Federal government for terrestrial telecommand. There are also several Federal government aeronautical mobile stations, land-based aeronautical mobile stations, and land mobile stations in the band. Furthermore, there are several Federal government surface telemetering mobile stations in the band that are used to send telemetry information to other stations on the ground. The 14.4-14.5 GHz band appears to be used predominately by fixed, mobile, and transportable telemetry

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<sup>76</sup> Letter from Robert E. Spearing, Deputy Associate Administrator for Space Communications, Office of Space Flight, National Aeronautics and Space Administration, to Craig Holman, Regulatory Counsel, The Boeing Company (dated Dec. 18, 2001). In connection with its pending AMSS application, ARINC filed a coordination agreement that it reached with NASA concerning its AES/TDRSS coordination. *See* Coordination Agreement Between the National Aeronautics and Space Administration (hereinafter “NASA”) and ARINC, Incorporated (hereinafter “ARINC”) for Operation of the ARINC SKYLink AMSS in the 14.0-14.5 GHz-Band, dated Sept. 3, 2004.

<sup>77</sup> *See* Letter from Robert E. Spearing, Deputy Associate Administrator for Space Communications, Office of Space Flight, National Aeronautics and Space Administration, to Craig Holman, Regulatory Counsel, The Boeing Company (dated Dec. 18, 2001) and Coordination Agreement Between the National Aeronautics and Space Administration (hereinafter “NASA”) and ARINC, Incorporated (hereinafter “ARINC”) for Operation of the ARINC SKYLink AMSS in the 14.0-14.5 GHz-Band, dated Sept. 3, 2004.

<sup>78</sup> *See ESV Report and Order* at para. 93; *see also* 47 C.F.R. § 101.147, note 24.

<sup>79</sup> *See ESV Report and Order* para. 94.



microwave systems. The band is also used to transmit air traffic control video links, closed circuit television, and range test data (including airborne downlink data transmissions). We seek comment on the extent to which the 14.4-14.5 GHz band is used to provide these various services.<sup>80</sup> Is it necessary to adopt any technical requirements or coordination procedures to protect these services adequately from AMSS operations in the 14.4-14.5 GHz band? If so, we invite parties to propose such technical or coordination requirements.

28. The Radio Astronomy Service (RAS) is allocated on a secondary basis internationally in the 14.47-14.5 GHz band, and pursuant to footnote US203 of the U.S. Table, radio astronomy observations of the formaldehyde line frequencies are permitted in this band at certain sites.<sup>81</sup> In keeping with our desire to provide full access to the 14.0-14.5 GHz uplink spectrum we propose to allow Ku-Band AMSS operators access to the spectrum between 14.47-14.5 GHz.<sup>82</sup> However, we do recognize the importance of radio astronomy for studying the universe. We also realize that ubiquitous airborne AES terminals have the potential to interfere significantly with RAS sites on the ground. With this in mind, we propose to require that, as a prerequisite to licensing, AMSS operations in the 14.0-14.5 GHz band be coordinated with the NTIA to resolve any potential concerns regarding radio astronomy facilities. We seek comment on this proposal. One option for completion of coordination may be an agreement on the

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<sup>80</sup> In the *ESV Report and Order*, we noted that we received no comment on secondary Federal Government mobile, fixed and transportable use of the 14.4-14.5 GHz band, and concluded that the standard primary/secondary sharing environment applies. See *ESV Report and Order* at para. 95.

<sup>81</sup> See 47 C.F.R. § 2.106, footnote US203. The sites identified in this footnote are the National Radio Astronomy Observatory, Green Bank, W. Va.; the National Radio Astronomy Observatory, Socorro, New Mexico; Hat Creek Observatory (U of Calif.), Hat Creek, Cal.; Haystack Radio Observatory (MIT-Lincoln Lab), Tyngsboro, Mass.; Owens Valley Radio Observatory (Cal. Tech.), Big Pine, Cal.; and Five College Radio Observatory Quabbin Reservoir (near Amherst), Massachusetts. Below, we propose a modification to update the list of sites contained in this footnote.

<sup>82</sup> We note that an interim process is currently in place to protect both SRS and RAS sites from AMSS operations in the 14.0-14.5 GHz band. By the conditions of its current non-conforming use license, Boeing may not constrain deployment of additional Federal Government stations operated by NASA in the SRS and Boeing must operate its system in accordance with its Technical Operational Coordination Agreement with the National Science Foundation to facilitate the protection of RAS. See *Boeing Transmit-Receive Order*, 16 FCC Rcd 22645. In the *Above 28 MHz Allocation Order*, we stated that until we adopt final rules relating to allocation changes in the 14.0-14.5 GHz band or licensing of AMSS terminals in that band, we will place the following conditions on any additional system authorizations that we may issue in that band for a service similar to Boeing's:

- (1) The system shall be designed and operated so as not to cause harmful interference to TDRSS or RAS operations in the United States; and
- (2) The system shall not constrain future deployment of additional Federal Earth Stations in the SRS and RAS authorized pursuant to existing allocations.

See *Above 28 MHz Allocation Order*, 18 FCC Rcd at 23454, para. 76. See also "Memorandum of Understanding Between the Federal Communications Commission and the National Telecommunications and Information Administration Addressing the Aeronautical Mobile-Satellite Service In the 14.0-14.5 GHz Band," July 8, 2002, at 2.

part of the AES operator that it simply will not operate in the “vicinity of” the RAS site.<sup>83</sup> We note that this proposal would require coordination for operations occurring outside the 14.47-14.5 GHz band in which radio astronomers observe the formaldehyde line. Although the U.S. Table of Frequency Allocations does not provide an allocation for radio astronomy in the 14.47-14.5 GHz band, the International Table of Frequency Allocations does provide a secondary allocation for RAS in this band.<sup>84</sup> In addition, Recommendation ITU-R M.1643 recommends protection of radio astronomy services by AMSS operations in the 14.0-14.5 GHz band, as opposed to only the 14.47-14.5 GHz sub-band.<sup>85</sup> We specifically seek comment on whether the sensitivity of U.S. RAS sites, combined with the limited signal attenuation of signals from AMSS stations, as compared to non-aeronautical platforms, may warrant coordination between RAS and AMSS operations throughout the 14.0-14.5 GHz band. We also seek comment on whether we should modify the status of RAS in the U.S. Table of Frequency Allocations to secondary, relative to AMSS. Under this proposal, RAS sites would have co-secondary status with regard to AMSS, but would retain their permissive status with regard to other services in the 14.47-14.5 GHz band. We seek comment on whether co-secondary status would be sufficient to protect the RAS from AMSS operations. We also seek comment on whether protection of co-secondary RAS sites should be limited to those sites listed in footnote US203.

29. We also seek comment on whether, and if so how, AMSS licensees should coordinate their operations with future RAS sites. If we require AMSS licensees to coordinate only with sites listed in footnote US203, the addition of new sites would be subject to the notice and comment rulemaking process in order to achieve modification of footnote US203. Alternatively, should coordination for future sites proceed on an ad hoc basis with each AMSS licensee, and if so, what framework should we establish to guide that coordination?

30. We note that radio observations in the 14.47-14.5 GHz band are not performed on a continuous basis and are usually scheduled in advance.<sup>86</sup> Thus, coordination between AMSS and RAS operations should be possible and should not unnecessarily delay Ku-band AMSS operators from initiating their licensed service in areas that may interfere with RAS sites. Nor do we believe that such coordination would be a burden for AESs. Indeed, both Boeing and ARINC have coordinated their AMSS operations with the National Science Foundation in this band.<sup>87</sup> We seek comment on whether Boeing’s suggestion that, where practical, RAS observatories should be required to provide advance notice to AMSS operators regarding their observations,<sup>88</sup> should be implemented as part of the coordination proposal described above.

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<sup>83</sup> We understand that the “vicinity” of a radio astronomy site refers to the area where an AES is in line-of-sight of the radio astronomy site. *See also supra* n. 72.

<sup>84</sup> *See* 47 C.F.R. § 2.106.

<sup>85</sup> *See* Recommendation ITU-R M.1643 at Part C (“Essential requirements related to sharing with the RAS”).

<sup>86</sup> *See ESV Report and Order* at para. 97.

<sup>87</sup> *See* Technical Operational Coordination Agreement for the Joint Usage of the Band 14.0-14.5 GHz Between the National Science Foundation and Aircraft Earth Stations Operating in the Boeing Connexion Aeronautical Mobile Network, dated Dec. 13, 2001 (“NSF Agreement”) and A Coordination Agreement Between the National Science Foundation (hereinafter “NSF”) and ARINC, Incorporated (hereinafter “ARINC”) for Operation of the ARINC SKYLink AMSS and Radio Astronomy Sites Jointly Sharing the 14.0-14.5 GHz-Band, dated September 24, 2004.

<sup>88</sup> Boeing Petition at 19-20, *citing* 47 C.F.R. § 25.213(a)(1)(vi).

**c. Proposed Footnotes**

31. Based on our proposals to permit AES terminals in the 11.7-12.2 GHz and 14.0-14.5 GHz bands to communicate with space stations of the FSS, we propose to add the following non-Federal government footnote NGyyy to the U.S. Table of Frequency Allocations for these bands:

**NGyyy** In the bands 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 GHz (Earth-to-space), aircraft earth stations in the aeronautical mobile-satellite service are an application of the Fixed-Satellite Service (FSS). The provisions of ITU Radio Regulations Nos. 5.29, 5.30 and 5.31<sup>89</sup> apply, except that reception from geostationary space stations in the fixed-satellite service in the 11.7-12.2 GHz shall be protected in the United States on a primary basis, provided that the aircraft earth stations operate under the same parameters as earth stations in the fixed-satellite service.

We seek comment on this proposal.

32. In order to protect government space research operations, we propose to add the following Federal government footnote USxxx to the U.S. Allocations Table for the 14.0-14.5 GHz band:

**USxxx** In the band 14.0-14.5 GHz, operations of Aeronautical Mobile-Satellite Service earth stations are subject to coordination with NTIA in order to minimize interference to NASA's Tracking and Data Relay Satellite System (TDRSS) earth stations and the radio astronomy sites listed in US203 that observe in the 14.47-14.5 GHz band.

We seek comment on this proposal.

33. We take this opportunity to seek comment on updating the list of RAS sites currently listed in footnote US203 to the U.S. Table of Allocations. This footnote lists sites used for radioastronomy observations of the formaldehyde line frequencies 14.470-14.500 GHz at specific observatories (presently, National Radio Astronomy Observatory, Green Bank, W. Va.; National Radio Astronomy Observatory, Socorro, New Mexico; Hat Creek Observatory (U. of Calif.), Hat Creek, Cal.; Haystack Radio Observatory (MIT-Lincoln Lab), Tyngsboro, Mass.; Owens Valley Radio Observatory (Cal. Tech.), Big Pine, Cal.; Five College Radio Astronomy Observatory Quabbin Reservoir (near Amherst), Mass.).<sup>90</sup> We seek comment whether the sites currently described in US203 accurately reflect all the sites

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<sup>89</sup> ITU Radio Regulation Nos. 5.29, 5.30, 5.31 state that stations of a secondary service:

5.29 a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

5.30 b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;

5.31 c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

<sup>90</sup> Specifically, this footnote says that “[e]very practicable effort will be made to avoid assignment of frequencies to stations in the fixed or mobile services in these bands [*i.e.*, 4825-4835 MHz and 14.470-14.500 GHz]. Should such assignment result in harmful interference to these observations, the situation will be remedied to the extent practicable.” See 47 CF.R. § 2.106, US203.

actually observing the formaldehyde frequency lines at 14.470-14.500 GHz. For example, the Technical Operational Coordination Agreement that Boeing and the National Science Foundation entered into in 2001 (“NSF Agreement”) regarding protection of radio astronomy sites that observe in the 14.47-14.5 GHz band lists a number of sites that are not currently listed in footnote US203.<sup>91</sup> The sites listed in the NSF Agreement are:

Observatory	West Longitude	North Latitude	Elevation
Arecibo Observatory.....	.....66° 45' 11"	....18° 20' 46"	.....496 m
Green Bank Telescope (GBT).....	.....79° 50' 24"	....38° 25' 59"	.....825 m
Very Large Array (VLA), Socorro, NM.....	.....107° 37' 04"	....34° 04' 44"	.....2126 m
Very Long Baseline Array (VLBA) Stations:			
Brewster, WA.....	.....119° 40' 55"	....48° 07' 53"	.....255 m
Fort Davis, TX.....	.....103° 56' 39"	....30° 38' 06"	.....1615 m
Hancock, NH.....	.....71° 59' 12"	....42° 56' 01"	.....309 m
Kitt Peak, AZ.....	.....111° 36' 42"	....31° 57' 22"	.....1916 m
Los Alamos, NM.....	....106° 14' 42"	....35° 46' 30"	.....1967 m
Mauna Kea, HI.....	.....155° 27' 29"	....19° 48' 16"	.....3720 m
North Liberty, IA.....	.....91° 34' 26"	....41° 46' 17"	.....241 m
Owens Valley, CA.....	.....118° 16' 34"	....37° 13' 54"	.....1207 m
Pie Town, NM.....	.....108° 07' 07"	....34° 18' 04"	.....2371 m
St. Croix, VI.....	.....64° 35' 03"	....17° 45' 31"	.....16 m

We seek comment on revising footnote US203 to list these, or other, sites as the ones that observe the formaldehyde line frequencies in the 14.47-14.5 GHz band. We also seek comment on whether the current list is accurate, *i.e.*, whether any of the observatories listed are no longer active.<sup>92</sup>

## **B. Technical and Operational Requirements for AES of AMSS networks in the band 14.0-14.5 GHz (Earth-to-space)**

### **1. Essential Requirements Related to the Protection of Adjacent Satellite Operators**

#### **a. Off-Axis e.i.r.p. Density Limits and Associated Conditions**

34. Adopted at WRC-03, ITU recommendation ITU-R M.1643 suggests that the AMSS networks should be coordinated and operated in such a manner that the aggregate off-axis e.i.r.p. density levels produced by all co-frequency AES terminals within AMSS networks are no greater than the interference levels that have been published and coordinated for the specific and/or typical earth station(s) pertaining

<sup>91</sup> See Technical Operational Coordination Agreement for the Joint Usage of the Band 14.0-14.5 GHz Between the National Science Foundation and Aircraft Earth Stations Operating in the Boeing Connexion Aeronautical Mobile Network, dated Dec. 13, 2001 (“NSF Agreement”).

<sup>92</sup> Specifically, we note that in comments filed in IB Docket No. 02-10, the National Academy of Sciences, through the National Research Council’s Committee on Radio Frequencies (CORF), stated that radio observations are no longer performed in the 14.47-14.5 GHz band at the Hat Creek, Tyngsboro, or Amherst sites. CORF comments at 5, IB Docket No. 02-10, at 5 (March 3, 2004).

to FSS networks where FSS transponders are used.<sup>93</sup> As Boeing notes, this means that “AMSS systems should be designed, coordinated and operated in such a manner that the aggregate off-axis e.i.r.p. density levels produced by all co-frequency AES terminals are no greater than the interference levels that have been coordinated for the FSS satellite system being used.”<sup>94</sup>

35. In its Petition, Boeing states that for Ku-band AES 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, relying on the Commission’s 2-degree orbital spacing rules rather than operator-to-operator coordination agreements.<sup>95</sup> Based on its experience, Boeing believes that instead of imposing separate antenna performance requirements and input power levels, AMSS licensing rules need only ensure that the aggregate off-axis EIRP density of all co-frequency AES transmissions will 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 2-degree spacing environment.<sup>96</sup> Boeing suggests that in the view of maximum VSAT power and antenna gain requirements noted above, AES aggregate off-axis EIRP density along the geostationary satellite’s orbital arc for co-polarized signals should not exceed the following values:

<u>Angle off-axis</u>	<u>Maximum e.i.r.p density in any 4 KHz band</u>
$1.0^{\circ} \leq \theta \leq 7.0^{\circ}$	$15 - 25 \log \theta$ dBW
$7.0^{\circ} < \theta \leq 9.2^{\circ}$	-6 dBW
$9.2^{\circ} < \theta \leq 48^{\circ}$	$18 - 25 \log \theta$ dBW
$\theta > 48^{\circ}$	-24 dBW <sup>97</sup>

36. In its comments on the Boeing Petition, PanAmSat suggests that the Commission should develop AMSS power limits on a case-by-case basis rather than adopting a fixed e.i.r.p density standard for AMSS stations equivalent to that of VSAT power levels, as Boeing suggested.<sup>98</sup> Boeing asserts that PanAmSat “seeks to reopen the debate on power limits in the context of each and every AMSS licensing proceeding.”<sup>99</sup> We recognize that for Ku-band AES terminals communicating with FSS satellites, the

<sup>93</sup> See Recommendation ITU-R M.1643 at Annex 1, Part A, Section 1.

<sup>94</sup> Boeing Petition at 14.

<sup>95</sup> Boeing Petition at 14.

<sup>96</sup> Boeing Petition at 14-15. See also 47 C.F.R. §§ 25.134, 25.209.

<sup>97</sup> Boeing Petition at 15.

<sup>98</sup> PanAmSat comments at 2.

<sup>99</sup> Boeing Reply Comments at 3.

starting point for protecting adjacent FSS networks is contained in 47 C. F.R. §§ 25.134(a)(1) and 25.209.

We understand that adopting an aggregate off-axis EIRP density limit will give more flexibility to Network Control and Monitoring Centers (NCMCs) in assigning power limits to AES for simultaneous co-frequency transmissions, while satisfying the aggregate value. Specifically, this will permit AES terminals to have different off-axis e.i.r.p. density values depending on each AES characteristics. However, considering the fact that AES terminals are moving rapidly and a network's topology is changing continuously, enforcement and control of off-axis EIRP density limits on individual AES terminals might be simpler for NCMCs than controlling an aggregate value. Therefore, alternatively, we seek comment on adjusting the AES off-axis EIRP envelope in Boeing's proposal to apply to individual AES terminals. Specifically, we invite comment on limiting the AES off-axis e.i.r.p. density along the geostationary satellite orbital arc for co-polarized signals to the following values:

<u>Angle off-axis</u>	<u>Maximum e.i.r.p density in any 4 KHz band</u>
$1.0^{\circ} \leq \theta \leq 7.0^{\circ}$	$15 - 25 \log \theta$ dBW
$7.0^{\circ} < \theta \leq 9.2^{\circ}$	-6 dBW
$9.2^{\circ} < \theta \leq 48^{\circ}$	$18 - 25 \log \theta$ dBW
$\theta > 48^{\circ}$	-24 dBW

Where:  $\theta$  is the angle in degrees from the axis of the main lobe.

The off-axis EIRP density limits listed here pertain to emissions from a single transmitter if the selected modulations permit one carrier per channel at the satellite receiver. If an AMSS operator chooses to implement a modulation technique, such as CDMA, that can operate with multiple co-frequency transmissions from different AES terminals being simultaneously received at the same satellite, we propose introducing equal off-axis EIRP density limits on each individual AES. That is, if "N" AES transmitters were implemented, each operating on the same channel, transmitting to the same satellite, at the same time, the EIRP density limit on each individual transmitter would be reduced by a factor of  $10 \cdot \log(N)$ , in dB. For example, if five AES terminals were equipped with CDMA AMSS transmitters all operating to the same satellite, in the same uplink bandwidth, the e.i.r.p. density of the individual transmitters would be reduced by a factor of  $10 \cdot \log(5) = 7.0$  dB.

37. We believe that both of the proposed approaches mentioned above (*i.e.*, Boeing's aggregate off-axis e.i.r.p. density limits and our individual off-axis e.i.r.p. density limits) have their own advantages and disadvantages. Therefore we seek comment on both approaches and feasibility of each in practice. Also we seek comment whether we should be concerned about the approach used by an applicant as long as the applicant's system meets the aggregate envelope.

38. In addition, Boeing argues that the Commission should permit minor variances in the off-axis e.i.r.p density values to account for variations in antenna performance where such variances would not adversely affect adjacent satellite operators.<sup>100</sup> We recognize that the antenna gain variations captured in

<sup>100</sup> Boeing Petition at 16.

§25.209(a), for Ku-band antennas, are part of the VSAT antenna envelope, therefore, we propose that the e.i.r.p density of an individual sidelobe may not exceed the envelope defined above for  $\theta$  between 1.0 and 7.0 degrees. For  $\theta$  greater than 7.0 degrees, we propose that the envelope may be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the e.i.r.p density envelope given above by more than 3 dB. We seek comment on these values.

39. Boeing states that, since AMSS receivers will operate on an unprotected basis in the 11.7-12.2 GHz band, there is no need to specify the antenna performance requirements which protect receive operations from interference caused by adjacent satellite downlinks.<sup>101</sup> PanAmSat in its comments suggests a modification to Boeing's draft AMSS rules. PanAmSat asserts that Boeing is proposing that the applications for blanket licenses be subject to routine processing, without regard to the diameter of the AMSS stations and the angle at which the AMSS stations conform to the "29-25 log  $\theta$ " standard.<sup>102</sup> PanAmSat believes that "the Commission has well-established procedures for processing small diameter antennas, and has established a dividing line between those that are eligible for routine processing and those that are not."<sup>103</sup> Furthermore PanAmSat argues that if FSS earth stations that fall "below the line," and that are operating on a primary basis in the Ku-band, are not eligible for routine processing, neither should "below the line" AMSS stations that are operating on a secondary basis.<sup>104</sup> In its reply comments, Boeing states that the primary purpose of specifying the gain characteristics of FSS earth station antennas is to define the protection they receive as a primary service.<sup>105</sup> Boeing asserts that in contrast, AMSS receive operations are conducted in the 11.7-12.2 GHz band on an unprotected basis only and by definition, cannot claim protection from other conforming users of the band; therefore, Boeing argues that it is illogical to suggest that AMSS service rules must specify the gain characteristic of AMSS receive antennas in that frequency band.<sup>106</sup> We seek comment on the relationship between unprotected receive operations of AES terminals in the 11.7-12.2 GHz band and technical standards (e.g., antenna performance standards, if necessary), applicable to those operations.

40. Boeing also asserts that, like Ku-band VSAT operators, AMSS systems should have the flexibility to coordinate AES transmissions in excess of these e.i.r.p. density values, subject to an additional technical showing and the rights of future Ku-band licensees to require compliant operations in certain circumstances.<sup>107</sup> ARINC supports Boeing's proposed rule.<sup>108</sup> Boeing argues that evidence of operator-to-operator coordination regarding adjacent satellite interference can be demonstrated "by

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<sup>101</sup> Boeing Petition at 15.

<sup>102</sup> PanAmSat comments at 2.

<sup>103</sup> PanAmSat comments at 2.

<sup>104</sup> PanAmSat comments at 2. We believe that in referring to "below the line" applications for Earth stations, PanAmSat is referring to stations with a diameter smaller than that referenced under current Section 25.209, therefore making the application ineligible for routine processing. *See* 47 C.F.R. § 25.209.

<sup>105</sup> Boeing reply at 3.

<sup>106</sup> Boeing reply at 3.

<sup>107</sup> Boeing Petition at 15.

<sup>108</sup> ARINC comments at 6.

obtaining a certification from their satellite providers that the aggregate off-axis e.i.r.p. density levels produced by all co-frequency AES terminals communicating with the relevant satellite will be no greater than the interference levels that have been accepted by adjacent satellite systems through the operator-to-operator coordination process.”<sup>109</sup> Our first question for comment is whether, in the first instance, we should consider granting any AMSS application for a system that exceeds our proposed EIRP density levels. If such applications should be considered, we propose a certification procedure similar to what Boeing recommends. We note that the Commission proposed a certification procedure similar to the Boeing proposal for FSS earth stations considered “non-routine” under the current Part 25 rules.<sup>110</sup> We seek comment on whether those streamlined procedures are appropriate for AMSS in the event that either we do, or do not, adopt our off-axis EIRP envelope proposal.

#### b. Antenna Pointing Accuracy

41. Consistent with ITU Recommendation ITU-R M.1643,<sup>111</sup> Boeing’s Petition,<sup>112</sup> and the *Boeing Transmit-Receive Order*,<sup>113</sup> we propose that an AMSS applicant will need to provide information demonstrating that it has accounted for the following factors in the design, coordination and operation of an AES and we seek comment in this regard. These factors could vary the aggregate off-axis e.i.r.p. density levels generated by the AES:

- i. Mispointing of AES antennas. This includes, *e.g.*, effects caused by bias and latency of their pointing systems, tracking error of closed loop tracking systems, misalignment between transmit and receive apertures for systems that use separate apertures, and misalignment between transmit and receive feeds for systems that use combined apertures; therefore, consistent with WRC-03, we are proposing that the AES operator should maintain pointing accuracy within 0.2 degrees for all antennas within its licensed network.
- ii. Variations in the antenna pattern of AES. This includes, *e.g.*, effects caused by manufacturing tolerances, ageing of the antenna and environmental effects. AMSS networks using certain types of AES antennas, such as phased arrays, should account for variation in antenna pattern with scan angles (elevation and azimuth). Networks using phased arrays should also account for element phase error, amplitude error and failure rate;
- iii. Variations in the transmit e.i.r.p. density from AES. This includes, *e.g.*, effects caused by measurement error, control error and latency for closed loop power control systems. Network control and monitoring centers (NCMCs) that calculate the e.i.r.p. density of AES based on the received signal need to take

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<sup>109</sup> Boeing Petition at 16.

<sup>110</sup> See 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, IB Docket No. 00-248, *Notice of Proposed Rulemaking*, 15 FCC Rcd 25128 (2000) (“*Part 25 Earth Station NPRM*”).

<sup>111</sup> See Recommendation ITU-R M.1643 at Annex 1, Part A, Section 2.

<sup>112</sup> Boeing Petition at 17.

<sup>113</sup> See *Boeing Transmit-Receive Order*, 16 FCC Rcd at 22655.



into account error sources and latency in this calculation. NCMCs that calculate the e.i.r.p. density of AES based on input power must account for measurement error and reporting latency.

We seek comment on each of these proposals.

### c. Additional Requirements

42. We seek comment on several rule revisions that would be consistent with ITU Recommendation ITU-R M.1643,<sup>114</sup> and Boeing's proposed rules.<sup>115</sup> First, we propose that AES terminals that use closed loop tracking<sup>116</sup> of the satellite signal need to employ an algorithm that is resistant to capturing and tracking adjacent satellite signals. AES terminals would have to immediately inhibit transmission when they detect that unintended satellite tracking has happened or is about to happen. We seek comment on this proposal.

43. We also propose that the AES terminals should be subject to the monitoring and control of a NCMC or equivalent facility, located within the United States. Under this proposal AES terminals must be able to receive at least "enable transmission" and "disable transmission" commands from the NCMC. AES terminals would have to automatically cease transmissions immediately upon receiving any "parameter change" command, which may cause harmful interference during the change, until the AES receives an "enable transmission" command from its NCMC. In addition, it should be possible for the NCMC to monitor the operation of an AES to determine if it is malfunctioning. ARINC in its comments supported Boeing's proposed rule in this regard.<sup>117</sup> Our proposal regarding NCMC control is consistent with the Bureau's action in *Boeing Transmit-Receive Order*.<sup>118</sup>

44. Finally, we propose that AES terminals need also to be self-monitoring and if an individual AES detects a fault which can cause harmful interference to FSS networks, the AES must automatically mute its transmissions until the cause of harmful interference has been remedied. This would also be consistent with the Bureau's action in *Boeing Transmit-Receive Order*.<sup>119</sup> We seek comment in this regard.

## 2. Essential Requirements Related to the Protection of the Fixed Service

45. In its Petition, Boeing argues that since there is no allocation for terrestrial FS operations in the 14.0-14.5 GHz band in the United States or any bordering countries, there should not be any

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<sup>114</sup> See Recommendation ITU-R M.1643 at Annex 1, Part A, Section 3.

<sup>115</sup> Boeing Petition at 18.

<sup>116</sup> 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.

<sup>117</sup> ARINC Comments at 6.

<sup>118</sup> See *Boeing Transmit-Receive Order*, 16 FCC Rcd at 22654, para. 19h.

<sup>119</sup> See *Boeing Transmit-Receive Order*, 16 FCC Rcd at 22654-55, para. 19h.

requirements for protection of fixed service in the Commission's Rules with respect to domestic operations.<sup>120</sup> However, Boeing states that AMSS providers operating in the international airspace near territories with co-frequency FS operations should be required to protect such operations from harmful interference.<sup>121</sup> Further, in its comments, Boeing suggests that, when operating co-frequency with terrestrial FS stations within the line of sight of the territory of a foreign Administration that has a primary FS allocation in the 14.0-14.5 GHz band, the operations of an AES should be in accordance with Annex 1, Part B of the latest version of Recommendation ITU-R M.1643, unless the foreign Administration has imposed other conditions for protecting its FS stations.<sup>122</sup> Boeing says that such alternative conditions may be included in the authorization of the AMSS network to operate within the territory of a foreign Administration (*i.e.*, the authorization issued by the foreign administration) or pursuant to a coordination agreement with the foreign administration governing the operations of the AMSS network.<sup>123</sup>

46. Boeing's recommendation on this issue warrants further consideration. Accordingly, we propose that, when AMSS providers operate in the 14.0-14.5 GHz frequency band 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 AES of an AMSS network should not exceed the following values unless the foreign Administration has imposed other conditions for protecting its FS stations:

$$\begin{array}{ll} -132 + 0.5 \cdot \theta \text{ dB(W/(m}^2 \cdot \text{MHz))} & \text{for } \theta \leq 40^\circ \\ -112 \text{ dB(W/(m}^2 \cdot \text{MHz))} & \text{for } 40^\circ < \theta \leq 90^\circ \end{array}$$

Where:  $\theta$  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.

We seek comment on an alternative proposal that these pfd limits apply only in the absence of an explicit adoption of different conditions by a foreign administration.<sup>124</sup> We also invite comment on Boeing's proposal that in cases where AMSS 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."<sup>125</sup>

<sup>120</sup> Boeing Petition at 19.

<sup>121</sup> Boeing Petition at 19.

<sup>122</sup> Boeing comments at 10. *See also* Recommendation ITU-R M.1643.

<sup>123</sup> Boeing comments at 10.

<sup>124</sup> *Cf.* Boeing comments at 9. Boeing suggests that an AMSS operator may be subject to alternative operating conditions in a foreign administration via either a coordination agreement or conditions included in a foreign authorization. *See also* Boeing comments at 9-10.

<sup>125</sup> Boeing comments at 9.

### C. AES Licensing Considerations

47. In establishing a new regulatory framework for AMSS, we endeavor to craft rules that will minimize licensees' regulatory burden. Therefore, we invite commenters to identify, either generally or in connection with specific proposals, any licensing methods that may simplify and speed the licensing process, while still addressing our core regulatory concern with avoiding harmful interference.

48. *Blanket licensing.* We are proposing that AMSS networks operate under the direct control of a Network Control and Monitoring Center (NCMC) located within the United States.<sup>126</sup> The individual AES stations can operate anywhere in the satellite footprint. We seek comment on whether AES terminals should be permitted to operate under blanket licensing rules<sup>127</sup> that are similar to those under which VSATs and ESVs operate.<sup>128</sup> Boeing advocates the blanket licensing approach in its Petition.<sup>129</sup> Generally, blanket licensing for VSATs requires applicants to request a single license for the overall earth station network including the hub earth station and remote earth stations without site-specific information on each remote earth station.<sup>130</sup> As with ESVs, AMSS networks may or may not require the licensing of a hub earth station, however.<sup>131</sup> We propose that we will issue an AMSS system license (consisting of a hub, located in the U.S., and/or blanket earth station license) to applicants who demonstrate that they are capable of controlling all aspects of the AMSS network. Whether or not an applicant requests hub authority, we propose that the system license will also require that the licensee maintain in the United States both a NCMC and a 24 hours a day, seven days a week point of contact. We believe that, by making the AMSS system licensee responsible for meeting the operational considerations we propose, we ensure the protection of other in-band and out-of-band licensees.

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<sup>126</sup> See *supra* para. 43.

<sup>127</sup> Routine Licensing of Large Networks of Small Antenna Earth Stations Operating in the 12/14 GHz Frequency Bands, *Declaratory Order*, 1986 WL291567 at paras. 4-6 ("*VSAT Order*"). A Form 312 is required for each large (*i.e.*, diameter of 5 meters or more) hub station in addition to one Form 312 for each representative type of small (*i.e.*, diameter of less than 5 meters) earth terminal to be employed in the network. *Id.*

<sup>128</sup> See 47 C.F.R. § 25.134 and *ESV Report and Order* at paras. 114-17.

<sup>129</sup> Boeing Petition at 21.

<sup>130</sup> The satellites used in an AMSS network must be authorized to serve the United States. If an AMSS network operator proposes to communicate with a non-U.S.-licensed satellite the AMSS operator would be required to receive a case-by-case authorization to access the non-U.S. satellite. Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites Providing Domestic and International Service in the United States, *Report and Order*, 12 FCC Rcd 24094 (1997) ("*DISCO II*"). AMSS providers operating a network out of the United States would have to get Commission authorization for four situations: access to U.S. satellites; access to non-U.S. satellites; service to U.S. aircraft; and service to non-U.S. aircraft.

<sup>131</sup> For example, Boeing's current non-conforming use AMSS authorization is only for the remote terminals. Boeing did not seek authority to operate a fixed hub. The Bureau required that Boeing's AES terminals be monitored and controlled by the NCMC. In such an AMSS system, transmissions between the satellite and the ground are carried out using one or more fixed Earth station hubs that are separately licensed by the Commission. See *Boeing Transmit-Receive Order*, 16 FCC Rcd at 22654, paras. 3, 19. See also *ESV Report and Order* at paras. 114-17 (noting that an ESV system license consists of "a hub and/or blanket earth station license").

49. We consider blanket licensing for AES terminals because the number and mobility of AES locations would make it impractical to license AES terminals on a site-by-site basis. Under a blanket licensing approach, 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 earth station comprising the network. We propose requiring a point of contact to maintain information about the location of aircraft and the frequencies that they use. After the applicant submits point of contact and other relevant information, the Commission can then issue a blanket authorization for the system, which would encompass each hub station in the United States and/or each class of the AES terminals.<sup>132</sup>

50. We also seek comment on whether we should provide for the licensing of individual earth stations, using the same technical criteria that are applied to the antennas in a blanket-licensed AMSS network.<sup>133</sup> Although we believe that demand for such uses will be limited, we seek comment on whether there are any specific rule provisions that might be required to address such cases. In addition, we invite comment regarding any modifications to FCC Form 312 that might be necessary to accommodate applications for AMSS systems.<sup>134</sup>

51. *ALSAT authority.* We also seek comment on whether we should authorize Ku-band AMSS operators to operate with any U.S.-licensed satellite (*i.e.* ALSAT authority<sup>135</sup>) and non-U.S. satellites on the Permitted List using the parameters consistent with earth stations, specifically that the AES terminals comply with the proposed off-axis EIRP density requirements proposed herein. Or, for reasons relating to potential interference to two-degree spaced satellites, should AMSS operators be granted authority to access individual satellites only? Boeing argues that no technical reason exists to prohibit Ku-band AMSS from operating pursuant to ALSAT authority because these systems must be compliant with the Commission's 2-degree spacing rules, and cannot interfere with adjacent satellite operators.<sup>136</sup> In the *Part 25 Earth Station* proceeding, the Commission proposed a procedure under which ALSAT authority is not available to FSS earth station applicants whose operations must be coordinated with adjacent satellite

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<sup>132</sup> See *VSAT Order*, 1986 WL291567 at para. 20.

<sup>133</sup> Specifically, we seek comment on whether to license AES terminals on an individual basis pursuant to the proposed off-axis EIRP requirements discussed in Section III.B.1.a. of this NPRM.

<sup>134</sup> Applications for new or modified transmitting and/or receiving earth stations must be filed on FCC Form 312. See 47 C.F.R. §§ 25.130, 25.131.

<sup>135</sup> "ALSAT" means "all U.S.-licensed space stations." Originally, under an ALSAT earth station license, an earth station operator providing fixed-satellite service in the conventional C- and Ku-bands could access any U.S. satellite without additional Commission action, provided that those communications are in accordance with the same technical parameters and conditions established in the earth stations' licenses. See 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, *Report and Order*, IB Docket No. 96-111, 15 FCC Rcd 7207, 7210-11, at para. 6 (1999) (*DISCO II First Reconsideration Order*). The *DISCO II First Reconsideration Order* expanded ALSAT earth station licenses to allow access to any satellite on the Permitted List. *DISCO II First Reconsideration Order*, 15 FCC Rcd at 7215-16 (para. 19).

<sup>136</sup> Boeing Petition at 23-24. Boeing adds that AMSS's secondary status reinforces that no interference risk exists for adjacent satellites. *Id.* at 24.

operators.<sup>137</sup> Similarly, in the event that we decide to apply that procedure to AMSS applicants, ALSAT authority would not be available to those AMSS applicants whose operations must be coordinated with adjacent satellite operators, especially if the AES terminals exceed the proposed off-axis EIRP density requirements.<sup>138</sup> We seek comment on this tentative conclusion.

52. *License term.* Other licensed networks of earth stations have fifteen-year license terms.<sup>139</sup> In the context of Ku-band AMSS operations, we seek comment on whether there is any reason to diverge from the fifteen-year license terms. Nevertheless, we tentatively conclude that fifteen-year license terms for Ku-band AMSS networks are reasonable. We seek comment on this tentative conclusion.

53. We believe that these proposals for licensing Ku-band AMSS operations are consistent with the decisions of WRC-03. Additionally, our proposals would alleviate concerns that the current system of authorizing AMSS operations through case-by-case licensing procedures results in longer overall processing times, additional administrative burdens, and increased uncertainty in the marketplace. Furthermore, licensing Ku-band AMSS operations would promote more intensive and efficient use of this band by encouraging development of new services for aircraft without restricting current usage and the expansion of current services. We seek comment on the above proposals and any other proposals or comments that may be raised in the record.

#### **D. Tracking AES Terminals**

54. We seek comment on the need to track AES operations because opening the Ku-band to swiftly mobile AES terminals requires additional steps to allow proper enforcement. A necessary part to identifying sources of interference has always been the knowledge of exactly where the transmitting and receiving stations are, the frequency channels used and, the exact pointing angles of the antennas. We seek comment whether AMSS operators should maintain aircraft tracking data for a one-year period of time and provide the Commission, NTIA, or other interested parties (*e.g.*, a frequency coordinator or fixed-satellite system operator) with detailed information on the operating channels of its AES terminals on a particular air route within 24 hours upon request. Recognizing that “real time” public access to exact aircraft location information may present a security risk for the aircraft, the Commission would not make it public, but would use the operating frequency information provided by the AMSS operator for harmful interference resolution and enforcement purposes. The Commission would have a record of where AES terminals have operated and, if it receives a complaint of harmful interference, the interference could be eliminated or the AMSS operator could be ruled out as having caused the harmful interference. We seek comment on the anticipated effectiveness and utility of this process and whether a trial period could be implemented to gain experience with the process. We seek comment on whether this process would be adequate to protect SRS users of Ku-band spectrum from harmful interference. The ability to track AES terminals in real time would present FSS, FS,<sup>140</sup> space research and radio astronomy operators with an opportunity to identify a potentially interfering AES and take immediate steps to have the harmful interference resolved, including through termination of the AES operations, if necessary.

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<sup>137</sup> *Part 25 Earth Station NPRM*, 15 FCC Rcd at 25137 (para. 23); 25140 (para. 32).

<sup>138</sup> See also discussion in para. 40, *supra*, regarding our proposals for authorizing non-routine operations.

<sup>139</sup> See 47 C.F.R. § 25.121.

<sup>140</sup> We are referring to foreign FS operators, since there is no U.S. allocation for FS in the 14.0-14.5 GHz band.

55. We seek comment whether AMSS operators should be required to make exact aircraft location information accessible, in a secure fashion, to individual operators in the Ku-band so that they can identify a potentially interfering AES, or should AMSS operators be required to make this information accessible to a third-party, single point of contact representing commercial or government agencies? We will consider all alternative methods for identifying harmful interference sources in a secure and controlled environment.

### **E. Regulation of AMSS Operations Based on Aircraft Country of Registry**

56. As set forth in detail above, AES terminals are a mobile application of FSS technology and, therefore, have a higher potential for creating interference to terrestrial and space systems than other FSS applications operating in the same frequencies. We have proposed rules in this *Notice* with the goal of controlling this potential interference to other co-frequency applications. There are three very important regulatory factors related to the technical rules under which AES terminals must operate: the aircraft's country of registry; the country in which the AMSS operator and its control systems are located; and the physical location of the aircraft if a claim of interference occurs.<sup>141</sup> This section proposes the U.S. requirements that would apply to AMSS operations under the possible combinations of these factors.

#### **1. U.S.-Registered Aircraft**

57. Aircraft routes are not confined within the borders of the United States. U.S.-registered aircraft travel international routes both to and from the United States. At the outset, we observe that the Commission has the responsibility under the ITU Radio Regulations<sup>142</sup> and the Communications Act<sup>143</sup> for licensing AES operations of U.S.-registered aircraft, other than stations owned and operated by the federal government. Section 301(e) of the Act provides that no person shall engage in radio communication "upon any vessel or aircraft of the United States" without a Commission license.<sup>144</sup> The Act does not indicate, nor do we believe, that such jurisdiction is restricted to the location of vessels or aircraft. Therefore, the Commission's licensing obligation would apply regardless of whether the AES operates with a U.S. or foreign hub or is traveling though U.S. or international airspace.<sup>145</sup> Consequently, we are concerned with the potential for interference that may be caused by AES terminals operating on U.S.-registered aircraft. For this reason, to comply with our proposal that all AMSS systems maintain an NCMC in the United States, we propose that operators of any AES terminals on U.S.-registered aircraft must have a 24 hour point of contact within the United States that will have the capability and authority to cause such AES terminals to cease transmitting.<sup>146</sup> We propose that this obligation would apply

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<sup>141</sup> In the *ESV Report and Order*, we identified similar regulatory factors that affect ESV operations. See *ESV Report and Order* at para. 119. Accordingly, the proposals and analysis in this section are modeled after our decision in the ESV proceeding.

<sup>142</sup> See, e.g., ITU Radio Regulation 18.8.

<sup>143</sup> See 47 U.S.C. § 301(e).

<sup>144</sup> See 47 U.S.C. § 301(e).

<sup>145</sup> We reached a similar conclusion regarding our obligations to license ESVs on U.S.-registered vessels. See *ESV Report and Order* at para. 120.

<sup>146</sup> See NCMC discussion in para. 43, *supra*.

regardless of whether or not the hub through which the AES communicates is in the United States, and without concern for the location of the aircraft (*i.e.*, in U.S. airspace, over international waters, or in a foreign administration's airspace). Specifically, the point of contact would need to have a direct connection to the hub's or NCMC's network functions controlling AES terminals on U.S. aircraft. We do not wish to have U.S. sovereignty and regulatory control of U.S.-licensed AES terminals to be subject to the sovereignty and regulatory control of a foreign administration.

58. Next, we seek comment on rules to prevent interference that AMSS 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). With regard to AES operations in or near the airspace of foreign nations, we propose that the AMSS operator follow a procedure similar to the one we adopted regarding ESV operations on U.S.-registered vessels near foreign coasts.<sup>147</sup> Under this proposal, we would require that prior to operations within the foreign nation's airspace, the AMSS operator would have to ascertain whether the relevant administration has operations that could be affected by AES terminals, and determine whether that administration has adopted specific requirements concerning AES operations. Once the aircraft enters foreign airspace, the AES would have to operate under our technical rules, or those of the foreign administration, which ever is more constraining.<sup>148</sup> To the extent that all relevant administrations have identified geographic areas from which AMSS operations would not affect their radio operations, AMSS 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 AES operations, we propose that AMSS operators would be required to coordinate their operations with any potentially affected operations. We seek comment on this proposal.

59. With regard to the authorization of AES operations of U.S.-registered aircraft flying over international waters, we seek comment whether the only concern should be the protection of adjacent satellite operators. If this is the only concern, we seek comment on whether to require any AMSS operator seeking to operate over international waters to certify that the operator(s) of all satellites to be accessed over international waters have confirmed that the proposed AMSS operations would be within the coordinated parameters of the satellite. Alternatively, we request comment on whether such confirmation is necessary for AMSS operators that comply with off-axis envelope proposed above, in the event that the Commission adopts that proposal.

## **2. Non-U.S.-Registered Aircraft Using U.S.-Operated AMSS Systems in U.S. Airspace**

60. Foreign aircraft equipped with AES terminals are just as likely to travel through U.S. airspace<sup>149</sup> as United States-registered aircraft. Presently, Boeing's Connexion service is not available on any U.S.-registered aircraft, although it is available on Lufthansa flights that travel through United States

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<sup>147</sup> See *ESV Report and Order* at para. 121.

<sup>148</sup> We also would encourage bilateral arrangements between the United States and the foreign administration that would spell out the specific technical rules that an AES must meet in foreign airspace.

<sup>149</sup> 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).

airspace.<sup>150</sup> We seek comment on whether we should develop rules to authorize AES communications of foreign-registered aircraft that are traveling through U.S. airspace and communicating with U.S.-located hub stations and/or are controlled by a U.S.-located AMSS operator.<sup>151</sup> In the ESV proceeding, we addressed a similar issue, given that foreign-registered vessels would be likely to use ESVs while approaching or in U.S. territorial waters. We concluded that, because both Section 301 and 306 of the Communications Act give the Commission the authority and responsibility to adopt regulations to protect U.S. licensed radio communications systems from receiving harmful interference from foreign vessels,<sup>152</sup> and given the likelihood of U.S. ESV hub operators communicating with ESVs on foreign-registered ships, we believed that adoption of some measure to protect both U.S. satellite and terrestrial licensees from ESV operations was warranted.<sup>153</sup> We believe measures are warranted for regulation of AES terminals on foreign-registered aircraft when these AES terminals are traveling through U.S. airspace and are part of a U.S. AMSS operator's network (as is the case with Boeing's Connexion service, which is installed on foreign-registered aircraft).<sup>154</sup>

61. Although Section 306 of the Act prohibits the Commission from licensing earth stations on foreign-registered ships, this section does not apply to aircraft.<sup>155</sup> The United States is a signatory to the Convention on International Civil Aviation ("Chicago Convention"), which states that 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.<sup>156</sup> The Commission could require the operator of the AES on the foreign-registered aircraft to apply for a license authorizing transmissions while traveling through U.S. airspace. The licensee would then be subject to any and all rules we may adopt concerning AMSS operations. We invite comment on this approach. We also seek comment whether a U.S. licensee's blanket AES license could permit the licensee to install terminals on any aircraft, regardless of the country of registration. As long as the aircraft is within U.S. airspace, the AES would operate pursuant to the U.S. operator's blanket license. We seek comment on these proposals.

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<sup>150</sup> See "The New Era of Inflight Connectivity Is Here: Connexion by Boeing and Lufthansa Announce the World Premiere of Airborne Internet," Boeing Press Release, [http://www.boeing.com/news/releases/2004/q2/nr\\_040511j.html](http://www.boeing.com/news/releases/2004/q2/nr_040511j.html) (May 11, 2004); Boeing Petition at 2.

<sup>151</sup> Boeing identifies such AMSS systems as "associated with a U.S. AMSS licensee." Boeing Petition at 22.

<sup>152</sup> 47 U.S.C. §§ 301, 306. We noted in the ESV proceeding that Section 306 of the Act prohibits the Commission from licensing earth stations on foreign-flagged ships. *ESV Report and Order* at para. 122. However, this section does not apply to aircraft. See 47 U.S.C. §§ 306, 3(39)(A) (definition of "ship" excludes aircraft).

<sup>153</sup> *ESV Report and Order* at para. 122.

<sup>154</sup> In the next section, we propose a regulatory framework for foreign-based (*i.e.*, the hub and or network control systems are located outside the United States) and foreign-licensed AMSS operators operating on foreign-registered aircraft that fly through U.S. airspace.

<sup>155</sup> See 47 U.S.C. §§ 306, 3(39)(A) (definition of "ship" excludes aircraft).

<sup>156</sup> Convention on International Civil Aviation, signed Dec. 7, 1944, Article 30. 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 AES onboard a single aircraft could have a separate license for each nation through which it passes.



62. In its petition, Boeing proposes that foreign-licensed AES terminals onboard foreign-registered aircraft and associated with a U.S. operator “be temporarily associated with and licensed to the U.S. AMSS licensee (or service vendor authorized by the operator) when the AES is operating within U.S. airspace.”<sup>157</sup> During this temporary period, Boeing suggests that the U.S.-licensed AMSS operator assume responsibility for the foreign AES “as if the AES were regularly licensed to it.”<sup>158</sup> Boeing notes that such an approach is similar to the Commission’s treatment of MSS transceivers designed to operate with U.S.-licensed systems.<sup>159</sup> We seek comment on whether this approach to authorizing foreign-registered aircraft AES terminals would be preferable to the approaches described above.

63. A different approach would be to prohibit operations by non-U.S. licensed AES terminals on aircraft of foreign registry in U.S. airspace, and to prohibit U.S. hub stations from serving and or U.S. AMSS operators from operating such AES terminals. We tentatively conclude that this approach would be overly restrictive and preclude a number of AMSS operations, including those already provided by Boeing on foreign carriers. Bilateral agreements between the United States and the relevant administrations of foreign registered aircraft may help provide U.S. licensees with adequate protection from AES terminals on foreign-registered aircraft. However, the extent of protection will depend on the specific language in these bilateral agreements, which may not be adequate to fully protect U.S. licensed services if the AES terminals have not been licensed by the Commission. In such cases, we tentatively conclude that we need to require operators of non-U.S. licensed AES terminals onboard foreign-registered aircraft communicating with U.S. hubs to be responsible for complying with all FCC rules in order to provide the necessary safeguards for protecting U.S. licensed services. We seek comment on this tentative conclusion.

64. We propose that the AMSS operator using a U.S. hub to communicate with non-U.S. licensed AES terminals (or using a U.S.-located NCMC to control the AMSS network) on foreign-registered aircraft be responsible for ensuring that the operations of the AES terminals comply with all of our rules, and that failure to do so could result in sanctions, including possible license forfeiture. Accordingly, the AMSS operator communicating with foreign-registered aircraft through a U.S. hub would need to have a 24 hour point of contact in the U.S. with the capability and authority to terminate transmissions of AES terminals that cause interference or otherwise fail to comply with any rules that we may eventually adopt. Authorizing AMSS operators in a manner that requires such control over all AES terminals with which the hub communicates ensures an environment where potential interference can be properly managed. We invite comment on this proposal.

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<sup>157</sup> Boeing Petition at 22.

<sup>158</sup> Boeing Petition at 22.

<sup>159</sup> Boeing Petition at 22 *citing* 47 C.F.R. §§ 25.136(c), 25.135(d), and 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, at 6016, para. 208 (1995) (“*Big LEO Order*”).

### 3. Non-U.S.-Registered Aircraft Using Foreign-Based and Foreign-Licensed AMSS Systems

65. We next seek comment whether we should develop policies or rules to prevent any harmful interference that could result when foreign-licensed AES terminals traveling through U.S. airspace are communicating with foreign-licensed, rather than U.S.-licensed, hubs and/or are controlled by foreign-located NCMCs (in other words, a situation in which a foreign-registered aircraft has onboard a foreign-licensed AMSS system that does not communicate with and is not controlled by any U.S. network components). Although the Act specifically states that the Commission may not license radio communications on foreign ships while they are within United States jurisdiction, no such provision exists regarding foreign aircraft.<sup>160</sup> Therefore, similar to the proposal above regarding U.S. AMSS operators operating on foreign-registered aircraft, we propose that a foreign-licensed AMSS operator obtain U.S. approval prior to operating its system in U.S. airspace. As noted above, the United States is a signatory to the Chicago Convention.<sup>161</sup> 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.

66. We also seek comment on an alternative framework that we recently adopted for foreign-licensed ESVs operating on foreign-registered vessels within U.S. territorial waters.<sup>162</sup> 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.<sup>163</sup> Some administrations may authorize AMSS operations for their registered aircraft based on ITU RR 4.4. However, we believe that operations of such systems in U.S. airspace may not provide adequate protection to U.S. services because of the typically high speeds involved in aircraft operations which, unlike those involved in maritime operations, may cause transient interference where identification of the source is extremely difficult.

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<sup>160</sup> See 47 U.S.C. § 306. This section also provides that communications from a foreign vessel located in U.S. jurisdiction still must be in accordance with any relevant rules designed to prevent interference. *Id.*

<sup>161</sup> Convention on International Civil Aviation, signed Dec. 7, 1944, Article 30. The Commission implemented this Article in the Part 87, the regulations concerning aviation services. Section 87.191(a) provides:

Aircraft of member States of the International Civil Aviation Organization may carry and operate radio transmitters in the United States airspace only if a license has been issued by the State in which the aircraft is registered and the flight crew is provided with a radio operator license of the proper class, issued or recognized by the State in which the aircraft is registered. The use of radio transmitters in the United States airspace must comply with these rules and regulations. 47 C.F.R. § 87.191(a).

<sup>162</sup> *ESV Report and Order* at paras. 127-28.

<sup>163</sup> 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, as station operating in accordance with the provisions of the Constitution, the Convention and these Regulations.”

67. We propose to permit foreign AES terminals to operate on aircraft registered with foreign administrations through hubs located outside of the United States while flying through U.S. airspace by requiring the AMSS operator to apply for and obtain U.S. authorization, as proposed above in paragraph 65. We also seek comment whether, as an alternative to licensing, such foreign AES terminal operations should be permitted in the vicinity of radio astronomy and TDRSS sites<sup>164</sup> only after the technical parameters and operational procedures of these terminals and their associated hubs have been coordinated with the FCC/NTIA and been determined to satisfy Commission rules established for this service. We seek comment whether foreign AMSS systems should be subject to any or all of the operational requirements that we have proposed for U.S. systems, including, for example, the U.S.-located 24 hour point of contact that would be capable of terminating AES transmissions.<sup>165</sup> We are concerned that foreign AES terminal/hub operations over international waters and in the vicinity of U.S. TDRSS stations, such as the Guam station, may cause interference to those TDRSS stations. We invite comment on methods for preventing such interference, including whether we should adopt a regulation implementing Part D of ITU-R M.1643, which recommends a procedure for protection of space research systems.<sup>166</sup> Additionally, should we find evidence that AES terminals on aircraft of foreign registry communicating with non-U.S. hubs cause harmful interference to any U.S.-licensed satellite or terrestrial systems, we expect the Commission to take all appropriate actions, including requesting that the Department of State request that the appropriate foreign administration require the foreign-registered aircraft to cease further AES operations in the vicinity of TDRSS and radio astronomy sites. We invite comment on these proposals.

#### IV. CONCLUSION

68. The proposed licensing procedures described above for Ku-band AMSS reflect our interest in providing regulatory certainty to both new and incumbent operators in the Ku frequency band. The proposals set forth in this *Notice* are designed to: 1) address existing government, space research, RAS, and FSS operations that may be affected by AES terminals; 2) allow for future growth of FSS networks; 3) establish rules and a regulatory framework that minimize the regulatory burden on AMSS licensees to the extent possible; 4) promote more efficient use of the spectrum by permitting new uses of the band by AES terminals, thereby enabling important new communications services to be provided to consumers on board aircraft. We seek comment on each of the matters set forth above.

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<sup>164</sup> See *supra* fn. 72.

<sup>165</sup> See *supra* paras. 48-49, 57.

<sup>166</sup> Part D provides, in part:

Coordination agreements should be developed between AMSS and space research systems based on controlling the emissions levels of the AES in the frequency band used by the SRS systems, and, in severe cases, may require cessation of AES emissions on frequencies used by the SRS system when operating in the vicinity of the space research earth station. ITU Recommendation ITU-R M.1643, Part D.

## V. PROCEDURAL MATTERS

### A. Ex Parte Presentations

69. This proceeding shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's ex parte rules.<sup>167</sup> Persons making oral ex parte presentations are reminded that memoranda summarizing the presentations must contain summaries of the substance of the presentations and not merely a listing of the subjects discussed. More than a one or two sentence description of the views and arguments presented is generally required.<sup>168</sup> Other rules pertaining to oral and written presentations are set forth in Section 1.1206(b) of the Commission's rules as well.

### B. Initial Regulatory Flexibility Analysis

70. Pursuant to the Regulatory Flexibility Act (RFA),<sup>169</sup> the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and actions considered in this Notice. The text of the IRFA is set forth in Appendix B. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the Notice as provided in paragraph 73 below. The Commission will send a copy of the Notice, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.<sup>170</sup>

### C. Initial Paperwork Reduction Act of 1995 Analysis

71. *Paperwork Reduction Act.* This NPRM contains proposed new and modified information collection(s). The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget (OMB) to comment on the information collection(s) contained in this NPRM, as required by the Paperwork Reduction Act of 1995, Public Law No. 104-13. Public and agency comments are due 60 days from date of publication of the NPRM in the Federal Register. Comments should address: (a) whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimates; (c) ways to enhance the quality, utility, and clarity of the information collected; and (d) ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law No. 107-198, *see* 44 U.S.C. § 3506(c)(4), we seek specific comment on how we might "further reduce the information collection burden for small business concerns with fewer than 25 employees."

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<sup>167</sup> 47 C.F.R. §§ 1.1200, 1.1206; Amendment of 47 C.F.R. § 1.1200 et seq. Concerning Ex Parte Presentations in Commission Proceedings, GC Docket No. 95-21, *Report and Order*, 12 FCC Rcd 7348 (1997).

<sup>168</sup> 47 C.F.R. § 1.1206(b)(2).

<sup>169</sup> *See* 5 U.S.C. § 603. The RFA, *see* U.S.C. §601 et seq., has been amended by the Contract with America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

<sup>170</sup> 5 U.S.C. § 603(a).

72. A copy of any comments on the information collections contained herein should be submitted to Judy Boley Herman, Federal Communications Commission, Room 1-C804, 445 12th Street, SW, Washington, DC 20554, or via the Internet to [jbHerman@fcc.gov](mailto:jbHerman@fcc.gov) and to Kristy L. LaLonde, OMB Desk Officer, Room 10234 NEOB, 725 17th Street, N.W., Washington, DC 20503, via the Internet to [Kristy\\_L.LaLonde@omb.eop.gov](mailto:Kristy_L.LaLonde@omb.eop.gov), or via fax at 202-395-5167.

#### **D. Comment Filing Procedures**

73. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments in response to this Notice no later than on or before 75 days after Federal Register publication. Reply comments to these comments may be filed no later than on or before 105 days after Federal Register publication. All pleadings are to reference IB Docket No. 05-20. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. Parties are strongly encouraged to file electronically. See Electronic Filing of Documents in Rulemaking Proceedings, 63 Fed. Reg. 24,121 (1998).

74. Comments filed through the ECFS can be sent as an electronic file via the Internet to <http://www.fcc.gov/e-file/ecfs.html>. Parties should transmit one copy of their comments to the docket in the caption of this rulemaking. In completing the transmittal screen, commenters should include their full name, U.S. Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to [ecfs@fcc.gov](mailto:ecfs@fcc.gov) and should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

75. Parties choosing to file by paper must file an original and four copies of each filing in IB Docket No. 05-20. Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail (although we continue to experience delays in receiving U.S. Postal Service mail). If more than one docket or rulemaking number appears in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. The Commission's mail contractor, Vistrionix, Inc. will receive hand-delivered or messenger-delivered paper filings for the Commission's Secretary at 236 Massachusetts Avenue, N.E., Suite 110, Washington, D.C. 20002. The filing hours at this location are 8:00 a.m. to 7:00p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes 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 mail, Express Mail, and Priority Mail should be addressed to 445 12<sup>th</sup> Street, S.W., Washington, D.C. 20554. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

76. Comments submitted on diskette should be on a 3.5 inch diskette formatted in an IBM-compatible format using Word for Windows or compatible software. The diskette should be clearly labeled with the commenter's name, proceeding (including the docket number, in this case, IB Docket No. 05-20), type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy - Not an Original." Each diskette should contain only one party's pleadings, preferably in a single electronic file.

77. All parties must file one copy of each pleading electronically or by paper to each of the following: (1) The Commission's duplicating contractor, Best Copy and Printing, Inc., 445 12th Street, S.W., Room CY-B402, Washington, D.C. 20554, telephone (202) 488-5300, facsimile (202) 488-5563, or

via e-mail at [FCC@BCPIWEB.COM](mailto:FCC@BCPIWEB.COM). (2) Arthur Lechtman, Attorney, Satellite Division, International Bureau, 445 12<sup>th</sup> Street, S.W., Washington, D.C. 20554; e-mail [Arthur.Lechtman@fcc.gov](mailto:Arthur.Lechtman@fcc.gov).

78. Comments and reply comments and any other filed documents in this matter may be obtained from Best Copy and Printing, Inc., in person at 445 12th Street, S.W., Room CY-B402, Washington, D.C. 20554, via telephone at (202) 488-5300, via facsimile (202) 488-5563, or via e-mail at [FCC@BCPIWEB.COM](mailto:FCC@BCPIWEB.COM). The pleadings will be also available for public inspection and copying during regular business hours in the FCC Reference Information Center, Room CY-A257, 445 Twelfth Street, S.W., Washington, D.C. 20554 and through the Commission's Electronic Filing System (ECFS) accessible on the Commission's World Wide Website, [www.fcc.gov](http://www.fcc.gov).

79. Comments and reply comments must include a short and concise summary of the substantive arguments raised in the pleading. Comments and reply comments must also comply with Section 1.49 and all other applicable sections of the Commission's rules.<sup>171</sup> All parties are encouraged to utilize a table of contents, and to include the name of the filing party and the date of the filing on each page of their submission. We also strongly encourage that parties track the organization set forth in this Notice in order to facilitate our internal review process.

80. Commenters who file information that they believe is proprietary may request confidential treatment pursuant to Section 0.459 of the Commission's rules. Commenters should file both their original comments for which they request confidentiality and redacted comments, along with their request for confidential treatment. Commenters should not file proprietary information electronically. *See* Examination of Current Policy Concerning the Treatment of Confidential Information Submitted to the Commission, Report and Order, 13 FCC Rcd 24816 (1998), Order on Reconsideration, 14 FCC Rcd 20128 (1999). Even if the Commission grants confidential treatment, information that does not fall within a specific exemption pursuant to the Freedom of Information Act (FOIA) must be publicly disclosed pursuant to an appropriate request. *See* 47 C.F.R. § 0.461; 5 U.S.C. § 552. We note that the Commission may grant requests for confidential treatment either conditionally or unconditionally. As such, we note that the Commission has the discretion to release information on public interest grounds that does fall within the scope of a FOIA exemption.

#### **E. Further Information**

81. For further information regarding this proceeding, contact Arthur Lechtman, Attorney, Satellite Division, International Bureau at (202) 418-0719. Information regarding this proceeding and others may also be found on the Commission's website at [www.fcc.gov](http://www.fcc.gov).

#### **VI. ORDERING CLAUSES**

82. Accordingly, IT IS ORDERED that, pursuant to the authority contained in Sections 1, 4(i), 4(j), 7(a), 301, 303(c), 303(f), 303(g), 303(r), 303(y), and 308 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 151, 154(i), 154(j), 157(a), 301, 303(c), 303(f), 303(g), 303(r), 303(y), 308, this Notice of Proposed Rulemaking IS ADOPTED.

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<sup>171</sup> 47 C.F.R. § 1.49.

83. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center shall send a copy of this NOTICE OF PROPOSED RULEMAKING, including the 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. (1981).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

**APPENDIX A**

**Parties Filing Comments**  
(3 Commenters)

Name of Party

Aeronautical Radio Inc.  
The Boeing Company  
PanAmSat Corporation

**Parties Filing Reply Comments**  
(5 Reply Commenters)

Name of Party

The Boeing Company  
Intelsat LLC  
Loral Space & Communications Ltd.  
Rockwell Collins Inc.  
SES Americom, Inc.

**Parties Filing *Ex Parte* Comments**  
(1 *ex parte*)

SES Americom, Inc.



## APPENDIX B

## INITIAL REGULATORY FLEXIBILITY ANALYSIS

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>172</sup> 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 Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in the Frequency Bands Allocated to the Fixed Satellite Service, Notice of Proposed Rulemaking (Notice).<sup>173</sup> Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the Notice provided in paragraph 73 of the Notice. The Commission will send a copy of the Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).<sup>174</sup> In addition, the Notice and IRFA (or summaries thereof) will be published in the Federal Register.<sup>175</sup>

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

In this Notice the Commission makes proposals and seeks information on measures to provide a level of regulatory certainty to government, space research, radio astronomy, and fixed satellite service (FSS) operators regarding operations of the Aeronautical Mobile Satellite Service (AMSS). As discussed in greater detail below, the Commission proposes rules and procedures to license aeronautical earth stations (AES) for operation in the Ku-band similar to the Commission's current licensing rules for very small aperture terminals (VSATs) that operate in the Ku-band, with appropriate modifications. However, rather than propose rules requiring minimum earth station antenna sizes and power limits, the NPRM proposes an off-axis EIRP envelope that, if adopted, would give AES operators more flexibility over their operations. This off-axis EIRP envelope proposal would provide for a minimally intrusive licensing regime for AESs that would maximize the efficient use of the Ku-band spectrum, by allowing a new service to be provided in that band, while respecting the legitimate expectations of incumbent operators. Establishing a licensing regime for AMSS also facilitates provision of a new service in the Ku-band, which would also advance the Commission's continuing effort to provide licensees with greater authority to most efficiently use of the spectrum that they occupy.

It is the Commission's view that if adopted, the off-axis EIRP licensing methodology proposed in the Notice would benefit businesses both large and small by streamlining the process for obtaining authority from the Commission to provide AMSS service, which currently must be obtained on a case-by-case basis. The proposed procedures would provide license terms of fifteen years and would permit

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<sup>172</sup> 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).

<sup>173</sup> See Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in the Frequency Bands Allocated to the Fixed Satellite Service, IB Docket No. 05-20, Notice of Proposed Rulemaking (Notice).

<sup>174</sup> See 5 U.S.C. § 603(a).

<sup>175</sup> See 5 U.S.C. § 603(a).

parties to seek authorization using simplified procedures. The proposed procedures would also require AMSS operators to provide aircraft tracking information to the Commission upon request. This would benefit businesses large and small by providing businesses that might be affected by AMSS operations with a simple, clear mechanism with minimal administrative burden to resolve any possible claims of harmful interference resulting from those operations.

## **B. Legal Basis**

The Notice is adopted pursuant to Sections 1, 4(i), 4(j), 7(a), 301, 303(c), 303(f), 303(g), 303(r), 303(y), and 308 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 151, 154(i), 154(j), 157(a), 301, 303(c), 303(f), 303(g), 303(r), 303(y), 308.

## **C. Description and Estimate of the Number of Small entities to Which the Proposals 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 proposed rules, if adopted.<sup>176</sup> The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."<sup>177</sup> In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.<sup>178</sup> A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>179</sup> Below, we further describe and estimate the number of small entity licensees that may be affected by the adopted rules.

***Satellite Telecommunications.*** The SBA has developed a small business size standard for Satellite Telecommunications Carriers, which consists of all such companies having \$12.5 million or less in annual receipts.<sup>180</sup> According to Census Bureau data for 1997, there were 324 firms in the category Satellite Telecommunications, total that operated for the entire year.<sup>181</sup> Of this total, 273 firms had annual receipts of \$5 million to \$9,999,999 and an additional 24 firms had annual receipts of \$10 million to

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<sup>176</sup> 5 U.S.C. § 603(b)(3).

<sup>177</sup> *Id.* § 601(6).

<sup>178</sup> 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).

<sup>179</sup> Small Business Act, 15 U.S.C. § 632 (1996).

<sup>180</sup> 13 C.F.R. § 121.201, NAICS code 517410.

<sup>181</sup> U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, "Receipt Size of Firms Subject to Federal Income Tax: 1997," Table 4, NAICS code 517410 (issued Oct. 2000).

\$24,999,990.<sup>182</sup> Thus, under this size standard, the majority of firms can be considered small.

**Space Stations (Geostationary).** Commission records reveal that there are 15 space station licensees. We do not request nor collect annual revenue information, and thus are unable to estimate of the number of geostationary space stations that would constitute a small business under the SBA definition cited above, or apply any rules providing special consideration for Space Station (Geostationary) licensees that are small businesses.

**Fixed Satellite Transmit/Receive Earth Stations.** Currently there are approximately 3,390 operational fixed-satellite transmit/receive earth stations authorized for use in the C- and Ku-bands. 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.

**Cellular and Other Wireless Telecommunications.** The SBA has developed a small business size standard for Cellular and Other Wireless Telecommunication, which consists of all such firms having 1,500 or fewer employees.<sup>183</sup> According to Census Bureau data for 1997, in this category there was a total of 977 firms that operated for the entire year.<sup>184</sup> Of this total, 965 firms had employment of 999 or fewer employees, and an additional twelve firms had employment of 1,000 employees or more.<sup>185</sup> Thus, under this size standard, the majority of firms can be considered small.

**Paging.** The SBA has developed small business size standard for Paging, which consists of all such firms having 1,500 or fewer employees.<sup>186</sup> According to Census Bureau data for 1997, in this category there was a total of 1,320 firms that operated for the entire year.<sup>187</sup> Of this total, 1,303 firms had employment of 999 or fewer employees, and an additional seventeen firms had employment of 1,000 employees or more.<sup>188</sup> Thus, under this size standard, the majority of firms can be considered small.

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

The proposed rules would, if adopted, require satellite telecommunications operators to establish

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<sup>182</sup> U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, “Establishment and Firm Size (Including Legal Form of Organization),” Table 4, NAICS code 513340 (issued October 2000).

<sup>183</sup> 13 C.F.R. § 121.201, NAICS code 517212.

<sup>184</sup> U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, “Establishment and Firm Size (Including Legal Form of Organization),” Table 5, NAICS code 513322 (issued October 2000).

<sup>185</sup> *Id.* The census data do not provide a more precise estimate of the number of firms that have 1,500 or fewer employees; the largest category provided is “Firms with 1,000 employees or more.”

<sup>186</sup> 13 C.F.R. § 121.201, NAICS code 517211.

<sup>187</sup> U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, “Establishment and Firm Size (Including Legal Form of Organization),” Table 5, NAICS code 513321 (issued October 2000).

<sup>188</sup> *Id.* The census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is “Firms with 1,000 employees or more.”

a database for tracking the location of AES remote earth stations. This database would assist investigations of interference claims. The Notice seeks comment on this proposal, including the effectiveness and utility of the proposal, and seeks comment regarding possible alternatives. The proposed rules, if adopted, would also require AMSS operators to name a point of contact to maintain information about aircraft location and frequencies used by AESs. Such information would assist in investigating interference claims. The Commission does not expect significant costs associated with these proposals, if adopted. Therefore, we do not anticipate that the burden of compliance would be greater for smaller entities.

The Notice seeks comment on possible methods for coordinating AMSS operations with space research service and radio astronomy operations.

**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 or the rule, or any part thereof, for small entities.<sup>189</sup>

This Notice solicits comment on alternatives for more efficient processing of aircraft earth station (AES) applications and simplifying AMSS procedures, for example, by migrating from non-conforming use licensing to a licensing method that would provide for licenses with terms of fifteen years. The Notice also seeks comment on streamlining the application process for AMSS operations by permitting blanket licensing of multiple AES terminals in a single application, as an alternative to requiring all AESs to be licensed individually. Adoption of some of these proposals would simplify the application process for AESs and establish license terms consistent with other satellite-based services (such as Earth Stations on Vessels). Accordingly, the Commission believes that adoption of these proposed rules would benefit all AMSS applicants, including small entities, by significantly reducing the cost associated with obtaining and maintaining authority to operate an AMSS network.

As described above, the Commission also seeks comment on a number of alternative compliance and coordination processes. For example, the Commission seeks on whether to base the off-axis EIRP requirement on an aggregate limit or on a per-earth station limit. The Commission has taken care to consider the costs on business both large and small and has solicited comment on alternatives to its proposals.

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

None.

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<sup>189</sup> 5 U.S.C. § 603(c)(1)-(c)(4).

**APPENDIX C**

ITU Recommendation ITU-R M.1643

Rec. ITU-R M.1643

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## RECOMMENDATION ITU-R M.1643\*

**Technical and operational requirements for aircraft earth stations  
of aeronautical mobile-satellite service including those  
using fixed-satellite service network transponders in  
the band 14-14.5 GHz (Earth-to-space)**

(2003)

**Summary**

This Recommendation provides the technical and operational requirements for aircraft earth stations (AES) of aeronautical mobile-satellite service (AMSS), including those using FSS network transponders operating in the band 14-14.5 GHz (Earth-to-space), that should be used by administrations as a technical guideline for establishing conformance requirements for AES and facilitating their licensing, for worldwide use.

The ITU Radiocommunication Assembly,

*considering*

- a) that various technically and operationally different aeronautical mobile-satellite service (AMSS) networks have been designed to commence operation in the near future;
- b) that these planned AMSS networks may provide access to a variety of broadband communication applications (Internet, email, internal corporate networks) to and from aircraft on a global basis;
- c) that the aircraft earth station (AES) will operate on national and international airlines around the world;
- d) that circulation of AES is usually a subject of a number of national and international rules and regulations including satisfactory conformance to a mutually agreed technical standard and operational requirements;
- e) that there is a need for identifying the technical and operational requirements for the conformance testing of AES;

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\* NOTE – The Arab Group represented at RA-03 reserves its position on this Recommendation and is not ready to accept any repercussions with respect to WRC-03 Agenda item 1.11.

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f) that the identification of technical and operational requirements for AES would provide a common technical basis for facilitating conformance testing of AES by various national and international authorities and the development of mutual recognition arrangements for conformance of AES;

g) that the technical and operational requirements need to achieve an acceptable balance between radio equipment complexity and the need for effective use of the radio-frequency spectrum,

*considering also*

a) that in the frequency band 14-14.5 GHz there are allocations to the FSS (Earth-to-space), radionavigation, fixed and mobile (except aeronautical mobile) services on a primary basis; that secondary services allocated in the band 14-14.5 GHz or in parts of the band include mobile-satellite (except aeronautical mobile-satellite) service (Earth-to-space), space research service (SRS), radio astronomy service (RAS), and radionavigation-satellite service;

b) that there is a requirement to fully protect all primary services and pre-existing systems of secondary services in the band 14-14.5 GHz;

c) that results of the studies conducted in accordance with Resolution 216 (Rev.WRC-2000) showed the feasibility of using the band 14-14.5 GHz by AMSS (Earth-to-space) on a secondary basis under certain conditions and arrangements<sup>1</sup>;

d) that the identification by ITU-R of technical and operational requirements for AES operating in the band 14-14.5 GHz could assist administrations to prevent harmful and/or unacceptable interference to other services;

e) that technical and operational characteristics should be continuously and accurately measurable and controllable,

*recommends*

**1** that the technical and operational requirements<sup>1</sup> for aircraft earth stations of AMSS networks operating in the band 14-14.5 GHz given in Annexes 1 and 2 be used by administrations as a guideline for:

- establishing conformance requirements for AES;
- facilitating AES operations.

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<sup>1</sup> The characteristics of the typical aircraft earth stations need to fulfil the requirements described in this Recommendation and, further, need to be within the envelope of those initially published in the International Frequency Information Circular (BR IFIC) relating to the corresponding FSS network. In the case that the characteristics are outside of the envelope of those in the initial publication, the required coordination of such an aircraft earth station needs to be effected in accordance with the current provisions of the Radio Regulations (RR) and a modified Rule of Procedure as contained in § 2 of the Rules of Procedure relating to RR No. 11.32, as appropriate.

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**Annex 1****Technical and operational requirements for AES of AMSS networks in the band 14-14.5 GHz (Earth-to-space)****Part A****Essential requirements related to the protection of FSS networks**

**1** AMSS networks should be coordinated and operated in such a manner that the aggregate off-axis e.i.r.p. levels produced by all co-frequency AES within AMSS networks are no greater than the interference levels that have been published and coordinated for the specific and/or typical earth station(s) pertaining to FSS networks where FSS transponders are used.

**2** The design, coordination and operation of an AES should, at least, account for the following factors which could vary the aggregate off-axis e.i.r.p. levels generated by the AES:

**2.1** mispointing of AES antennas. Where applicable, this includes, at least, effects caused by bias and latency of their pointing systems, tracking error of closed loop tracking systems, misalignment between transmit and receive apertures for systems that use separate apertures, and misalignment between transmit and receive feeds for systems that use combined apertures;

**2.2** variations in the antenna pattern of AES. Where applicable, this includes, at least, effects caused by manufacturing tolerances, ageing of the antenna and environmental effects. AMSS networks using certain types of AES antennas, such as phased arrays, should account for variation in antenna pattern with scan angles (elevation and azimuth). Networks using phased arrays should also account for element phase error, amplitude error and failure rate;

**2.3** variations in the transmit e.i.r.p. from AES. Where applicable, this includes, at least, effects caused by measurement error, control error and latency for closed loop power control systems. Network control and monitoring centres (NCMCs) that calculate the e.i.r.p. of AES based on the received signal need to take into account error sources and latency in this calculation. NCMCs that calculate the e.i.r.p. of AES based on input power must account for measurement error and reporting latency.

**3** AES that use closed loop tracking of the satellite signal need to employ an algorithm that is resistant to capturing and tracking adjacent satellite signals. AES must immediately inhibit transmission when they detect that unintended satellite tracking has happened or is about to happen.

**4** AES should be subject to the monitoring and control by an NCMC or equivalent facility. AES must be able to receive at least "enable transmission" and "disable transmission" commands from the NCMC. AES must automatically cease transmissions immediately on receiving any



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“parameter change” command, which may cause harmful interference during the change, until it receives an “enable transmission” command from its NCMC. In addition, it should be possible for the NCMC to monitor the operation of an AES to determine if it is malfunctioning.

5 AES need also to be self-monitoring and, should a fault which can cause harmful interference to FSS networks be detected, the AES must automatically mute its transmissions.

**Part B****Essential requirements related to the protection of the fixed service**

In the 14-14.5 GHz frequency band as used by fixed service networks, within line-of-sight of the territory of an administration where fixed service networks are operating in this band, the maximum pfd produced at the surface of the Earth by emissions from a single AES, of an AMSS network should not exceed:

$$\begin{array}{lll} -132 + 0.5 \cdot \theta & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for } \theta \leq 40^\circ \\ -112 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for } 40 < \theta \leq 90^\circ \end{array}$$

where  $\theta$  is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

NOTE 1 – The aforementioned limits relate to the pfd and angles of arrival that would be obtained under free-space propagation conditions.

NOTE 2 – An e.i.r.p. mask can be derived from the aforementioned pfd mask by applying the method given in Annex 2 of this Recommendation. Simplification of the resulting e.i.r.p. mask could also be considered.

**Part C****Essential requirements related to sharing with the RAS**

In order to protect the radio astronomy in the band 14.47-14.5 GHz, AMSS earth stations should comply with both following measures:

*AMSS channels in the 14.47-14.5 GHz band*

- AMSS stations do not transmit in the 14.47-14.5 GHz band within line-of-sight of radio astronomy stations operating within this band;
- or,
- if an AMSS operator intends to operate co-frequency within the visibility of the radio astronomy station, a specific agreement with the radio astronomy station will be needed to ensure that AMSS AES will meet the requirements of Recommendations ITU-R RA.769 and ITU-R RA.1513 within the 14.47-14.5 GHz band during observations. Where practicable, this may include advance information to AMSS operators regarding observation schedules.

*AMSS channels in the 14-14.47 GHz band*

All AES transmitters on channels in the 14-14.47 GHz band within line-of-sight of radio astronomy stations during radio astronomy observations have emissions in the band 14.47-14.5 GHz such that they meet the levels and percentage of data loss given in

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Recommendations ITU-R RA.769 and ITU-R RA.1513. Results from studies show that the following AES pfd levels (dB(W/(m<sup>2</sup> · 150 kHz))) in the band 14.47-14.5 GHz are sufficient, with some margin, to meet the radio astronomy pfd levels in Recommendation ITU-R RA.769 and the percentage of data loss given in Recommendation ITU-R RA.1513, i.e.:

$$\begin{array}{lll} -190 + 0.5 \cdot \theta & \text{dB(W/(m}^2 \cdot 150 \text{ kHz))} & \text{for } \theta \leq 10^\circ \\ -185 & \text{dB(W/(m}^2 \cdot 150 \text{ kHz))} & \text{for } 10^\circ < \theta \leq 90^\circ \end{array}$$

where  $\theta$  is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

Such AES pfd levels in the band 14.47-14.5 GHz may be achieved by the AMSS operators through a combination of reduced AES signal power, sharp filtering, maintaining adequate frequency separation, or better AES antenna performance.

## Part D

### Essential requirements related to sharing with the space research service

Coordination agreements should be developed between AMSS and space research systems based on controlling the emissions levels of the AES in the frequency band used by the SRS systems, and, in severe cases, may require cessation of AES emissions on frequencies used by the SRS system when operating in the vicinity of the space research earth station. Specifics of the agreements will vary based on the characteristics of the individual SRS sites and the AMSS networks.

## Annex 2

### Derivation of a lower hemisphere e.i.r.p. mask from a pfd mask

In testing AMSS equipment to determine if it meets a given pfd mask, such as the one in Annex 1, Part B, it may be useful to determine an equivalent e.i.r.p. mask that can be used for testing purposes.

The pfd mask, pfd( $\theta$ ) where  $\theta$  is the angle of arrival (elevation angle) at the Earth's surface, can be used to mathematically determine an e.i.r.p. mask, e.i.r.p.( $\gamma, H$ ) where  $\gamma$  is the angle below the local horizontal plane and  $H$  is the altitude of the aircraft. This conversion proceeds in two steps. First,  $\gamma$  is converted to an equivalent angle of arrival,  $\theta$ . Then the length of the propagation path for angle of arrival  $\theta$  is determined and used to calculate the spreading loss for the path and the resulting e.i.r.p.

*Step 1:* Calculation of an angle of arrival in degrees,  $\theta$ , from  $\gamma$  and  $H$ :

$$\theta = \arccos((R_e + H) \cos(\gamma)/R_e)$$

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where:

- $\theta$ : angle of arrival
- $R_e$ : earth radius (6378 km)
- $H$ : altitude of the aircraft (km)
- $\gamma$ : angle below horizontal.

NOTE 1 – If the argument of the arccos function is greater than 1, the propagation path in the direction of the angle  $\gamma$  does not intersect the Earth. In this case, which occurs for values of  $\gamma$  of about  $3.5^\circ$  or less, a value for  $\theta$  does not exist and so there is no defined value for the pfd mask.

Step 2: Calculation of the e.i.r.p. value from the defined pfd( $\theta$ ):

$$d = (R_e^2 + (R_e + H)^2 - 2 R_e (R_e + H) \cos(\gamma - \theta))^{1/2}$$

$$\text{e.i.r.p.}(\gamma, H) = \text{pfd}(\theta) + 10 \log_{10}(4 \pi d^2) + 60$$

where:

- $d$ : distance between the AES and the considered point on the Earth's surface (km)
- pfd( $\theta$ ): (dB(W/(m<sup>2</sup> · MHz)))
- e.i.r.p.: (dB(W/MHz)).

The graph in Fig. 1 shows this function for various aircraft altitudes based on the pfd mask provided in Annex 1, Part B of this Recommendation.

FIGURE 1  
e.i.r.p. mask derived from pfd mask

