

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

In the Matter of)	
)	
Panasonic Avionics Corporation)	File Nos. SES-LIC-20100805-00992
)	SES-AMD-20100914-01163
Application for Authority to Operate Up to)	SES-AMD-20101115-01432
50 Technically Identical Aeronautical)	SES-AMD-20110325-00358
Mobile-Satellite Service Aircraft Earth)	SES-AFS-20110405-00402
Stations in the 14.0-14.4 GHz and)	SES-STA-20110104-00005
11.7-12.2 GHz Frequency Bands)	
)	Call Sign: E100089

ORDER AND AUTHORIZATION

Adopted: August 31, 2011

Released: August 31, 2011

By the Chief, International Bureau, and the Chief, Office of Engineering and Technology:

I. INTRODUCTION

1. With this Order, we grant blanket authority to Panasonic Avionics Corporation (Panasonic) for domestic operation of up to 50 technically identical transmit/receive aircraft earth stations in the Aeronautical Mobile Satellite Service (AMSS). The aircraft earth stations, which are installed in foreign-flagged commercial aircraft operated by Lufthansa, will communicate in U.S. airspace via leased transponders on Galaxy 17, a geostationary-orbit (GSO) satellite at the 91° W.L. orbital location. The aircraft earth stations transmit in the 14.0-14.4 GHz frequency band and receive downlink signals in the 11.7-12.2 GHz band. This authorization will allow Panasonic to provide two-way, in-flight broadband services, including Internet access, to passengers and flight crews aboard commercial airliners, thereby enhancing competition in an important sector of the mobile telecommunications market in the United States.¹

II. BACKGROUND

A. Ku-Band AMSS

2. In 2003, the World Radiocommunication Conference added a worldwide secondary Earth-to-space AMSS allocation in the 14.0-14.5 GHz band, and the International Telecommunication Union's Radiocommunication Sector adopted detailed recommendations for operation of AMSS aircraft terminals in that band.² The Commission accordingly amended the U.S. Table of Allocations to add a

¹ The Commission has previously granted similar blanket earth station licenses for a number of other AMSS systems. See n.6, *infra*.

² Rec. 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

secondary Earth-to-space AMSS allocation in the 14.0-14.5 GHz band.³ In a Notice of Proposed Rulemaking released in 2005, the Commission proposed to establish rules prescribing licensing procedures and operational requirements for Ku-Band AMSS.⁴ This rulemaking remains pending. Thus, at present there are no service-specific rules for licensing and operation of AMSS facilities in the 14.0-14.5 GHz band. Nor is there a domestic allocation for AMSS in the 11.7-12.2 GHz band. Nevertheless, the Commission has granted blanket authority for aircraft earth stations to operate in the 14.0-14.5 GHz uplink band on a secondary basis and the 11.7-12.2 GHz downlink band on a non-interference, unprotected basis for communication via leased transponders on Fixed Satellite Service (FSS)⁵ space stations, subject to any future rules that may be adopted in the Ku-Band AMSS proceeding.⁶

B. System Description

3. Panasonic requests authority to operate up to 50 “eXConnect” aircraft earth stations in U.S. airspace in the 11.7-12.2 GHz and 14.0-14.5 GHz bands.⁷ Panasonic’s “eXConnect” AMSS system has been operating in U.S. airspace in those frequency bands on a trial basis under an experimental license

(Earth-to-space) (2003).

³ *Amendment of Parts 2, 25, and 87 of the Commission’s Rules to Implement Decisions from the World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range, Amendment of Parts 2 and 25 of the Commission’s Rules to Allocate Spectrum For Government and Non-Government Use in the Radionavigation-Satellite Service*, ET Docket No. 02-305 and RM-10331, Report and Order, 18 FCC Rcd 23426, 23454, ¶ 76 (2003). The amendment deleted a proviso that had limited the scope of the Mobile Satellite Services (MSS) allocation in the band by specifically excluding AMSS. Stations operating pursuant to a secondary allocation may not cause harmful interference to or claim protection from primary-service stations. See 47 C.F.R. §§ 2.104(d), 2.105(c). Non-conforming services may be provided only on a non-harmful-interference basis to any authorized conforming service and may not claim interference protection from those services.

⁴ *Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 05-20, Notice of Proposed Rulemaking, 20 FCC Rcd 2906 (2005) (*Ku-Band AMSS NPRM*).

⁵ See 47 C.F.R. § 25.201 (definition of Fixed Satellite Service).

⁶ See *Row 44, Inc., Application for Blanket Authority to Operate up to 1,000 Technically Identical Aeronautical Mobile Satellite Service Transmit/Receive Earth Stations Aboard Commercial and Private Aircraft*, Order and Authorization, 24 FCC Rcd 10223 (Int’l Bur. and OET 2009) (*Row 44 AMSS Order*); *ViaSat Inc., Application for Blanket Authority for Operation of Up to 1,000 Technically Identical Ku-Band Aircraft Earth Stations in the United States and Over Territorial Waters*, Order and Authorization, 22 FCC Rcd 19964 (Int’l Bur. and OET 2007) (*ViaSat AMSS Order*); *ARINC Incorporated Application for Blanket Authority for Operation of up to One Thousand Technically Identical Ku-Band Transmit/Receive Airborne Mobile Stations Aboard Aircraft Operating in the United States and Adjacent Waters*, Order and Authorization, 20 FCC Rcd 7553 (Int’l Bur. and OET 2005) (*ARINC AMSS Order*); *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 (Int’l Bur. and OET, 2001) (*Boeing AMSS Order*);

⁷ Panasonic initially requested authority to operate 15 eXConnect aircraft earth stations in U.S. airspace but later filed an amendment to increase the number to 50. IBFS File No. SES-AMD-20110325-00358.

granted in January 2010.⁸ The eXConnect system is comprised of aircraft earth stations (AESs), leased satellite capacity on commercial FSS satellites, redundant network operations centers in California and Florida, and a licensed hub/gateway earth station in Holmdel, New Jersey.⁹ The hub/gateway is operated by another company, Maritime Telecommunications Network.¹⁰

4. Most of the equipment used in the eXConnect AESs was installed in Lufthansa aircraft by the Boeing Company and formerly operated in U.S. airspace under an AMSS license granted to Boeing.¹¹ Boeing eventually terminated the service and surrendered its blanket AES license.¹² Panasonic subsequently modified the Boeing-installed AESs by replacing their modems. The other components of Panasonic's eXConnect AESs – including the antennas, radomes, power amplifiers, up-converters, power supplies, and antenna controllers – are the same equipment that Boeing installed.¹³ Panasonic's application incorporates by reference information previously filed by Boeing for the gain pattern and pointing accuracy of the AES antennas.¹⁴

5. *Off-Axis Emissions.* Radio-frequency radiation emitted by an earth station's transmitting antenna in directions other than in the axis of its main lobe can interfere with reception of co-frequency signals by geostationary satellites in orbital positions near the earth station's target satellite. Such interference could also result from mispointing an earth station's transmitting antenna.¹⁵

6. According to Panasonic, potential interference caused by off-axis emissions from eXConnect AES terminals is limited by controlling antenna pointing error; selecting appropriate signal bandwidth and spreading factors; adjusting power to the antenna as a function of elevation and skew angles;¹⁶ and inhibiting transmission when those angles exceed specified thresholds.¹⁷ Panasonic

⁸ See Panasonic, Call Sign WD9XQT, ELS File Nos. 0339-EX-ST-2009 (2010). The experimental license authorizes operation of up to 10 aircraft earth stations in U.S. airspace at any given time.

⁹ Panasonic, Application for Blanket AES Operating Authority, IBFS No. SES-LIC-20100805-00992 (filed Aug. 5, 2010) (Panasonic Application), Technical Appendix at 1 and 5.

¹⁰ *Id.* at 5.

¹¹ See *Boeing AMSS Order*, 16 FCC Rcd 22645 (granting authority to operate up to 800 AESs with phased-array antennas); *Satellite Communications Services Information Re: Actions Taken*, Public Notice, Report No. SES-00553 (Int'l Bur., rel. Nov. 19, 2003) (public notice of grant of modification of Boeing's AMSS license to allow use of MELCO reflective antenna).

¹² Letter from Carlos M. Nalda, Counsel, The Boeing Company, to Marlene H. Dortch, Secretary, FCC (dated Sept. 14, 2006) (filed in IBFS No. SES-LIC-20000828-01578).

¹³ Response to Petition of Row 44, Inc. filed Nov. 15, 2010 (Reply of Panasonic), at 7.

¹⁴ Panasonic Application, Narrative at 7; Reply to "Consolidated Reply" of Row 44, Inc., filed Dec. 13, 2010 (Panasonic Further Reply), at 8-9 (identifying relevant portions of Boeing's 2003 application for license modification).

¹⁵ The antenna is a mechanically-steered cassegrain antenna with tracking rates of 40 deg/sec in azimuth and 25 deg/sec in elevation. The antenna controller uses aircraft attitude data, location data, and satellite coordinates to continuously generate steering commands for antenna elevation, azimuth, and polarization. A local inertial sensor on the antenna base plate compensates for possible aircraft inertial navigation system errors caused by airframe deformation and data latency.

¹⁶ The skew angle is the angle between the long axis of a parabolic-reflector AES antenna with an elliptical aperture

asserts that eXConnect AES antenna 1-sigma pointing error will be less than 0.25 degree¹⁸ and that the controller will terminate AES transmission within 100 milliseconds if pointing error ever exceeds 0.5 degrees.

7. *Coordination with Satellite Operators.* Panasonic proposes to operate the AESs to communicate via Intelsat's Galaxy 17 satellite, which is at the 91° W.L. orbital location.¹⁹ Aside from other satellites operated by Intelsat, SES Americom's AMC-3 satellite at 87° W.L. is the only other satellite within six degrees of Galaxy 17 that receives signals in the 14.0-14.5 GHz band from earth stations in North America. Panasonic certifies that the proposed eXConnect AES operation has been coordinated with operators of all Ku-band FSS satellites within ±6 degrees of Galaxy 17.²⁰ Panasonic also certifies that eXConnect operations will conform to any future coordination agreements with operators of future satellites adjacent to Galaxy 17, and Panasonic has submitted a statement from an Intelsat representative certifying that Intelsat will include the technical parameters of the eXConnect system in future coordinations for as long as Panasonic has authority from the Commission to communicate via Galaxy 17.²¹ Panasonic has also submitted a coordination letter endorsed by a representative of SES Americom in which Panasonic promised to terminate AES transmission immediately upon receiving notice from an affected party that the AES operation is causing unacceptable interference.²² Further, Panasonic submitted a signed statement from another representative of SES Americom certifying that (1) SES Americom has received "detailed technical information regarding Panasonic's eXConnect ... system"; (2) SES Americom is aware that Panasonic

and the geometric plane defined by: i) a line-of-sight from the antenna to the target satellite and ii) a line tangent to the geostationary-orbit arc at the target satellite's position, which is perpendicular to the line of sight. AES skew angle would be zero when the aircraft bearing an AES is in level flight and the target satellite's orbital location is due south of the aircraft's geographic location. The skew angle would increase as a direct function of any displacement of the target satellite to eastward or westward of a due-south bearing and would also vary as a function of aircraft attitude. Because a cross-section of the antenna beam would be elliptical, the short axis of the elliptical beam being parallel to the long axis of the antenna, off-axis radiation toward adjacent satellites will increase with increasing AES skew angle if the reflector and feed horn are rigidly attached to each other and are steerable in only azimuth and elevation.

¹⁷ Panasonic Application, Technical Appendix at 11.

¹⁸ One-sigma is a statistical term that means one standard deviation from a baseline value. Panasonic's representation that 1-sigma pointing error will be less than 0.25 degree means that the error will be 0.25° or less 68.2% of the time and 0.5° or less 95.2 % of the time.

¹⁹ eXConnect AESs also communicate via another Ku-band satellite with (partial) U.S. coverage: Telstar 14 (call sign S2474), also known as Estrela do Sul, a Ku-band satellite at 63° W.L. operated by Telesat Canada. eXConnect AESs will not communicate with Telstar 14 from within U.S. airspace, however. See Letter from Carlos M. Nalda, Counsel, Panasonic, to Marlene H. Dortch, Secretary, FCC (dated March 30, 2011); SES-AFS-2011040405-00402.

²⁰ Panasonic Application, Technical Appendix at 12. Panasonic asserts that the coordinated characteristics include AES off-axis EIRP spectral density, downlink power spectral density, and AES pointing error.

²¹ Panasonic Application, Narrative Attachment at 8; Letter from Jose Albuquerque, Senior Director for Spectrum Engineering, Intelsat (dated Aug. 2, 2010) (filed in Attachment B to the Technical Appendix of the Panasonic Application).

²² Letter dated Dec. 16, 2009 from Jose Albuquerque, Senior Director for Spectrum Engineering, Intelsat, with endorsement by Krish Jonnalagadda, Manager, Spectrum Development, SES Americom (included in Attachment B to the Technical Appendix of the Panasonic Application).

has been flight testing the system since January 2010 under an experimental license; and (3) SES Americom has no objection to grant of Panasonic's application.²³ In a supplemental statement, an SES Americom representative certifies that SES Americom is aware that Panasonic has amended its application to increase the proposed number of eXConnect AESs that may operate in U.S. airspace at a given time from fifteen to fifty and that SES Americom has no objection to grant of the application as thus amended.²⁴

C. Procedural History

8. Panasonic's application was placed on public notice as accepted for filing on September 15, 2010.²⁵ On October 15, 2010, Row 44, Inc. (Row 44), the operator of another Ku-band AMSS system, filed a petition asking us to dismiss or deny the application unless Panasonic filed additional information.²⁶ Panasonic filed an opposition with supplemental information; Row 44 filed a reply; and Panasonic filed a response to the reply.²⁷

9. On January 4, 2011, Panasonic filed a request for Special Temporary Authority (STA) to commercially operate up to 10 eXConnect AESs in U.S. airspace commencing on February 1, 2011.²⁸

²³ Statement of Satellite Operators signed by Jose Albuquerque and Suzanne Malloy, Executive Director, International & Regulatory Affairs, SES Americom (filed in Reply of Panasonic, Attachment B).

²⁴ See Letter from Carlos M. Nalda and Joshua T. Guyan, Counsel, Panasonic, to Marlene Dortch, Secretary, FCC (dated June 6, 2011), with attached letter from Krish Jonnalagadda.

²⁵ *Satellite Communications Services Information Re: Satellite Radio Applications Accepted for Filing*, Public Notice, Report No. SES-01277 (Int'l Bur., rel. Sept. 15, 2010). Panasonic has since amended the application in several respects. See Panasonic Avionics Corporation, IBFS File No. SES-AMD-20100914-01163 (filed Sept. 14, 2010) (providing supplemental data on off-axis radiation); Panasonic Avionics Corporation, IBFS File No. SES-AMD-20101115-01432 (filed Nov. 15, 2010) (reducing maximum carrier EIRP specification and providing antenna gain plots, revised link budgets, supplemental statements pertaining to coordination with operators of adjacent satellites, and a radiation-hazard analysis); Panasonic Avionics Corporation Minor Amendment to Application for Blanket AES Operating Authority; File No. SES-LIC-20100805-00992, Call Sign E1000890, IBFS File No. SES-AMD-20110325-00358 (filed Mar. 25, 2011), *Minor Amendment to Application for Blanket AES Operating Authority*, Public Notice, Report No. SES-01335 (Int'l Bur., rel. Apr. 6, 2011) (increasing number of authorized terminals in U.S. airspace from 15 to 50); and Panasonic Avionics Corporation, IBFS File No. SES-AFS-20110405-00402 (filed Apr. 5, 2011) (deleting Telstar-14 as a point of communication).

²⁶ Petition of Row 44, Inc., filed Oct. 15, 2010 (Row 44 Petition).

²⁷ Response to Petition of Row 44 Inc., filed Nov. 15, 2010 (Reply of Panasonic); Consolidated Reply of Row 44, Inc. to Panasonic Avionics' Response and Panasonic Avionics' November 15 Amendment, filed Dec. 1, 2010 (Row 44 Reply); Reply to "Consolidated Reply" of Row 44, Inc., filed Dec. 13, 2010 (Further Reply of Panasonic). Panasonic argues that the Row 44 Reply was late-filed without good cause and therefore urges us to disregard that pleading. Letters from Carlos M. Nalda, Counsel, Panasonic, to Marlene H. Dortch, Secretary, FCC (dated Nov. 22, and Dec. 7, 2010). We do not find it necessary to rule on the timeliness of the Row 44 Reply, as any delay was non-prejudicial.

²⁸ Panasonic Avionics Corporation, Request of Panasonic Avionics Corporation for Special Temporary Authorization to Operate Up to 10 Technically Identical Aeronautical Mobile-Satellite Service ("AMSS") Aircraft Earth Stations ("AESs") in the 14.0-14.4 GHz and 11.7-12.2 GHz Frequency Bands, IBFS File No. SES-STA-20110104-00005 (filed Jan. 4, 2011).

Panasonic stated that it believed, based on consultation with staff of the Commission's Office of Engineering and Technology, that its experimental license permitted such operation but that it was requesting the STA "out of an abundance of caution" to support introduction of commercial eXConnect service pending action on the blanket application. Because we grant a regular license for the AESs in this order, we dismiss this STA request as moot.

III. DISCUSSION

A. Operation in the 11.7-12.2 GHz Downlink Band

10. The 11.7-12.2 GHz band is domestically allocated on a primary basis for FSS downlink operations and on a secondary basis for operations of grandfathered terrestrial radio stations.²⁹ The Commission has proposed to add an allocation for AMSS downlinks in the 11.7-12.2 GHz band,³⁰ but there is no such allocation at the present time. Hence, Panasonic requests a waiver of the Table of Frequency Allocations to permit eXConnect AESs to receive downlinks in the 11.7-12.2 GHz band on a non-interference, unprotected basis, in compliance with coordination agreements between Intelsat and operators of satellites in the vicinity of Galaxy 17.³¹ Intelsat has certified that the EIRP density of downlink signals from Galaxy 17 to eXConnect AESs will not exceed 13 dBW/4kHz, which is within the satellite's routine operating envelope for FSS downlinks.³² SES Americom has expressly consented to Panasonic's proposed downlink operations.³³

11. The Commission has previously granted waivers of the Table of Frequency Allocations to Boeing, ARINC, ViaSat, and Row 44 to allow them to use the 11.7-12.2 GHz band for AMSS downlink transmissions from existing FSS satellites. The Commission has granted these waivers based upon either a showing that the proposed AMSS downlink transmissions will not exceed the 10 dBW/4kHz limit for routine processing in Section 25.134(g)(2) of the Commission's rules or proof that adjacent satellite operators have consented to the operations.³⁴ Consistent with these precedents, we grant Panasonic a waiver to use the 11.7-12.2 GHz band for AMSS downlinks on a non-interference, non-protected basis. That is, Panasonic's downlink operations may not cause harmful interference to any authorized service and may not claim interference protection from such services.

²⁹ 47 C.F.R. § 2.106, Footnote NG184.

³⁰ *Ku-Band AMSS NPRM*, 20 FCC Rcd at 2915-16, ¶ 15

³¹ Panasonic Application, Narrative Attachment at 9.

³² Letter from Jose Albuquerque, Senior Director for Spectrum Engineering, Intelsat (dated Dec. 16, 2009) (included in Panasonic AMSS Application, Technical Appendix, Attachment B).

³³ See Panasonic Reply at Attachment B.

³⁴ *Boeing AMSS Order*, 16 FCC Rcd at 5867 ¶ 10 (granting blanket license conditioned on submission of proof that operators of adjacent satellites had no objection to proposed operation with peak downlink EIRP density in excess of the 10 dBW/4KHz routine licensing limit); *ARINC AMSS Order*, 20 FCC Rcd at 7571 ¶ 54; *ViaSat AMSS Order*, 22 FCC Rcd at 19972 ¶ 26; *Row 44 AMSS Order* at ¶ 33.

B. Operation in the 14.0-14.5 GHz Uplink Band

12. The 14.0-14.5 GHz band is allocated on a secondary basis for non-Federal-government MSS Earth-to-space transmission.³⁵ Operators of radio stations licensed on a secondary basis must protect or coordinate with previously-authorized systems operating on a secondary basis and all systems authorized on a primary basis.³⁶ Other services that operate, or could operate, in the 14.0-14.5 GHz uplink band include: (1) primary-status GSO FSS systems; (2) primary-status non-geostationary-orbit (NGSO) FSS networks; (3) space research stations operating in the 14.0-14.2 GHz band on a secondary basis; (4) government-operated terrestrial fixed and mobile stations operating on a secondary basis in the 14.4-14.5 GHz segment; (5) grandfathered non-governmental land mobile stations licensed on a secondary basis in the 14.2-14.4 GHz segment; and (6) radio astronomy stations receiving in the 14.47-14.5 GHz segment. We discuss each of these below.

1. Protection of GSO FSS Satellites

13. To minimize the risk of interference with GSO FSS satellite operation, the Commission has adopted rules that require license applicants for FSS earth stations with nonconforming gain patterns,³⁷ Earth Stations on Vessels (ESVs), and Vehicle-Mounted Earth Stations (VMESs) to either demonstrate that the spectral density of off-axis emissions will not exceed certain levels or, alternatively, submit proof that the proposed earth stations' operating parameters are permissible under the terms of coordination agreements with operators of geostationary satellites within six degrees of the target satellites.³⁸ Panasonic asserts that off-axis EIRP spectral density generated by an eXConnect AES terminal will not exceed the following levels in the geostationary-orbit plane, where Θ is the angle in degrees from a line from the antenna's focal point to the target satellite:

15–25log10(Θ) dBW/4 kHz for $1.5^\circ \leq \Theta \leq 7^\circ$

–6 dBW/4 kHz For $7^\circ < \Theta \leq 9.2^\circ$

18–25log10(Θ) dBW/4 kHz for $9.2^\circ < \Theta \leq 48^\circ$

–24 dBW/4 kHz For $48^\circ < \Theta \leq 85^\circ$

–14 dBW/4 kHz For $85^\circ < \Theta \leq 180^\circ$

As Panasonic notes, these emission limits are consistent with the limits on off-axis emissions in the geostationary-orbit plane that nonconforming FSS, ESV, and VMES earth stations transmitting with time-division multiple access (TDMA) in the conventional Ku-band must meet to qualify for licensing without proof of adjacent-satellite coordination.³⁹

³⁵ See 47 C.F.R. § 2.106.

³⁶ See 47 C.F.R. § 2.105(b)(2).

³⁷ See 47 C.F.R. § 25.209(a) and (b), which define an off-axis antenna gain envelope.

³⁸ See 47 C.F.R. §§ 25.218, 25.220(b)(1)(ii), 25.222(b)(2)(ii), 25.226(b)(2)(ii). The Commission has proposed, or invited comment on, adoption of similar requirements for Ku-band AESs using an access protocol (such as TDMA) that precludes simultaneous co-frequency operation of multiple terminals. See *Ku-Band AMSS NPRM* at ¶¶ 36 and 40.

³⁹ See 47 C.F.R. §§ 25.218(f)(1), 25.222(a)(1)(A), and 25.226(a)(1)(i)(A).

14. Further, Panasonic has submitted evidence that its system has been coordinated with the operators of potentially affected GSO satellites.⁴⁰ Therefore, Panasonic contends that the circumstances here are analogous to those considered in the International Bureau's decision to grant a blanket license for Ku-band AES operation to Row 44 based on a similar coordination showing.⁴¹

15. Panasonic also contends that the Commission's grant of a license for the now-defunct Boeing AMSS system supports its request for authorization of the eXConnect system. Panasonic maintains that the antenna and mechanical components of its eXConnect AESs are the same as those that Boeing deployed and asserts that the AES antenna's operating characteristics – gain pattern, pointing accuracy, pointing methodology, and automatic shut-down capability – are no different than they were when Boeing installed the antennas in the same aircraft for Boeing's own system.⁴² Panasonic further maintains that its eXConnect AESs have less interference potential than Boeing's AESs, for two reasons: 1) eXConnect AESs generate slightly lower peak EIRP spectral density than Boeing's AESs; and 2) Boeing used a contention protocol that allowed more than one AES to transmit simultaneously in the same bandwidth, whereas the eXConnect system uses a TDMA protocol that does not permit such simultaneous co-frequency operation.⁴³

16. Row 44 contends that the allegedly interference-free operation of the Boeing AMSS system is not relevant. Row 44 asserts that Panasonic uses different modulation techniques, a different multiple-access technique, different signal bandwidths, different frequency spreading factors, and a different type of modem than Boeing. Row 44 also asserts that Panasonic AESs must operate over a wider range of skew angles than Boeing's AESs⁴⁴ and that the off-axis emission data that Panasonic submitted for skew angles greater than zero appear to be based on calculation rather than actual measurement.⁴⁵ Hence, Row 44 contends that Panasonic should be required to submit measured EIRP spectral density patterns for both orthogonal senses of polarization and all skew angles from -34 to +34 degrees.⁴⁶ Further, Row 44 contends that Panasonic should provide data based on recent measurement, as the antennas may operate outside their original specifications due to wear and/or corrosion of

⁴⁰ See ¶ 8, *supra*.

⁴¹ See Row 44 AMSS Order.

⁴² Panasonic Further Reply at 3-4.

⁴³ Panasonic Application, Narrative at 14.

⁴⁴ Row 44 Reply at 5-7. Panasonic replies that its antenna-pointing method is exactly the same as Boeing's and is unaffected by the use of a different modem and denies that there is any significant difference in the maximum skew angles at which its AESs will operate, as compared with Boeing's. Panasonic Further Reply at 10-11.

⁴⁵ Row 44 Reply at 11.

⁴⁶ *Id.* at 9. Panasonic replies that all of its off-axis radiation data is based on measured gain patterns and that ongoing operational data will enable it to detect and compensate for any change in antenna performance over time. Panasonic also asserts that no AMSS applicant has ever provided radiation patterns for the entire range of possible skew angles and that to require it to provide such information would be unfair and needlessly burdensome. Further Panasonic Reply at 16-17. Panasonic specified a "skew angle threshold" of 34°. Panasonic Application, Technical Appendix at 11. We construe this to mean that AES transmission automatically shuts down when the skew angle exceeds 34°.

mechanical components.⁴⁷

17. Row 44 maintains, moreover, that Panasonic's "0.25° one-sigma" specification means that maximum pointing error would be approximately 0.75° and contends that Panasonic should have provided data on off-axis emission levels with this amount of mispoint.⁴⁸ Row 44 also argues that Panasonic has failed to explain how eXConnect AESs can automatically cut off transmission within 100 milliseconds when the pointing error exceeds 0.5° or can automatically cease transmission within 100 milliseconds when the specified off-axis radiation limits are exceeded.⁴⁹ Row 44 further maintains that there is a discrepancy between a "noise bandwidth" specification in Panasonic's link budget and signal bandwidth specifications in Schedule B and that an amended EIRP limit is not reflected in the link budget or in Panasonic's EIRP spectral density specifications.⁵⁰ Further, Row 44 contends that if, as Panasonic has stated, transmit power rolls off at the edges of the carrier bandwidth, Panasonic should provide actual measurements of the transmit signal bandwidth.⁵¹ Finally, Row 44 contends that Panasonic failed to provide a complete description of the geographic area in which eXConnect AESs would operate.⁵²

18. Row 44's arguments here focus on the potential for adjacent satellite interference. Panasonic has resolved all concerns regarding such potential interference by successfully coordinating its proposed operations with potentially affected satellite operators. Consequently, we need not further address Row 44's technical arguments. This holding is consistent with our disposition of Row 44's own application for a blanket license for Ku-band aircraft earth stations. In that case, ViaSat, a previously-licensed AMSS provider, raised various interference issues with respect to Row 44's application.⁵³ We granted Row 44's application without addressing ViaSat's technical arguments on the merits, relying, instead, on proof that the operators of all Ku-band satellites within six degrees of the target satellites

⁴⁷ Row 44 Reply at 10 and 17.

⁴⁸ *Id.* at 13-14.

⁴⁹ *Id.* at 14-15. Panasonic replies that its AESs track the difference in antenna pointing relative to the aircraft inertial navigation system and local rate gyros and generate a shut-off command when pointing offset exceeds 0.5° and that the 0.25° 1-sigma specification only applies to periods of high-rate maneuvers that rarely occur in the flight profiles of wide-body aircraft. Further Panasonic Reply at 19-20. Furthermore, Panasonic asserts that the operators of its target satellite and adjacent satellites were made well aware of the antenna's pointing accuracy and off-axis emission levels in the course of coordination. Further Panasonic Reply at 19.

⁵⁰ Row 44 Reply at 15-16.

⁵¹ *Id.* Panasonic replies that the noise bandwidth mentioned in the link budget corresponds to the signal symbol rate, whereas the carrier bandwidth specifications in Schedule B pertain to necessary bandwidth; that its EIRP spectral density specifications are accurate; and that there is no need to measure signal bandwidth. Further Panasonic Reply at 21-22. Necessary bandwidth is defined in 47 C.F.R. § 2.202(b).

⁵² Row 44 Reply at 17. Panasonic replies that eXConnect operation in U.S. airspace will be restricted to areas where AES skew angle with respect to the target satellite does not exceed 34°. Further Panasonic Reply at 23.

⁵³ See *Row 44 AMSS Order* at ¶19. Among other things, ViaSat argued that Row 44 had failed to account for the effect of aircraft banking on antenna misorientation or shown that its AESs could mute transmission within 100 milliseconds when pointing error exceeded 0.5°. Viasat also maintained that Row 44 AESs would generate off-axis EIRP density in excess of the limits for routinely-processed FSS earth stations even if pointing error were limited to 0.2°.

had consented to grant of the application. In doing so, we noted that Section 25.220 of the Commission's rules permits grant of Ku-band FSS earth station applications based on coordination with potentially affected satellite operators, even if the applications do not qualify for routine processing based on compliance with off-axis radiation limits.⁵⁴ In the *Row 44 AMSS Order*, we rejected an argument that we should place less weight on coordination when considering applications for AMSS earth stations than when considering applications for FSS earth stations. We held, moreover, that denying Row 44's application on the premise that adjacent satellite operators may be unable to assess the risk of potential interference to their own systems would be inconsistent with the reasoning underlying the Commission's adoption of the coordination-based licensing rule in Section 25.220⁵⁵ and with the Commission's general preference for licensing procedures that do not unreasonably interfere with business negotiations and market mechanisms.⁵⁶ We concluded that potentially-affected satellite operators should be presumed capable of assessing the potential interference impact of proposed Ku-band AMSS operation.⁵⁷

19. We agree with Panasonic that the Row 44 decision supports an analogous result in this case. Panasonic has produced direct, undisputed evidence that the operator of the only conventional Ku-band satellite within six degrees of the target Intelsat satellite (aside from other satellites operated by Intelsat) explicitly consents to grant of the application subject to the technical limits and conditions proposed therein. To protect future satellite operators, we are conditioning the authorization to require Panasonic to terminate eXConnect operation in U.S. airspace in the event a new co-frequency satellite commences operation at an orbital location within six degrees of the target satellite(s), unless eXConnect operation is pre-coordinated with the new satellite's operator or Panasonic demonstrates that it will not cause interference to the new satellite system. As we did in the Row 44 AMSS authorization, we also require Panasonic to record AES transmission parameters at intervals of two minutes or less and make the data available upon request from the Commission or satellite-system operators. This will facilitate identification of the source of any interference that may result from eXConnect operation in the United States.

⁵⁴ *Id.* at ¶ 18; *see also* 47 C.F.R. § 25.220(b)(2) and (d)(1). *Cf.* 47 C.F.R. § 25.222(a)(2) and (b)(2) (similar coordination-based licensing rules for Ku-band Earth Stations on Vessels); § 25.226(a)(2) and (b)(2) (similar coordination-based licensing rules for Ku-band Vehicle-Mounted Earth Stations).

⁵⁵ *Row 44 AMSS Order* at ¶ 24, citing *2000 Biennial Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum by, Satellite Network Earth Stations and Space Stations, Amendment of Part 25 of the Commission's Rules and Regulations to Reduce Alien Carrier Interference Between Fixed-Satellites at Reduced Orbital Spacings and to Revise Application Procedures for Satellite Communication Services*, Fifth Report and Order, IB Docket No. 00-248 and CC Docket No. 86-496, 20 FCC Rcd 5666, 5688 ¶ 51 (2005) (“Satellite operators are aware of the link budgets and other operating parameters of their satellite systems and are capable of determining whether a given non-routine earth station operating at a given power level can be accommodated within those link budgets, transponder plans, or business plans. In the coordination process, satellite operators use refined analysis to determine whether earth station operations can be accommodated Satellite operators do not need the Commission to adopt standards for non-routine earth station operations to make that determination.”)

⁵⁶ *Row 44 AMSS Order* at ¶ 23, citing *Amendment of the Commission's Space Station Licensing Rules and Policies, Mitigation of Orbital Debris*, First Report and Order and Further Notice of Proposed Rulemaking, IB Docket Nos. 02-34 and 02-54, 18 FCC Rcd 10760, 10766-67 ¶ 7 (2003).

⁵⁷ *Row 44 AMSS Order* at ¶ 24.

2. Protection of NGSO FSS Uplink Reception

20. In 2001, the Commission adopted rules to permit NGSO FSS systems to operate in the 14.0-14.5 GHz uplink band on a primary basis.⁵⁸ Panasonic, as the operator of a secondary-status AMSS system in that band, must protect any authorized Ku-band NGSO FSS operations from interference from its AMSS system. At present, there are no U.S.-authorized Ku-band NGSO FSS systems and no applications are pending for such systems. If the Commission were to authorize a Ku-band NGSO FSS system in the future, Panasonic would have to cease U.S. eXConnect operation when the NGSO FSS system commences operation, unless Panasonic either demonstrates that it will not cause interference to the NGSO FSS system or reaches a coordination agreement with the system's licensed operator.

3. Protection of Space Research Operation

21. The 14.0-14.2 GHz band is domestically allocated for secondary-status Federal earth-station operation in the Space Research Service (SRS).⁵⁹ NASA operates SRS Tracking and Data Relay Satellite System (TDRSS) earth stations in the 14.0-14.05 GHz segment of that band. Panasonic has signed a coordination agreement with NASA for protection of current and future TDRSS sites from interference that might otherwise result from eXConnect operation.⁶⁰ Under the agreement, Panasonic must specify a 24/7 point of contact to resolve interference issues and to terminate transmissions from any AES that would exceed defined interference thresholds when in line of sight of a TDRSS earth station. We condition the authority granted in this Order upon Panasonic complying with the requirements of this coordination agreement.

4. Protection of Terrestrial Radio Systems

22. The U.S. Table of Allocations formerly included an allocation for non-government terrestrial mobile radio services in the 14.2-14.4 GHz band. Footnote NG184 to the U.S. Table of Allocations provides that land mobile stations licensed for operation in that band prior to March 1, 2005 may continue operating on a secondary basis until their licenses expire. Our records indicate that all but one of the licenses for such grandfathered stations have expired and that the remaining license will expire on July 23, 2012. It is unlikely that uplink transmission from eXConnect aircraft terminals will interfere with operation of the single remaining land mobile station. If such interference occurs, however, Panasonic's 24/7 point of contact can quickly terminate the interfering operation.

23. The 14.4-14.5 GHz segment of the Ku Band is allocated domestically on a secondary basis

⁵⁸ 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; Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band by Direct Broadcast Satellite Licensees and Their Affiliates; and Applications of Broadwave USA, PDC Broadband Corporation, and Satellite Receivers, Ltd. to Provide A Fixed Service in the 12.2-12.7 GHz Band*, First Report and Order and Further Notice of Proposed Rule Making, ET Docket No. 98-206, RM-9147, RM-9245, 16 FCC Rcd 4096 (2000).

⁵⁹ 47 C.F.R. § 2.106.

⁶⁰ Letter from Carlos M. Nalda and Joshua T. Guyan, Counsel, Panasonic, to Marlene Dortch, Secretary, FCC (dated Feb. 1, 2011).

for Federal fixed and mobile radio services.⁶¹ We have coordinated Panasonic's application with the National Telecommunications and Information Administration (NTIA), which administers authorizations for Federal radio stations. NTIA has informed the Commission that it has no objection to Panasonic's proposed AMSS operation. Moreover, Panasonic states that it will keep power flux density from its AMSS operation within the limits recommended in ITU-R M.1643 at any location where protection of secondary fixed stations is required.⁶²

5. Protection of Radio Astronomy

24. The National Science Foundation (NSF), a Federal agency, supports radio-astronomy observation in the 14.47-14.5 GHz band at National Radio Astronomy Observatories in New Mexico, West Virginia, and Puerto Rico. Footnote US203 to the U.S. Table of Allocations recognizes the use of this band for radio-astronomy observation at those sites.⁶³ The NSF also supports radio-astronomy observation in the 14.47-14.5 GHz band at various other sites in the continental United States, Hawaii, and the U.S. Virgin Islands. ITU Recommendation ITU-R M.1643 states that aircraft earth stations should cease transmission in the 14.47-14.5 GHz band and meet PFD limits in the 14.0-14.47 GHz band when within line of sight of radio astronomy stations observing in the 14.47-14.5 GHz band.⁶⁴ Although Panasonic is not proposing to operate in the 14.47-14.5 GHz band, it has signed a coordination agreement with NSF that requires aggregate PFD from eXConnect AESs to be limited to -221 dBW/m²/Hz at the National Radio Astronomy Observatories and -189 dBW/m²/Hz at other specified radio astronomy sites in the United States.⁶⁵ We condition its authorization accordingly.

IV. CONCLUSION

25. We find, pursuant to Section 309 of the Communications Act, 47 U.S.C. § 309, that grant of Panasonic's blanket license application for AMSS operation, as conditioned herein, will serve the public interest, convenience, and necessity.

V. ORDERING CLAUSES

26. Accordingly, IT IS ORDERED that the subject application, File No. SES-LIC-20100805-00992, as amended by SES-AMD-20100914-01163, SES-AMD-20101115-01432, SES-AMD-20110325-00358, and SES-AFS-20110405-00402, IS GRANTED to the extent indicated herein, and Panasonic Avionics Corporation IS AUTHORIZED to operate up to 50 technically identical transmit/receive mobile earth stations aboard aircraft in the continental United States and over its

⁶¹ 47 C.F.R. § 2.106.

⁶² Panasonic Application, Narrative at 17. ITU-R M.1643 recommends imposition of certain power flux density (PFD) limits on emissions from aircraft earth stations in the 14.0-14.5 GHz band when they are within line of sight of any area where fixed terrestrial networks are in operation.

⁶³ 47 C.F.R. § 2.106, Footnote US203.

⁶⁴ Rec. ITU-R M.1643, Annex 1, Part B.

⁶⁵ Panasonic Application, Technical Appendix at Attachment C.

territorial waters, linking with the Galaxy 17 satellite at 91° W.L. in the 11.7-12.2 GHz (space-to-Earth) and 14.0-14.4 GHz (Earth-to-space) frequency bands, consistent with the specifications in the amended application and in compliance with the Commission's rules, except insofar as waived herein, and subject to the following conditions:

- a) Panasonic must accept interference from lawful operation of any station operating with either primary or secondary status in the 11.7-12.2 GHz band in accordance with the U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106.
- b) In the event that another GSO FSS satellite commences operation in the 14.0-14.4 GHz band at a location within six degrees of Galaxy 17, Panasonic shall cease operation of its AMSS system unless its AMSS operation has been coordinated with the new satellite's operator or Panasonic has demonstrated that its AMSS operation will not cause harmful interference to the new co-frequency satellite.
- c) In the event that an NGSO satellite system commences operation in the 14.0-14.4 GHz band, Panasonic shall cease AMSS operation unless such operation has been coordinated with the operator of the NGSO system or Panasonic has demonstrated that its AMSS operation will not cause harmful interference to the NGSO system.
- d) Operation of an aircraft earth station authorized herein shall immediately terminate upon notification that such operation is causing harmful interference, not permitted under the terms of coordination agreements, with (1) lawful operation of any radio system in the 14.0-14.5 GHz band authorized on a primary basis in conformance with the U.S. Table of Frequency Allocations or authorized on a secondary basis prior to the effective date of this order, or (2) operation of any TDRSS earth station in the band 14-14.2 GHz, or (3) radio astronomy observations in the 14.47-14.5 GHz band.
- e) Panasonic shall maintain a point of contact available 24 hours per day, seven days per week, with the authority and ability to terminate operations authorized herein, for discussing interference concerns with other licensees and U.S. Government agencies, and shall submit a letter to be included in its license file with the name and telephone number of the point of contact prior to commencing operation.
- f) Aircraft earth stations authorized herein must employ a tracking algorithm that is resistant to capturing and tracking adjacent satellite signals, and each station must be capable of inhibiting its own transmission in the event it detects unintended satellite tracking.
- g) Aircraft earth stations authorized herein must be monitored and controlled by a ground-based network control and monitoring center. Such stations must be able to receive "enable transmission" and "disable transmission" commands from the network control center and must cease transmission immediately after receiving a "parameter change" command until receiving an "enable transmission" command from the network control center. The network control center must monitor operation of each aircraft earth station to determine if it is malfunctioning, and each aircraft earth station must self-monitor and automatically cease transmission on detecting an operational fault that could cause harmful interference to a fixed satellite service network.
- h) Stations authorized herein shall not be used to provide air traffic control communications.
- i) Panasonic's AMSS system shall operate in compliance with any limits established by the International Telecommunication Union (ITU) for AMSS systems to protect other services allocated internationally.
- j) Operation pursuant to this authorization shall conform to the requirements of Panasonic's coordination agreements with NASA and NSF and with the terms of coordination agreements between the operator of Galaxy 17 and operators of other Ku-band geostationary satellites within

- six angular degrees of Galaxy 17.
- k) Panasonic shall maintain records of the following data for each operating AES: location (latitude, longitude, altitude); aircraft attitude (pitch, yaw, roll); transmit frequency and occupied bandwidth; data rate; EIRP; and target satellite. This data shall be recorded at intervals of no more than two minutes while an AES is transmitting and every 30 seconds when aircraft roll angle is greater than 10 degrees. Panasonic shall also record instances when AES pointing error exceeds 0.2 degrees. Panasonic shall make this data available upon request to an FSS system operator or the Commission within 24 hours after receiving the request.
 - l) Panasonic shall take all reasonable and customary measures to prevent human exposure to harmful non-ionizing radiation exceeding the maximum permissible exposure limits in Section 1.1310 of the Commission's rules, 47 C.F.R. § 1.1310. The exterior surface of the antenna shall be prominently marked with a warning of the potential for exposure to high levels of radiofrequency energy.

27. IT IS FURTHER ORDERED that Section 2.106 of the Commission's rules IS WAIVED with respect to operation of the eXConnect AMSS network in the 11.7-12.2 GHz downlink band, consistent with the terms of this authorization.

28. IT IS FURTHER ORDERED that Panasonic's application for Special Temporary Authority, SES-STA-20110104-00005, IS DISMISSED as moot.

29. This *Order and Authorization* is issued on delegated authority pursuant to Sections 0.241 and 0.261 of the Commission's rules, 47 C.F.R. §§ 0.241 and 0.261, and is effective upon release.

FEDERAL COMMUNICATIONS COMMISSION

Mindel De La Torre
Chief, International Bureau

Julius P. Knapp
Chief, Office of Engineering and Technology