

NARRATIVE DESCRIPTION AND PUBLIC INTEREST STATEMENT

Ground and Flight Testing of the eXConnect Ku-Band AMSS System

Panasonic Avionics Corporation (“PAC”), pursuant to Section 5.55 of the Commission’s rules, 47 C.F.R. § 5.55, hereby seeks experimental license authority for ground and flight testing of up to twenty (20) aircraft earth stations (“AESs”) of two AES types -- ten (10) MELCO Reflector terminals and ten (10) Aura LE terminals -- to further test and demonstrate the functionality of its eXConnect Ku-band Aeronautical Mobile-Satellite Service (“AMSS”) system. PAC presently holds experimental special temporary authority (“STA”) granted in Call Sign WD9XQT (File No. 0339-EX-ST-2009), which enables flight and ground testing of these eXConnect AESs through July 7, 2010. For the reasons discussed herein, PAC seeks longer term authority to permit continued operation for a period of two years.

I. INTRODUCTION

As the Commission is aware, PAC, a leading provider of in-flight entertainment (“IFE”) systems, is developing the eXConnect Ku-band AMSS system to provide satellite-based broadband connectivity to commercial aircraft. eXConnect will provide broadband Internet access, real-time video content, voice and other services aboard commercial aircraft. Passengers may use these services for entertainment and to enhance productivity. These services will also be available to the crew and will enable a range of airline operational and administrative applications, allowing airlines to operate more effectively and efficiently.

The eXConnect system will use Ku-band Fixed-Satellite Service (“FSS”) satellites under an existing domestic and international secondary allocation to Mobile-Satellite Service (“MSS”) in the 14.0-14.5 GHz band. Adjacent FSS satellites will be protected from harmful

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interference by limiting the off-axis EIRP spectral density along the GSO arc to no more than the levels permitted for routinely licensed Ku-band VSAT terminals. eXConnect will also protect radio astronomy and space service operating in the Ku-band by limiting emissions in the vicinity of these stations and, when necessary, automatically inhibiting emissions. The technical aspects of the eXConnect system are discussed in detail in the attached Technical Appendix.¹

There is ample precedent for granting PAC an experimental license to perform this testing based on prior authority for Ku-band AMSS experimental operations granted to Boeing (Call Sign WC2XVE), ARINC (Call Sign WC2XPE), Hughes Network Systems (Call Sign WE2XEW) and, of course, PAC itself (Call Sign WD9XQT).

II. BACKGROUND

On December 2, 2008, the Commission granted PAC six-month STA (Call Sign WD9XQT) to conduct ground testing of up to five (5) Ku-band transmit/receive terminals for testing and demonstration purposes.² PAC's STA application listed one Aura LE aircraft earth station ("AES") manufactured by EMS Technologies. PAC further explained that, although these terminals were being evaluated for use in the AMSS context, its application requested temporary authority for ground testing only. The proposed experimental operations were to be conducted at and around specified test facilities for a very limited duration (*e.g.*, several hours per test session) and scheduled intermittently during the six (6) month

¹ See Exhibit 1.

² On February 5, 2009, PAC filed a Section 5.77 notice (47 C.F.R. § 5.77) in connection with Call Sign WD9XQT to inform the Commission that it intended to test two terminals not specifically listed in its original STA application: AESs manufactured by TECOM Industries and MELCO. PAC later informed the Commission that it did not intend to test the TECOM antenna.

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authorization of the STA. The experimental STA was renewed on June 1, 2009 to permit further ground testing of the antenna.

On January 7, 2010, the Commission granted PAC a six month STA to conduct ground and flight testing for demonstration purposes of up to ten (10) AESs each (up to 20 total) of two types, the Aura LE and the MELCO antennas. On March 8, 2010, PAC filed a Section 5.77 notice (47 C.F.R. § 5.77) in connection with Call Sign WD9XQT to inform the Commission that it intended to test five (5) MIJET Lite antennas under that authority.³ Although PAC tested the MIJET Lite antenna pursuant to the STA, PAC does not intend to further test the MIJET Lite and does not seek authority for such testing in the instant application.

PAC provided detailed technical information on the Aura LE antenna in its original experimental STA filing, which is hereby incorporated by reference.⁴ Additional technical data regarding the antenna, as well as information on the MELCO antenna, is provided in the Technical Appendix attached hereto.

III. DESCRIPTION OF PROPOSED EXPERIMENTAL OPERATIONS

PAC seeks to conduct ground and flight testing throughout the continental United States (“CONUS”), subject to protection of U.S. Government radio astronomy and space research operations. PAC recognizes and accepts that any experimental authority will be conditioned upon coordination with and/or protection of these co-frequency operations.⁵

³ See Letter to James R. Burtle, March 8, 2010, re Panasonic Avionics Corporation, Call Sign WD9XQT, File No. 0339-EX-ST-2009; Addition of New Antenna Type for Testing and Demonstration.

⁴ See ELS File No. 0544-EX-ST-2008.

⁵ See 47 C.F.R. § 5.111(a)(2); see also 47 C.F.R. § 25.222 (analogous rules governing Ku-band earth stations onboard vessels).

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The general objectives of the testing to be carried out under this experimental authority include: (i) integrating and testing the Aura LE and MELCO terminals and eXConnect network; (ii) demonstrating two-way data service from an in-flight aeronautical mobile platform; (iii) validating the predicted performance of the system; (iv) demonstrating that the system meets the established interference requirements for Ku-band AMSS systems; and (v) conducting limited market studies of the system to verify commercial and technical viability in trial roll-out periods.

Importantly, due to the unavailability of flight test aircraft, PAC has not yet been able to conduct flight testing with the Aura LE terminal. Limited flight tests have been conducted using the MELCO antenna. PAC anticipates that it will need to conduct additional ground and flight testing of both antenna types for more than six months as the program develops and additional customer requirements materialize. Thus, a two-year experimental license is appropriate.

A. Ground Testing

PAC seeks to retain experimental authority to conduct ground testing of the Aura LE, and MELCO antennas in three modes: (i) fully stationary; (ii) mounted on a three-axis motion platform that simulates aircraft yaw, pitch and roll; and (iii) on a ground vehicle rooftop for in-motion testing.

Extensive receive-only tests also will be conducted to verify antenna performance and subsystem integration prior to any transmit operation. Two-way tests requiring transmit operation will then be performed to evaluate, optimize and demonstrate return link performance as well as the passenger experience with fixed, ground-based terminals.

With respect to vehicle-mounted tests, limited operations will occur subject to limitations set forth in coordination agreements and FCC rules provisions designed to protect radio astronomy sites and the Tracking and Data Relay Satellite System (TDRSS) sites for

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space research at White Sands, New Mexico and the US Naval Research Lab at Blossom Point, Maryland.⁶ Additional coordination with NSF to avoid experimental operations during period of RAS observations, as well as with NASA, will further ensure that there is no potential for interference from PAC's planned experimentations.

B. Flight Testing

PAC also seeks authorization to conduct flight testing under the requested experimental authority. Initial testing will involve deploying the Aura LE AES on a single test aircraft (provisionally a Boeing Business Jet 737 aircraft) and MELCO antennas installed on existing commercial aircraft. Additional flight testing will likely be required but firm flight test plans have not yet been developed. Testing will involve single beam coverage and iDirect automatic beam switching.

PAC will conduct flight testing only in areas that are outside exclusion zones for radio astronomy sites (during observations) and NASA TDRSS sites, and in accordance with applicable coordination agreements and FCC rules. In addition, PAC may conduct flight tests in international airspace (e.g., over the Pacific Ocean off the coast of California near PAC's headquarters).

The following performance objectives will be examined in connection with flight testing:

- hand-off performance;
- geographic mapping and automated shut-off;
- reliability of data link;
- two-way data link performance and coverage;
- receive-only video link performance and coverage;
- antenna performance;
- Doppler correction; and

⁶ In conjunction with its experimental application, PAC has contacted NASA and the National Science Foundation to initiate coordination discussions for both on-ground and in-flight operations. PAC will accept technical limitations imposed on other Ku-band land-mobile and AMSS operations necessary to protect RAS and TDRSS operations.

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- o network management and operation.

This testing will be very limited in duration (several days of testing over the two year experimental authority period). In all cases, the aircraft will operate in selected test conditions in a dedicated manner under close control of PAC's network control personnel.

IV. LIMITED MARKET STUDIES

Given the development and installation lead times, PAC does not envision formal launch of the eXConnect system onboard U.S. commercial airlines in the near term.

Nonetheless, PAC is preparing an FCC blanket license application for authority to operate eXConnect AESs on a full commercial basis.

In the meantime, PAC seeks to maintain authority to conduct limited market studies pursuant to Sections 5.3(j) and 5.93 of the Commission's Rules, 47 C.F.R. §§ 5.3(j), 5.93. Although PAC was granted limited market study authority in its prior experimental STA and undertook measures to comply with the Commission's rules and policies governing limited market studies (e.g., retaining ownership of AESs that may be involved in such studies), no such market studies or foreign commercial operations have yet been conducted.

PAC remains in advanced discussions and/or has executed agreements with potential foreign airline participants in limited trials and future commercial introduction of the eXConnect system, some of which may operate flights that intermittently traverse U.S. airspace. Among other things, these foreign airlines seek to test market and collect commercial and operational data regarding eXConnect system capabilities. For its part, PAC intends to use the limited market studies to demonstrate the potential uses and performance of its terminals, and to collect engineering and operational data regarding these uses.

PAC proposes maintaining limited market study authority that will permit it (and foreign airline customers) to evaluate the commercial viability and usage characteristics of its AES terminals in international AMSS operations. Through the study, PAC seeks to obtain

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information regarding the frequency and duration of use in in-flight and on-ground modes, data rates achieved to and from aircraft and aggregate data rates achieved in the network. PAC also seeks to validate the network's performance by collecting data relating to quality of service, including bit error rates, latency and possible degradation of service at the edge of service contours.

The Commission has previously permitted limited market studies in the context of experimental AMSS operations. *See, e.g.,* ARINC Experimental Authorization, Call Sign WC2XPE. Furthermore, consistent with Section 5.93(b) of the Commission's Rules, PAC will inform its trial partners and the users involved with testing that the AMSS service is being provided only on a test basis under an experimental authorization, is being offered only on a strictly temporary basis, and that PAC has not yet received Commission approval for the offering of a long-term commercial service. As noted previously, PAC intends to obtain long-term authority subject to license requirements and AMSS licensing and service rules adopted by the Commission.

V. SATELLITES AND HUB EARTH STATIONS

PAC will utilize commercial FSS satellite capacity to conduct its experimental operations. Specifically, capacity will be leased on the Horizons 1, Galaxy 17, Galaxy 19 and Telstar 14 satellites.⁷ and coordinated with adjacent satellite operators within +/- 6 degrees of each satellite. PAC has filed coordination affidavits from the operators of the Horizons 1, Galaxy 17, Galaxy 19 and Telstar 14 satellites that reflect adjacent satellite

⁷ Authority to communicate with the Telstar 14 satellite was added post-grant with filing of the requisite coordination affidavit from the serving satellite operator. *See* Letter to Anthony Serafini dated March 11, 2010, re Panasonic Avionics Corporation, Call Sign WD9XQT, File No. 0339-EX-ST-2009; Addition of Satellite Point of Communication. Additional satellites may be added in the future, subject to applicable coordination requirements.

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operator consent for the proposed operations.⁸ PAC will not commence operations with other satellite points of communications until the operations have been coordinated and PAC will file the relevant satellite operator coordination affidavits in the record of this proceeding. Communication with these satellites is essential to the experimentations to confirm that the eXConnect terminals can effectively communicate with existing satellites of various operators in diverse geographic regions to ensure efficient and interference-free operations once the PAC commences full commercial operations.⁹

The hub earth stations for the proposed experimental operations are located at Steele Valley, California (serving Horizons 1) and Holmdel, New Jersey (serving Galaxy 17, Galaxy 19 and Telstar 14). These earth stations are licensed as FSS earth stations and are connected to eXConnect network control facilities. Network control of eXConnect operations will be provided pursuant to PAC's direction and control from a Network Operations Center in Miramar, Florida.

VI. PROTECTION OF OTHER USERS IN THE 14.0–14.5 GHZ BAND

Protection of Fixed-Satellite Service. The FCC has not yet established service rules applicable to AMSS terminal operations, but interference considerations are analogous to those that currently apply to mobile ESVs set forth in 47 C.F.R. § 25.222. PAC's terminals will operate in such a manner that the off-axis EIRP levels are no greater than the levels produced by routinely licensed VSAT earth stations. This is consistent with past FCC licensing conditions in the AMSS context. To the extent that any adjacent satellite operator

⁸ See Exhibit 2.

⁹ Operation only with other experimental stations would plainly not be adequate for PAC's experimentations since Ku-band AMSS terminals must communicate using Ku-band FSS satellites. See 47 C.F.R. § 5.125.

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experiences unacceptable interference from PAC's experimental operations, PAC will cease terminal transmissions immediately.¹⁰

Protection of Potential NGSO FSS Systems. Panasonic acknowledges that non-geostationary orbit ("NGSO") systems are also permitted to operate in the Ku-band. However, no such systems are currently authorized or plan to operate within the period contemplated for the proposed experimental operations.

Protection of Terrestrial Radio Services. PAC has examined current spectrum use in the 14.0-14.5 GHz band and has determined that there are no active FCC-licensed terrestrial services in this band in North America with which its proposed operations could conflict.

Protection of the Radio Astronomy Service. For purposes of protecting radio astronomy sites, consistent with Recommendation ITU-R M.1643, Part C, PAC will limit aggregate power flux density (pfd) in the band of 14.47 GHz to 14.5 GHz as follows:

- 221 dBW/m²/Hz (for protection of Green Bank, Arecibo and Socorro)
- 189 dBW/m²/Hz (for protection all other Radio Astronomy sites)

For purposes of this experimental application, PAC terminals will not operate within line-of-sight vicinity of Radio Astronomy sites and during observation periods.

Protection of Space Research Service. PAC recognizes the utilization of the frequency band from 14.0-14.05 GHz and the possible use of the band from 14.05-14.2 GHz allocated to the National Aeronautics and Space Administration ("NASA") Tracking and Data Relay Satellite System ("TDRSS") for space research conducted at White Sands, New Mexico and Blossom Point, Maryland. For purposes of this experimental application, PAC will avoid AES operation within line-of-sight vicinity of these earth stations.

¹⁰ See 47 C.F.R. § 5.111(a)(2).

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VII. SUPERVISION AND CONTROL

For purposes of these experiments, the PAC terminals will be operated under PAC's full supervision and control. The point of contact for the planned experimental operations is:

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26200 Enterprise Way
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This contact will have access to all network functions, and will have the ability and authority to cease all transmissions from the terminals wherever they are located.

VIII. CONCLUSION

Grant of this experimental license will allow Panasonic to further develop and demonstrate the eXConnect AMSS system and confirm the operational characteristics of the system. The eXConnect system combines available Ku-band satellite capacity and proven waveforms with high-performance antennas to provide cost-effective, broadband AMSS service to passengers and crew onboard commercial aircraft. eXConnect has been designed to protect other uses in the Ku-band from interference and will make use of an existing secondary allocation to AMSS in the Ku-band. There is ample precedence for granting this experimental authority and it is clearly in the public interest to do so.

EXHIBIT 1

Exhibit 1
Technical Description of the eXConnect System

This Technical Description clarifies the prior application and post-grant information provided in connection with experimental STA Call Sign WD9XQT (File No. 0339-EX-ST-2009), which is hereby incorporated by reference, to reflect current operating authority.

1. The eXConnect System

A system block diagram for the eXConnect Ku-band AMSS system is shown in Figure 1. The system consists of up to twenty (20) previously authorized Aura LE and MELCO terminals, leased satellite capacity on a commercial Ku-band FSS satellite and a gateway earth station facility. PAC seeks experimental authority to further test and demonstrate the eXConnect terminals only, but provides a full eXConnect system description to convey the operating and control parameters of the system.

The Aura LE terminal is a dual-panel, mechanically steered antenna, which has been specifically designed for the aeronautical environment (*see* Section 3.1). The terminal's broadband controller ("BC") will contain a DVB-S2 receiver, an iDirect Deterministic Time Division Multiple Access waveform (D-TDMA) modulator and control and routing capabilities (*see* Section 3.2). The BC will interface with the aircraft cabin distribution system and in-flight entertainment system.

The MELCO reflector antenna is a mechanically-steered Cassegrain antenna with an elliptical profile to be compatible with installation on an aircraft. The MELCO reflector antenna has been installed on over 100 passenger aircraft and has a proven history performance and reliability. This antenna has been previously licensed by the FCC for AMSS service in the United States and by other countries around the world.

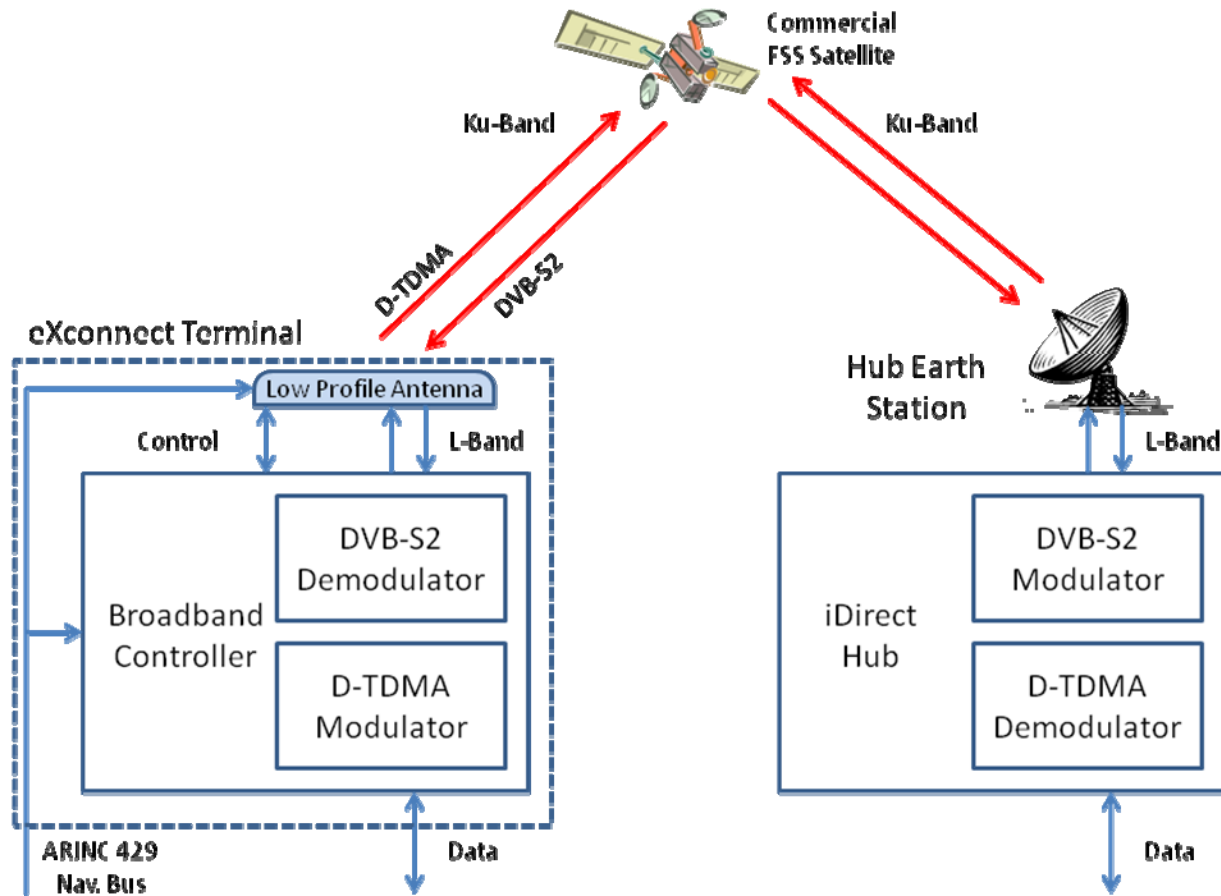


Figure 1 eXConnect System Block Diagram

Commercial FSS satellite capacity will be leased on the Horizons 1, Galaxy 17, Galaxy 19 and Telstar 14 satellites.¹ PAC has filed coordination affidavits from the operators of the Horizons 1, Galaxy 17, Galaxy 19 and Telstar 14 satellites that reflect adjacent satellite operator consent for the proposed operations.

The forward (hub-to-terminal) link will consist of a single DVB-S2 carrier which may occupy up to a full transponder may operate at up to 2.04 Mbps (*see* Section 2.1). The return (terminal-to-hub) link will consist of one or more iDirect D-TDMA in-routes (*see* Section 2.2), which may be shared by multiple terminals on a TDMA basis. The return link will operate at up to 384 kbps under this experimental.

¹ Authority to communicate with the Telstar 14 satellite was added post-grant with filing of the requisite coordination affidavit from the serving satellite operator. *See* Letter to Anthony Serafini dated March 11, 2010, re Panasonic Avionics Corporation, Call Sign WD9XQT, File No. 0339-EX-ST-2009; Addition of Satellite Point of Communication. Additional satellites may be added in the future, subject to applicable coordination requirements.

The hub earth stations for the proposed experimental operations are located at Steele Valley, California (serving Horizons 1) and Holmdel, New Jersey (serving Galaxy 17, Galaxy 19 and Telstar 14). These earth stations are licensed as FSS gateways and will include an iDirect hub which consists of a DVB-S2 forward link modulator and an iDirect D-TDMA demodulator (*see* Section 2.3). Network control of experimental eXConnect operations will be provided pursuant to PAC's direction and control from a Network Operations Center in Miramar, Florida.

Operation of the system will be controlled so as to prevent interference to other users of the Ku-band. Principally, this will be accomplished by controlling the off-axis EIRP spectral density emissions of the terminal along the GSO arc to protect adjacent FSS satellites, and by frequency avoidance and/or exclusion zones with respect to radio astronomy and space research sites. In this connection, subject to further coordination of limited flight test operations with NASA and the National Science Foundation ("NSF"), PAC will accept the restrictions in its existing experimental STA and those set forth in Section 25.222 of the Commission's rules for analogous Ku-band operations of earth stations onboard vessels ("ESVs").²

Prior to obtaining new coordination agreements with the NSF and NASA, the eXConnect terminal will not be operated within line of sight or other distance specified in the Commission's rules of any radio astronomy station (during observations) or space research earth station. The broadband controller within the terminal will inhibit transmissions when within line of sight of these facilities based on navigation data received from the aircraft navigation bus. Once coordination agreements are in place with the NSF and NASA, the terminal will be operated in accordance with those agreements. PAC will also comply with Special Condition 1 of its existing STA and restrict operations below 14050 MHz in the area of White Sands Missile Range, NM (radius of 410 km surrounding 323240N 1063648W).

Off-axis EIRP spectral density will be controlled through the directivity of the antenna, limitations on the transmit power spectral density, control of pointing error and control of skew angle relative to the serving satellite orbital location. The capability of the terminal to limit off-axis EIRP spectral density is discussed further in Section 3.

2. Network Description

The eXConnect system will be implemented using iDirect network technology. iDirect provides satellite network technology that has been used for a wide range of Ku-band FSS networks, including mobile applications such as ESVs. The use of proven network technology with proven

² PAC references Section 25.222 governing Ku-band ESV licensing as a general guide to provisions that may be useful in ensuring that Ku-band AMSS systems operate without causing harmful interference to co-frequency operations. However, PAC is not applying under nor is AMSS operating authority available under Section 25.222 of the Commission's rules.

control and monitoring protocols minimizes the risk of interference. The following sections discuss the forward link, return link and hub used for eXConnect experimental operations.

eXConnect will leverage existing satellite capacity on Ku-Band FSS satellites and proven waveforms - DVB-S2 and iDirect's D-TDMA - to provide these services at minimum cost and risk. Using existing waveforms will minimize development cost. DVB-S2 is a highly efficient waveform that is used widely in the FSS industry and will be used for the forward link. iDirect's D-TDMA waveform, which will be used for the return link, is well-established waveform for FSS applications and has also been widely used for mobile applications. In particular, iDirect's D-TDMA waveform is already used for ESV applications and supports spread spectrum for small mobile terminals so it is ideal for a Ku-band AMSS applications.

2.1. Forward Link

The forward link will consist of a single DVB-S2 carrier which may occupy up to a full transponder and operate in saturation. Data may be multiplexed on this carrier for multiple terminals. DVB-S2 is a widely adopted standard for digital data and video broadcasting over satellite. The DVB-S2 standard supports Adaptive Coding and Modulation (ACM) with QPSK, 8PSK, and 16APSK modulations and Low Density Parity Check Coding rates between 0.25 and 0.9. The forward link is not being licensed under this experimental application but will operate at up to 2.04 Mbps.

2.2. Return Link

The return link will use iDirect's proprietary D-TDMA. D-TDMA supports multi-frequency (MF) TDMA sharing of return link carriers, although the eXConnect terminal will be assigned to only one in-route carrier with fixed data rate, modulation and coding parameters. Frequency and time slot parameters are managed by the iDirect hub. Terminal transmit EIRP is also power controlled so that the minimum power is used to close the satellite link. D-TDMA supports BPSK, QPSK and 8PSK modulations, turbo code rates between 0.431 and 0.793, and spread spectrum factors between 1 and 16. The return link will operate at up to 1024 kbps under this experimental authority using occupied bandwidths between 160 kHz and 5.12 MHz (emissions designators 160KG7D to 5M12G7D).

2.3. Hub Earth Station

The hub earth station consists of licensed gateway earth stations, an iDirect hub at each location, and the interface to the Internet and other content sources. The iDirect hub will consist of a DVB-S2 modulator and an iDirect D-TDMA demodulator. Operation of the hub earth station and the network will be controlled by a Network Operations Center (NOC) in Miramar, Florida subject to PAC's direction and control. The NOC will maintain the ability to inhibit transmissions from any terminal in the network, including the hub and eXConnect terminal, at any time.

3. Terminal Description

3.1. Antennas

PAC seeks to test and demonstrate the Aura LE antenna, developed by EMS Technologies, under this experimental authority.³ The Aura LE antenna is a mechanically steered, flat-plate AES with two transmit/receive apertures. At most elevation angles, both apertures are coherently combined to form a beam. At low elevation angles, only a single aperture is used. This allows the antenna to maintain high performance over a large range of elevation angles between 5 degrees and 90 degrees in flight (10 degrees on the ground) while maintaining a low profile for aerodynamic integration with an aircraft. The Aura LE was previously examined by the Commission and authorized in experimental STA Call Sign WD9XQT (File Nos. 0544-EX-ST-2008, 0339-EX-ST-2009). The basic characteristics of the antenna are summarized in Table 1.

PAC's second antenna type, the MELCO reflector antenna, was developed by Mitsubishi Electronics Company for the Connexion by Boeing AMSS system.⁴ It is a mechanically-steered Cassegrain antenna with an elliptical profile designed to be compatible with installation and operation onboard an aircraft. The MELCO antenna was previously examined by the Commission and authorized in experimental Call Sign WC2XVE (File No. 0002-EX-PL-2004) and commercial blanket license Call Sign E000723 (File No. SES-MOD-20030512-00639). The basic characteristics of the MELCO antenna are also summarized in Table 1.

Table 1. Aura LE and MELCO Antenna Characteristics

Characteristic	EMS Aura LE	MELCO Reflector
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz	Tx: 14.0 GHz to 14.4 GHz Rx: 11.2 GHz to 12.8 GHz
Aperture Size	2 Apertures of 35" X 6" each	25.6" X 7.7"
EIRP	42.5 dBW @ 5 deg Elevation 48.0 dBW @ 90 deg Elevation	47.2 dBW
G/T	11 dB/K @ 5 deg Elevation 14 dB/K @ 90 deg Elevation	8.0 dB/K @ 11.2 to 11.7GHz 9.3 dB/K @ 11.9 to 12.8GHz
Tracking Rate	40 deg/sec in Azimuth 25 deg/sec in Elevation	40 deg/sec in Azimuth 25 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma	0.25 deg 1-sigma
Antenna Patterns	<i>See Appendix A</i>	<i>See Appendix B</i>

³ A Radiation Hazard analysis for the Aura LE is included as Exhibit 1a.

⁴ A Radiation Hazard analysis for the MELCO Reflector is included as Exhibit 1b.

The Aura LE and MELCO antennas are designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antennas are pointed based on aircraft position and attitude information obtained from the ARINC 429 data bus, which is standard on commercial aircraft. This information is augmented with higher rated data from an inertial sensor package that is integrated with the antenna and compensates for INS errors that result from latency and bending of the airframe between the aircraft INS unit and the antenna. The pointing accuracy of the MELCO reflector is 0.25 deg 1-sigma and the pointing accuracy of the Aura LE antenna will be less than 0.2 deg 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5 degrees, then transmissions will be automatically inhibited within 100 ms.⁵

3.2. Broadband Controller

The Broadband Controller (“BC”) contains the modem and control functionality of the terminal. The modem will include a DVB-S2 demodulator and iDirect D-TDMA modulator. With respect to control functionality, the BC includes the ability to inhibit transmissions as a function of location and skew angle, control transmit power and select the serving satellite as a function of location.

The ability to inhibit transmission by location is essential to protecting Radio Astronomy and Space Research. Prior to obtaining further coordination with the NSF and NASA, the terminal will inhibit transmissions when within line of sight at altitude of any Radio Astronomy site (during observations) and Space Research site based on maps that will be preloaded onto the BC. The ability to inhibit transmission as a function of skew angle and control transmit power is essential for controlling the off-axis EIRP spectral density projected along the GSO arc (*see* Section 3.3 for more details). Skew angle control will be enforced regardless of whether the skew angle results from the location of the aircraft with respect to the satellite or the attitude of the aircraft. Finally, the BC will select the serving satellite based on preloaded maps.

3.3. Off Axis-EIRP Control

Control of off-axis EIRP spectral density is essential to protect adjacent satellites operating in the Ku-band. The eXConnect system will control the off-axis EIRP spectral density generated by a single terminal so that it is no greater than is accepted for Ku-band terminals under Part 25. Terminals do not operate on a co-frequency basis so management of aggregate emissions is not required.

The Commission’s off axis EIRP spectral density limits are defined by Section 25.222 for analogous ESV operations (*see also* Section 25.218(f)(1), where N = 1 for TDMA) and the

⁵ *See* 47 C.F.R. § 25.222(a)(7) (rule governing Ku-band ESVs).

terminal may be mispointed by up to 0.2 degrees. The effective off-axis EIRP spectral density generated by a conforming terminal will be:

$15-25\log_{10}(\Theta + 0.2)$	dBW/4 kHz	For	$1.5^{\circ} \leq \Theta \leq 7^{\circ}$
-6	dBW/4 kHz	For	$7^{\circ} < \Theta \leq 9.2^{\circ}$
$18-25\log_{10}(\Theta + 0.2)$	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	$85^{\circ} < \Theta \leq 180^{\circ}$

The eXConnect system will limit off-axis EIRP spectral density to no more than this level by:

- Limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate in-route carrier bandwidths.
- Controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold.
- Controlling pointing error and inhibiting transmissions when the pointing error exceeds a threshold of 0.5 deg.

The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance. Higher transmit power and narrower bandwidth will result in a more restrictive skew angle threshold.

An example of off-axis EIRP control is shown in Figures 2 and 3 for the MELCO and Aura LE antennas, respectively. These off-axis EIRPs are based on the specific link parameters shown in the link budget in Section 4. They represent edge of beam cases where the terminal is operating with a 3.76 MHz carrier bandwidth and a skew angle threshold of 30 degrees. The terminal off-axis EIRP spectral density, shown in the solid red line, remains well below the 25.218(f)(1) off-axis EIRP spectral density limit, shown in the solid blue line. Even with the mispointing of the terminal at the point where it automatically inhibits transmissions – 0.5 deg pointing offset – the off-axis EIRP spectral density of the terminal, shown in the dashed red line, remains below the off-axis EIRP spectral density of a conforming FSS terminal which is mispointed by 0.2 degrees.

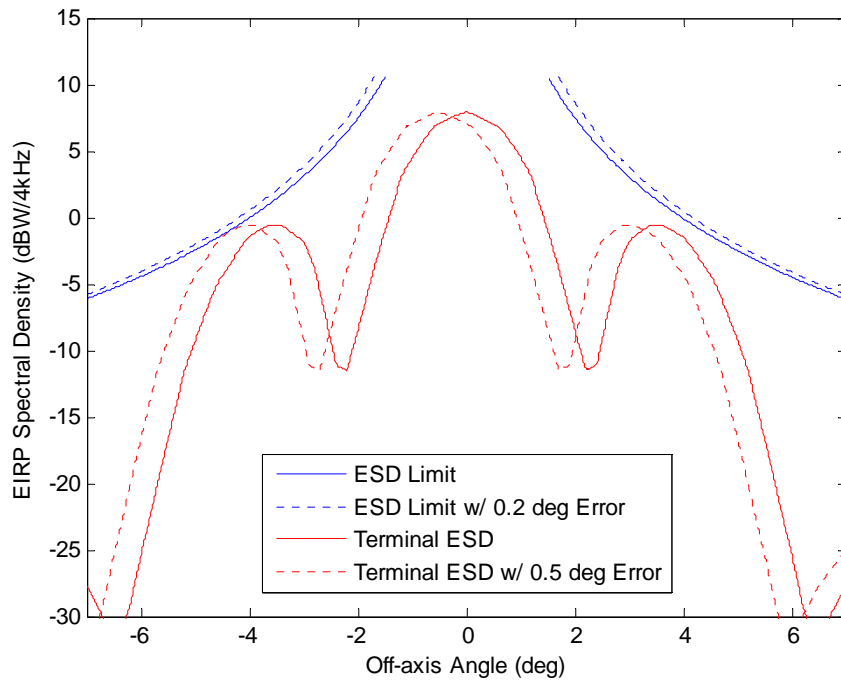


Figure 2 Maximum Off-Axis EIRP Spectral Density for the MELCO Antenna

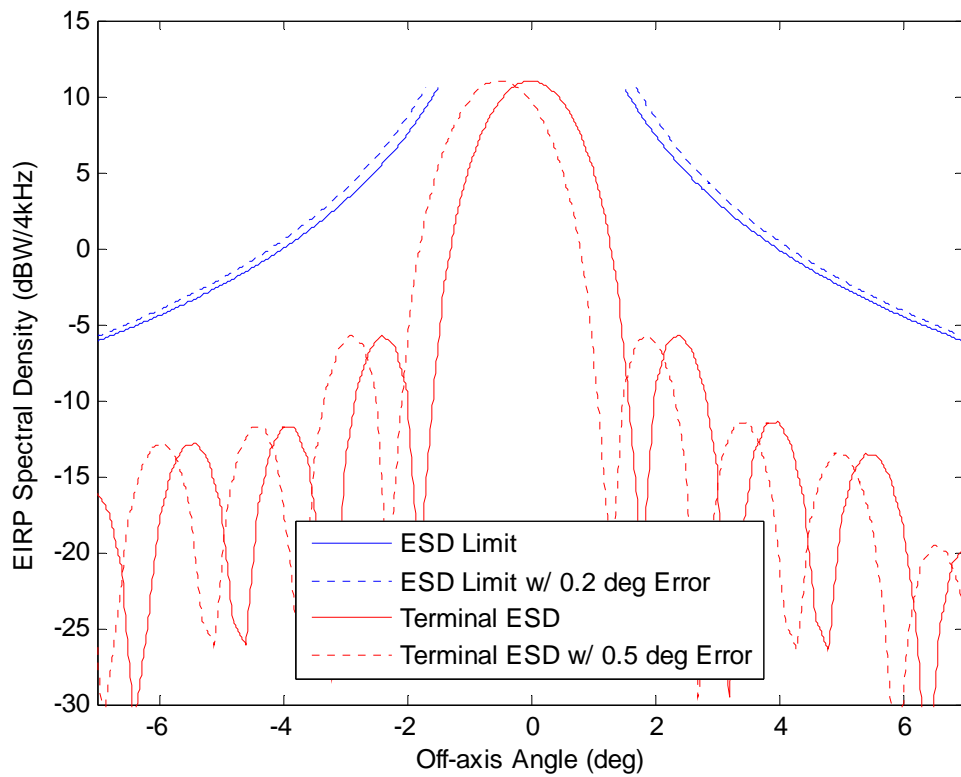


Figure 3. Maximum Off-Axis EIRP Spectral Density of the Aura LE

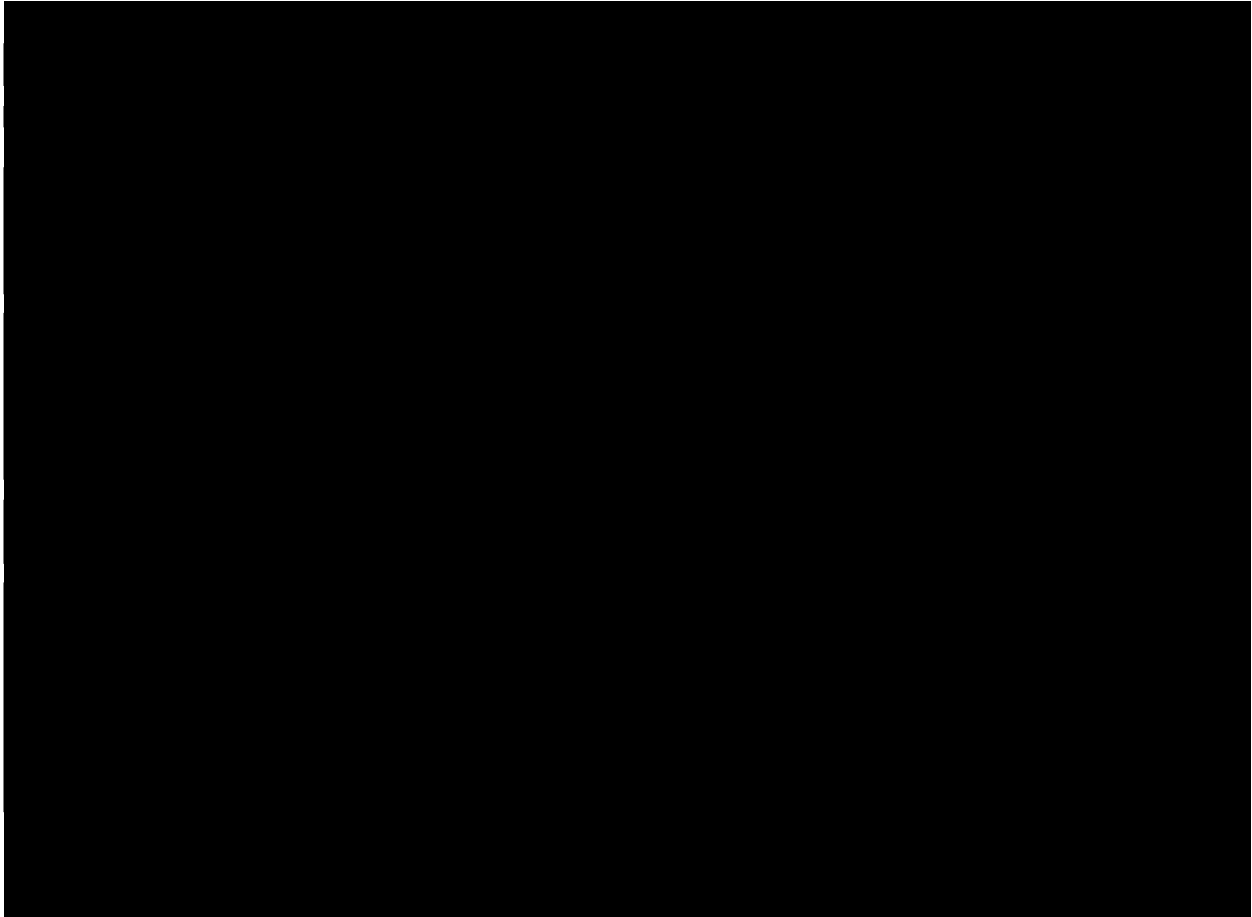
It should be emphasized that the examples in Figures 2 and 3 are extreme cases: worst-case power (edge of coverage), worst-case skew, and worst-case pointing error. Reaching the limits in this way will only occur rarely and briefly.

At the present time, the eXConnect system exceeds the off-axis EIRP spectral density values set forth in the Commission's rules in directions away from the geostationary arc. The separate off-axis EIRP spectral density mask in Section 25.218(f)(1) was intended to protect Ku-band NGSO FSS systems. However, no systems of this type are presently planned or are operating. PAC will enter into a coordination arrangement with any future Ku-band NGSO FSS system to protect such system from interference from eXConnect AES transmissions.

4. Link Budgets

Edge of coverage link budgets for the eXConnect forward and return links are shown in Table 2 for both antenna types. The eXConnect network in this example is operating with a 2.048 Mbps forward link and a 192 kbps return link for the MELCO reflector and a 384 kbps return link for the Aura LE. The transmit EIRP for each return link has been backed off to produce a 0.5 dB target Eb/No margin. As shown by the table, the terminals are able to close the link with positive link margin.

Table 2. Aura LE and MELCO Link Budgets



Appendix A - Aura LE Gain Patterns

This appendix includes predicted transmit gain patterns for the Aura LE antenna. Because the antenna pattern for the Aura LE changes with elevation angle, patterns are included for the minimum and maximum elevation angles of the antenna: 5 deg and 90 deg. Azimuth patterns are plotted against the 25.209(a)(2) antenna pattern mask. Elevation patterns are plotted against the 25.209(a)(4) antenna pattern mask. The patterns are plotted 14.25 GHz.

A.1 Aura LE Antenna Patterns for 5 deg Elevation

A.1.1 Transmit Antenna Patterns for 5 deg Elevation

A.1.1.1 Transmit Azimuth Antenna Patterns for 5 deg Elevation

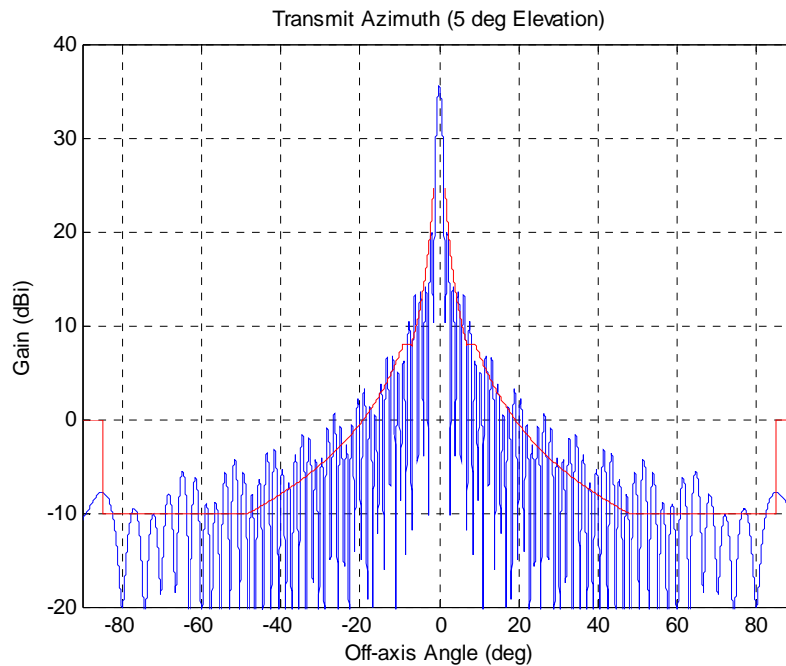


Figure A.1 Transmit Azimuth Pattern (5 deg Elevation)

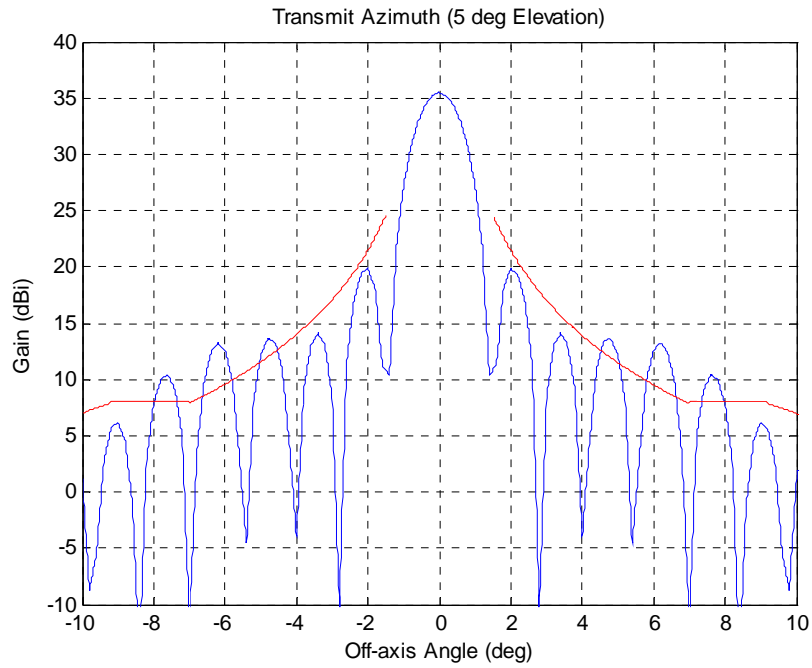


Figure A.2 Transmit Azimuth Pattern (5 deg Elevation) - Detail

A.1.1.2 Transmit Elevation Antenna Patterns for 5 deg Elevation

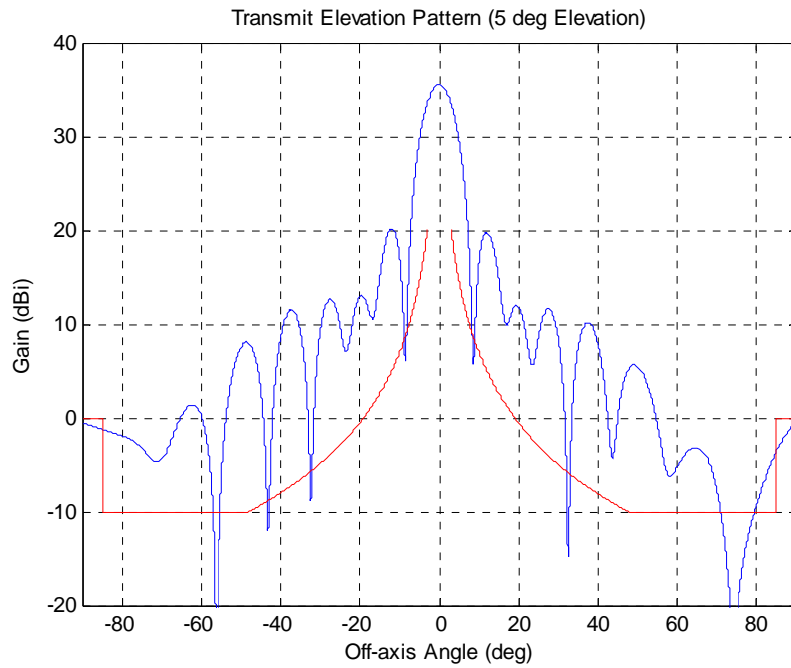


Figure A.3 Transmit Elevation Pattern (5 deg Elevation)

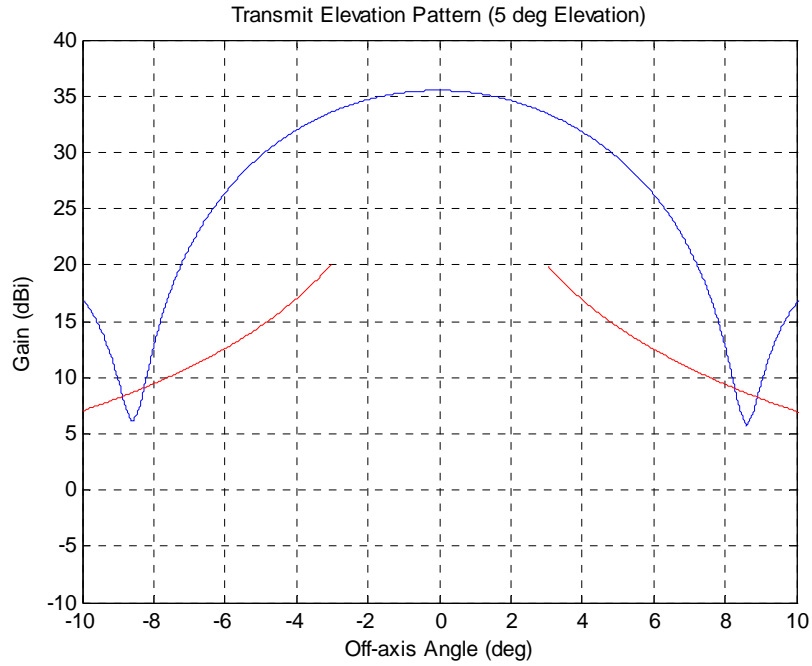


Figure A.4 Transmit Elevation Pattern (5 deg Elevation) - Detail

A.2 Aura LE Antenna Patterns for 90 deg Elevation

A.2.1 Transmit Antenna Patterns for 90 deg Elevation

A.2.1.1 Transmit Azimuth Antenna Patterns for 90 deg Elevation

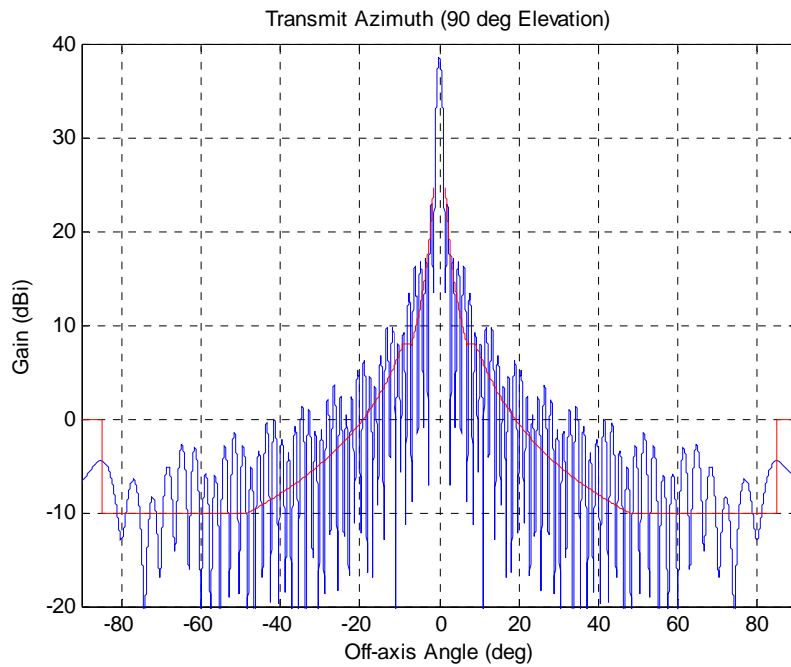


Figure A.9 Transmit Azimuth Pattern (90 deg Elevation)

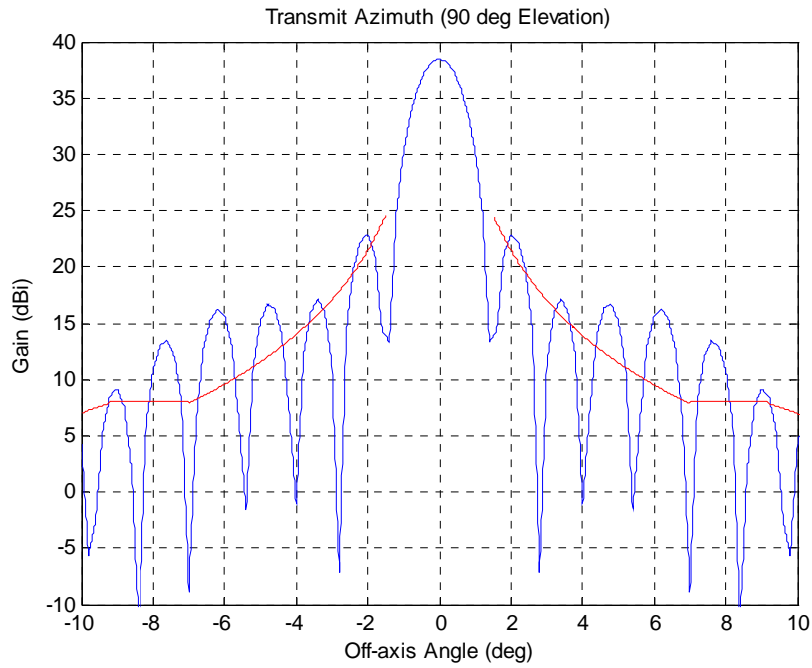


Figure A.10 Transmit Azimuth Pattern (90 deg Elevation) – Detail

A.2.1.2 Transmit Elevation Antenna Patterns for 90 deg Elevation

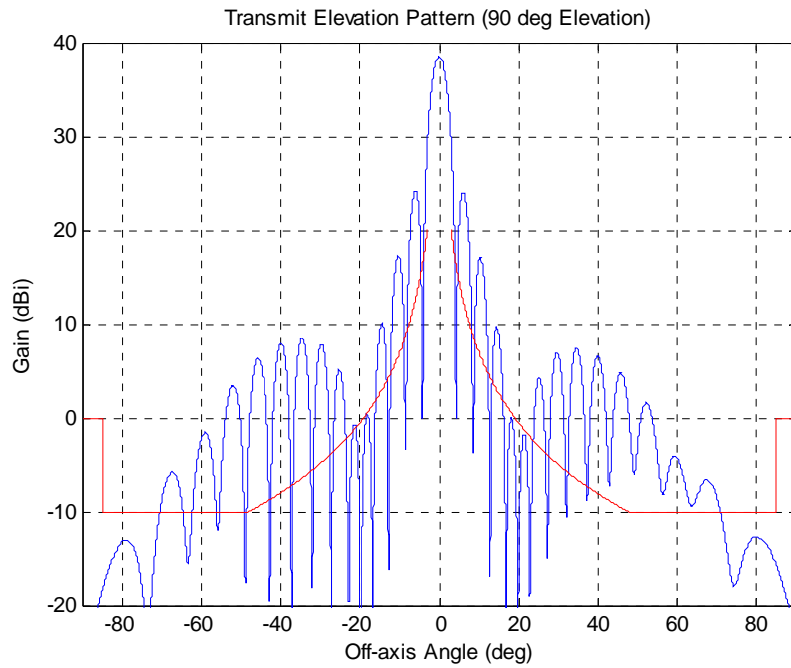


Figure A.11 Transmit Elevation Pattern (90 deg Elevation)

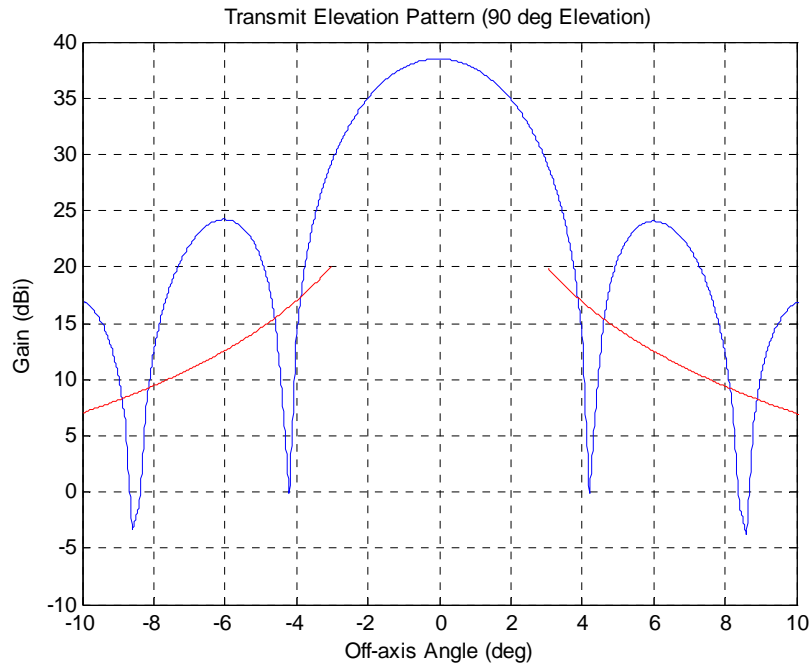


Figure A.12 Transmit Elevation Pattern (90 deg Elevation)

Appendix B - MELCO Reflector Gain Patterns

This appendix includes measured transmit gain patterns for the MELCO Reflector antenna. The MELCO Reflector antenna patterns are elevation independent. Azimuth patterns are plotted against the 25.209(a)(2) antenna pattern mask. Elevation patterns are plotted against the 25.209(a)(4) antenna pattern mask. The patterns were measured at 14.00 GHz.

B.1 MELCO Reflector Antenna Patterns

B.1.1 Transmit Antenna Patterns

B.1.1.1 Transmit Azimuth Antenna Patterns

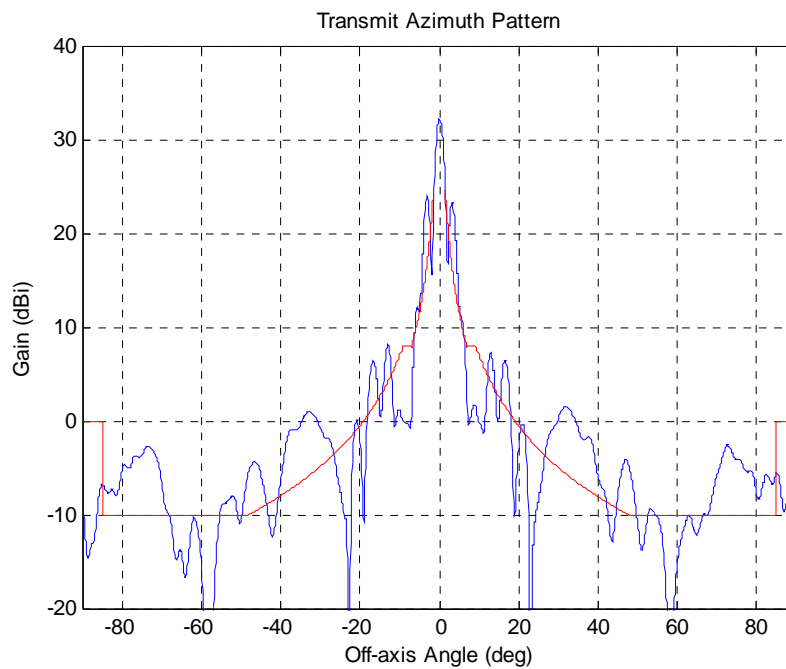


Figure B.1 Transmit Azimuth Pattern

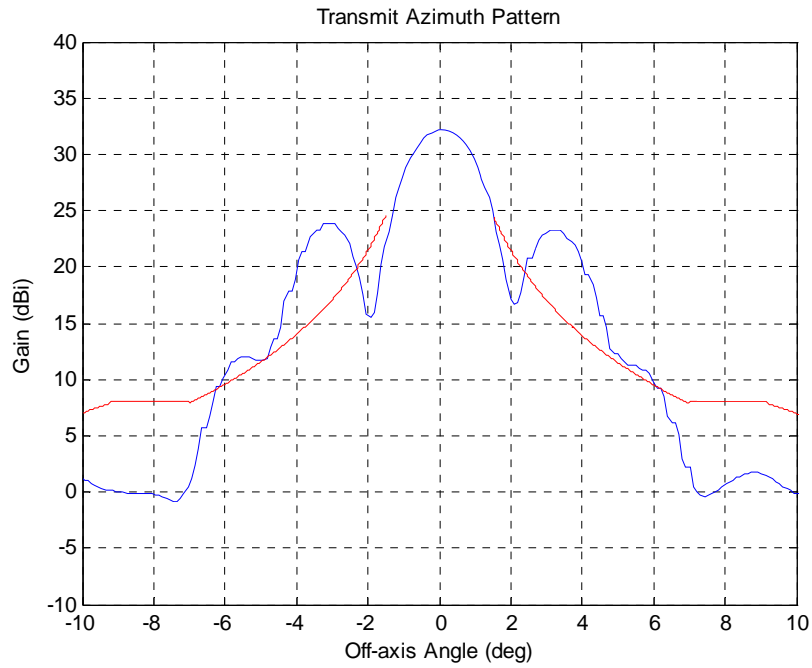


Figure B.2 Transmit Azimuth Pattern - Detail

B.1.1.2 Transmit Elevation Antenna Patterns

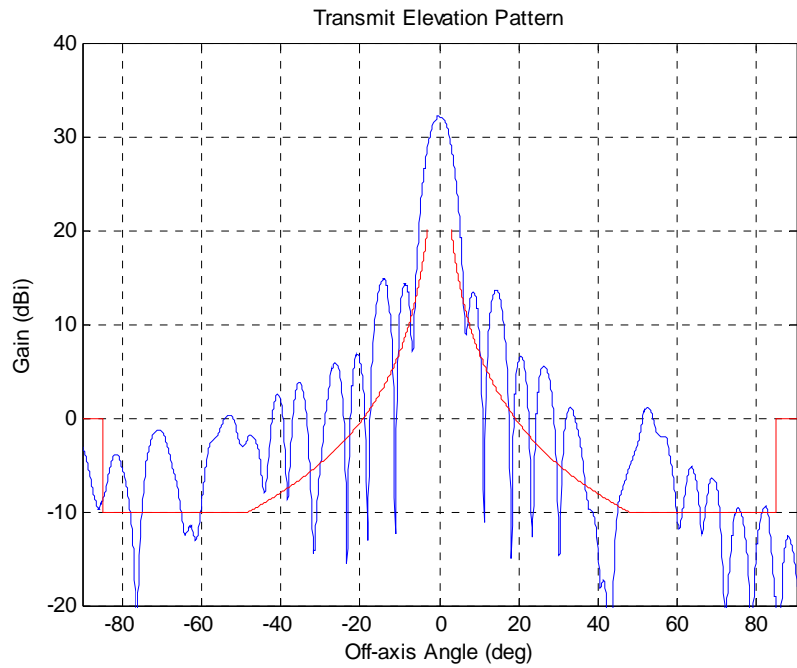


Figure B.3 Transmit Elevation Pattern

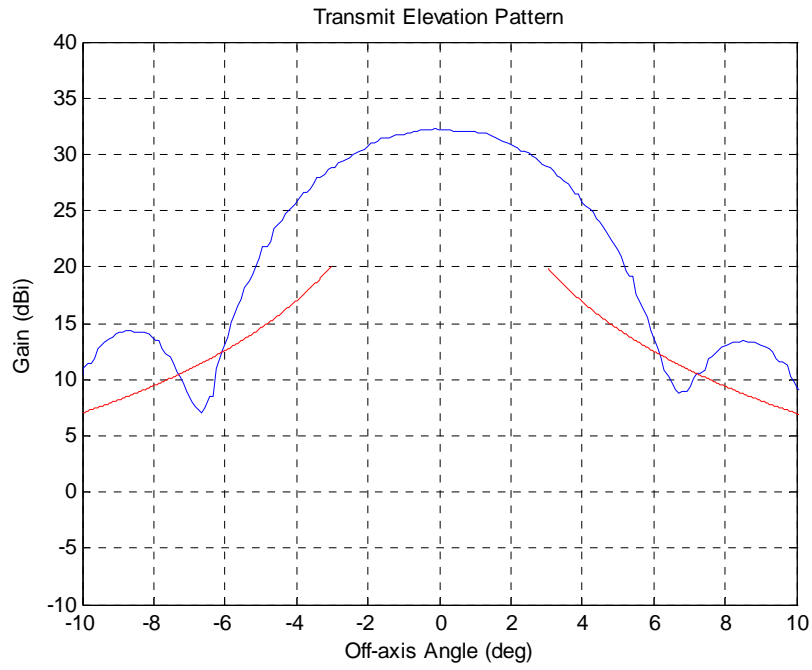


Figure B.4 Transmit Elevation Pattern - Detail

EXHIBIT 1a

Radiation Hazard Analysis for AURA LE

This report analyzes the non-ionizing radiation levels for the AURA LE antenna. This report is developed in accordance with the prediction methods contained in OET Bulletin No. 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, Edition 97-01.

Bulletin No. 65 specifies that there are two separate tiers of exposure limits that are dependant on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure -- the General Population/ Uncontrolled Environment and the Controlled Environment, where the general population does not have access.

The maximum level of non-ionizing radiation to which individuals may be exposed is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm^2) averaged over any 6 minute period in a controlled environment, and the maximum level of non-ionizing radiation to which the general public is exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm^2) averaged over any 30 minute period in a uncontrolled environment.

In the normal range of transmit powers for satellite antennas, the power densities at or around the antenna surface are expected to exceed safe levels. This area will not be accessible to the general public. Operators and technicians will receive training specifying this area as a high exposure area. Procedures will be established to ensure that all transmitters are turned off before this area may be accessed by operators, maintenance or other authorized personnel.

Near Field Exposure

The AURA LE antenna potentially exceeds MPE limits in the near field within the rectangular volume directly in front of the panels (7.0 mW/cm^2). For this calculation, it was assumed that all 10 watts from each SSPA module are uniformly distributed across the surface area of the panel. There are two SSPA modules, one for each antenna panel. This is a reasonable assumption for a flat panel waveguide fed phased array with minimal sidelobe tapering.

The extent of the near field region is defined by the following

$$R_{nf} = D^2 / (4\lambda)$$

8.9 meters

Where D is the width of the panel (0.86 meters)

The maximum power density in the Near Field can be determined by the following equation:

$$S_{nf} = P_{SSPA} / A$$

$$7 \text{ mW/cm}^2$$

Where A is the surface area of the panel and P is the power available from the SSPA.

In normal operation, this antenna is mounted on a rooftop with the main beam pointed toward the sky at a minimum elevation angle of 10 degrees when operated on the ground such that human exposure in the near field is not possible. Furthermore, normal TDMA operation uses a duty cycle of 10% or less, reducing maximum near field exposure by an order of magnitude to 0.7 mW/cm². Additionally, in normal operation, any blockage in the near field (human or otherwise) will cause the transmitter to be disabled within seconds as the system does not transmit unless it can receive the downlink carrier from the satellite. Therefore, prolonged exposure in the near field is not possible in normal operation.

Far Field Exposure (in main beam)

$$R_{ff} = 0.60D^2 / \lambda$$

$$22 \text{ m}$$

$$S_{ff} = P_{EIRP} / (4\pi R_{ff}^2)$$

$$1.0 \text{ mW/cm}^2$$

At a distance of 22 meters, the power density of the Aura LE is 1.0 mW/cm², which is within the limits of General Population/Uncontrolled Exposure (MPE) even in the direction of the main beam of the antenna.

As noted previously, the antenna will be mounted on a building or vehicle rooftop with the main beam pointed to the sky at a minimum elevation angle of 10 degrees. In this case, maximum far field exposure to humans would be due to a sidelobe which is at least 15 dB below the main beam. At a distance of 22 meters, the exposure to humans would be less than 0.032 mW/cm².

Transition Region Exposure (in main beam)

At a distance of 13 m from the antenna, maximum exposure in the main beam is 5 mW/cm². This assumes that PFD decreases linearly from 7 mW/cm² to 1.0 mW/cm² in this region between the near field and far field (8.9 m to 22 m from the antenna).

Exposure to personnel located below antenna height

The antenna will be mounted at a height above personnel. In this case, the worst case exposure is due to the first elevation sidelobe at a level of -15 dB. For the AURA LE antenna, the far field distance in the elevation plane is approximately 0.8 meters. The 5 mW/cm² threshold is reached at a distance of 1.8 meters and the 1 mW/cm² threshold is

reached at a distance of 4.0 m. Observing the safe radius distance noted above during transmit operations will ensure that the threshold will not be exceeded.

Table 1: Parameters Used for Determining PFD (Aura LE)

Antenna Width	34 in	0.8636 m
Antenna Height	6.5 in	0.1651 m
Antenna Surface Area		0.14258 m ²
Frequency		14250 MHz
Wavelength		0.021 m
Transmit Power		10 W
Antenna Gain		38 dBi
Antenna Gain		6309.573
EIRP		48 dBW
Far Field Boundary (Azimuth)		22.0 m
Power Density at far field boundary (Azimuth)		1.0 mW/cm ²
Near Field Distance (Azimuth)		8.9 m
Near Field Power Density (Azimuth)		7.0 mW/cm ²
Elevation sidelobe level		-15.0 dB
Far Field Boundary (Elevation)		0.8 m
Power Density at far field boundary (Elevation)		26.3 mW/cm ²
Safe Far Field Distance (Elevation)		1.8 m
Power Density		4.9 mW/cm ²
Safe Far Field Distance (Elevation)		4.0 m
Power Density		1.0 mW/cm ²

Conclusions

The radiation hazard can be divided into two cases: above the mounting plane of the antenna and below it. Different measures will be taken in each region to ensure that the exposure limits will not be exceeded.

The worse-case radiation hazards exist exists above the mounting plane of the antenna along the main beam axis. The antenna will be mounted on a building or vehicle rooftop so access to this region can be controlled and restricted to trained personnel so this case applies to personnel commissioning and testing the antenna. Transmit operations will only be conducted with a clear field of view towards the serving satellite so that the beam does not impose on any uncontrolled areas. By maintaining a safety radius of 22 meters in the boresight direction during transmit operations in this region, it can be guaranteed that the General Population/Uncontrolled Exposure limits will not be exceeded under any test conditions.

Below the mounting plane of the antenna radiation exposure can only occur through sidelobes, which are substantially attenuated. In this case, the safety radius where the General Population/Uncontrolled Exposure limits are satisfied is 4.0 meters in the worst case direction. The antenna will be mounted in such a way that the general population cannot approach to within the safety radius when below the plane of the antenna so that the General Population/Uncontrolled Exposure limits will not be exceeded under any test conditions.

EXHIBIT 1b

Radiation Hazard Analysis for the MELCO Reflector

This report analyzes the non-ionizing radiation levels for the MELCO reflector antenna. This report is developed in accordance with the prediction methods contained in OET Bulletin No. 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, Edition 97-01.

Bulletin No. 65 specifies that there are two separate tiers of exposure limits that are dependant on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure -- the General Population/ Uncontrolled Environment and the Controlled Environment, where the general population does not have access.

The maximum level of non-ionizing radiation to which individuals may be exposed is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm^2) averaged over any 6 minute period in a controlled environment, and the maximum level of non-ionizing radiation to which the general public is exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm^2) averaged over any 30 minute period in a uncontrolled environment.

In the normal range of transmit powers for satellite antennas, the power densities at or around the antenna surface are expected to exceed safe levels. This area will not be accessible to the general public. Operators and technicians will receive training specifying this area as a high exposure area. Procedures will be established to ensure that all transmitters are turned off before this area may be accessed by operators, maintenance or other authorized personnel.

Near Field Exposure

The MELCO reflector antenna potentially exceeds MPE limits in the near field within the rectangular volume directly in front of the reflector (18.0 mW/cm^2). The output power of the antenna is computed as the maximum EIRP minus the transmit gain, $46.7 \text{ dBW} - 33.1 \text{ dBi} = 13.6 \text{ dBW}$ or 23 watts. For this calculation, it was assumed that all 23 watts output power of the antenna is uniformly distributed across the surface area of the reflector.

The extent of the near field region is defined by the following

$$R_{nf} = D^2 / (4\lambda)$$

5.8 meters

Where D is the width of the panel (0.65 meters)

The maximum power density in the Near Field can be determined by the following equation:

$$S_{nf} = P_{SSPA} / A$$

$$18 \text{ mW/cm}^2$$

Where A is the surface area of the panel and P is the power available from the SSPA. The surface area of the antenna is approximated as the width of the antenna times its height, which is a reasonable approximation given its shape.

In normal operation, this antenna is mounted on a rooftop with the main beam pointed toward the sky at a minimum elevation angle of 10 degrees when operated on the ground such that human exposure in the near field is not possible. Furthermore, normal TDMA operation uses a duty cycle of 10% or less, reducing maximum near field exposure by an order of magnitude to 1.8 mW/cm². Additionally, in normal operation, any blockage in the near field (human or otherwise) will cause the transmitter to be disabled within seconds as the system does not transmit unless it can receive the downlink carrier from the satellite. Therefore, prolonged exposure in the near field is not possible in normal operation.

Far Field Exposure (in main beam)

$$R_{ff} = 0.60D^2 / \lambda$$

$$13 \text{ m}$$

$$S_{ff} = P_{EIRP} / (4\pi R_{ff}^2)$$

$$2.2 \text{ mW/cm}^2$$

At a distance of 13 meters, the power density of the MELCO reflector is 2.2 mW/cm², which exceeds the General Population/Uncontrolled Exposure (MPE) but is less than the controlled environment limit. The power density falls to the General Population / Uncontrolled Exposure (MPE) limit of 1 mW/cm² at 19.5 meters.

As noted previously, the antenna will be mounted on a building or vehicle rooftop with the main beam pointed to the sky at a minimum elevation angle of 10 degrees. In this case, maximum far field exposure to humans would be due to a sidelobe which is at least 16 dB below the main beam. At a distance of 13 meters, the exposure to humans would be less than 0.055 mW/cm².

Transition Region Exposure (in main beam)

At a distance of 11.7 m from the antenna, maximum exposure in the main beam is 5 mW/cm². This assumes that PFD decreases linearly from 18 mW/cm² to 2.2 mW/cm² in this region between the near field and far field (5.8 m to 13 m from the antenna).

Exposure to personnel located below antenna height

The antenna will be mounted at a height above personnel. In this case, the worst case exposure is due to the first elevation sidelobe at a level of -16 dB. For the MELCO reflector antenna, the far field distance in the elevation plane is approximately 1.1 meters.

The 5 mW/cm² threshold is reached at a distance of 1.4 meters and the 1 mW/cm² threshold is reached at a distance of 3.0 m. Observing the safe radius distance noted above during transmit operations will ensure that the threshold will not be exceeded.

Table 1: Parameters Used for Determining PFD (MELCO reflector)

Antenna Width	25.6 in	0.65 m
Antenna Height	7.7 in	0.196 m
Antenna Surface Area		0.14258 m ²
Frequency		14250 MHz
Wavelength		0.021 m
Transmit Power		23 W
Antenna Gain		33.1 dBi
Antenna Gain		2042
EIRP		46.7 dBW
Far Field Boundary (Azimuth)		13.0 m
Power Density at far field boundary (Azimuth)		2.2 mW/cm ²
Safe Far Field Distance (Azimuth)		19.5 m
Power Density		1.0 mW/cm ²
Near Field Distance (Azimuth)		5.0 m
Near Field Power Density (Azimuth)		16.1 mW/cm ²
Elevation sidelobe level		-16.0 dB
Far Field Boundary (Elevation)		1.1 m
Power Density at far field boundary (Elevation)		7.8 mW/cm ²
Safe Far Field Distance (Elevation)		1.4 m
Power Density		4.8 mW/cm ²
Safe Far Field Distance (Elevation)		3.0 m
Power Density		1.0 mW/cm ²

Conclusions

The radiation hazard can be divided into two cases: above the mounting plane of the antenna and below it. Different measures will be taken in each region to ensure that the exposure limits will not be exceeded.

The worse-case radiation hazards exist exists above the mounting plane of the antenna along the main beam axis. The antenna will be mounted on a building or vehicle rooftop so access to this region can be controlled and restricted to trained personnel so this case

applies to personnel commissioning and testing the antenna. Transmit operations will only be conducted with a clear field of view towards the serving satellite so that the beam does not impose on any uncontrolled areas. By maintaining a safety radius of 19.5 meters in the boresight direction during transmit operations in this region, it can be guaranteed that the General Population/Uncontrolled Exposure limits will not be exceeded under any test conditions.

Below the mounting plane of the antenna radiation exposure can only occur through sidelobes, which are substantially attenuated. In this case, the safety radius where the General Population/Uncontrolled Exposure limits are satisfied is 3.0 meters in the worst case direction. The antenna will be mounted in such a way that the general population cannot approach to within the safety radius when below the plane of the antenna so that the General Population/Uncontrolled Exposure limits will not be exceeded under any test conditions.

EXHIBIT 2

December 16, 2009



INTELSAT. Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

To Whom It May Concern:

This letter certifies that Horizons Satellite LLC (“Horizons”) is aware that Panasonic Avionics Corporation (“PAC”) is seeking FCC authorization to access Horizons 1 at 127° WL,¹ as an authorized point of communication, for its eXConnect Ku-band aeronautical mobile-satellite service (“AMSS”) system using transmit/receive antennas that are not strictly compliant with the FCC’s antenna gain requirements.² However, as described below, the terminals comply with the FCC’s two-degree spacing rules by maintaining off-axis EIRP spectral density levels below those set forth in analogous Ku-band earth stations onboard vessels (“ESV”) and vehicle-mounted earth stations (“VMES”) rules.³

Horizons understands that PAC plans to operate two AMSS antenna types: (i) the MELCO antennas previously operated with the Connexion by Boeing system; and (ii) the Aura LE antenna designed specifically for the eXConnect system and manufactured by EMS Technologies. The MELCO antenna is a mechanically-steered Cassegrain antenna with an elliptical profile that was previously examined by the FCC and authorized for AMSS operations in experimental Call Sign WC2XVE (File No. 0002-EX-PL-2004) and commercial blanket license Call Sign E000723 (File No. SES-MOD-20030512-00639). The Aura LE antenna is a mechanically steered, flat-plate AES with two transmit/receive apertures that is similarly designed to meet the technical requirements imposed on U.S. and international AMSS operations.⁴ The basic

¹ Horizons Satellite LLC owns and operates the Horizons 1 satellite, which is licensed by Ministry of Internal Affairs and Communications (“MIC”) of Japan.

² See 47 CFR §25.209.

³ See 47 CFR §25.222.

⁴ The Aura LE antenna’s two transmit/receive apertures are coherently combined to form a single beam. At very low elevation angles, only the front aperture is used due to blockage. This allows the antenna to maintain high performance over a large range of elevation angles between 5 degrees and 90 degrees while maintaining a low profile for aerodynamic integration with an aircraft.

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characteristics of the MELCO and Aura LE antenna are also summarized in Table 1.

Table 1. Aura LE and MELCO Antenna Characteristics

Characteristic	EMS Aura LE	MELCO Reflector
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz (11.7-12.2 GHz in the U.S.)	Tx: 14.0 GHz to 14.4 GHz Rx: 11.2 GHz to 12.8 GHz (11.7-12.2 GHz in the U.S.)
Aperture Size	2 Apertures of 35" X 6" each	25.6" X 7.7"
EIRP	42.5 dBW @ 5 deg Elevation 48.0 dBW @ 90 deg Elevation	47.2 dBW
G/T	11 dB/K @ 5 deg Elevation 14 dB/K @ 90 deg Elevation	8.0 dB/K @ 11.2 to 11.7GHz 9.3 dB/K @ 11.9 to 12.8GHz
Tracking Rate	40 deg/sec in Azimuth 25 deg/sec in Elevation	40 deg/sec in Azimuth 25 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma	0.25 deg 1-sigma



Both the MELCO and Aura LE antennas are designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antennas are pointed based on aircraft position and attitude information obtained from the ARINC 429 data bus, which is standard on commercial aircraft. This information is augmented with higher rated data from an inertial sensor package that is integrated with the antenna and compensates for INS errors that result from latency and bending of the airframe between the aircraft INS unit and the antenna. The pointing accuracy of the MELCO reflector is 0.25 deg 1-sigma and the pointing accuracy of the EMS Aura LE antenna will be less than 0.2 deg 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5 degrees, then transmissions will be automatically inhibited within 100 ms.⁵

The FCC's off axis EIRP spectral density limits for analogous ESV and VMES operations are defined by Sections 25.222(a)(1) and 25.226(a)(1)(i). The effective off-axis EIRP spectral density generated by a conforming terminal will be:

15-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	1.5° ≤ Θ ≤ 7°
-6	dBW/4 kHz	for	7° < Θ ≤ 9.2°
18-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	9.2° < Θ ≤ 48°
-24	dBW/4 kHz	for	48° < Θ ≤ 85°
-14	dBW/4 kHz	for	85° < Θ ≤ 180°

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite.

⁵ See 47 C.F.R. § 25.222(a)(7) (Ku-band ESVs) and § 25.226(b)(1)(iv)(B)(Ku-band VMESs).



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The eXConnect system will limit off-axis EIRP spectral density to no more than this level through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate carrier bandwidths; (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold and (iii) controlling pointing error and inhibiting transmissions when the pointing offset exceeds a threshold of 0.5 deg. The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance.

Based on the foregoing factors, the MELCO antenna will operate at a maximum input power density at the antenna waveguide flange of -21.6 dBW /4 kHz, employing BPSK modulation; and the Aura LE antenna will operate at a maximum input power density at the antenna waveguide flange of -15.1 dBW /4 kHz, employing BPSK modulation. Even in the rare circumstance when transmitting at pointing offsets equivalent to their design tolerances, these antenna terminals are compliant with the off-axis EIRP density level requirements specified in Sections §25.222 and §25.226, or the combined effect of §25.209 and §25.212(c) of the Commission's Rules, at all off-axis angles up to and including 6 degrees off-axis angle. PAC's conservative approach of including antenna pointing offsets in selecting the maximum power levels defined above ensures that the operation of these antennas, with the associated off-axis EIRP density envelope, will not cause unacceptable interference into adjacent satellites.

The undersigned further certifies that the maximum downlink satellite EIRP density of 13.0 dBW/4KHz, operational level of the Ku-band AMSS network operated by PAC, is routinely used at 2-degree spacing without causing unacceptable interference to adjacent satellite operators. .

Furthermore, in order to prevent unacceptable interference into adjacent satellites, Horizons and PAC acknowledge that the antennas will be installed in compliance with the technical, operational and performance requirements of Part 25 of the FCC Rules and any requirements set forth in the licenses granted by the FCC for the above AMSS antenna system.

Horizons and PAC confirm that the use of the above antennas will not cause unacceptable interference into adjacent satellites in accordance with the FCC's two-degree spacing policy and accept that these antennas will not require more protection from adjacent satellites compared to an earth station employing an antenna conforming to the FCC antenna performance standards defined in Section 25.209 of the FCC rules. If the use of this antenna should cause unacceptable interference into other systems, PAC has agreed that it will terminate transmission immediately upon notice from the affected parties.

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Sincerely,

Jose Albuquerque
Jose Albuquerque
for Horizons Satellite LLC

16 December 2009
Date



Acceptance by Panasonic Avionics Corporation:

PAC testifies that the information provided to Horizons and reflected in this affidavit is true and accurate to the best of PAC's knowledge.

Paul Saraffe
Paul Saraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

Dec. 17, 2009
Date

Acceptance by EchoStar Satellite Services:

EchoStar Satellite Services agrees to the use of the PAC MELCO and Aura LE antennas, provided the power density into the antenna flange is adjusted such that compliance with the uplink off-axis EIRP density limits stated in this letter is assured, with respect to EchoStar satellites and the associated satellite networks that are within +/- 6 degrees orbital spacing from Horizons 1 at 127° WL.

David Bair
David Bair
Senior Vice President
EchoStar

17 Dec 2009
Date



December 16, 2009

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

To Whom It May Concern:

This letter certifies that Horizons Satellite LLC ("Horizons") is aware that Panasonic Avionics Corporation ("PAC") is seeking FCC authorization to access Horizons 1 at 127° WL,¹ as an authorized point of communication, for its eXConnect Ku-band aeronautical mobile-satellite service ("AMSS") system using transmit/receive antennas that are not strictly compliant with the FCC's antenna gain requirements.² However, as described below, the terminals comply with the FCC's two-degree spacing rules by maintaining off-axis EIRP spectral density levels below those set forth in analogous Ku-band earth stations onboard vessels ("ESV") and vehicle-mounted earth stations ("VMES") rules.³

Horizons understands that PAC plans to operate two AMSS antenna types: (i) the MELCO antennas previously operated with the Connexion by Boeing system; and (ii) the Aura LE antenna designed specifically for the eXConnect system and manufactured by EMS Technologies. The MELCO antenna is a mechanically-steered Cassegrain antenna with an elliptical profile that was previously examined by the FCC and authorized for AMSS operations in experimental Call Sign WC2XVE (File No. 0002-EX-PL-2004) and commercial blanket license Call Sign E000723 (File No. SES-MOD-20030512-00639). The Aura LE antenna is a mechanically steered, flat-plate AES with two transmit/receive apertures that is similarly designed to meet the technical requirements imposed on U.S. and international AMSS operations.⁴ The basic

¹ Horizons Satellite LLC owns and operates the Horizons 1 satellite, which is licensed by Ministry of Internal Affairs and Communications ("MIC") of Japan.

² See 47 CFR §25.209.

³ See 47 CFR §25.222.

⁴ The Aura LE antenna's two transmit/receive apertures are coherently combined to form a single beam. At very low elevation angles, only the front aperture is used due to blockage. This allows

characteristics of the MELCO and Aura LE antenna are also summarized in Table 1.

Table 1. Aura LE and MELCO Antenna Characteristics

Characteristic	EMS Aura LE	MELCO Reflector
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz (11.7-12.2 GHz in the U.S.)	Tx: 14.0 GHz to 14.4 GHz Rx: 11.2 GHz to 12.8 GHz (11.7-12.2 GHz in the U.S.)
Aperture Size	2 Apertures of 35" X 6" each	25.6" X 7.7"
EIRP	42.5 dBW @ 5 deg Elevation 48.0 dBW @ 90 deg Elevation.	47.2 dBW
G/T	11 dB/K @ 5 deg Elevation 14 dB/K @ 90 deg Elevation	8.0 dB/K @ 11.2 to 11.7GHz 9.3 dB/K @ 11.9 to 12.8GHz
Tracking Rate	40 deg/sec in Azimuth 25 deg/sec in Elevation	40 deg/sec in Azimuth 25 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma	0.25 deg 1-sigma



Both the MELCO and Aura LE antennas are designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antennas are pointed based on aircraft position and attitude information obtained from the ARINC 429 data bus, which is standard on commercial aircraft. This information is augmented with higher rated data from an inertial sensor package that is integrated with the antenna and compensates for INS errors that result from latency and bending of the airframe between the aircraft INS unit and the antenna. The pointing accuracy of the MELCO reflector is 0.25 deg 1-sigma and the pointing accuracy of the EMS Aura LE antenna will be less than 0.2 deg 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5 degrees, then transmissions will be automatically inhibited within 100 ms.⁵

The FCC's off axis EIRP spectral density limits for analogous ESV and VMES operations are defined by Sections 25.222(a)(1) and 25.226(a)(1)(i). The effective off-axis EIRP spectral density generated by a conforming terminal will be:

15-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	1.5° ≤ Θ ≤ 7°
-6	dBW/4 kHz	for	7° < Θ ≤ 9.2°
18-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	9.2° < Θ ≤ 48°
-24	dBW/4 kHz	for	48° < Θ ≤ 85°
-14	dBW/4 kHz	for	85° < Θ ≤ 180°

the antenna to maintain high performance over a large range of elevation angles between 5 degrees and 90 degrees while maintaining a low profile for aerodynamic integration with an aircraft.

⁵ See 47 C.F.R. § 25.222(a)(7) (Ku-band ESVs) and § 25.226(b)(1)(iv)(B)(Ku-band VMESs).

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite.



INTELSAT.

The eXConnect system will limit off-axis EIRP spectral density to no more than this level through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate carrier bandwidths; (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold and (iii) controlling pointing error and inhibiting transmissions when the pointing offset exceeds a threshold of 0.5 deg. The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance.

Based on the foregoing factors, the MELCO antenna will operate at a maximum input power density at the antenna waveguide flange of -21.6 dBW /4 kHz, employing BPSK modulation; and the Aura LE antenna will operate at a maximum input power density at the antenna waveguide flange of -15.1 dBW /4 kHz, employing BPSK modulation. Even in the rare circumstance when transmitting at pointing offsets equivalent to their design tolerances, these antenna terminals are compliant with the off-axis EIRP density level requirements specified in Sections §25.222 and §25.226, or the combined effect of §25.209 and §25.212(c) of the Commission's Rules, at all off-axis angles up to and including 6 degrees off-axis angle. PAC's conservative approach of including antenna pointing offsets in selecting the maximum power levels defined above ensures that the operation of these antennas, with the associated off-axis EIRP density envelope, will not cause unacceptable interference into adjacent satellites.

The undersigned further certifies that the maximum downlink satellite EIRP density of 13.0 dBW/4KHz, operational level of the Ku-band AMSS network operated by PAC, is routinely used at 2-degree spacing without causing unacceptable interference to adjacent satellite operators.

Furthermore, in order to prevent unacceptable interference into adjacent satellites, Horizons and PAC acknowledge that the antennas will be installed in compliance with the technical, operational and performance requirements of Part 25 of the FCC Rules and any requirements set forth in the licenses granted by the FCC for the above AMSS antenna system.

Horizons and PAC confirm that the use of the above antennas will not cause unacceptable interference into adjacent satellites in accordance with the FCC's two-degree spacing policy and accept that these antennas will not require more protection from adjacent satellites compared to an earth station employing an antenna conforming to the FCC antenna performance standards defined in Section 25.209 of the FCC rules. If the use of this antenna should cause unacceptable interference into other systems, PAC has agreed that it will terminate transmission immediately upon notice from the affected parties.

Sincerely,

Jose Albuquerque
Jose Albuquerque
for Horizons Satellite LLC

16 December 2009
Date



Acceptance by Panasonic Avionics Corporation:

PAC testifies that the information provided to Horizons and reflected in this affidavit is true and accurate to the best of PAC's knowledge.

Paul Saraffe
Paul Saraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

Dec 16, 2009
Date

Acceptance by SES Americom:

SES Americom agrees to the use of the PAC MELCO and Aura LE antennas with the above power density into the antenna flange and the uplink EIRP density level as stated in this letter, with respect to SES satellites and the associated satellite networks that are within +/- 6 degrees orbital spacing from Horizons 1 at 127° WL.

K. Jonnalagadda
Krish Jonnalagadda
Manager, Spectrum Development
SES Americom

16 Dec 09
Date

December 16, 2009



Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

To Whom It May Concern:

This letter certifies that Intelsat is aware that Panasonic Avionics Corporation ("PAC") is seeking FCC authorization to access Galaxy 17 at 91° WL, as an authorized point of communication, for its eXConnect Ku-band aeronautical mobile-satellite service ("AMSS") system using transmit/receive antennas that are not strictly compliant with the FCC's antenna gain requirements.¹ However, as described below, the terminals comply with the FCC's two-degree spacing rules by maintaining off-axis EIRP spectral density levels below those set forth in analogous Ku-band earth stations onboard vessels ("ESV") and vehicle-mounted earth stations ("VMES") rules.²

Intelsat understands that PAC plans to operate two AMSS antenna types: (i) the MELCO antennas previously operated with the Connexion by Boeing system; and (ii) the Aura LE antenna designed specifically for the eXConnect system and manufactured by EMS Technologies. The MELCO antenna is a mechanically-steered Cassegrain antenna with an elliptical profile that was previously examined by the FCC and authorized for AMSS operations in experimental Call Sign WC2XVE (File No. 0002-EX-PL-2004) and commercial blanket license Call Sign E000723 (File No. SES-MOD-20030512-00639). The Aura LE antenna is a mechanically steered, flat-plate AES with two transmit/receive apertures that is similarly designed to meet the technical requirements imposed on U.S. and international AMSS operations.³ The basic

¹ See 47 CFR §25.209.

² See 47 CFR §25.222.

³ The Aura LE antenna's two transmit/receive apertures are coherently combined to form a single beam. At very low elevation angles, only the front aperture is used due to blockage. This allows the antenna to maintain high performance over a large range of elevation angles between 5 degrees and 90 degrees while maintaining a low profile for aerodynamic integration with an aircraft.

characteristics of the MELCO and Aura LE antenna are also summarized in Table 1.

Table 1. Aura LE and MELCO Antenna Characteristics



INTELSAT

Characteristic	EMS Aura LE	MELCO Reflector
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz (11.7-12.2 GHz in the U.S.)	Tx: 14.0 GHz to 14.4 GHz Rx: 11.2 GHz to 12.8 GHz (11.7-12.2 GHz in the U.S.)
Aperture Size	2 Apertures of 35" X 6" each	25.6" X 7.7"
EIRP	42.5 dBW @ 5 deg Elevation 48.0 dBW @ 90 deg Elevation	47.2 dBW
G/T	11 dB/K @ 5 deg Elevation 14 dB/K @ 90 deg Elevation	8.0 dB/K @ 11.2 to 11.7GHz 9.3 dB/K @ 11.9 to 12.8GHz
Tracking Rate	40 deg/sec in Azimuth 25 deg/sec in Elevation	40 deg/sec in Azimuth 25 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma	0.25 deg 1-sigma

Both the MELCO and Aura LE antennas are designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antennas are pointed based on aircraft position and attitude information obtained from the ARINC 429 data bus, which is standard on commercial aircraft. This information is augmented with higher rated data from an inertial sensor package that is integrated with the antenna and compensates for INS errors that result from latency and bending of the airframe between the aircraft INS unit and the antenna. The pointing accuracy of the MELCO reflector is 0.25 deg 1-sigma and the pointing accuracy of the EMS Aura LE antenna will be less than 0.2 deg 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5 degrees, then transmissions will be automatically inhibited within 100 ms.⁴

The FCC's off axis EIRP spectral density limits for analogous ESV and VMES operations are defined by Sections 25.222(a)(1) and 25.226(a)(1)(i). The effective off-axis EIRP spectral density generated by a conforming terminal will be:

15-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	1.5° ≤ Θ ≤ 7°
-6	dBW/4 kHz	for	7° < Θ ≤ 9.2°
18-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	9.2° < Θ ≤ 48°
-24	dBW/4 kHz	for	48° < Θ ≤ 85°
-14	dBW/4 kHz	for	85° < Θ ≤ 180°

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite.

⁴ See 47 C.F.R. § 25.222(a)(7) (Ku-band ESVs) and § 25.226(b)(1)(iv)(B)(Ku-band VMESs).



INTELSAT

The eXConnect system will limit off-axis EIRP spectral density to no more than this level through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate carrier bandwidths; (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold and (iii) controlling pointing error and inhibiting transmissions when the pointing offset exceeds a threshold of 0.5 deg. The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance.

Based on the foregoing factors, the MELCO antenna will operate at a maximum input power density at the antenna waveguide flange of -21.6 dBW /4 kHz, employing BPSK modulation; and the Aura LE antenna will operate at a maximum input power density at the antenna waveguide flange of -15.1 dBW /4 kHz, employing BPSK modulation. Even in the rare circumstance when transmitting at pointing offsets equivalent to their design tolerances, these antenna terminals are compliant with the off-axis EIRP density level requirements specified in Sections §25.222 and §25.226, or the combined effect of §25.209 and §25.212(c) of the Commission's Rules, at all off-axis angles up to and including 6 degrees off-axis angle. PAC's conservative approach of including antenna pointing offsets in selecting the maximum power levels defined above ensures that the operation of these antennas, with the associated off-axis EIRP density envelope, will not cause unacceptable interference into adjacent satellites.

The undersigned further certifies that the maximum downlink satellite EIRP density of 13.0 dBW/4KHz, operational level of the Ku-band AMSS network operated by PAC, is routinely used at 2-degree spacing without causing unacceptable interference to adjacent satellite operators.

Furthermore, in order to prevent unacceptable interference into adjacent satellites, Horizons and PAC acknowledge that the antennas will be installed in compliance with the technical, operational and performance requirements of Part 25 of the FCC Rules and any requirements set forth in the licenses granted by the FCC for the above AMSS antenna system.

Horizons and PAC confirm that the use of the above antennas will not cause unacceptable interference into adjacent satellites in accordance with the FCC's two-degree spacing policy and accept that these antennas will not require more protection from adjacent satellites compared to an earth station employing an antenna conforming to the FCC antenna performance standards defined in Section 25.209 of the FCC rules. If the use of this antenna should cause unacceptable interference into other systems, PAC has agreed that it will terminate transmission immediately upon notice from the affected parties.

Sincerely,



INTELSAT

Jose Albuquerque
Jose Albuquerque
Senior Director, Spectrum Engineering
Intelsat

16 December 2009
Date

Acceptance by Panasonic Avionics Corporation:

PAC testifies that the information provided to Intelsat and reflected in this affidavit is true and accurate to the best of PAC's knowledge.

Paul Saraffe
Paul Saraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

Dec. 16, 2009
Date

Acceptance by SES Americom:

SES Americom agrees to the use of the PAC MELCO and Aura LE antennas with the above power density into the antenna flange and the uplink EIRP density level as stated in this letter, with respect to SES satellites and the associated satellite networks that are within +/- 6 degrees orbital spacing from Galaxy 17 at 91° WL.

K. Jonnalagadda 16 Dec 09
Krish Jonnalagadda Date
Manager, Spectrum Development
SES Americom



December 16, 2009

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

To Whom It May Concern:

This letter certifies that Intelsat is aware that Panasonic Avionics Corporation ("PAC") is seeking FCC authorization to access Galaxy 19 at 97° WL, as an authorized point of communication, for its eXConnect Ku-band aeronautical mobile-satellite service ("AMSS") system using transmit/receive antennas that are not strictly compliant with the FCC's antenna gain requirements.¹ However, as described below, the terminals comply with the FCC's two-degree spacing rules by maintaining off-axis EIRP spectral density levels below those set forth in analogous Ku-band earth stations onboard vessels ("ESV") and vehicle-mounted earth stations ("VMES") rules.²

Intelsat understands that PAC plans to operate two AMSS antenna types: (i) the MELCO antennas previously operated with the Connexion by Boeing system; and (ii) the Aura LE antenna designed specifically for the eXConnect system and manufactured by EMS Technologies. The MELCO antenna is a mechanically-steered Cassegrain antenna with an elliptical profile that was previously examined by the FCC and authorized for AMSS operations in experimental Call Sign WC2XVE (File No. 0002-EX-PL-2004) and commercial blanket license Call Sign E000723 (File No. SES-MOD-20030512-00639). The Aura LE antenna is a mechanically steered, flat-plate AES with two transmit/receive apertures that is similarly designed to meet the technical requirements imposed on U.S. and international AMSS operations.³ The basic

¹ See 47 CFR §25.209.

² See 47 CFR §25.222.

³ The Aura LE antenna's two transmit/receive apertures are coherently combined to form a single beam. At very low elevation angles, only the front aperture is used due to blockage. This allows the antenna to maintain high performance over a large range of elevation angles between 5 degrees and 90 degrees while maintaining a low profile for aerodynamic integration with an aircraft.

characteristics of the MELCO and Aura LE antenna are also summarized in Table 1.

Table 1. Aura LE and MELCO Antenna Characteristics

Characteristic	EMS Aura LE	MELCO Reflector
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz (11.7-12.2 GHz in the U.S.)	Tx: 14.0 GHz to 14.4 GHz Rx: 11.2 GHz to 12.8 GHz (11.7-12.2 GHz in the U.S.)
Aperture Size	2 Apertures of 35" X 6" each	25.6" X 7.7"
EIRP	42.5 dBW @ 5 deg Elevation 48.0 dBW @ 90 deg Elevation	47.2 dBW
G/T	11 dB/K @ 5 deg Elevation 14 dB/K @ 90 deg Elevation	8.0 dB/K @ 11.2 to 11.7GHz 9.3 dB/K @ 11.9 to 12.8GHz
Tracking Rate	40 deg/sec in Azimuth 25 deg/sec in Elevation	40 deg/sec in Azimuth 25 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma	0.25 deg 1-sigma

Both the MELCO and Aura LE antennas are designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antennas are pointed based on aircraft position and attitude information obtained from the ARINC 429 data bus, which is standard on commercial aircraft. This information is augmented with higher rated data from an inertial sensor package that is integrated with the antenna and compensates for INS errors that result from latency and bending of the airframe between the aircraft INS unit and the antenna. The pointing accuracy of the MELCO reflector is 0.25 deg 1-sigma and the pointing accuracy of the EMS Aura LE antenna will be less than 0.2 deg 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5 degrees, then transmissions will be automatically inhibited within 100 ms.⁴

The FCC's off axis EIRP spectral density limits for analogous ESV and VMES operations are defined by Sections 25.222(a)(1) and 25.226(a)(1)(i). The effective off-axis EIRP spectral density generated by a conforming terminal will be:

15-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	1.5° ≤ Θ ≤ 7°
-6	dBW/4 kHz	for	7° < Θ ≤ 9.2°
18-25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	9.2° < Θ ≤ 48°
-24	dBW/4 kHz	for	48° < Θ ≤ 85°
-14	dBW/4 kHz	for	85° < Θ ≤ 180°

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite.

⁴ See 47 C.F.R. § 25.222(a)(7) (Ku-band ESVs) and § 25.226(b)(1)(iv)(B)(Ku-band VMESs).





INTELSAT

The eXConnect system will limit off-axis EIRP spectral density to no more than this level through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate carrier bandwidths; (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold and (iii) controlling pointing error and inhibiting transmissions when the pointing offset exceeds a threshold of 0.5 deg. The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance.

Based on the foregoing factors, the MELCO antenna will operate at a maximum input power density at the antenna waveguide flange of -21.6 dBW /4 kHz, employing BPSK modulation; and the Aura LE antenna will operate at a maximum input power density at the antenna waveguide flange of -15.1 dBW /4 kHz, employing BPSK modulation. Even in the rare circumstance when transmitting at pointing offsets equivalent to their design tolerances, these antenna terminals are compliant with the off-axis EIRP density level requirements specified in Sections §25.222 and §25.226, or the combined effect of §25.209 and §25.212(c) of the Commission's Rules, at all off-axis angles up to and including 6 degrees off-axis angle. PAC's conservative approach of including antenna pointing offsets in selecting the maximum power levels defined above ensures that the operation of these antennas, with the associated off-axis EIRP density envelope, will not cause unacceptable interference into adjacent satellites.

The undersigned further certifies that the maximum downlink satellite EIRP density of 13.0 dBW/4KHz, operational level of the Ku-band AMSS network operated by PAC, is routinely used at 2-degree spacing without causing unacceptable interference to adjacent satellite operators.

Furthermore, in order to prevent unacceptable interference into adjacent satellites, Horizons and PAC acknowledge that the antennas will be installed in compliance with the technical, operational and performance requirements of Part 25 of the FCC Rules and any requirements set forth in the licenses granted by the FCC for the above AMSS antenna system.

Horizons and PAC confirm that the use of the above antennas will not cause unacceptable interference into adjacent satellites in accordance with the FCC's two-degree spacing policy and accept that these antennas will not require more protection from adjacent satellites compared to an earth station employing an antenna conforming to the FCC antenna performance standards defined in Section 25.209 of the FCC rules. If the use of this antenna should cause unacceptable interference into other systems, PAC has agreed that it will terminate transmission immediately upon notice from the affected parties.

Sincerely,

Jose Albuquerque
Jose Albuquerque
Senior Director, Spectrum Engineering
Intelsat

16 December 2009
Date



Acceptance by Panasonic Avionics Corporation:

PAC testifies that the information provided to Intelsat and reflected in this affidavit is true and accurate to the best of PAC's knowledge.

Paul Saraffe
Paul Saraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

Dec 16, 2009
Date

Acceptance by SES Americom:

SES Americom agrees to the use of the PAC MELCO and Aura LE antennas with the above power density into the antenna flange and the uplink EIRP density level as stated in this letter, with respect to SES satellites and the associated satellite networks that are within +/- 6 degrees orbital spacing from Galaxy 19 at 97° WL.

K. Jonnalagadda
Krish Jonnalagadda
Manager, Spectrum Development
SES Americom

16 Dec 09
Date



Robert Condurso
Director, Government and Regulatory Affairs

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February 8, 2010

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

To Whom It May Concern:

This letter certifies that Telesat Canada ("Telesat") is aware that Panasonic Avionics Corporation ("PAC") is seeking FCC authorization to access the Telstar 14 satellite at 63° WL,¹ as an authorized point of communication, for its eXConnect Ku-band aeronautical mobile-satellite service ("AMSS") system using transmit/receive antennas that are not strictly compliant with the FCC's antenna gain requirements.² However, as described below, Telesat believes that the terminals comply with the FCC's two-degree spacing rules by maintaining off-axis EIRP spectral density levels below those set forth in analogous Ku-band earth stations onboard vessels ("ESV") and vehicle-mounted earth stations ("VMES") rules.³

Telesat understands that PAC plans to operate two AMSS antenna types: (i) the MELCO antennas previously operated with the Connexion by Boeing system; and (ii) the Aura LE antenna designed specifically for the eXConnect system and manufactured by EMS Technologies. We understand that the MELCO antenna is a mechanically-steered Cassegrain antenna with an elliptical profile that was previously examined by the FCC and authorized for AMSS operations in experimental Call Sign WC2XVE (File No. 0002-EX-PL-2004) and commercial blanket license Call Sign E000723 (File No. SES-MOD-20030512-00639). We understand that the Aura LE antenna is a mechanically steered, flat-plate AES with two transmit/receive apertures that is similarly designed

¹ Telesat, through its subsidiary Telesat Brasil Capacidade de Satelites Ltda., operates the Telstar 14 satellite pursuant to a license issued by Brazil. Telstar 14 has been granted FCC authority to serve the United States.

² See 47 CFR §25.209.

³ See 47 CFR §25.222.

to meet the technical requirements imposed on U.S. and international AMSS operations.⁴ The basic characteristics of the MELCO and Aura LE antennas, as specified by the manufacturers, are also summarized in Table 1.

Table 1. Aura LE and MELCO Antenna Characteristics

Characteristic	EMS Aura LE	MELCO Reflector
Frequency	Tx: 14.0 GHz to 14.5 GHz Rx: 10.7 GHz to 12.75 GHz (11.7-12.2 GHz in the U.S.)	Tx: 14.0 GHz to 14.4 GHz Rx: 11.2 GHz to 12.8 GHz (11.7-12.2 GHz in the U.S.)
Aperture Size	2 Apertures of 35" X 6" each	25.6" X 7.7"
EIRP	42.5 dBW @ 5 deg Elevation 48.0 dBW @ 90 deg Elevation	47.2 dBW
G/T	11 dB/K @ 5 deg Elevation 14 dB/K @ 90 deg Elevation	8.0 dB/K @ 11.2 to 11.7GHz 9.3 dB/K @ 11.9 to 12.8GHz
Tracking Rate	40 deg/sec in Azimuth 25 deg/sec in Elevation	40 deg/sec in Azimuth 25 deg/sec in Elevation
Az Pointing Accuracy	0.2 deg 1-sigma	0.25 deg 1-sigma

Based on our review of the technical specifications and conversations with PAC, we understand that both the MELCO and Aura LE antennas are designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antennas are pointed based on aircraft position and attitude information obtained from the ARINC 429 data bus, which is standard on commercial aircraft. This information is augmented with higher rated data from an inertial sensor package that is integrated with the antenna and compensates for Inertial Navigation System (“INS”) errors that result from latency and bending of the airframe between the aircraft INS unit and the antenna. The pointing accuracy of the MELCO reflector is 0.25 deg 1-sigma and the pointing accuracy of the EMS Aura LE antenna will be less than 0.2 deg 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5 degrees, then transmissions will be automatically inhibited within 100 ms.⁵

The FCC’s off axis EIRP spectral density limits for analogous ESV and VMES operations are defined by Sections 25.222(a)(1) and 25.226(a)(1)(i). The effective off-axis EIRP spectral density generated by a conforming terminal will be:

15–25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	1.5° ≤ Θ ≤ 7°
–6	dBW/4 kHz	for	7° < Θ ≤ 9.2°
18–25log ₁₀ (Θ + 0.2)	dBW/4 kHz	for	9.2° < Θ ≤ 48°
–24	dBW/4 kHz	for	48° < Θ ≤ 85°

⁴ The Aura LE antenna’s two transmit/receive apertures are coherently combined to form a single beam. At very low elevation angles, only the front aperture is used due to blockage. This allows the antenna to maintain high performance over a large range of elevation angles between 5 degrees and 90 degrees while maintaining a low profile for aerodynamic integration with an aircraft.

⁵ See 47 C.F.R. § 25.222(a)(7) (Ku-band ESVs) and § 25.226(b)(1)(iv)(B)(Ku-band VMESs).

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite.

We have been advised by PAC that the eXConnect system will limit off-axis EIRP spectral density to no more than these levels through various means, including: (i) limiting transmit power spectral density by controlling the transmit power of the terminal and by selecting appropriate carrier bandwidths; (ii) controlling the off-axis gain of the antenna along the GSO by inhibiting transmissions when the skew angle exceeds a specified threshold; and (iii) controlling pointing error and inhibiting transmissions when the pointing offset exceeds a threshold of 0.5 deg. The specific transmit power, bandwidth and skew angle thresholds will be selected based on the desired terminal transmission rates, coverage area, and satellite performance.


Based on the foregoing factors and discussions with PAC, we understand that the MELCO antenna will operate at a maximum input power density at the antenna waveguide flange of -21.6 dBW /4 kHz, employing BPSK modulation; and the Aura LE antenna will operate at a maximum input power density at the antenna waveguide flange of -15.1 dBW /4 kHz, employing BPSK modulation. Even in the rare circumstance when transmitting at pointing offsets equivalent to their design tolerances, we believe that these antenna terminals are compliant with the off-axis EIRP density level requirements specified in Sections 25.222 and 25.226, or the combined effect of Sections 25.209 and 25.212(c) of the FCC's rules, at all off-axis angles up to and including 6 degrees off-axis angle. PAC has advised us that it includes antenna pointing offsets in selecting the maximum power levels defined above to ensure that the operation of these antennas, with the associated off-axis EIRP density envelope, will not cause unacceptable interference into adjacent satellites.

Based on the above advice and understandings, Telesat agrees that the use of the above antennas will not cause unacceptable interference into adjacent satellites in accordance with the FCC's two-degree spacing policy, and that these antennas will not require more protection from adjacent satellites compared to an earth station employing an antenna conforming to the FCC antenna performance standards defined in Section 25.209 of the FCC rules. PAC has represented to Telesat that the antennas will be installed in compliance with the technical, operational and performance requirements of Part 25 of the FCC rules and any requirements set forth in the licenses granted by the FCC for the above AMSS antenna system. If the use of these antennas should cause unacceptable interference into other systems, PAC has agreed that it will terminate transmission immediately upon notice from the affected parties.

Telesat further states that the maximum downlink satellite EIRP density of 13.0 dBW/4KHz, the operational level of the Ku-band AMSS network operated by PAC, is routinely used by satellite operators during frequency coordination at two-degree spacing without causing unacceptable interference to adjacent satellite operators.

Finally, Telesat confirms that the PAC Ku-band AMSS operations described above fall within the operating parameters previously coordinated with adjacent satellite operators within +/- 6 degrees of Telstar 14. Since the Telstar 14 satellite commenced commercial operations, Ku-band operations have been supported that are consistent with these coordination agreements. Telesat has no current plans to alter the coordinated operating parameters for the Telstar 14 satellite.

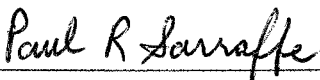
Sincerely,


Robert Condurso
for Telesat Canada

8 Feb 2010
Date

Acceptance by Panasonic Avionics Corporation:

PAC testifies that the information provided to Telesat Canada and reflected in this affidavit is true and accurate to the best of PAC's knowledge.


Paul Saraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

9-Feb-2010
Date