**NARRATIVE DESCRIPTION AND PUBLIC INTEREST STATEMENT**

**On-Ground and Flight Testing of the**
**Aura LE Aircraft Earth Station Antenna**
**with the eXConnect Ku-Band AMSS System**

WCA Holdings III, LLC ("Applicant"), pursuant to Section 5.55 of the Commission's rules, 47 C.F.R. § 5.55, hereby seeks further experimental authority for on-ground and flight testing of a single aircraft earth station ("AES") antenna – an Aura LE antenna – to assist with Federal Aviation Administration ("FAA") Supplemental Type Certification ("STC") testing, as well as further testing and demonstration of the functionality of the AES with the eXConnect Ku-band Aeronautical Mobile-Satellite Service ("AMSS") system. Applicant proposes to operate the AES antenna in accordance with the terms and conditions of its existing experimental special temporary authorization ("STA")[1] and the terms previously adopted by the Commission for operation of this antenna.

Upon grant of the Panasonic Avionics Corporation ("Panasonic") AMSS application discussed below, with the addition of authority to operate the Aura LE antenna, Applicant intends to surrender its experimental authority and/or withdraw the instant application because operation of the antenna will be conducted on a long-term basis pursuant to the Panasonic commercial license.

## I. INTRODUCTION

Applicant has partnered with Panasonic, proponent of the eXConnect System, for AES testing purposes and Applicant has purchased the aircraft on which the Aura LE antenna is being tested. Panasonic presently holds experimental authority granted in Call Sign

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[1] *See* ELS File No. 0398-EX-ST-2010, Call Sign WE9XMO. In accordance with Section 5.61(b), 47 C.F.R. § 5.61(b), Applicant intends to operate pursuant to its experimental STA while the instant application for full experimental authority is pending.

WD9XQT (File No. 0339-EX-ST-2009), which enables flight and ground testing of the Aura LE and MELCO AES antennas.[2] Panasonic has also filed a blanket license application for long-term commercial authority to operate the eXConnect System with the MELCO AES antenna, which is presently installed on a number of Lufthansa commercial aircraft.[3] In that application, Panasonic notified the Commission of its intention to request authority to operate the Aura LE antenna once it completes scheduled testing.[4] Once Panasonic adds authority to operate the Aura LE to its commercial license, the Applicant's Aura LE terminal will operate pursuant to the Panasonic commercial license and Applicant will surrender its experimental license or withdraw the instant application. Until that time, however, the antenna will be operated by Applicant pursuant to its experimental authority for ongoing testing and demonstration activities.

In connection with testing of the eXConnect System, Panasonic has installed a single Aura LE AES antenna on Applicant's aircraft for FAA STC testing and for additional testing and demonstration of antenna performance. Applicant's Boeing Business Jet 737 serves as an AES "test bed" for the Aura LE terminal.[5] Applicant will maintain ultimate control of the AES equipment onboard its aircraft and, through a contractual arrangement with Panasonic,

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[2] Panasonic timely filed for a two-year experimental license to permit further AES testing on different aircraft types and configurations (ELS File No. 0281-EX-PL-2010, Call Sign WF2XMD, filed June 21, 2010), which resulted in automatic extension of its experimental STA authority pending FCC action on the experimental license application. *See* 47 C.F.R. § 5.61(b).

[3] *See* Application of Panasonic Avionics Corporation for Authority to Operate Up to 15 Technically Identical Aeronautical Mobile-Satellite Service ("AMSS") Aircraft Earth Stations ("AESs") in the 14.0-14.4 GHz and 11.7-12.2 GHz Frequency Bands, File Nos. SES-LIC-201000805-00992, SES-AMD-20100914-01163 and SES-AMD-20101115-01432 (Call Sign E100089) ("Panasonic AMSS Application").

[4] *See* Panasonic AMSS Application Narrative at n.3.

[5] *See* "Slingbox, Netflix Successfully Tested on Panasonic-Fitted BBJ," included as Exhibit 1.

will operate the equipment consistent with previously authorized terms and conditions for this antenna.

The eXConnect system will operate using 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 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 research service sites operating in the Ku-band as discussed below. The technical aspects of the eXConnect system are discussed in detail in the attached Technical Appendix.[6]

There is ample precedent for granting the requested experimental license. First, the Applicant currently holds an experimental STA, which its seeks to extend herein. Earlier, on January 7, 2010, the Commission granted Panasonic a six month STA to conduct ground and flight testing of up to ten Aura LE antennas.[7] Thus, the operating conditions for the Aura LE antenna are well known to the Commission.

Second, Applicant has and will continue to operate this single AES consistent with the conditions imposed in its experimental STA and those imposed on Panasonic in prior experimental STA grants for this antenna.[8] Because these conditions have been previously imposed on eXConnect AESs and have resulted in interference-free flight test operations of

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[6] *See* Exhibit 2.

[7] *See* ELS File No. 0339-EX-ST-2009. Panasonic provided detailed technical information on the Aura LE antenna in its original experimental STA filing, which is hereby incorporated by reference. *See* ELS File No. 0544-EX-ST-2008.

[8] *See* ELS File Nos. 0544-EX-ST-2008 and 0339-EX-ST-2009.

eXConnect AES antennas, this application for authority may be granted without delay to permit further FAA STC testing and other flight test operations.

## II. DESCRIPTION OF PROPOSED EXPERIMENTAL OPERATIONS

Applicant seeks to conduct continued ground and flight testing throughout the continental United States ("CONUS") and adjacent international airspace, subject to protection of U.S. Government radio astronomy and space research service operations. Applicant recognizes and accepts that any experimental authority will be conditioned upon coordination with and/or protection of these co-frequency operations.[9]

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

Applicant, together with Panasonic, will conduct flight testing only in areas that are outside exclusion zones for radio astronomy sites (during observations) and National Aeronautics and Space Administration ("NASA") Tracking and Data Relay Satellite System ("TDRSS") sites, and in accordance with applicable coordination agreements and FCC rules. In addition, flight tests may be conducted in international airspace (e.g., over the Atlantic or Pacific Oceans).

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

- hand-off performance;

[9] *See* 47 C.F.R. § 5.111(a)(2); *see also* Call Sign WE9XMO (experimental license Special Condition 4 to protect TDRSS sites) and 47 C.F.R. §§ 25.222 and 25.226 (analogous rules governing Ku-band earth stations onboard vessels and vehicle-mounted earth stations).

- o geographic mapping and automated shut-off;
- o reliability of data link;
- o two-way data link performance and coverage;
- o receive-only video link performance and coverage;
- o antenna performance;
- o Doppler correction; and
- o network management and operation.

## III. SATELLITES AND HUB EARTH STATIONS

The eXConnect System will utilize commercial FSS satellite capacity to conduct its experimental operations. Specifically, capacity will be leased on the Horizons 1, Galaxy 17, and Telstar 14 satellites[10] and has been coordinated with adjacent satellite operators within +/- 6 degrees of each satellite. Panasonic has filed coordination affidavits from the operators of the these satellites that reflect adjacent satellite operator consent to the eXConnect System technical parameters associated with the proposed operations.[11] 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 antenna commences full commercial operations.[12]

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 and

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[10] Panasonic's 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.

[11] *See* Exhibit 3.

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

Telstar 14). These earth stations are separately licensed as FSS earth stations and are connected to eXConnect network control facilities. Network control of eXConnect operations will be provided from a Network Operations Center in Miramar, Florida.

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

*Protection of Fixed-Satellite Service.* The Commission has not yet established service rules applicable to AMSS terminal operations, but interference considerations are analogous to those that currently apply to mobile earth stations onboard vessels ("ESVs") set forth in 47 C.F.R. § 25.222. The Applicant's terminal 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 Commission licensing conditions in the AMSS context. To the extent that any adjacent satellite operator experiences unacceptable interference from Applicant's experimental operations, Applicant will cease terminal transmissions immediately.[13]

*Protection of Potential NGSO FSS Systems.* Applicant 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.* Applicant 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.

[13] *See* 47 C.F.R. § 5.111(a)(2).

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

-221 dBW/$m^2$/Hz (for protection of Green Bank, Arecibo and Socorro)
-189 dBW/$m^2$/Hz (for protection all other Radio Astronomy sites)

For purposes of this experimental application, the Applicant's terminal will not operate within line-of-sight vicinity of radio astronomy sites and during observation periods and will comply with the coordination agreement executed between Panasonic and the National Science Foundation to protect radio astronomy operations.

*Protection of Space Research Service.* Applicant 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 NASA TDRSS for space research conducted at White Sands, New Mexico, Guam and Blossom Point, Maryland. In accordance with Applicant's experimental STA, the Applicant agrees to the following conditions: (i) Applicant will not operate the AES terminals wile on the ground within 125 km of the two TDRSS earth stations at White Sands, New Mexico (32.5430N, 106.6121W and 32.5008N, 106.6086W) or the TDRSS Guam site (13.5881N, 144.8410E); and (ii) Applicant will not operate the AES terminal while airborne within radio line-of-sight ("RLOS") distance of the above sites, as calculated in accordance within the following formulas: RLOS (km) = 1.609 x (Sq Root (2x aircraft altitude (h) in feet)) + 15, and RLOS (miles) – Sq Root (2 x h) + 9.

Applicant understands that Panasonic is actively engaged in coordination discussions with NASA and will comply with the terms of any coordination agreement applicable to eXConnect operations.

## VI. SUPERVISION AND CONTROL

For purposes of these experiments, the AES terminal will be operated under Applicant's ultimate supervision and control via contractual arrangements with Panasonic. The point of contact for the planned experimental operations is:

Primary: Will Clark, Director of Flight Operations
Office: (406) 523-1351, Mobile: (406) 370-6881
WClark@washcorp.com
Secondary: Dan Barnes - Director of Maintenance, Mobile: (406) 531-8617
dbarnes@washcorp.com
Address:
WCA Holdings III, LLC
101 International Way, Missoula MT 59808

As a back up, the points of contact for eXConnect operations are:

Primary: Philippe Lagarde; (Office) 1-425-415-9164; (Mobile) 1-425-319-3537
Secondary: Gilbert Dizon; (Office) 1-949-462-1940; (Mobile) 1-949-614-3163
MCC@panasonic.aero
Address:
Panasonic Avionics Corporation
Attn: Network Operating Center
26200 Enterprise Way
Lake Forest, CA 92630 USA

as well as:

Primary: Edgar Estevan; (Office) +1 954 538-4110; (Mobile) +1 305 776-7795
Secondary: Greg Hill; (Office) +1 954 538-4195; (Mobile) +1 954 376-1531
NOC Direct Telephone: +1 954 538-4074
NOC email address: NOC@mtnsat.com
Address:
MTN Satellite Communications
Attn: Network Operating Center
3044 N. Commerce Parkway
Miramar, FL 33025

These contacts 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.

## VII. CONCLUSION

Grant of this experimental license will allow Applicant to further assist Panasonic develop and demonstrate the Aura LE antenna in connection with the eXConnect AMSS system. The Applicant is currently authorized to operate an Aura LE AES pursuant to an experimental STA and Panasonic has been previously authorized to operate the terminals on an experimental basis. Applicant will comply fully with conditions imposed in its experimental STA. There is ample precedent for granting the requested experimental authority and such grant would serve the public interest by facilitating the development and maintenance of U.S. leadership in next-generation aeronautical broadband services.

# EXHIBIT 1

## Slingbox, Netflix successfully tested on Panasonic-fitted BBJ

By Mary Kirby on January 31, 2011 7:44 PM | Permalink | Comments (0) | TrackBacks (0)

by John

If you're among the industry execs who took a ride on 26 January on a Boeing Business Jet (BBJ) fitted with Panasonic Avionics' Ku-band satellite-based in-flight broadband Internet system, then you already know that the carrier's IPTV service, dubbed eXTV, is working like a charm.

One of the happy passengers tells me that Slingbox, Netflix and Skype were tested on multiple devices and worked really well. That doesn't mean that 150 passengers on one aircraft can simultaneously do those things (no sir-e Bob!) but nonetheless, it was a pretty impressive show.

So what does Panasonic have to say for itself? The firm says its so-called eXConnect in-flight connectivity service successfully delivered a live television feed to the BBJ on 26 January, and that it "successfully tested and demonstrated" that its system can support Slingbox, Netflix and Skype.

These specific applications technically aren't part of the firm's eXTV service (which runs over eXConnect), however, and most will be disallowed based on airline preference, regulatory requirements (groan), or for pure network management purposes (i.e. it's no different than any of the other in-flight connectivity services).

A number of carriers, including Cathay Pacific and its Dragonair subsidiary, have signed up for eXTV. So what can passengers expect once on board?

Well, when Panasonic talks about eXTV, it is talking about very specific live television channels such as Japan's NHK World Premium and IMG Worldwide's Barclays Premier League Content.

I think you can sum up some of the demand for in-flight IPTV with two words - sports, sports and news (okay, that's three). Indeed, Lufthansa **has said it wants to show German soccer** to its passengers and Virgin Atlantic's Richard Branson has said he hopes **Virgin will offer live coverage of the World Cup in 2014**.

Panasonic bills eXTV as offering "the only global solution to address the bandwidth and licensing rights constraints that have traditionally hindered in-flight television services".

In other words - here comes international in-flight television!

"We are very excited by the results of our first eXTV test flight because it clearly proves the concept and demonstrates the robust performance of our TV solution," says Panasonic Avionics vice-president, global communications suite David Bruner. "Not only can we deliver a quality, live television feed, but we can do it using the same antenna and using the same network as our global eXConnect service."

The BBJ is fitted with a new EMS antenna (not the older MELCO antennas on 69 Lufthansa aircraft).

(Photo above - which was snapped way back in 2005 - can be found at **jsmjr's Flickr photo stream**.)

## VIDEO: Inside the brand new Bombardier CRJ1000

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- alloycowboy commented on Boeing rakes in the orders for 737 Sky Interior: Hey Marry,
- Cristiano commented on Travel writers to put Oman Air's in-flight Wi-Fi to the test!: One more w
- Anthony commented on

# EXHIBIT 2

**Technical Appendix**
**Technical Description of the Panasonic eXConnect System**

WCA Holdings III, LLC ("Applicant") seeks experimental authority for ground and flight testing of one (1) Aura LE aircraft earth station ("AES") with Panasonic Avionics Corporation's ("Panasonic's") eXConnect Ku-band Aeronautical Mobile-Satellite Service ("AMSS") system. This Technical Appendix highlights information provided in connection with grant of Applicant's experimental special temporary authorization ("STA") (Call Sign WE9XMO) and Panasonic's experimental STA (Call Sign WD9XQT), which also authorized operation of the Aura LE antenna. That information is hereby incorporated by reference.

## 1. Aura LE and the eXConnect System

The eXConnect System is a Ku-band AMSS system being developed by Panasonic. The Aura LE terminal is a dual-panel, mechanically steered antenna, which has been specifically designed for the aeronautical environment.

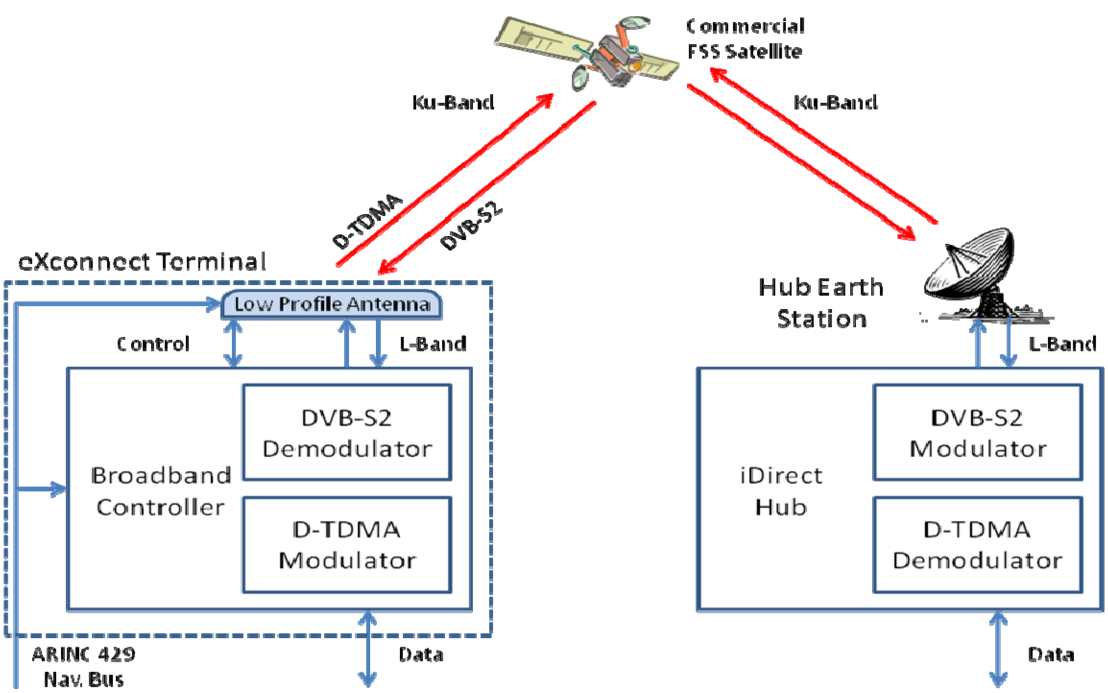


**Figure 1 eXConnect System Block Diagram**

As discussed below, 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 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 control and monitoring protocols minimizes the risk of interference.

### *1.1. 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.

### *1.2. 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).

### *1.3. Hub Earth Station*

The hub earth station consists of licensed gateways located at Steele Valley, California (serving Horizons 1) and Holmdel, New Jersey (serving Galaxy 17 and Telstar 14), 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 network operations centers ("NOCs") in Lake Forest, California and Miramar, Florida, although Applicant will have ultimate direction and control over its Aura LE terminal via a contractual relationship with Panasonic. The NOCs will maintain the ability to inhibit transmissions from any terminal in the network, including the hub and eXConnect terminal, at any time.

## 2. Terminal Description

### *2.1. Antenna*

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° and 90° in flight (10° 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 No. 0544-EX-ST-2008). The basic characteristics of the antenna are summarized in Table 1.[1]

**Table 1. Aura LE Antenna Characteristics**

| Characteristic | Aura LE |
|---|---|
| Frequency | Tx: 14.0 GHz to 14.5 GHz<br>Rx: 10.7 GHz to 12.75 GHz |
| Aperture Size | 2 Apertures of 35" X 6" each |
| EIRP | 42.5 dBW @ 5° Elevation<br>48.0 dBW @ 90° Elevation |
| G/T | 11 dB/K @ 5° Elevation<br>14 dB/K @ 90° Elevation |
| Tracking Rate | 40 deg/sec in Azimuth<br>25 deg/sec in Elevation |
| Az Pointing Accuracy | 0.2° 1-sigma |
| Antenna Patterns | *See* Appendix 1 |

The Aura LE antenna is designed to maintain pointing towards the intended satellite through the full range of maneuvers carried out by commercial aircraft. The antenna is 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 EMS Aura LE antenna will be less than 0.2° 1-sigma. Pointing error will be continuously monitored and if it ever exceeds 0.5°, then transmissions will be automatically inhibited within 100 ms.

[1] A Radiation Hazard analysis for the Aura LE is included as Exhibit A.

*2.2. Broadband Controller*

The 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 (to protect radio astronomy and space research), inhibit transmissions as a function of skew angle and control transmit power (to protect adjacent satellites), and select the serving satellite as a function of location. 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.

*2.3. 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 and 25.226 for analogous ESV and VMES operations (*see also* Section 25.218(f)(1), where N = 1 for TDMA) and the terminal may be mispointed by up to 0.2°. The effective off-axis EIRP spectral density generated by a conforming terminal is no greater than:

| | | | |
|---|---|---|---|
| $15–25\log10(\Theta + 0.2)$ | dBW/4 kHz | for | $1.5° \leq \Theta \leq 7°$ |
| –6 | dBW/4 kHz | for | $7° < \Theta \leq 9.2°$ |
| $18–25\log10(\Theta + 0.2)$ | dBW/4 kHz | for | $9.2° < \Theta \leq 48°$ |
| –24 | dBW/4 kHz | for | $48° < \Theta \leq 85°$ |
| –14 | dBW/4 kHz | for | $85° < \Theta \leq 180°$ |

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°.

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 Figure 2 for the Aura LE antenna. These off-axis EIRPs are based on the specific link parameters shown in the link budget in Section 3. 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°. 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° pointing offset – the off-axis EIRP spectral density of the terminal, shown in the dashed red line, remains well below the off-axis EIRP spectral density of a conforming FSS terminal.

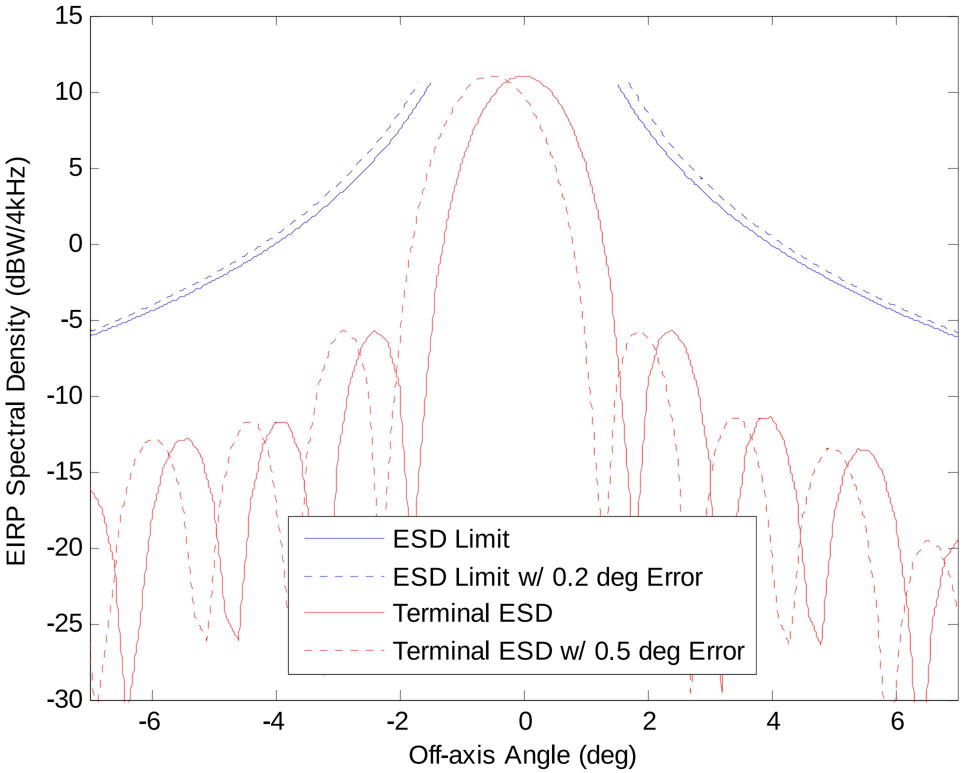


**Figure 2. Maximum Off-Axis EIRP Spectral Density of the Aura LE**

It should be emphasized that the example in Figure 2 is an extreme case: 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.

## 3. 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 384 kbps return link for the Aura LE antenna.[2] As shown by the table, the terminal is able to close the link with positive link margin.

**Table 2. Aura LE Link Budgets**

**Forward Link Budget**

| | | |
|---|---|---|
| **eXconnect Terminal** | | |
| Antenna | MELCO Reflector | EMS Aura LE |
| G/T | 9.3 | 11 dB/K |
| **Hub Earth Station** | | |
| EIRP max | 73.1 | 73.1 dBW |
| **Signal** | | |
| Waveform | DVB-S2 | DVB-S2 |
| Modulation and Coding | QPSK/0.25 | QPSK/0.25 |
| Data Rate | 2.048E+06 | 2.048E+06 bps |
| Spectral Efficiency | 0.348 | 0.348 bps/Hz |
| Noise Bandwidth | 5.89E+06 | 5.89E+06 Hz |
| Eb/No Threshold | 2.8 | 2.8 dB |
| **Uplink** | | |
| Frequency | 14.25 | 14.25 dBW |
| Back off | 18.1 | 18.1 dB |
| EIRP Spectral Density | 23.3 | 23.3 dBW/4kHz |
| Slant Range | 39000 | 39000 km |
| Space Loss, Ls | 207.3 | 207.3 dB |
| ASI Degradation | 0.5 | 0.5 dB |
| Transponder G/T @ Hub | 2.0 | 2.0 dB/K |
| C/No | 79.0 | 79.0 dBHz |
| **Satellite** | | |
| Flux Density | -107.8 | -107.8 dBW/m2 |
| SFD @ Hub | -102.5 | -102.5 dBW/m2 |
| OBO | 5.3 | 5.3 dB |
| **Downlink** | | |
| Frequency | 11.95 | 11.95 GHz |
| Transponder Sat. EIRP @ Beam Peak | 50.0 | 50.0 dBW |
| Transponder Sat. EIRP @ Beam Edge | 46.0 | 46.0 dBW |
| DL PSD Limit | 13.0 | 13.0 dBW/4kHz |
| DL PSD @ Beam Peak | 13.0 | 13.0 dBW/4kHz |
| Carrier EIRP @ Beam Peak | 44.7 | 44.7 dBW |
| Carrier EIRP @ Beam Edge | 40.7 | 40.7 dBW |
| Slant Range | 39000 | 39000 km |
| Space Loss, Ls | 205.8 | 205.8 dB |
| ASI Degradation @ 30 deg skew | 4.9 | 1.5 dB |
| C/No | 67.9 | 73.0 dBHz |
| **End to End** | | |
| End to End C/No | 67.5 | 72.0 dBHz |
| Implementation Loss | 0.5 | 0.5 dB |
| End to End Eb/No | 3.9 | 8.4 dB |
| Link Margin | 1.1 | 5.6 dB |

**Return Link Budget**

| | | |
|---|---|---|
| **eXconnect Terminal** | | |
| Antenna | MELCO Reflector | EMS Aura LE |
| EIRP | 42.5 | 42.5 dBW |
| **Hub Earth Station** | | |
| G/T | 28.1 | 28.1 dB/K |
| **Signal** | | |
| Waveform | iDirect D-TDMA | iDirect D-TDMA |
| Modulation and Coding | BPSK/SF4/0.43 | BPSK/SF4/0.43 bps |
| Data Rate | 3.84E+05 | 3.84E+05 |
| Spectral Efficiency | 0.102 | 0.102 bps/Hz |
| Noise Bandwidth | 3.76E+06 | 3.76E+06 Hz |
| Eb/No Threshold | 4.6 | 4.6 dB |
| **Uplink** | | |
| Frequency | 14.25 | 14.25 dBW |
| Back off | 0 | 0 dB |
| EIRP Spectral Density | 12.8 | 12.8 dBW/4kHz |
| Slant Range | 39000 | 39000 km |
| Space Loss, Ls | 207.3 | 207.3 dB |
| ASI Degradation | 0.5 | 0.5 dB |
| Transponder G/T @ Beam Edge | 0.0 | 0.0 dB/K |
| C/No | 63.3 | 63.3 dBHz |
| **Satellite** | | |
| Flux Density | -120.3 | -120.3 dBW/m2 |
| SFD @ Beam Edge | -100.5 | -100.5 dBW/m2 |
| OBO | 19.8 | 19.8 dB |
| **Downlink** | | |
| Frequency | 11.95 | 11.95 GHz |
| Transponder Sat. EIRP @ Beam Peak | 50.0 | 50.0 dBW |
| Transponder Sat. EIRP @ Hub | 48.0 | 48.0 dBW |
| DL PSD Limit | 10.0 | 10.0 dBW/4kHz |
| DL PSD @ Beam Peak | 0.4 | 0.4 dBW/4kHz |
| Carrier EIRP @ Beam Peak | 30.2 | 30.2 dBW |
| Carrier EIRP @ Hub | 28.2 | 28.2 dBW |
| Slant Range | 39000 | 39000 km |
| Space Loss, Ls | 205.8 | 205.8 dB |
| ASI Degradation | 0.5 | 0.5 dB |
| C/No | 78.6 | 78.6 dBHz |
| **End to End** | | |
| End to End C/No | 63.1 | 63.1 dBHz |
| Implementation Loss | 0.5 | 0.5 dB |
| End to End Eb/No | 6.8 | 6.8 dB |
| Link Margin | 2.2 | 2.2 dB |

[2] Link budget information is also provided for the MELCO AES antenna, which is not a subject of this application.

## Appendix 1 - 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° and 90°. 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 at 14.25 GHz.

### A.1 Aura LE Antenna Patterns for 5° Elevation

*A.1.1 Transmit Antenna Patterns for 5° Elevation*

A.1.1.1 Transmit Azimuth Antenna Patterns for 5° Elevation

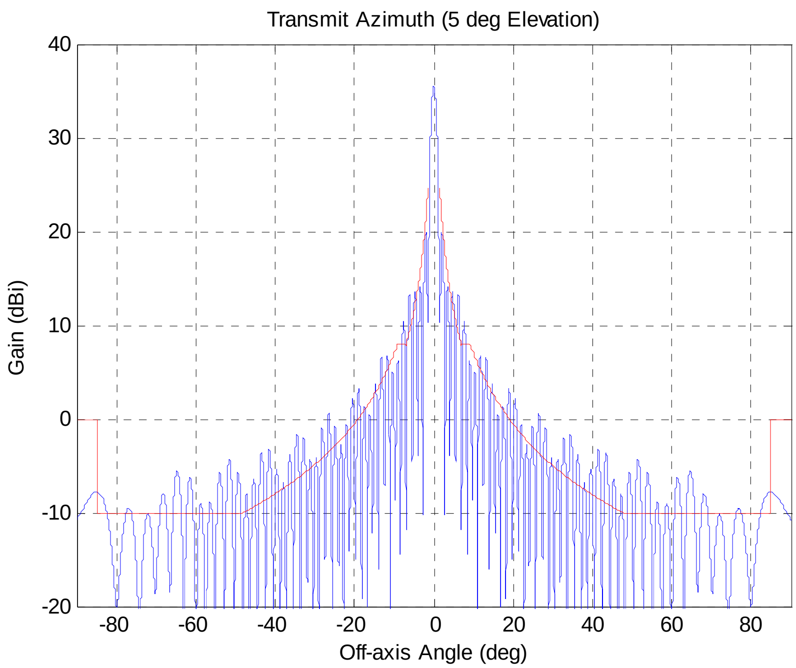


Figure A.1 Transmit Azimuth Pattern (5° Elevation)

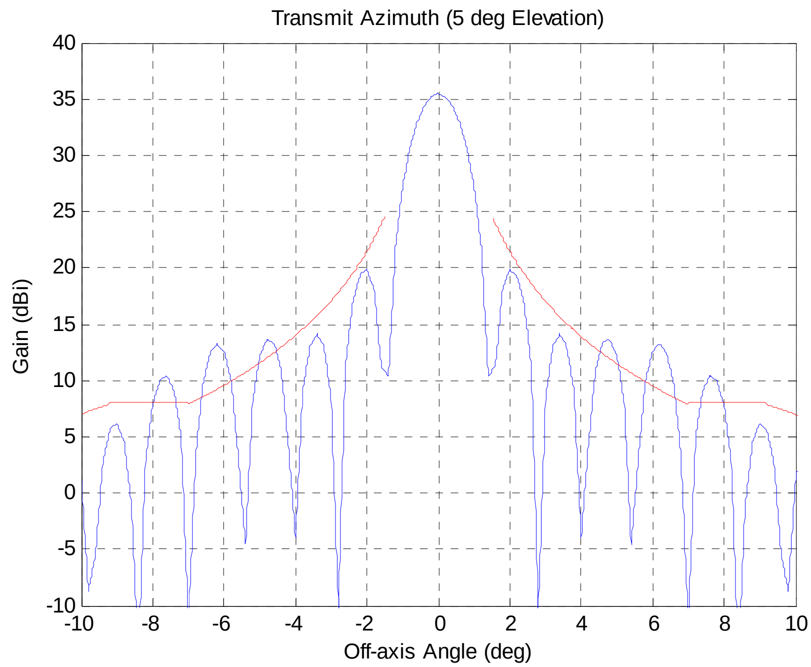


Figure A.2 Transmit Azimuth Pattern (5° Elevation) - Detail

A.1.1.2 Transmit Elevation Antenna Patterns for 5° Elevation

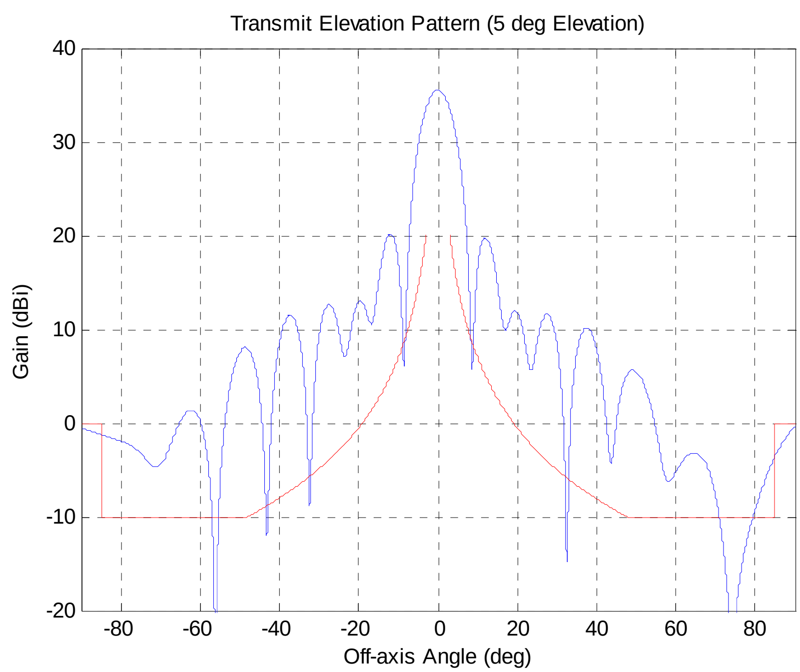


Figure A.3 Transmit Elevation Pattern (5° Elevation)

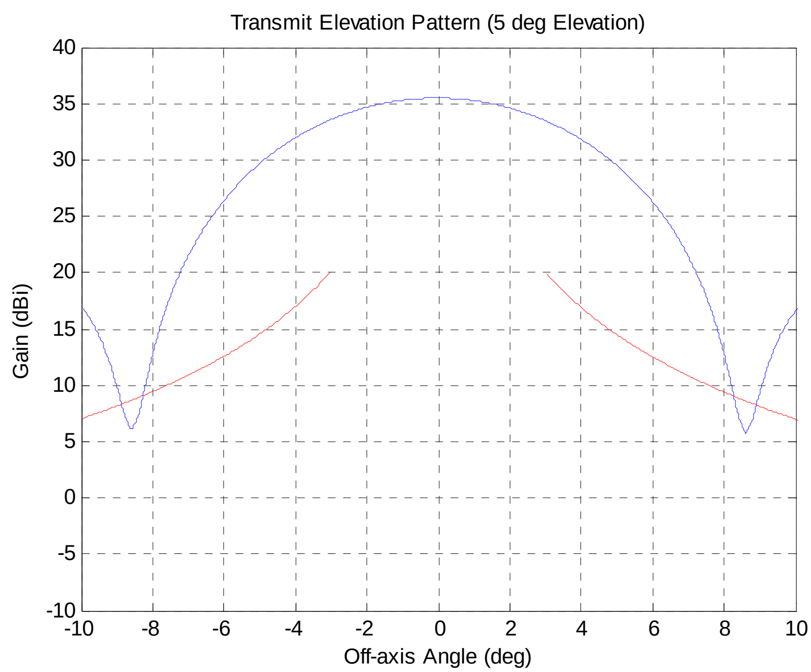


Figure A.4 Transmit Elevation Pattern (5° Elevation) - Detail

## A.2 EMS Aura LE Antenna Patterns for 90° Elevation

### *A.2.1 Transmit Antenna Patterns for 90° Elevation*

#### A.2.1.1 Transmit Azimuth Antenna Patterns for 90° Elevation

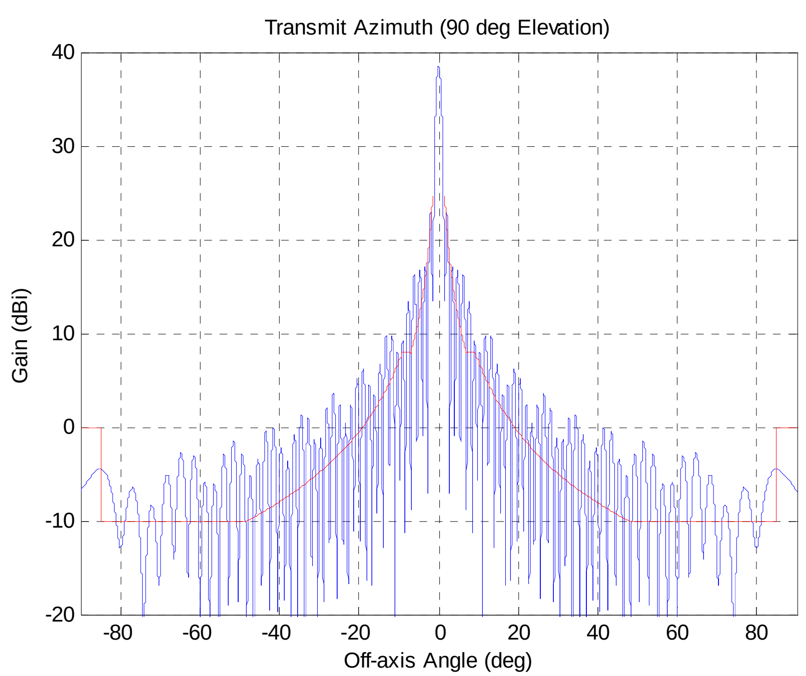


Figure A.9 Transmit Azimuth Pattern (90° Elevation)

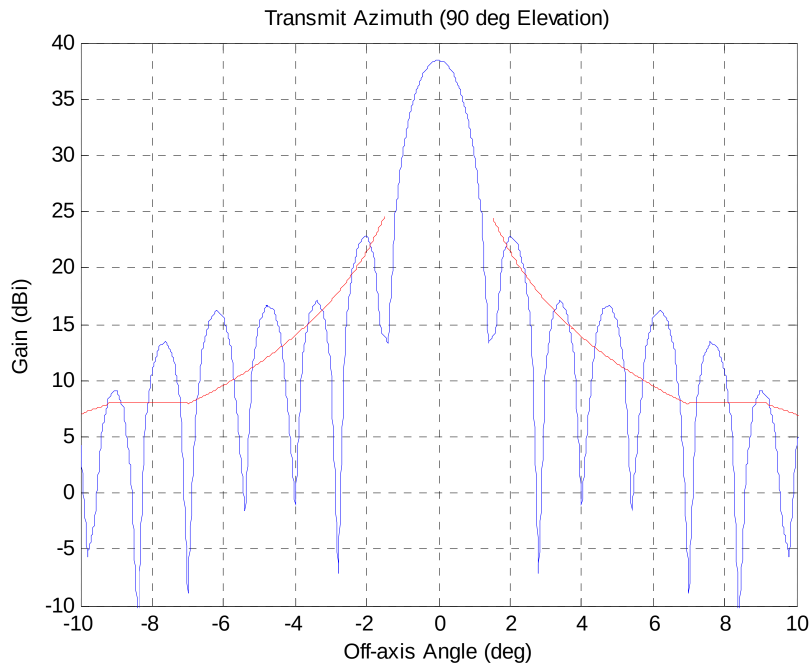


Figure A.10 Transmit Azimuth Pattern (90° Elevation) – Detail

A.2.1.2 Transmit Elevation Antenna Patterns for 90° Elevation

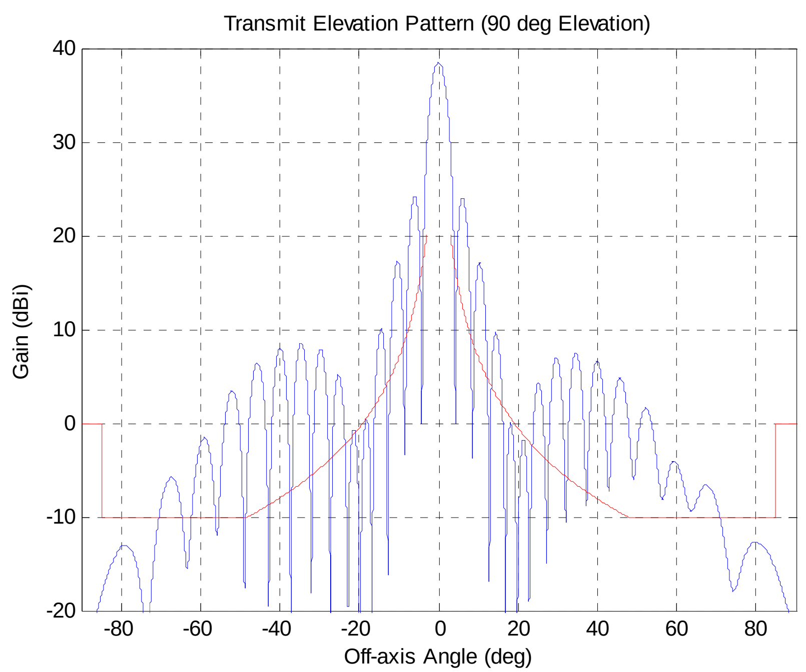


Figure A.11 Transmit Elevation Pattern (90° Elevation)

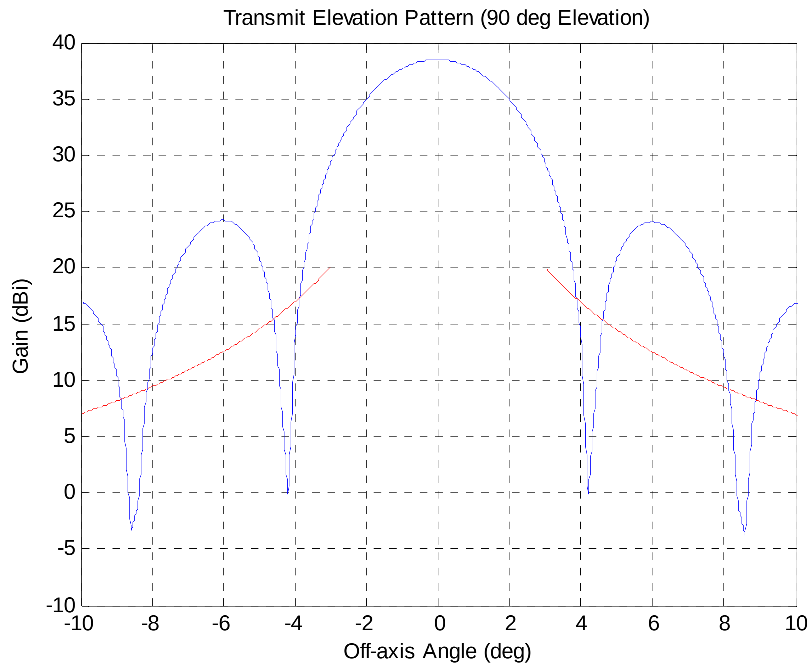


Figure A.12 Transmit Elevation Pattern (90° Elevation)

# EXHIBIT A

# 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 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/cm$^2$. 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)*

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

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

At a distance of 22 meters, the power density of the Aura LE is 1.0 mW/cm$^2$, 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/cm$^2$.

## *Transition Region Exposure (in main beam)*

At a distance of 13 m from the antenna, maximum exposure in the main beam is 5 mW/cm$^2$. This assumes that PFD decreases linearly from 7 mW/cm$^2$ to 1.0 mW/cm$^2$ 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/cm$^2$ threshold is reached at a distance of 1.8 meters and the 1 mW/cm$^2$ 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 3

Telesat

**Robert Condurso**
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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<br>Rx: 10.7 GHz to 12.75 GHz<br>(11.7-12.2 GHz in the U.S.) | Tx: 14.0 GHz to 14.4 GHz<br>Rx: 11.2 GHz to 12.8 GHz<br>(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<br>48.0 dBW @ 90 deg Elevation | 47.2 dBW |
| G/T | 11 dB/K @ 5 deg Elevation<br>14 dB/K @ 90 deg Elevation | 8.0 dB/K @ 11.2 to 11.7GHz<br>9.3 dB/K @ 11.9 to 12.8GHz |
| Tracking Rate | 40 deg/sec in Azimuth<br>25 deg/sec in Elevation | 40 deg/sec in Azimuth<br>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:

| | | | |
|---|---|---|---|
| $15-25\log_{10}(\Theta + 0.2)$ | dBW/4 kHz | for | $1.5° \leq \Theta \leq 7°$ |
| $-6$ | dBW/4 kHz | for | $7° < \Theta \leq 9.2°$ |
| $18-25\log_{10}(\Theta + 0.2)$ | dBW/4 kHz | for | $9.2° < \Theta \leq 48°$ |
| $-24$ | dBW/4 kHz | for | $48° < \Theta \leq 85°$ |

[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).

$-14$ dBW/4 kHz for $85° < \Theta \leq 180°$

where Θ is the angle in degrees from the line connecting the focal point of the antenna to the 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 Sarraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

9-Feb-2010
Date

Telesat

August 5, 2010

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

To Whom It May Concern:

This letter supplements the letter dated February 8, 2010 from Telesat Canada ("Telesat") regarding Panasonic Avionics Corporation's ("PAC") proposed Ku-band aeronautical mobile-satellite service ("AMSS") operations with the Telstar 14 satellite at 63° W.L. Telesat confirms that so long as PAC maintains FCC authority to communicate with Telstar 14, Telesat will take into account the technical parameters described in the aforementioned letter in all future satellite network coordinations for the satellite.

Sincerely,

Robert Condurso
for Telesat Canada

August 5, 2010
Date

*Acceptance by Panasonic Avionics Corporation:*

PAC hereby certifies that it will comply with all coordination agreements reached by Telesat for the Telstar 14 satellite.

Paul Saraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

8/5/10
Date

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 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**

| Characteristic | EMS Aura LE | MELCO Reflector |
|---|---|---|
| Frequency | Tx: 14.0 GHz to 14.5 GHz<br>Rx: 10.7 GHz to 12.75 GHz<br>(11.7-12.2 GHz in the U.S.) | Tx: 14.0 GHz to 14.4 GHz<br>Rx: 11.2 GHz to 12.8 GHz<br>(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<br>48.0 dBW @ 90 deg Elevation | 47.2 dBW |
| G/T | 11 dB/K @ 5 deg Elevation<br>14 dB/K @ 90 deg Elevation | 8.0 dB/K @ 11.2 to 11.7GHz<br>9.3 dB/K @ 11.9 to 12.8GHz |
| Tracking Rate | 40 deg/sec in Azimuth<br>25 deg/sec in Elevation | 40 deg/sec in Azimuth<br>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:

| | | | |
|---|---|---|---|
| $15-25\log10(\Theta + 0.2)$ | dBW/4 kHz | for | $1.5° \leq \Theta \leq 7°$ |
| $-6$ | dBW/4 kHz | for | $7° < \Theta \leq 9.2°$ |
| $18-25\log10(\Theta + 0.2)$ | dBW/4 kHz | for | $9.2° < \Theta \leq 48°$ |
| $-24$ | dBW/4 kHz | for | $48° < \Theta \leq 85°$ |
| $-14$ | dBW/4 kHz | for | $85° < \Theta \leq 180°$ |

where $\Theta$ 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

16 December 2009

Jose Albuquerque
Senior Director, Spectrum Engineering
Intelsat

Date

INTELSAT.

*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 Sarraffe

Dec. 16, 2009

Paul Sarraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

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
Manager, Spectrum Development
SES Americom

Date

August 2, 2010

INTELSAT.

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

To Whom It May Concern:

This letter supplements the letter dated December 16, 2009 from Intelsat regarding Panasonic Avionics Corporation's ("PAC") proposed Ku-band aeronautical mobile-satellite service ("AMSS") operations with the Galaxy 17 satellite at 91° W.L. Intelsat confirms that so long as PAC maintains FCC authority to communicate with Galaxy 17, Intelsat will include the technical parameters described in the aforementioned letter in all future satellite network coordinations for the satellite.

Sincerely,

Jose Albuquerque

Jose Albuquerque
for Intelsat

Date 2 August 2010

*Acceptance by Panasonic Avionics Corporation:*

PAC hereby certifies that it will comply with the all coordination agreements reached by Intelsat for the G-17 satellite.

Paul Sarraffe

Paul Sarraffe
Panasonic Avionics Corporation
eXConnect Systems Engineering

Date August 3, 2010

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

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

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**Table 1. Aura LE and MELCO Antenna Characteristics**

| Characteristic | EMS Aura LE | MELCO Reflector |
|---|---|---|
| Frequency | Tx: 14.0 GHz to 14.5 GHz<br>Rx: 10.7 GHz to 12.75 GHz<br>(11.7-12.2 GHz in the U.S.) | Tx: 14.0 GHz to 14.4 GHz<br>Rx: 11.2 GHz to 12.8 GHz<br>(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<br>48.0 dBW @ 90 deg Elevation | 47.2 dBW |
| G/T | 11 dB/K @ 5 deg Elevation<br>14 dB/K @ 90 deg Elevation | 8.0 dB/K @ 11.2 to 11.7GHz<br>9.3 dB/K @ 11.9 to 12.8GHz |
| Tracking Rate | 40 deg/sec in Azimuth<br>25 deg/sec in Elevation | 40 deg/sec in Azimuth<br>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:

| | | | |
|---|---|---|---|
| $15-25\log10(\Theta+0.2)$ | dBW/4 kHz | for | $1.5° \le \Theta \le 7°$ |
| $-6$ | dBW/4 kHz | for | $7° < \Theta \le 9.2°$ |
| $18-25\log10(\Theta+0.2)$ | dBW/4 kHz | for | $9.2° < \Theta \le 48°$ |
| $-24$ | dBW/4 kHz | for | $48° < \Theta \le 85°$ |
| $-14$ | dBW/4 kHz | for | $85° < \Theta \le 180°$ |

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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.

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.

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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.

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Sincerely,

Jose Albuquerque

Jose Albuquerque
for Horizons Satellite LLC

16 December 2009
Date

INTELSAT.

*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
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