

TECHNICAL APPENDIX
Modification Application (Call Sign E140087)
Astronics AeroSat Corporation

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I. Technical Description

A. Proposed Operations

1. Overview

Astronics AeroSat's FliteStream™ Ku-band aeronautical broadband system is comprised of earth station aboard aircraft ("ESAA") equipment, leased capacity on commercial fixed-satellite service ("FSS") satellites and an associated ground segment. Astronics AeroSat has previously provided the Commission a detailed description of the operational characteristics of the FliteStream™ system and network technology¹ and, except as indicated in this application, no further changes are proposed thereto.

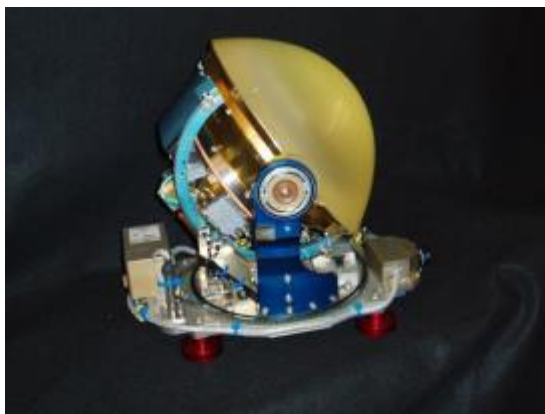
Astronics AeroSat seeks to operate its previously licensed HR6400 ESAA terminal with certain additional satellite points of communication.² Additionally, Astronics AeroSat seeks to operate its HR129 "tail mount" ESAA terminal³ with the FliteStream™ system while communicating with certain U.S. and non-U.S. licensed satellites.

B. HR129 Terminal

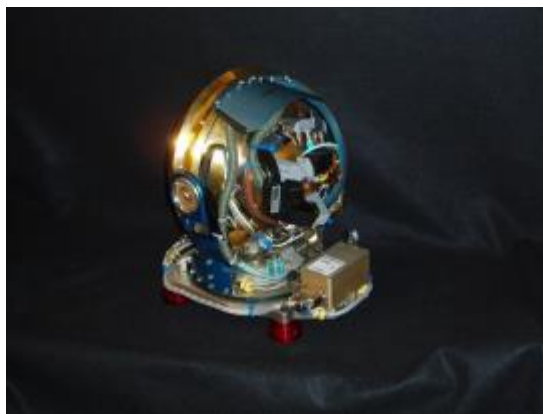
1. Technical Parameters

Operated in the same way as Astronics AeroSat's currently authorized HR6400 terminal, HR129 terminal is a tail-mounted ESAA terminal that enables Astronics AeroSat to provide two-way broadband communications in commercially available Ku-band FSS spectrum to smaller business aviation aircraft consistent with the Commission's ESAA rules, 47 C.F.R. §25.227, and other applicable Commission rules and policies. The HR129 terminal is shown in Figure 1 and the basic characteristics of the HR129 terminal are summarized in Tables 1 and 2, below.

Figure 1: HR129 Terminal



Side View



Back View

¹ See Astronics AeroSat Corporation, File No. SES-LIC-20140902-00688 (Call Sign E140087), Technical Appendix.

² The technical characteristics of the HR6400 Ku-band terminal previously described to the Commission have not change and Astronics AeroSat incorporates by reference the technical information provided with its original ESAA blanket license application. See generally File No. SES-LIC-20140902-00688 (Call Sign E140087).

³ The HR129 terminal is also known as Astronics AeroSat's T-200 Series antenna system.

Table 1 – Summary of Technical Parameters (HR129)

Parameter	Performance
Antenna Diameter	29 cm
Type of Antenna	Circular Rexolite® Fresnel lens
Peak Power (SSPA)	25 watts
Gain	28.9 dBi @ 10.7 GHz 30.4 dBi @ 12.75 GHz 31.1 dBi @ 14.0 GHz 31.3 dBi @ 14.5 GHz
EIRP	41.9 dBW @ 14.5 GHz
Transmit Frequency Range	14.0 GHz to 14.5 GHz
Receive G/T (15°K Sky Temperature)	10.0 dB/K @ 10.7 GHz 11.5 dB/K @ 12.75 GHz
Receive Frequency Range	10.7 GHz to 12.75 GHz
Receive Bandwidth	2050 MHz (10.7-12.75 GHz)
Polarization	Linear Tx/Dual Pol Rx, Dual Pol Circular Rx only

Table 2 – Summary of Control Parameters (HR129)

Azimuth	Continuous, 360°
Elevation	0° to 90°
Pointing Accuracy Azimuth: Elevation:	0.2° 0.2°
Azimuth, Elevation, Polarization Rates of Change	7.0° sec
Azimuth, Elevation, Polarization Acceleration	7.0° sec ²

2. HR129 Terminal Components and Characteristics

The HR129 Ku-band terminal is comprised of the following components:

- Antenna Tail Mount Unit (“TMU”)
- Antenna Control and Modem Unit (“ACMU”)
- Low Power Transceiver (“LPT”)
- Power Amplifier Unit (“PAU”)
- Diplexer

The TMU affixes the terminal to the aircraft tail and has been certified for in-flight use. The terminal will not transmit until it receives the appropriate outbound signal from the satellite and it has validated antenna pointing within 0.2° and will cease transmission immediately in certain instances to avoid causing interference.

The ACMU controls the antenna pointing accuracy to a pointing error of less than 0.2° between the target satellite and the axis of the antenna’s main lobe. The ACMU continuously monitors the pointing error and will mute the transmitter if the pointing error exceeds 0.5°. All emissions automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the antenna exceeds 0.5°, and transmission is not resumed until the pointing error is less than 0.2°.

The terminal also will cease transmissions automatically in the following instances:

- If the ACMU loses communication with the aircraft inertial navigation system (“INS”), or

- If the modem loses receive signal, or
- If there is a failure of the ACMU itself, or
- If the reference oscillator fails.

The LPT allows accurate power control, and the ACMU ensures compliance with applicable power spectral density (“PSD”) limits. The power detector within the LPT is stable over frequency and temperature and reports the Ku-band transmit power from the PAU. In this way, Astronics AeroSat can maintain accurate power control at the PAU output regardless of variations in PAU gain over temperature and frequency.

3. Off-Axis EIRP Spectral Density

Astronics AeroSat is applying for ESAA operating authority under Section 25.227(a)(2) of the Commission’s Rules because it proposes to operate the HR129 terminal with certain satellite points of communication at off-axis EIRP spectral density levels in excess of those specified in Section 25.227(a)(1). Accordingly, Astronics AeroSat has included satellite operator certifications and other technical information required by Section 25.227(b)(2).

Nonetheless, Astronics AeroSat will conduct HR129 operations in the United States consistent with the off-axis EIRP spectral density levels along the geostationary arc specified in Section 25.227(a)(1) (*i.e.*, consistent with two-degree spacing levels). Astronics AeroSat will control off-axis EIRP spectral density emissions from the HR129 terminal through limitations on the transmit power spectral density and control of pointing error.

4. Satellite Points of Communication for HR129 Terminal

Astronics AeroSat will utilize commercial Ku-band FSS capacity for its proposed commercial operations. Astronics AeroSat seeks to operate the HR129 terminals with the following satellite points of communication:

Table 3 – HR129 Terminal Proposed Satellite Points of Communication

Satellite	Licensing Admin.	Orbital Location	Downlink Freq. (GHz) ⁴	ITU Region Coverage Area	Serves U.S. ⁵
Anik G1	Canada	107.3°	11.7-12.2	R2	No
Apstar 6	China	134° E	10.7-12.75	R3	No
Apstar 7	China	76.5° E	11.45-11.7	R1, R3	No
Asiasat 5	China	100.5° E	11.45-12.2	R1	No
Eutelsat 10A (W2A)	France	10° E	12.5-12.75	R1	No
Eutelsat 70B	France	70.5° E	10.95-11.7; 12.5-12.75	R1, R3	No

⁴ ESAA uplinks will be operated in all or part of the 14.0-14.5 GHz band depending on available capacity and national/regional restrictions on Ku-band aeronautical uplink operations.

⁵ “Yes” indicates that the relevant satellite will be used for ESAA operations in U.S. territory. “No” indicates that ESAA operations will be conducted outside U.S. territory, even if the satellite may have some coverage of the United States.

Satellite	Licensing Admin.	Orbital Location	Downlink Freq. (GHz) ⁴	ITU Region Coverage Area	Serves U.S. ⁵
Eutelsat 115WB (Satmex 7)	Mexico	114.9°W	11.7-12.2	R2	Yes
Eutelsat 117WA	Mexico	116.8°W	11.7-12.2	R2	No
Eutelsat 172A	U.S.	172° E	10.95 - 11.2; 11.45 - 11.7; 12.2 - 12.75	R2, R3	No
IS-14	U.S.	45° W	11.45-11.7	R1, R2	No
IS-15 (JCSAT-85)	U.S.	85° E	12.5-12.75	R1, R2	No
IS-29E	U.S.	50° W	10.95-12.5	R1, R2	Yes
JCSAT-5A	Japan	132° E	12.25-12.75	R3	No
NSS-6	Netherlands	95° E	11.45-11.7; 12.5-12.75	R3	No
Superbird C2	Japan	144° E	12.2-12.75	R3	No
Telstar 11N	U.S.	37.5° W	10.95 - 11.2; 12.25 - 12.75	R1	No
Telstar 12V	U.S.	15° W	10.95-12.2	R1, R2	No
Yamal 300K	Netherlands	183° E	10.95-11.7	R1, R2	Yes
Yamal 401	Russia	90° E	10.95-11.2; 11.45-12.75	R1, R3	No

The operational coverage area maps and link budgets for each of the foregoing satellites are included in the Technical Appendix.

Each satellite operator has reviewed and confirmed that Astronics AeroSat's proposed commercial operations of the HR129 terminal are consistent with the satellite operator's coordination agreements and will not result in unacceptable interference to other satellite operations within +/- 6 degrees of each satellite. Letters from each satellite operator confirming these conclusions are included in the Technical Appendix.

5. Gateway Earth Stations

As indicated in Table 2 below, the gateway earth stations for the Astronics AeroSat network are located in various countries around the world to provide global coverage. The earth stations include an iDirect hub (consisting of a DVB-S2 modulator and an iDirect D-TDMA demodulator) and are connected to Astronics AeroSat's network control facilities.

Table 4 – Gateway Earth Stations

Satellite	Satellite Operator	Gateway Earth Station Location	Country	Gateway Operator	FCC Call Sign
Anik G1	Telesat	Lima	Peru	NewCom	N/A
Apstar 6	APT	Beijing	China	ChinaTelecom Satellite	N/A
Apstar 7	APT	Ortuchhio	Italy	Telespazio	N/A
Asiasat 5	Asiasat	Kofinou	Cyprus	Stellar	N/A
Eutelsat 10A (W2A)	Eutelsat	Cologne	Germany	Stellar	N/A
Eutelsat 70B	Eutelsat	Kofinou	Cyprus	Stellar	N/A
Eutelsat 115WB (Satmex 7)	Eutelsat Americas	Brewster, WA	U.S.	USEI	S2938
Eutelsat 117WA	Eutelsat Americas	Houston, TX	U.S.	Harris CapRock	E030279
Eutelsat 172A	Eutelsat	Brewster, WA	U.S.	USEI	E910548
IS-14	Intelsat	Aberdeen	U.K.	Harris CapRock	N/A
IS-15 (JCSAT-85)	Intelsat	Kofinou	Cyprus	Stellar	S2789
IS-29E	Intelsat	Hagerstown, MD	U.S.	Intelsat	S2913
JCSAT-5A	SPJSAT	Yokohama	Japan	SPJSAT	N/A
NSS-6	SES	Kofinou	Cyprus	Stellar	N/A
Superbird C2	SPJSAT	Hong Kong	China	PCCW	N/A
Telstar 11N	Telesat	Melbourne, FL	U.S.	Harris CapRock	S2357
Telstar 12V (MW, MC, ME, MN)	Skynet	Mt. Jackson, VA	U.S.	Telesat	S2933
Telstar 12V (NS)	Skynet	Chalfont	U.K.	Arqiva	S2933
Yamal 300K	Gazprom	Brewster, WA	U.S.	USEI	E120043
Yamal 401	Gazprom	Moscow	Russia	RuSat	N/A

C. HR6400 Terminal

The technical characteristics of the HR6400 Ku-band terminal have been previously described to the Commission and Astronics AeroSat incorporates by reference the technical information provided with its original ESAA blanket license application. Although Astronics AeroSat has included satellite operator certifications as required by Section 25.227(b)(2), it intends to conduct operations in the United States with the relevant Table 1 satellites consistent with the off-axis EIRP

spectral density levels along the geostationary arc specified in Section 25.227(a)(1) (*i.e.*, consistent with two-degree spacing levels).

As previously demonstrated by Astronics AeroSat, the off-axis EIRP spectral density of the HR6400 Ku-band terminal will comply with the FCC's two-degree spacing policies as set forth in Section 25.227(a)(1) of the FCC Rules at all operational skew angles from 0-55° when operating in the United States. The maximum input power into the antenna has been selected to ensure compliance at the maximum skew angle of 55°.

The terminal will not transmit until it receives the appropriate outbound signal from the satellite and it has validated antenna pointing within 0.2° and will cease transmission immediately in certain instances to avoid causing interference.

As with the HR129 terminal, each satellite operator has reviewed and confirmed that Astronics AeroSat's proposed HR6400 operations are consistent with the satellite operator's coordination agreements and will not result in unacceptable interference to other satellite operations within +/- 6 degrees of each satellite. Letters from each satellite operator confirming these conclusions, in addition to link budgets for each satellite, are included in the Technical Appendix. Astronics AeroSat also provides the FCC Form 312 and Schedule B for information that is changing as a result of the requested modification. Astronics AeroSat proposes to communication with the following fourteen (14) satellite points of communications:⁶

- Anik G1
- Apstar 6
- Asiasat 5
- Eutelsat 10A
- Eutelsat 70B
- Eutelsat 115WB
- IS-15
- IS-29E
- JCSAT-5A
- NSS-6
- Superbird C2
- Telstar 12V
- Yamal 300K
- Yamal 401

D. Network Control

Network control of Astronics AeroSat's proposed commercial operations will be provided pursuant to Astronics AeroSat's direction and control from a Network Operations Center ("NOC") in Amherst, New Hampshire, through its network control partner, Panasonic, who will provide managed network services to Astronics AeroSat. The NOC will be responsible for configuring, monitoring, controlling, and, if necessary, preventing transmissions from any HR129 or HR6400 terminal. The NOC will be staffed at all times, providing continuous supervision and monitoring of such operations. In addition, network control personnel will be accessible to address any operational issues.

⁶ See Table 3 and Table 4 for relevant satellite and gateway earth station information.

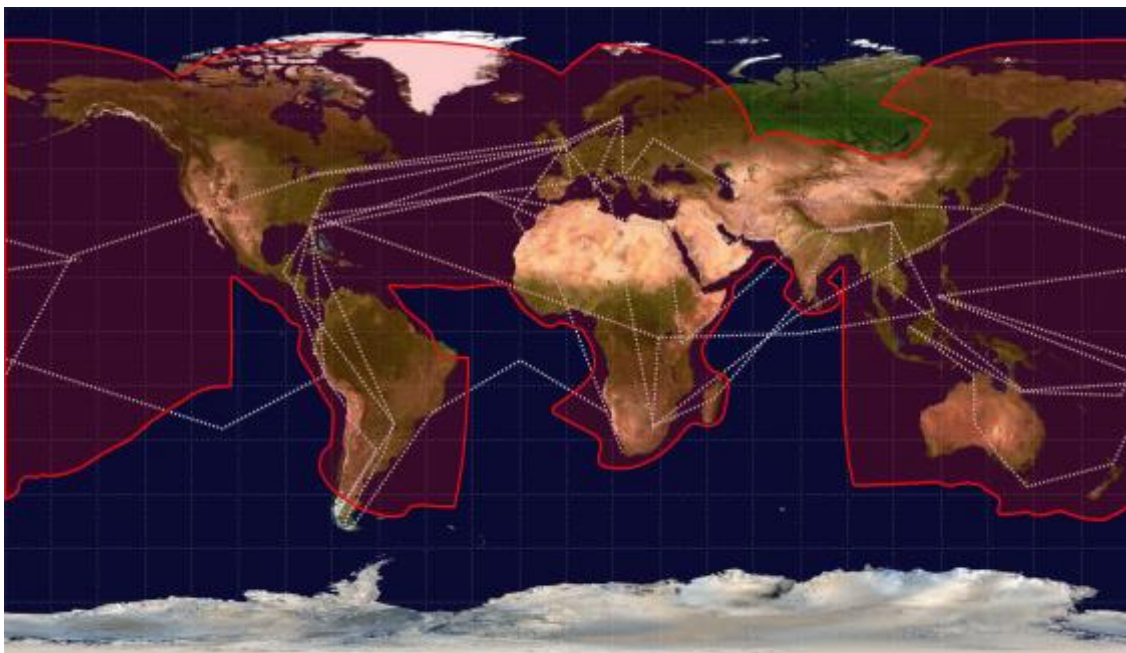
Primary Point of Contact:
Networks Operations Center Coordinator
Office: +1 (603) 879-0205
Fax: +1 (603) 386-6488
Company Address:
Astronics AeroSat Corporation
Suite #2B 62 New Hampshire 101A
Amherst, NH 03031
Email Address: NOC@astronics.com

Secondary Point of Contact:
Panasonic Avionics Corporation
Mission Control Center
26200 Enterprise Way
Lake Forest, CA 92630
Office: (425) 415-9800
Email Address: mcc@panasonic.aero

E. Geographic Area(s) of the ESAA Network

The Astronics AeroSat's FliteStream™ system will operate globally within the service area of the satellites/beams identified herein. The figure below provides the notional coverage over the global network (with example flight city-pair routes). The Technical Appendix provides detailed service areas for each serving satellite.

Figure 2: Geographic Coverage of ESAA Network



II. Proposed Satellite Points of Communication

1. ANIK G1

Coverage Map



Satellite Operator Certification Letter



Telesat,
1601 Telesat Court
Ottawa, ON, Canada K1B 5P4

27 May 2016

Federal Communications Commission
International Bureau
445 12th Street SW
Washington, DC 20554

Re: Engineering Certification for Astronics AeroSat

To Whom It May Concern:

This letter certifies that Telesat is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals to communicate with the Anik G1, Telstar 12V, and Telstar 11N satellites which are located at 107.3°W, 15°W, and 37.5°W, respectively. Specifically, we understand that Astronics AeroSat seeks to operate two types of Ku-band antennas, HR6400 antenna and HR129 antenna, for communication with these satellites for commercial purposes consistent with the FCC's Part 25 rules, including Section 25.227.

Based on the information provided by Astronics AeroSat, Telesat understands the technical characteristics of the HR6400 and HR129 antennas and Telesat (i) recognizes that operation of these terminals at the power density levels provided to Telesat is consistent with the existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from Anik G1, Telstar 12V, and Telstar 11N; (ii) acknowledges that the proposed operation of these terminals has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; and (iii) if the FCC authorizes the operations proposed by Astronics AeroSat, Telesat will take into consideration the power density levels associated with such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

A handwritten signature in black ink, appearing to be "B. Borna", enclosed within a circular scribble.

BAHRAM BORNA
Satellite Spectrum Coordination Engineer
Telesat

Link Budgets

Forward Link Budget

Flitestream	
Antenna Type	HR6400
Lat	-0.8 deg
Lon	-79.4 deg
G/T	12.1 dB/K
Satellite	
Name	Anik-G1
Longitude	-107.3 deg
Hub Earth Station	
Site	Peru
Lat	-12.092 deg
Lon	-77.027 deg
EIRP max	81.4 dBW
Signal	
Waveform	DVB-S2 iDX2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.60
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.13 bps/Hz
Data Rate	2.69E+07 bps
Information Rate (Data + Overhead)	2.86E+07 bps
Symbol Rate	2.38E+07 Hz
Chip Rate (Noise Bandwidth)	2.38E+07 Hz
Occupied Bandwidth	2.86E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	2.7 dB
Uplink	
Frequency	14.250 GHz
Back off	6.5 dB
EIRP Spectral Density	37.1 dBW/4kHz
Slant Range	36936 km
Space Loss, Ls	206.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.6 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	1.0 dB/K
Thermal Noise, C/No	96.0 dBHz
C/(No+Io)	95.5 dBHz
Satellite	
Flux Density	-89.0 dBW/m ²
SFD @ Hub	-89.0 dBW/m ²
Small Signal Gain (IBO/OBO)	0.0 dB
OBO	0.0 dB
Downlink	
Frequency	12.000 GHz
Transponder Sat. EIRP @ Beam Peal	51.0 dBW
Transponder Sat. EIRP @ Terminal	47.0 dBW
DL PSD Limit	13.2 dBW/4kHz
DL PSD @ Beam Peak	13.2 dBW/4kHz
Carrier EIRP @ Beam Peak	51.0 dBW
Carrier EIRP @ Terminal	47.0 dBW
Slant Range	36647 km
Space Loss, Ls	205.3 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	82.2 dBHz
C/(No+Io)	80.8 dBHz
End to End	
End to End C/(No+Io)	80.7 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	5.9 dB
Link Margin	3.2 dB

Return Link Budget

Flitestream	
Antenna Type	HR6400
Lat	-0.8 deg
Lon	-79.4 deg
EIRP max	45.0 dBW
Satellite	
Name	Anik-G1
Longitude	-107.3 deg
Hub Earth Station	
Site	Peru
Lat	-12.092 deg
Lon	-77.027 deg
G/T	36.1 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.53
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.10 bps/Hz
Data Rate	6.37E+05 bps
Information Rate (Data + Overhead)	8.87E+05 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.66E+06 Hz
Occupied Bandwidth	7.99E+06 Hz
C/N Threshold	-4.4 dB
Uplink	
Frequency	14.250 GHz
Back off	2.0 dB
EIRP Spectral Density	10.8 dBW/4kHz
Slant Range	36647 km
Space Loss, Ls	206.8 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	1.0 dB/K
Thermal Noise, C/No	65.7 dBHz
C/(No+Io)	65.6 dBHz
Satellite	
Flux Density	-119.7 dBW/m ²
SFD @ Terminal	-92.0 dBW/m ²
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	25.2 dB
Downlink	
Frequency	12.000 GHz
Transponder Sat. EIRP @ Beam Peal	51.0 dBW
Transponder Sat. EIRP @ Hub	47.0 dBW
DL PSD Limit	13.2 dBW/4kHz
DL PSD @ Beam Peak	-6.1 dBW/4kHz
Carrier EIRP @ Beam Peak	26.2 dBW
Carrier EIRP @ Hub	22.2 dBW
Slant Range	36936 km
Space Loss, Ls	205.4 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.2 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	79.3 dBHz
C/(No+Io)	78.8 dBHz
End to End	
End to End C/(No+Io)	65.4 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-2.8 dB
Link Margin	1.6 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	5.8 deg
Lon	-75.2 deg
EIRP max	42.1 dBW
G/T	11.2 dB/K
Satellite	
Name	Anik-G1
Longitude	-107.3 deg
Hub Earth Station	
Site	Lima
Lat	12.092 deg
Lon	-77.027 deg
EIRP max	80.0 dBW
G/T	36.1 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.75
Overhead Rate	0.92
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.39 bps/Hz
Data Rate	4.16E+07 bps
Information Rate (Data + Overhead)	4.50E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	4.4 dB
Uplink	
Frequency	14.300 GHz
Back off	1.5 dB
EIRP Spectral Density	39.8 dBW/4kHz
Slant Range	36942 km
Space Loss, Ls	206.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.7 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	-1.0 dB/K
Thermal Noise, C/No	92.5 dBHz
C/(No+Io)	92.0 dBHz
Satellite	
Flux Density	-90.5 dBW/m2
SFD @ Hub	-87.0 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	1.0 dB
Downlink	
Frequency	12.000 GHz
Transponder Sat. EIRP @ Beam Peak	51.0 dBW
Transponder Sat. EIRP @ Terminal	50.0 dBW
DL PSD Limit	13.2 dBW/4kHz
DL PSD @ Beam Peak	11.2 dBW/4kHz
Carrier EIRP @ Beam Peak	50.0 dBW
Carrier EIRP @ Terminal	49.0 dBW
Slant Range	36956 km
Space Loss, Ls	205.4 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	82.9 dBHz
C/(No+Io)	80.9 dBHz
End to End	
End to End C/(No+Io)	80.6 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	4.8 dB
Link Margin	0.4 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	5.8 deg
Lon	-75.2 deg
EIRP max	42.1 dBW
G/T	11.2 dB/K
Satellite	
Name	Anik-G1
Longitude	-107.3 deg
Hub Earth Station	
Site	Lima
Lat	12.092 deg
Lon	-77.027 deg
EIRP max	80.0 dBW
G/T	36.1 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.12 bps/Hz
Data Rate	8.05E+05 bps
Information Rate (Data + Overhead)	1.11E+06 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	3.36E+05 Hz
C/N Threshold	-4.2 dB
Uplink	
Frequency	14.140 GHz
Back off	0.0 dB
EIRP Spectral Density	9.9 dBW/4kHz
Slant Range	36956 km
Space Loss, Ls	206.8 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	3.0 dB/K
Thermal Noise, C/No	66.3 dBHz
C/(No+Io)	65.8 dBHz
Satellite	
Flux Density	-120.8 dBW/m2
SFD @ Terminal	-94.0 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	24.3 dB
Downlink	
Frequency	11.840 GHz
Transponder Sat. EIRP @ Beam Peak	51.0 dBW
Transponder Sat. EIRP @ Hub	47.0 dBW
DL PSD Limit	13.2 dBW/4kHz
DL PSD @ Beam Peak	-5.6 dBW/4kHz
Carrier EIRP @ Beam Peak	26.7 dBW
Carrier EIRP @ Hub	22.7 dBW
Slant Range	36942 km
Space Loss, Ls	205.3 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	7.6 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	74.6 dBHz
C/(No+Io)	71.6176 dBHz
End to End	
End to End C/(No+Io)	64.8 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-3.4 dB
Link Margin	0.8 dB

2. APSTAR 6

Coverage Map



Satellite Operator Certification Letter



亞太通信衛星有限公司
APT SATELLITE COMPANY LIMITED

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July 11, 2016

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

Re: Engineering Certification of APT Satellite Company Limited for Astronics AeroSat

To Whom It May Concern:

This letter certifies that APT Satellite Company Limited ("APT Satellite") is aware that Astronics AeroSat Corporation ("AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAAs") – the HR6400 terminal and HR129 terminal – with the APSTAR-6 Satellite at 134° E.L. and with the APSTAR-7 Satellite at 76.5° E.L. AeroSat seeks to operate the HR129 and HR6400 terminals with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by AeroSat, APT Satellite understands the technical characteristics of the HR6400 and HR129 terminals, and APT Satellite (i) recognizes that operation of these terminals at the power density levels provided to APT Satellite is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from APSTAR-6 and APSTAR-7; (ii) acknowledges that the proposed operation of these terminals has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; and (iii) if the FCC authorizes the operations proposed by AeroSat, APT Satellite will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

Brian LO
Vice President & Company Secretary
APT Satellite Company Limited

July 11, 2016

Date

Link Budgets

Forward Link Budget

Flitestream Terminal	
Site	Hong Kong
Antenna Type	HR6400
Lat	22.1 deg
Lon	113.2 deg
G/T	12.3 dB/K
Satellite	
Name	APSTAR-6
Transponder	K2
Longitude	134.0 deg
Hub Earth Station	
Site	HongKong4_5m
Lat	22.45 deg
Lon	114.18 deg
EIRP max	80.0 dBW
Signal	
Waveform	DVB-S2
Modulation	16APSK
Bits per symbol	4
Spread Factor	1
Coding Rate	0.80
Overhead Rate	0.91
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	2.92 bps/Hz
Data Rate	6.73E+07 bps
Information Rate (Data + Overhead)	7.36E+07 bps
Symbol Rate	2.30E+07 Hz
Chip Rate (Noise Bandwidth)	2.30E+07 Hz
Occupied Bandwidth	2.76E+07 Hz
C/N Threshold	11.5 dB
Uplink	
Frequency	14.063000 GHz
Power Control Mode	Automatic Uplink Power Control
Back off	10.8 dB
EIRP Spectral Density	31.6 dBW/4kHz
Slant Range	36754 km
Space Loss, Ls	206.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.8 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	8.0 dB/K
Thermal Noise, C/No	95.3 dBHz
C/(No+Io)	93.4 dBHz
Satellite	
Flux Density	-96.9 dBW/m2
SFD @ Hub	-91.4 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	3.0 dB
Downlink	
Frequency	12.315000 GHz
Transponder Sat. EIRP @ Beam Pea	59.3 dBW
Transponder Sat. EIRP @ Terminal	55.0 dBW
DL PSD Limit	19.7 dBW/4kHz
DL PSD @ Beam Peak	18.7 dBW/4kHz
Carrier EIRP @ Beam Peak	56.3 dBW
Carrier EIRP @ Terminal	52.0 dBW
Slant Range	36776 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	87.2 dBHz
C/(No+Io)	86.9 dBHz
End to End	
End to End C/(No+Io)	86.0 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	12.4 dB
Link Margin	0.9 dB

Return Link Budget

Flitestream Terminal	
Site	Hong Kong
Antenna Type	HR6400
Lat	22.1 deg
Lon	113.2 deg
EIRP max	44.9 dBW
Satellite	
Name	APSTAR-6
Transponder	K2
Longitude	134.0 deg
Hub Earth Station	
Site	HongKong4_5m
Lat	22.45 deg
Lon	114.18 deg
G/T	29.9 dB/K
Signal	
Waveform	iDirectRL-SF4
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.79
Overhead Rate	0.90
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.43 bps/Hz
Data Rate	6.55E+06 bps
Information Rate (Data + Overhead)	7.14E+06 bps
Symbol Rate	4.50E+06 Hz
Chip Rate (Noise Bandwidth)	4.50E+06 Hz
Occupied Bandwidth	5.40E+06 Hz
C/N Threshold	6.6 dB
Uplink	
Frequency	14.077000 GHz
Power Control Mode	Automatic Uplink Power Control
Back off	0.0 dB
EIRP Spectral Density	14.4 dBW/4kHz
Slant Range	36776 km
Space Loss, Ls	206.7 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	8.0 dB/K
Thermal Noise, C/No	74.7 dBHz
C/(No+Io)	74.6 dBHz
Satellite	
Flux Density	-115.2 dBW/m2
SFD @ Terminal	-91.4 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	21.3 dB
Downlink	
Frequency	12.329000 GHz
Transponder Sat. EIRP @ Beam Pea	59.3 dBW
Transponder Sat. EIRP @ Hub	55.0 dBW
DL PSD Limit	19.7 dBW/4kHz
DL PSD @ Beam Peak	5.2 dBW/4kHz
Carrier EIRP @ Beam Peak	35.7 dBW
Carrier EIRP @ Hub	31.4 dBW
Slant Range	36754 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	4.4 dB
Radome, Lr	0.0 dB
Thermal Noise, C/No	80.0 dBHz
C/(No+Io)	79.9 dBHz
End to End	
End to End C/(No+Io)	73.4 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	6.9 dB
Link Margin	0.3 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	24.9 deg
Lon	120.8 deg
EIRP max	42.0 dBW
G/T	12.3 dB/K
Satellite	
Name	APSTAR-6
Longitude	134.0 deg
Hub Earth Station	
Site	Beijing
Lat	22.45 deg
Lon	114.18 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	DVB-S2
Modulation	16APSK
Bits per symbol	4
Spread Factor	1
Coding Rate	0.67
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	2.50 bps/Hz
Data Rate	7.49E+07 bps
Information Rate (Data + Overhead)	8.00E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	9.6 dB
Uplink	
Frequency	14.383 GHz
Back off	3.5 dB
EIRP Spectral Density	37.8 dBW/4kHz
Slant Range	36760 km
Space Loss, Ls	206.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	5.8 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	8.0 dB/K
Thermal Noise, C/No	100.5 dBHz
C/(No+Io)	100.0 dBHz
Satellite	
Flux Density	-91.5 dBW/m2
SFD @ Hub	-88.0 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	1.0 dB
Downlink	
Frequency	12.635 GHz
Transponder Sat. EIRP @ Beam Peak	59.3 dBW
Transponder Sat. EIRP @ Terminal	57.0 dBW
DL PSD Limit	19.7 dBW/4kHz
DL PSD @ Beam Peak	19.5 dBW/4kHz
Carrier EIRP @ Beam Peak	58.3 dBW
Carrier EIRP @ Terminal	56.0 dBW
Slant Range	36663 km
Space Loss, Ls	205.8 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	90.6 dBHz
C/(No+Io)	86.0 dBHz
End to End	
End to End C/(No+Io)	85.8 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	10.0 dB
Link Margin	0.4 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	24.9 deg
Lon	120.8 deg
EIRP max	42.0 dBW
G/T	12.3 dB/K
Satellite	
Name	APSTAR-6
Longitude	134.0 deg
Hub Earth Station	
Site	Beijing
Lat	22.45 deg
Lon	114.18 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	1
Coding Rate	0.75
Overhead Rate	0.81
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.61 bps/Hz
Data Rate	4.04E+06 bps
Information Rate (Data + Overhead)	5.00E+06 bps
Symbol Rate	6.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	6.47E+05 Hz
C/N Threshold	3.3 dB
Uplink	
Frequency	14.063 GHz
Back off	0.0 dB
EIRP Spectral Density	9.8 dBW/4kHz
Slant Range	36663 km
Space Loss, Ls	206.7 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	10.0 dB/K
Thermal Noise, C/No	73.3 dBHz
C/(No+Io)	72.8 dBHz
Satellite	
Flux Density	-120.9 dBW/m2
SFD @ Terminal	-97.9 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	20.5 dB
Downlink	
Frequency	12.315 GHz
Transponder Sat. EIRP @ Beam Peak	59.3 dBW
Transponder Sat. EIRP @ Hub	56.0 dBW
DL PSD Limit	19.7 dBW/4kHz
DL PSD @ Beam Peak	6.6 dBW/4kHz
Carrier EIRP @ Beam Peak	38.8 dBW
Carrier EIRP @ Hub	35.5 dBW
Slant Range	36760 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.4 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	89.5 dBHz
C/(No+Io)	77.7669 dBHz
End to End	
End to End C/(No+Io)	71.6 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	3.4 dB
Link Margin	0.1 dB

3. APSTAR 7

Coverage Map



Satellite Operator Certification Letter



亞太通信衛星有限公司
APT SATELLITE COMPANY LIMITED

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July 11, 2016

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

Re: Engineering Certification of APT Satellite Company Limited for Astronics AeroSat

To Whom It May Concern:

This letter certifies that APT Satellite Company Limited ("APT Satellite") is aware that Astronics AeroSat Corporation ("AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAAs") – the HR6400 terminal and HR129 terminal – with the APSTAR-6 Satellite at 134° E.L. and with the APSTAR-7 Satellite at 76.5° E.L. AeroSat seeks to operate the HR129 and HR6400 terminals with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by AeroSat, APT Satellite understands the technical characteristics of the HR6400 and HR129 terminals, and APT Satellite (i) recognizes that operation of these terminals at the power density levels provided to APT Satellite is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from APSTAR-6 and APSTAR-7; (ii) acknowledges that the proposed operation of these terminals has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; and (iii) if the FCC authorizes the operations proposed by AeroSat, APT Satellite will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

Brian LO
Vice President & Company Secretary
APT Satellite Company Limited

July 11, 2016

Date

Link Budget

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	18.0 deg
Lon	34.8 deg
EIRP max	42.1 dBW
G/T	11.8 dB/K
Satellite	
Name	APSTAR-7
Longitude	76.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.92 deg
Lon	33.64 deg
EIRP max	80.0 dBW
G/T	38.5 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.67
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.26 bps/Hz
Data Rate	2.51E+07 bps
Information Rate (Data + Overhead)	2.67E+07 bps
Symbol Rate	2.00E+07 Hz
Chip Rate (Noise Bandwidth)	2.00E+07 Hz
Occupied Bandwidth	2.40E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	3.5 dB
Uplink	
Frequency	14.272 GHz
Back off	3.6 dB
EIRP Spectral Density	39.4 dBW/4kHz
Slant Range	38671 km
Space Loss, Ls	207.3 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.6 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	97.1 dBHz
C/(No+Io)	96.6 dBHz
Satellite	
Flux Density	-89.0 dBW/m2
SFD @ Hub	-84.0 dBW/m2
Small Signal Gain (IBO/OBO)	4.0 dB
OBO	1.0 dB
Downlink	
Frequency	12.522 GHz
Transponder Sat. EIRP @ Beam Peak	50.0 dBW
Transponder Sat. EIRP @ Terminal	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	12.0 dBW/4kHz
Carrier EIRP @ Beam Peak	49.0 dBW
Carrier EIRP @ Terminal	48.0 dBW
Slant Range	37905 km
Space Loss, Ls	206.0 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	81.9 dBHz
C/(No+Io)	77.7 dBHz
End to End	
End to End C/(No+Io)	77.7 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	3.7 dB
Link Margin	0.2 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	18.0 deg
Lon	34.8 deg
EIRP max	42.1 dBW
G/T	11.8 dB/K
Satellite	
Name	APSTAR-7
Longitude	76.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.92 deg
Lon	33.64 deg
EIRP max	80.0 dBW
G/T	38.5 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.12 bps/Hz
Data Rate	8.05E+05 bps
Information Rate (Data + Overhead)	1.11E+06 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	1.80E+05 Hz
C/N Threshold	-4.2 dB
Uplink	
Frequency	14.272 GHz
Back off	0.0 dB
EIRP Spectral Density	9.9 dBW/4kHz
Slant Range	37905 km
Space Loss, Ls	207.1 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	4.0 dB/K
Thermal Noise, C/No	67.0 dBHz
C/(No+Io)	66.5 dBHz
Satellite	
Flux Density	-121.0 dBW/m2
SFD @ Terminal	-92.0 dBW/m2
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	26.0 dB
Downlink	
Frequency	12.522 GHz
Transponder Sat. EIRP @ Beam Peak	48.0 dBW
Transponder Sat. EIRP @ Hub	48.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-10.3 dBW/4kHz
Carrier EIRP @ Beam Peak	22.0 dBW
Carrier EIRP @ Hub	22.0 dBW
Slant Range	38671 km
Space Loss, Ls	206.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.7 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	79.2 dBHz
C/(No+Io)	71.5985 dBHz
End to End	
End to End C/(No+Io)	65.4 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-2.9 dB
Link Margin	1.3 dB

4. ASIASAT 5

Coverage Map



Satellite Operator Certification Letter



TM21-280616-047

28 June 2016

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

Re: Engineering Certification of Asia Satellite Telecommunication Co. Ltd.

To Whom It May Concern:

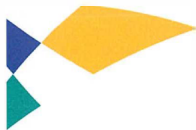
This letter certifies that Asia Satellite Telecommunication Co. Ltd. (hereafter "AsiaSat") is aware that Astronics AeroSat Corporation ("AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the AsiaSat 5 satellite located at 100.5° E.L. Specifically, we understand that in addition to the previously authorized HR6400 Ku-band ESAA terminal, AeroSat seeks to operate the HR129 terminal (also manufactured by AeroSat) with this satellite for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by AeroSat, AsiaSat understands the technical characteristics of the new HR6400 and HR129 terminals (manufactured by AeroSat) and AsiaSat

- (i) recognizes that operation of these terminals at the power density levels provided to AsiaSat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from AsiaSat 5;
- (ii) acknowledges that the proposed operation of these terminals has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; and
- (iii) if the FCC authorizes the operations proposed by AeroSat, AsiaSat will take into consideration the power density levels associated such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely,

Yathung CHAN
Spectrum Management



Link Budgets

Forward Link Budget

Flitestream Terminal	
Site	Jerusalem
Antenna Type	HR6400
Lat	32.4 deg
Lon	35.1 deg
G/T	12.4 dB/K
Satellite	
Name	Asiasat-5
Transponder	K4V
Longitude	100.5 deg
Hub Earth Station	
Site	Dubai
Lat	25.25 deg
Lon	55.31 deg
EIRP max	80.0 dBW
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.33
Overhead Rate	0.92
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.61 bps/Hz
Data Rate	2.75E+07 bps
Information Rate (Data + Overhead)	3.00E+07 bps
Symbol Rate	4.50E+07 Hz
Chip Rate (Noise Bandwidth)	4.50E+07 Hz
Occupied Bandwidth	5.40E+07 Hz
C/N Threshold	-0.8 dB
Uplink	
Frequency	14.188300 GHz
Power Control Mode	Automatic Uplink Power Control
Back off	9.8 dB
EIRP Spectral Density	29.7 dBW/4kHz
Slant Range	38418 km
Space Loss, Ls	207.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.2 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	92.4 dBHz
C/(No+Io)	91.6 dBHz
Satellite	
Flux Density	-93.7 dBW/m2
SFD @ Hub	-87.7 dBW/m2
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	3.0 dB
Downlink	
Frequency	12.440300 GHz
Transponder Sat. EIRP @ Beam Peak	52.5 dBW
Transponder Sat. EIRP @ Terminal	48.0 dBW
DL PSD Limit	15.0 dBW/4kHz
DL PSD @ Beam Peak	9.0 dBW/4kHz
Carrier EIRP @ Beam Peak	49.5 dBW
Carrier EIRP @ Terminal	45.0 dBW
Slant Range	40366 km
Space Loss, Ls	206.5 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	79.4 dBHz
C/(No+Io)	79.0 dBHz
End to End	
End to End C/(No+Io)	78.8 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	1.2 dB
Link Margin	2.0 dB

Return Link Budget

Flitestream Terminal	
Site	Jerusalem
Antenna Type	HR6400
Lat	32.4 deg
Lon	35.1 deg
EIRP max	45.0 dBW
Satellite	
Name	Asiasat-5
Transponder	K4V
Longitude	100.5 deg
Hub Earth Station	
Site	Dubai
Lat	25.25 deg
Lon	55.31 deg
G/T	34.1 dB/K
Signal	
Waveform	iDirectRL-SF8
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.43
Overhead Rate	0.68
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.07 bps/Hz
Data Rate	4.85E+05 bps
Information Rate (Data + Overhead)	7.18E+05 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.66E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
C/N Threshold	-5.0 dB
Uplink	
Frequency	14.197600 GHz
Power Control Mode	Automatic Uplink Power Control
Back off	0.0 dB
EIRP Spectral Density	12.8 dBW/4kHz
Slant Range	40366 km
Space Loss, Ls	207.6 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	2.0 dB/K
Thermal Noise, C/No	67.9 dBHz
C/(No+Io)	67.7 dBHz
Satellite	
Flux Density	-120.8 dBW/m2
SFD @ Terminal	-87.7 dBW/m2
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	30.1 dB
Downlink	
Frequency	12.449600 GHz
Transponder Sat. EIRP @ Beam Peak	52.5 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	15.0 dBW/4kHz
DL PSD @ Beam Peak	-7.2 dBW/4kHz
Carrier EIRP @ Beam Peak	25.0 dBW
Carrier EIRP @ Hub	21.5 dBW
Slant Range	38414 km
Space Loss, Ls	206.0 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.5 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	76.7 dBHz
C/(No+Io)	75.9 dBHz
End to End	
End to End C/(No+Io)	67.1 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-1.2 dB
Link Margin	3.8 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	25.8 deg
Lon	89.9 deg
EIRP max	42.0 dBW
G/T	11.8 dB/K
Satellite	
Name	Asiasat-5
Longitude	100.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.92 deg
Lon	33.64 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.83
Overhead Rate	0.93
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.56 bps/Hz
Data Rate	3.12E+07 bps
Information Rate (Data + Overhead)	3.33E+07 bps
Symbol Rate	2.00E+07 Hz
Chip Rate (Noise Bandwidth)	2.00E+07 Hz
Occupied Bandwidth	2.40E+07 Hz
Power Equivalent Bandwidth	4.79E+07 Hz
C/N Threshold	5.6 dB
Uplink	
Frequency	14.210 GHz
Back off	0.0 dB
EIRP Spectral Density	43.0 dBW/4kHz
Slant Range	40562 km
Space Loss, Ls	207.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	8.1 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	94.9 dBHz
C/(No+Io)	94.4 dBHz
Satellite	
Flux Density	-91.2 dBW/m2
SFD @ Hub	-87.7 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.5 dB
Downlink	
Frequency	12.462 GHz
Transponder Sat. EIRP @ Beam Peak	52.5 dBW
Transponder Sat. EIRP @ Terminal	51.0 dBW
DL PSD Limit	15.0 dBW/4kHz
DL PSD @ Beam Peak	13.9 dBW/4kHz
Carrier EIRP @ Beam Peak	50.9 dBW
Carrier EIRP @ Terminal	49.5 dBW
Slant Range	36649 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	83.7 dBHz
C/(No+Io)	79.8 dBHz
End to End	
End to End C/(No+Io)	79.7 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	5.7 dB
Link Margin	0.1 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	25.8 deg
Lon	89.9 deg
EIRP max	42.0 dBW
G/T	11.8 dB/K
Satellite	
Name	Asiasat-5
Longitude	100.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.92 deg
Lon	33.64 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.12 bps/Hz
Data Rate	8.05E+05 bps
Information Rate (Data + Overhead)	1.11E+06 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	1.88E+05 Hz
C/N Threshold	-4.2 dB
Uplink	
Frequency	14.150 GHz
Back off	0.0 dB
EIRP Spectral Density	9.8 dBW/4kHz
Slant Range	36649 km
Space Loss, Ls	206.7 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	4.0 dB/K
Thermal Noise, C/No	67.2 dBHz
C/(No+Io)	66.7 dBHz
Satellite	
Flux Density	-120.9 dBW/m2
SFD @ Terminal	-90.3 dBW/m2
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	27.6 dB
Downlink	
Frequency	12.402 GHz
Transponder Sat. EIRP @ Beam Peak	52.5 dBW
Transponder Sat. EIRP @ Hub	48.0 dBW
DL PSD Limit	15.0 dBW/4kHz
DL PSD @ Beam Peak	-7.4 dBW/4kHz
Carrier EIRP @ Beam Peak	24.9 dBW
Carrier EIRP @ Hub	20.4 dBW
Slant Range	40562 km
Space Loss, Ls	206.5 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	9.4 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	70.4 dBHz
C/(No+Io)	68.0842 dBHz
End to End	
End to End C/(No+Io)	64.3 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-3.9 dB
Link Margin	0.3 dB

5. EUTELSAT 10A

Coverage Map



Satellite Operator Certification Letter



June 9th, 2016

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

Re: Engineering Certification of Eutelsat

To Whom It May Concern:

This letter certifies that Eutelsat is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 70B satellite at 70.5°E and the Eutelsat 10A satellite at 10°E. Eutelsat understands that Astronics AeroSat seeks to operate the previously authorized HR6400 Ku-band antenna systems with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Eutelsat confirms and hereby certifies the following with respect to the ESAA terminal operations proposed by Astronics AeroSat:

- a) The proposed Ku-band operation of Astronics AeroSat's ESAA terminal has the potential to create harmful interference to adjacent satellite networks that may be unacceptable;
- b) Eutelsat capacity on the Eutelsat 70B and Eutelsat 10A satellites is used for other ESAA operations;
- c) The proposed operation of the Astronics AeroSat terminals at the proposed power density levels is consistent with existing satellite coordination agreements with the satellites of the Eutelsat 70B and Eutelsat 10A satellites.

If the FCC authorizes the operation proposed by Astronics AeroSat, Eutelsat will include the power density levels specified by Astronics AeroSat, defined within the satellite coordination agreements, in all future satellite network coordination with operators of satellite that are adjacent to those satellites addressed by this letter.

Sincerely,



For Eutelsat
Filipe De Oliveira
Director of Resources Engineering

www.eutelsat.com

June 9th, 2016

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

Re: Engineering Certification of Eutelsat

To Whom It May Concern:

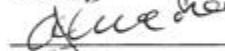
This letter certifies that Eutelsat is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 70B satellite at 70.5°E, Eutelsat 172A satellite at 172.0°E and the Eutelsat 10A satellite at 10°E. Eutelsat understands that Astronics AeroSat seeks to operate the previously authorized HR129 Ku-band antenna systems with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Eutelsat confirms and hereby certifies the following with respect to the ESAA terminal operations proposed by Astronics AeroSat:

- a) The proposed Ku-band operation of Astronics AeroSat's ESAA terminal has the potential to create harmful interference to adjacent satellite networks that may be unacceptable;
- b) Eutelsat capacity on the Eutelsat 70B, Eutelsat 172A and Eutelsat 10A satellites is used for other ESAA operations;
- c) The proposed operation of the Astronics AeroSat terminals at the proposed power density levels is consistent with existing satellite coordination agreements with the satellites of the Eutelsat 70B, Eutelsat 172A and Eutelsat 10A satellites.

If the FCC authorizes the operation proposed by Astronics AeroSat, Eutelsat will include the power density levels specified by Astronics AeroSat, defined within the satellite coordination agreements, in all future satellite network coordination with operators of satellite that are adjacent to those satellites addressed by this letter.

Sincerely,



For Eutelsat
Filipe De Oliveira
Director of Resources Engineering

Link Budgets

W2A Link Budget

Forward Link Budget

FliteStream Terminal	
Site	Ankara
Antenna Type	HR6400
Lat	40.0 deg
Lon	32.0 deg
G/T	11.7 dB/K
Satellite	
Name	Eutelsat W2A
Longitude	10.0 deg
Hub/Earth Station	
Site	Santander_7.2m
Lat	43.442 deg
Lon	-3.873 deg
EIRP _{max}	80.0 dBW
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per Symbol	2
Spread Factor	1
Coding Rate	0.67
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise/BW)	1.25 bps/Hz
Data Rate	8.46E+06 bps
Information Rate (Data+Overhead)	9.00E+06 bps
Symbol Rate	6.75E+06 Hz
Chip Rate (Noise Bandwidth)	6.75E+06 Hz
Occupied Bandwidth	8.10E+06 Hz
C/N ₀ Threshold	3.5 dB
Uplink	
Frequency	13.762410 GHz
Power Control Mode	Automatic Uplink Power Control
Backoff	9.1 dB
EIRP Spectral Density	38.6 dBW/4kHz
Slant Range	37939 km
Space Loss, L _s	206.8 dB
Pointing Loss, L _{pnt}	0.0 dB
Atmosphere/Weather Loss, L _a	1.3 dB
Radome, L _r	0.0 dB
Transponder G/T @ Hub	1.0 dB/K
Thermal Noise, T _c /No	92.4 dBHz
C/(No+I _o)	91.9 dBHz
Satellite	
Flux Density	-93.0 dBW/m ²
SFD @ Hub	-83.5 dBW/m ²
Small Signal Gain (IBO/OBO)	2.3 dB
OBO	7.2 dB
Downlink	
Frequency	11.462410 GHz
Transponder Sat. EIRP @ Beam Peak	49.0 dBW
Transponder Sat. EIRP @ Terminal	46.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	9.6 dBW/4kHz
Carrier EIRP @ Beam Peak	41.8 dBW
Carrier EIRP @ Terminal	38.8 dBW
Slant Range	37899 km
Space Loss, L _s	205.2 dB
Pointing Loss, L _{pnt}	0.1 dB
Atmosphere/Weather Loss, L _a	0.0 dB
Radome, L _r	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, T _c /No	73.8 dBHz
C/(No+I _o)	73.7 dBHz
End-to-End	
End-to-End C/(No+I _o)	73.6 dBHz
Implementation Loss	1.0 dB

End-to-End C/N ₀ /Imp Loss	4.3 dB
Link Margin	0.8 dB

Return Link Budget

FliteStream Terminal	
Site	Ankara
Antenna Type	HR6400
Lat	39.6 deg
Lon	31.3 deg
EIRP _{max}	45.0 dBW
Satellite	
Name	Eutelsat W2A
Longitude	10.0 deg
Hub/Earth Station	
Site	Santander_7.2m
Lat	43.442 deg
Lon	-3.873 deg
G/T	35.6 dB/K
Signal	
Waveform	iDirectL-SF4
Modulation	BPSK
Bits per Symbol	1
Spread Factor	4
Coding Rate	0.43
Overhead Rate	0.68
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise/BW)	0.07 bps/Hz
Data Rate	4.86E+05 bps
Information Rate (Data+Overhead)	7.18E+05 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.66E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
C/N ₀ Threshold	-5.0 dB
Uplink	
Frequency	14.153525 GHz
Power Control Mode	Automatic Uplink Power Control
Backoff	0.0 dB
EIRP Spectral Density	12.8 dBW/4kHz
Slant Range	37845 km
Space Loss, L _s	207.0 dB
Pointing Loss, L _{pnt}	0.1 dB
Atmosphere/Weather Loss, L _a	0.0 dB
Radome, L _r	0.0 dB
Transponder G/T @ Terminal	4.0 dB/K
Thermal Noise, T _c /No	70.5 dBHz
C/(No+I _o)	70.3 dBHz
Satellite	
Flux Density	-116.1 dBW/m ²
SFD @ Terminal	-86.5 dBW/m ²
Small Signal Gain (IBO/OBO)	2.3 dB
OBO	27.3 dB
Downlink	
Frequency	12.562635 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-7.6 dBW/4kHz
Carrier EIRP @ Beam Peak	24.6 dBW
Carrier EIRP @ Hub	20.1 dBW
Slant Range	37939 km
Space Loss, L _s	206.0 dB
Pointing Loss, L _{pnt}	0.0 dB
Atmosphere/Weather Loss, L _a	1.9 dB
Radome, L _r	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, T _c /No	76.4 dBHz
C/(No+I _o)	76.4 dBHz
End-to-End	
End-to-End C/(No+I _o)	69.3 dBHz
Implementation Loss	0.0 dB

End-to-End C/N ₀ /Imp Loss	1.1 dB
Link Margin	0.1 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	43.6 deg
Lon	-0.7 deg
EIRP max	42.3 dBW
G/T	11.1 dB/K
Satellite	
Name	Eutelsat W2A
Longitude	10.0 deg
Hub Earth Station	
Site	Cologne
Lat	50.94 deg
Lon	6.96 deg
EIRP max	80.0 dBW
G/T	37.1 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.83
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.83 bps/Hz
Data Rate	2.48E+07 bps
Information Rate (Data + Overhead)	3.00E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	0.9 dB
Uplink	
Frequency	13.771 GHz
Back off	6.2 dB
EIRP Spectral Density	35.0 dBW/4kHz
Slant Range	38475 km
Space Loss, Ls	206.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.9 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	5.0 dB/K
Thermal Noise, C/No	98.6 dBHz
C/(No+Io)	98.1 dBHz
Satellite	
Flux Density	-90.8 dBW/m2
SFD @ Hub	-87.5 dBW/m2
Small Signal Gain (IBO/OBO)	2.3 dB
OBO	1.0 dB
Downlink	
Frequency	11.471 GHz
Transponder Sat. EIRP @ Beam Peak	49.0 dBW
Transponder Sat. EIRP @ Terminal	48.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	9.2 dBW/4kHz
Carrier EIRP @ Beam Peak	48.0 dBW
Carrier EIRP @ Terminal	47.0 dBW
Slant Range	37895 km
Space Loss, Ls	205.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	81.0 dBHz
C/(No+Io)	76.7 dBHz
End to End	
End to End C/(No+Io)	76.7 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	0.9 dB
Link Margin	0.0 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	43.6 deg
Lon	-0.7 deg
EIRP max	42.3 dBW
G/T	11.1 dB/K
Satellite	
Name	Eutelsat W2A
Longitude	10.0 deg
Hub Earth Station	
Site	Cologne
Lat	50.94 deg
Lon	6.96 deg
EIRP max	80.0 dBW
G/T	37.1 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.12 bps/Hz
Data Rate	8.05E+05 bps
Information Rate (Data + Overhead)	1.11E+06 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	9.41E+04 Hz
C/N Threshold	-4.2 dB
Uplink	
Frequency	14.125 GHz
Back off	0.0 dB
EIRP Spectral Density	10.0 dBW/4kHz
Slant Range	37895 km
Space Loss, Ls	207.0 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	5.0 dB/K
Thermal Noise, C/No	68.3 dBHz
C/(No+Io)	67.8 dBHz
Satellite	
Flux Density	-120.8 dBW/m2
SFD @ Terminal	-85.5 dBW/m2
Small Signal Gain (IBO/OBO)	2.3 dB
OBO	33.0 dB
Downlink	
Frequency	12.625 GHz
Transponder Sat. EIRP @ Beam Peak	49.0 dBW
Transponder Sat. EIRP @ Hub	48.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-16.3 dBW/4kHz
Carrier EIRP @ Beam Peak	16.0 dBW
Carrier EIRP @ Hub	15.0 dBW
Slant Range	38475 km
Space Loss, Ls	206.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	71.5 dBHz
C/(No+Io)	67.3167 dBHz
End to End	
End to End C/(No+Io)	64.5 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-3.7 dB
Link Margin	0.5 dB

6. EUTELSAT 70B

Coverage Map



Satellite Operator Certification Letter



June 9th, 2016

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

Re: Engineering Certification of Eutelsat

To Whom It May Concern:

This letter certifies that Eutelsat is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 70B satellite at 70.5°E and the Eutelsat 10A satellite at 10°E. Eutelsat understands that Astronics AeroSat seeks to operate the previously authorized HR6400 Ku-band antenna systems with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Eutelsat confirms and hereby certifies the following with respect to the ESAA terminal operations proposed by Astronics AeroSat:

- a) The proposed Ku-band operation of Astronics AeroSat's ESAA terminal has the potential to create harmful interference to adjacent satellite networks that may be unacceptable;
- b) Eutelsat capacity on the Eutelsat 70B and Eutelsat 10A satellites is used for other ESAA operations;
- c) The proposed operation of the Astronics AeroSat terminals at the proposed power density levels is consistent with existing satellite coordination agreements with the satellites of the Eutelsat 70B and Eutelsat 10A satellites.

If the FCC authorizes the operation proposed by Astronics AeroSat, Eutelsat will include the power density levels specified by Astronics AeroSat, defined within the satellite coordination agreements, in all future satellite network coordination with operators of satellite that are adjacent to those satellites addressed by this letter.

Sincerely,



For Eutelsat
Filipe De Oliveira

Director of Resources Engineering

www.eutelsat.com

June 9th, 2016

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

Re: Engineering Certification of Eutelsat

To Whom It May Concern:

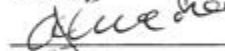
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- c) The proposed operation of the Astronics AeroSat terminals at the proposed power density levels is consistent with existing satellite coordination agreements with the satellites of the Eutelsat 70B, Eutelsat 172A and Eutelsat 10A satellites.

If the FCC authorizes the operation proposed by Astronics AeroSat, Eutelsat will include the power density levels specified by Astronics AeroSat, defined within the satellite coordination agreements, in all future satellite network coordination with operators of satellite that are adjacent to those satellites addressed by this letter.

Sincerely,



For Eutelsat
Filipe De Oliveira
Director of Resources Engineering

Link Budgets

Forward Link Budget

Flitestream Terminal	
Antenna Type	HR6400
Lat	31.4 deg
Lon	44.4 deg
G/T	10.3 dB/K
Satellite	
Name	E70B
Longitude	70.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.859 deg
Lon	33.384 deg
EIRP _{max}	85.2 dBW
G/T	37.4 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per Symbol	2
Spread Factor	1
Coding Rate	0.67
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise/BW)	1.26 bps/Hz
Data Rate	5.66E+07 bps
Information Rate (Data/Overhead)	6.00E+07 bps
Symbol Rate	4.50E+07 Hz
Chip Rate (Noise Bandwidth)	4.50E+07 Hz
Occupied Bandwidth	5.40E+07 Hz
Power Equivalent Bandwidth	5.40E+07 Hz
C/N ₀ threshold	3.5 dB
Uplink	
Frequency	13.125 GHz
Backoff	11.4 dB
EIRP Spectral Density	33.3 dBW/4kHz
Slant Range	38300 km
Space Loss, L _s	206.5 dB
Pointing Loss, L _{pnt}	0.0 dB
Atmosphere/Weather Loss, L _a	1.9 dB
Radome, L _r	0.0 dB
Transponder G/T @ Hub	3.8 dB/K
Thermal Noise, L _c /No	97.8 dBHz
C/(No+Io)	97.3 dBHz
Satellite	
Flux Density	-90.8 dBW/m ²
SFD @ Hub	-87.8 dBW/m ²
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.0 dB
Downlink	
Frequency	11.325 GHz
Transponder Sat. EIRP @ Beam Peak	50.0 dBW
Transponder Sat. EIRP @ Terminal	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	8.5 dBW/4kHz
Carrier EIRP @ Beam Peak	49.0 dBW
Carrier EIRP @ Terminal	48.0 dBW
Slant Range	37497 km
Space Loss, L _s	205.0 dB
Pointing Loss, L _{pnt}	0.1 dB
Atmosphere/Weather Loss, L _a	0.0 dB
Radome, L _r	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, L _c /No	83.1 dBHz
C/(No+Io)	83.0 dBHz
End to End	
End to End L _c /(No+Io)	82.8 dBHz
Implementation Loss	1.0 dB
End to End L _c /N ₀ /Imp Loss	5.3 dB
Link Margin	1.8 dB

Return Link Budget

Flitestream Terminal	
Antenna Type	HR6400
Lat	31.4 deg
Lon	44.4 deg
EIRP _{max}	45.2 dBW
Satellite	
Name	E70B
Longitude	70.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.859 deg
Lon	33.384 deg
G/T	37.4 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per Symbol	1
Spread Factor	1
Coding Rate	0.67
Overhead Rate	0.77
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise/BW)	0.51 bps/Hz
Data Rate	2.57E+06 bps
Information Rate (Data/Overhead)	3.34E+06 bps
Symbol Rate	5.00E+06 Hz
Chip Rate (Noise Bandwidth)	5.00E+06 Hz
Occupied Bandwidth	6.00E+06 Hz
C/N ₀ threshold	2.4 dB
Uplink	
Frequency	14.500 GHz
Backoff	0.0 dB
EIRP Spectral Density	14.2 dBW/4kHz
Slant Range	37497 km
Space Loss, L _s	207.2 dB
Pointing Loss, L _{pnt}	0.1 dB
Atmosphere/Weather Loss, L _a	0.0 dB
Radome, L _r	0.0 dB
Transponder G/T @ Terminal	3.8 dB/K
Thermal Noise, L _c /No	70.3 dBHz
C/(No+Io)	70.0 dBHz
Satellite	
Flux Density	-115.8 dBW/m ²
SFD @ Terminal	-92.8 dBW/m ²
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	21.1 dB
Downlink	
Frequency	12.625 GHz
Transponder Sat. EIRP @ Beam Peak	50.0 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-3.7 dBW/4kHz
Carrier EIRP @ Beam Peak	27.3 dBW
Carrier EIRP @ Hub	26.1 dBW
Slant Range	38296 km
Space Loss, L _s	206.1 dB
Pointing Loss, L _{pnt}	0.0 dB
Atmosphere/Weather Loss, L _a	3.3 dB
Radome, L _r	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, L _c /No	82.9 dBHz
C/(No+Io)	82.5 dBHz
End to End	
End to End L _c /(No+Io)	69.7 dBHz
Implementation Loss	0.0 dB
End to End L _c /N ₀ /Imp Loss	2.7 dB
Link Margin	0.3 dB

Forward Link Budget

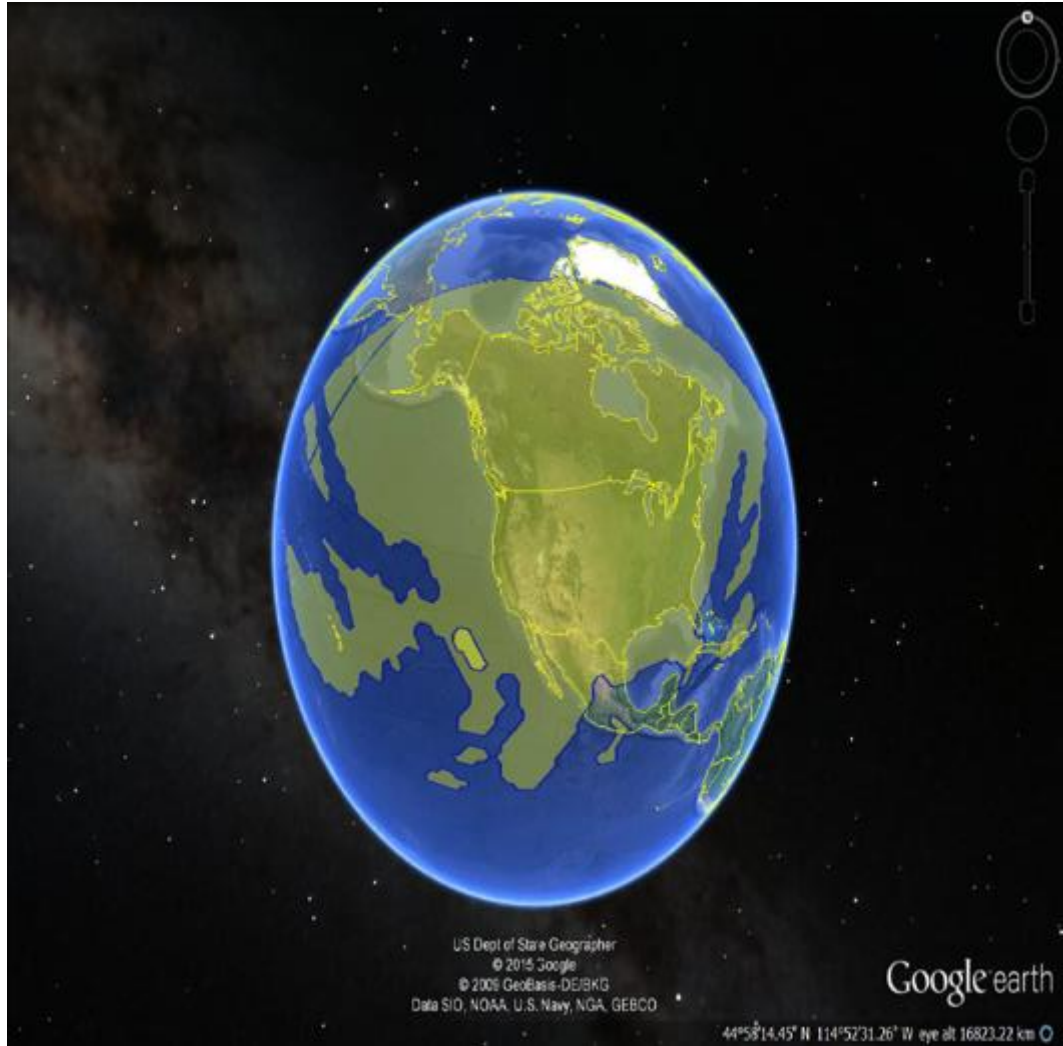
eXConnect Terminal	
Antenna Type	HR129
Lat	26.8 deg
Lon	91.0 deg
EIRP max	42.2 dBW
G/T	11.1 dB/K
Satellite	
Name	E70B
Longitude	70.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.92 deg
Lon	33.64 deg
EIRP max	77.8 dBW
G/T	37.4 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.25
Overhead Rate	0.71
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.35 bps/Hz
Data Rate	1.59E+07 bps
Information Rate (Data + Overhead)	2.25E+07 bps
Symbol Rate	4.50E+07 Hz
Chip Rate (Noise Bandwidth)	4.50E+07 Hz
Occupied Bandwidth	5.40E+07 Hz
Power Equivelent Bandwidth	5.40E+07 Hz
C/N Threshold	-3.7 dB
Uplink	
Frequency	13.156 GHz
Back off	2.0 dB
EIRP Spectral Density	35.4 dBW/4kHz
Slant Range	38287 km
Space Loss, Ls	206.5 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	3.8 dB/K
Thermal Noise, C/No	99.8 dBHz
C/(No+Io)	99.3 dBHz
Satellite	
Flux Density	-88.8 dBW/m2
SFD @ Hub	-85.8 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.0 dB
Downlink	
Frequency	11.356 GHz
Transponder Sat. EIRP @ Beam Peak	50.0 dBW
Transponder Sat. EIRP @ Terminal	49.0 dBW
DL PSD Limit	16.0 dBW/4kHz
DL PSD @ Beam Peak	8.4 dBW/4kHz
Carrier EIRP @ Beam Peak	49.0 dBW
Carrier EIRP @ Terminal	48.0 dBW
Slant Range	37005 km
Space Loss, Ls	204.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	82.2 dBHz
C/(No+Io)	75.2 dBHz
End to End	
End to End C/(No+Io)	75.2 dBHz
Implementation Loss	1.5 dB
End to End C/N w/ Imp Loss	-2.8 dB
Link Margin	0.9 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	26.8 deg
Lon	91.0 deg
EIRP max	42.2 dBW
G/T	11.1 dB/K
Satellite	
Name	E70B
Longitude	70.5 deg
Hub Earth Station	
Site	Cyprus
Lat	34.92 deg
Lon	33.64 deg
EIRP max	77.8 dBW
G/T	37.4 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.12 bps/Hz
Data Rate	8.05E+05 bps
Information Rate (Data + Overhead)	1.11E+06 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivelent Bandwidth	1.94E+05 Hz
C/N Threshold	-4.2 dB
Uplink	
Frequency	14.208 GHz
Back off	0.4 dB
EIRP Spectral Density	9.6 dBW/4kHz
Slant Range	37005 km
Space Loss, Ls	206.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	2.8 dB/K
Thermal Noise, C/No	65.8 dBHz
C/(No+Io)	65.3 dBHz
Satellite	
Flux Density	-121.1 dBW/m2
SFD @ Terminal	-89.8 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	29.4 dB
Downlink	
Frequency	12.708 GHz
Transponder Sat. EIRP @ Beam Peak	50.0 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	16.0 dBW/4kHz
DL PSD @ Beam Peak	-11.7 dBW/4kHz
Carrier EIRP @ Beam Peak	20.6 dBW
Carrier EIRP @ Hub	19.6 dBW
Slant Range	38287 km
Space Loss, Ls	206.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.9 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	75.4 dBHz
C/(No+Io)	70.7825 dBHz
End to End	
End to End C/(No+Io)	64.2 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-4.0 dB
Link Margin	0.2 dB

7. EUTELSAT 115WB

Coverage Map



Satellite Operator Certification Letter



September 6, 2016

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

Re: Engineering Certification of Eutelsat Americas (HR6400 on E115WB)

To Whom It May Concern:

This letter certifies that Eutelsat Americas ("EAS") is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 115WB (E115WB) satellite located at 114.9° W.L. Specifically, we understand that Astronics AeroSat seeks to operate the previously authorized HR6400 Ku-band antenna system with E115WB for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

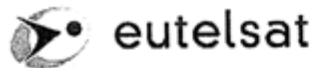
Based on the information provided by Astronics AeroSat, EAS understands the technical characteristics of the HR6400 terminal, and EAS (i) recognizes that operation of the HR6400 terminals at the power density levels provided to EAS is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from E115WB; (ii) acknowledges that the proposed operation of the HR6400 terminal has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; (iii) if the operation of this antenna should cause unacceptable interference towards adjacent satellite networks, Astronics AeroSat agrees to cease transmissions immediately upon notice from EAS; and (iv) if the FCC authorizes the operations proposed by Astronics AeroSat, EAS will take into consideration the power density levels associated with such operations in future satellite network coordinations with adjacent satellite operators.

Sincerely,

A handwritten signature in black ink, appearing to read "Hector Fortis", written over a horizontal line.

Hector Fortis
Eutelsat Americas
International and Regulatory Affairs

A handwritten signature in black ink, appearing to be a stylized name, located in the bottom right area of the page.



September 6, 2016

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

**Re: Engineering Certification of Eutelsat Americas
(HR129 on E115WB and E117WA)**

To Whom It May Concern:

This letter certifies that Eutelsat Americas ("EAS") is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 115WB (E115WB) satellite located at 114.9° W.L and the Eutelsat 117WA (E117WA) satellite located at 116.8° W.L. Specifically, we understand that Astronics AeroSat seeks to operate the HR129 Ku-band antenna system with E115WB and E117WA for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Astronics AeroSat, EAS understands the technical characteristics of the HR129 terminal, and EAS (i) recognizes that operation of the HR129 terminals at the power density levels provided to EAS is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from E115WB and E117WA; (ii) acknowledges that the proposed operation of the HR6400 terminal has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; (iii) if the operation of this antenna should cause unacceptable interference towards adjacent satellite networks, Astronics AeroSat agrees to cease transmissions immediately upon notice from EAS; and (iv) if the FCC authorizes the operations proposed by Astronics AeroSat, EAS will take into consideration the power density levels associated with such operations in future satellite network coordinations with adjacent satellite operators.

Sincerely,

A handwritten signature in black ink, appearing to read "Hector Fortis", written over a horizontal line.

Hector Fortis
Eutelsat Americas
International and Regulatory Affairs

Handwritten initials in black ink, possibly "JF" or "JR", located to the right of the signature block.

Link Budgets

Forward Link Budget

Flitestream Terminal

Site	
Antenna Type	HR6400
Lat	45.0 deg
Lon	-80.0 deg
G/T	12.1 dB/K

Satellite

Name	E 115WB
Longitude	-114.9 deg

Hub Earth Station

Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.1 dBW

Signal

Waveform	DVB-S2
Modulation	8PSK
Bits per symbol	3
Spread Factor	1
Coding Rate	0.75
Overhead Rate	0.92
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	2.07 bps/Hz
Data Rate	6.22E+07 bps
Information Rate (Data + Overhead)	6.75E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
C/N Threshold	8.5 dB

Uplink

Frequency	14.327000 GHz
Power Control Mode	Automatic Uplink Power Control
Back off	3.8 dB
EIRP Spectral Density	37.6 dBW/4kHz
Slant Range	38218 km
Space Loss, Ls	207.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.4 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	98.3 dBHz
C/(No+Io)	93.3 dBHz

Satellite

Flux Density	-87.7 dBW/m2
SFD @ Hub	-84.0 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.7 dB

Downlink

Frequency	12.027000 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Terminal	53.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	13.0 dBW/4kHz
Carrier EIRP @ Beam Peak	51.8 dBW
Carrier EIRP @ Terminal	51.3 dBW
Slant Range	38813 km
Space Loss, Ls	205.8 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	86.0 dBHz
C/(No+Io)	85.6 dBHz

End to End

End to End C/(No+Io)	84.9 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	9.2 dB
Link Margin	0.7 dB

Return Link Budget (Link 1)

Flitestream Terminal

Site	
Antenna Type	HR6400
Lat	45.0 deg
Lon	-80.0 deg
EIRP max	45.1 dBW

Satellite

Name	E 115WB
Longitude	-114.9 deg

Hub Earth Station

Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
G/T	33.4 dB/K

Signal

Waveform	iDirect
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.83
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.83 bps/Hz
Data Rate	5.53E+06 bps
Information Rate (Data + Overhead)	6.67E+06 bps
Symbol Rate	6.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
C/N Threshold	3.6 dB

Uplink

Frequency	14.327000 GHz
Power Control Mode	Automatic Uplink Power Control
Back off	0.0 dB
EIRP Spectral Density	12.9 dBW/4kHz
Slant Range	38813 km
Space Loss, Ls	207.3 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	6.0 dB/K
Thermal Noise, C/No	72.2 dBHz
C/(No+Io)	72.0 dBHz

Satellite

Flux Density	-116.9 dBW/m2
SFD @ Terminal	-100.0 dBW/m2
Small Signal Gain (IBO/OBO)	1.5 dB
OBO	15.4 dB

Downlink

Frequency	12.027 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	5.0 dBW/4kHz
Carrier EIRP @ Beam Peak	37.2 dBW
Carrier EIRP @ Hub	32.7 dBW
Slant Range	38218 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.6 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	87.4 dBHz
C/(No+Io)	86.7 dBHz

End to End

End to End C/(No+Io)	71.8 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	3.6 dB
Link Margin	0.0 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	51.9 deg
Lon	-96.2 deg
EIRP max	42.0 dBW
G/T	11.4 dB/K
Satellite	
Name	SatMex-7
Longitude	-114.9 deg
Hub Earth Station	
Site	Brewster
Lat	48.147 deg
Lon	-119.691 deg
EIRP max	80.0 dBW
G/T	32.4 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.83
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.83 bps/Hz
Data Rate	2.48E+07 bps
Information Rate (Data + Overhead)	3.00E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	0.9 dB
Uplink	
Frequency	14.380 GHz
Back off	10.1 dB
EIRP Spectral Density	31.1 dBW/4kHz
Slant Range	38225 km
Space Loss, Ls	207.3 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.5 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	6.0 dB/K
Thermal Noise, C/No	95.8 dBHz
C/(No+Io)	95.3 dBHz
Satellite	
Flux Density	-94.2 dBW/m2
SFD @ Hub	-91.2 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.0 dB
Downlink	
Frequency	12.080 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Terminal	53.0 dBW
DL PSD Limit	14.2 dBW/4kHz
DL PSD @ Beam Peak	13.7 dBW/4kHz
Carrier EIRP @ Beam Peak	52.5 dBW
Carrier EIRP @ Terminal	52.0 dBW
Slant Range	38787 km
Space Loss, Ls	205.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	85.6 dBHz
C/(No+Io)	77.3 dBHz
End to End	
End to End C/(No+Io)	77.2 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	1.5 dB
Link Margin	0.6 dB

Return Link Budget

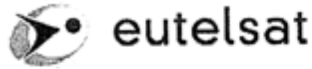
eXConnect Terminal	
Antenna Type	HR129
Lat	51.9 deg
Lon	-96.2 deg
EIRP max	42.0 dBW
G/T	11.4 dB/K
Satellite	
Name	SatMex-7
Longitude	-114.9 deg
Hub Earth Station	
Site	Brewster
Lat	48.147 deg
Lon	-119.691 deg
EIRP max	80.0 dBW
G/T	32.4 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.74
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.37 bps/Hz
Data Rate	2.45E+06 bps
Information Rate (Data + Overhead)	3.34E+06 bps
Symbol Rate	6.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	2.26E+06 Hz
C/N Threshold	0.5 dB
Uplink	
Frequency	14.350 GHz
Back off	0.8 dB
EIRP Spectral Density	9.0 dBW/4kHz
Slant Range	38787 km
Space Loss, Ls	207.4 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	8.0 dB/K
Thermal Noise, C/No	69.9 dBHz
C/(No+Io)	69.4 dBHz
Satellite	
Flux Density	-122.1 dBW/m2
SFD @ Terminal	-102.4 dBW/m2
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	16.8 dB
Downlink	
Frequency	12.050 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Hub	52.0 dBW
DL PSD Limit	14.2 dBW/4kHz
DL PSD @ Beam Peak	4.5 dBW/4kHz
Carrier EIRP @ Beam Peak	36.7 dBW
Carrier EIRP @ Hub	35.2 dBW
Slant Range	38225 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	88.5 dBHz
C/(No+Io)	82.2263 dBHz
End to End	
End to End C/(No+Io)	69.2 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	0.9 dB
Link Margin	0.4 dB

8. EUTELSAT 117WA

Coverage Map



Satellite Operator Certification Letter



September 6, 2016

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

**Re: Engineering Certification of Eutelsat Americas
(HR129 on E115WB and E117WA)**

To Whom It May Concern:

This letter certifies that Eutelsat Americas ("EAS") is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 115WB (E115WB) satellite located at 114.9° W.L and the Eutelsat 117WA (E117WA) satellite located at 116.8° W.L. Specifically, we understand that Astronics AeroSat seeks to operate the HR129 Ku-band antenna system with E115WB and E117WA for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Astronics AeroSat, EAS understands the technical characteristics of the HR129 terminal, and EAS (i) recognizes that operation of the HR129 terminals at the power density levels provided to EAS is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from E115WB and E117WA; (ii) acknowledges that the proposed operation of the HR6400 terminal has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; (iii) if the operation of this antenna should cause unacceptable interference towards adjacent satellite networks, Astronics AeroSat agrees to cease transmissions immediately upon notice from EAS; and (iv) if the FCC authorizes the operations proposed by Astronics AeroSat, EAS will take into consideration the power density levels associated with such operations in future satellite network coordinations with adjacent satellite operators.

Sincerely,

A handwritten signature in black ink, appearing to read "Hector Fortis", written over a horizontal line.

Hector Fortis
Eutelsat Americas
International and Regulatory Affairs

Handwritten initials in black ink, possibly "JF" or "JR", located to the right of the signature block.

Link Budget

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	28.9 deg
Lon	-82.2 deg
EIRP max	41.9 dBW
G/T	11.3 dB/K
Satellite	
Name	STM8
Longitude	-116.8 deg
Hub Earth Station	
Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.83
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.83 bps/Hz
Data Rate	2.48E+07 bps
Information Rate (Data + Overhead)	3.00E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	0.9 dB
Uplink	
Frequency	14.260 GHz
Back off	2.6 dB
EIRP Spectral Density	38.6 dBW/4kHz
Slant Range	38211 km
Space Loss, Ls	207.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.4 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	99.5 dBHz
C/(No+Io)	99.0 dBHz
Satellite	
Flux Density	-86.6 dBW/m2
SFD @ Hub	-84.3 dBW/m2
Small Signal Gain (IBO/OBO)	1.3 dB
OBO	1.0 dB
Downlink	
Frequency	11.960 GHz
Transponder Sat. EIRP @ Beam Peak	51.7 dBW
Transponder Sat. EIRP @ Terminal	50.9 dBW
DL PSD Limit	14.5 dBW/4kHz
DL PSD @ Beam Peak	11.9 dBW/4kHz
Carrier EIRP @ Beam Peak	50.7 dBW
Carrier EIRP @ Terminal	49.9 dBW
Slant Range	37837 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	83.8 dBHz
C/(No+Io)	77.0 dBHz
End to End	
End to End C/(No+Io)	76.9 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	1.2 dB
Link Margin	0.3 dB

Return Link Budget

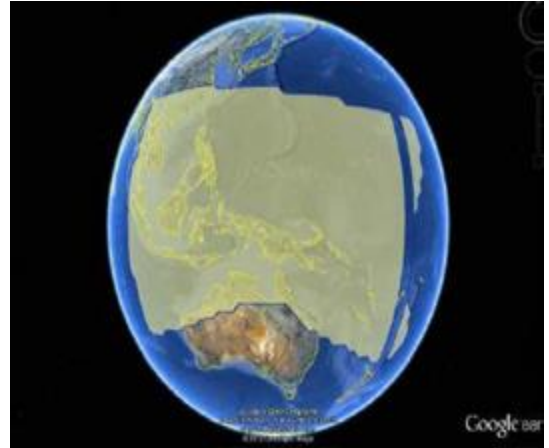
eXConnect Terminal	
Antenna Type	HR129
Lat	28.9 deg
Lon	-82.2 deg
EIRP max	41.9 dBW
G/T	11.3 dB/K
Satellite	
Name	STM8
Longitude	-116.8 deg
Hub Earth Station	
Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	8
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.06 bps/Hz
Data Rate	4.03E+05 bps
Information Rate (Data + Overhead)	5.56E+05 bps
Symbol Rate	8.34E+05 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	5.71E+04 Hz
C/N Threshold	-7.2 dB
Uplink	
Frequency	14.300 GHz
Back off	3.0 dB
EIRP Spectral Density	6.7 dBW/4kHz
Slant Range	37837 km
Space Loss, Ls	207.1 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	5.0 dB/K
Thermal Noise, C/No	64.9 dBHz
C/(No+Io)	64.4 dBHz
Satellite	
Flux Density	-124.2 dBW/m2
SFD @ Terminal	-91.2 dBW/m2
Small Signal Gain (IBO/OBO)	1.3 dB
OBO	31.7 dB
Downlink	
Frequency	12.000 GHz
Transponder Sat. EIRP @ Beam Peak	51.7 dBW
Transponder Sat. EIRP @ Hub	48.9 dBW
DL PSD Limit	14.5 dBW/4kHz
DL PSD @ Beam Peak	-12.3 dBW/4kHz
Carrier EIRP @ Beam Peak	20.0 dBW
Carrier EIRP @ Hub	17.2 dBW
Slant Range	38211 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.7 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	75.7 dBHz
C/(No+Io)	66.8776 dBHz
End to End	
End to End C/(No+Io)	62.5 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-5.8 dB
Link Margin	1.4 dB

9. EUTELSAT 172A

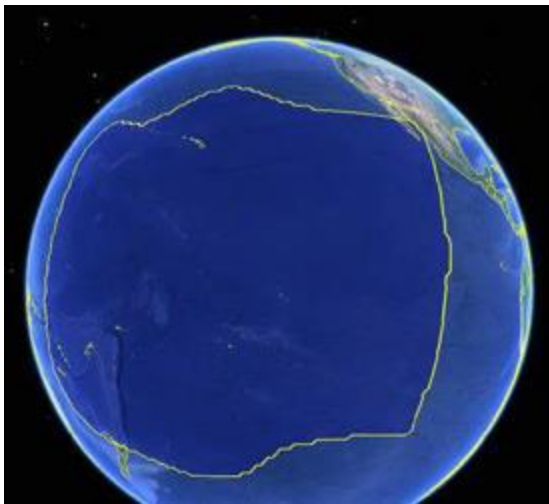
Coverage Map



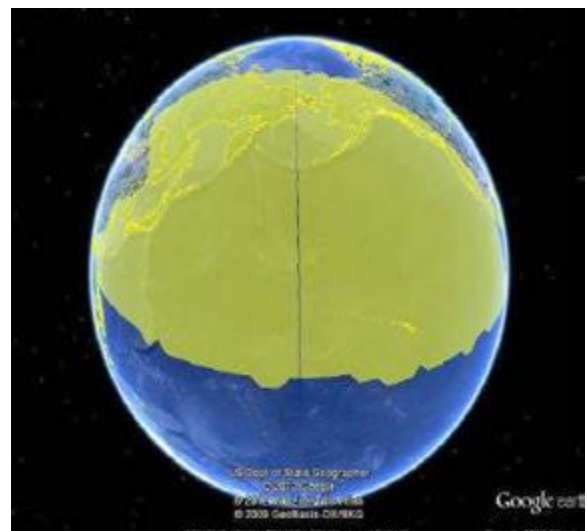
South Pacific



Southwest Pacific



Southeast Pacific



North Pacific

Satellite Operator Certification Letter



June 9th, 2016

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

Re: Engineering Certification of Eutelsat

To Whom It May Concern:

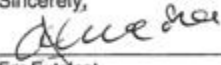
This letter certifies that Eutelsat is aware that Astronics AeroSat Corporation ("Astronics AeroSat") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminals with the Eutelsat 70B satellite at 70.5°E, Eutelsat 172A satellite at 172.0°E and the Eutelsat 10A satellite at 10°E. Eutelsat understands that Astronics AeroSat seeks to operate the previously authorized HR129 Ku-band antenna systems with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Eutelsat confirms and hereby certifies the following with respect to the ESAA terminal operations proposed by Astronics AeroSat:

- a) The proposed Ku-band operation of Astronics AeroSat's ESAA terminal has the potential to create harmful interference to adjacent satellite networks that may be unacceptable;
- b) Eutelsat capacity on the Eutelsat 70B, Eutelsat 172A and Eutelsat 10A satellites is used for other ESAA operations;
- c) The proposed operation of the Astronics AeroSat terminals at the proposed power density levels is consistent with existing satellite coordination agreements with the satellites of the Eutelsat 70B, Eutelsat 172A and Eutelsat 10A satellites.

If the FCC authorizes the operation proposed by Astronics AeroSat, Eutelsat will include the power density levels specified by Astronics AeroSat, defined within the satellite coordination agreements, in all future satellite network coordination with operators of satellite that are adjacent to those satellites addressed by this letter.

Sincerely,



For Eutelsat
Filipe De Oliveira
Director of Resources Engineering

www.eutelsat.com

Link Budget

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	4.9 deg
Lon	114.8 deg
EIRP max	42.0 dBW
G/T	11.0 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Brewster
Lat	47 deg
Lon	-122 deg
EIRP max	80.0 dBW
G/T	35.0 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.67
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.26 bps/Hz
Data Rate	9.72E+06 bps
Information Rate (Data + Overhead)	1.03E+07 bps
Symbol Rate	7.73E+06 Hz
Chip Rate (Noise Bandwidth)	7.73E+06 Hz
Occupied Bandwidth	9.28E+06 Hz
Power Equivalent Bandwidth	1.94E+07 Hz
C/N Threshold	3.5 dB
Uplink	
Frequency	14.363 GHz
Back off	6.5 dB
EIRP Spectral Density	40.7 dBW/4kHz
Slant Range	40858 km
Space Loss, Ls	207.8 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.8 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	1.0 dB/K
Thermal Noise, C/No	88.6 dBHz
C/(No+lo)	88.1 dBHz
Satellite	
Flux Density	-96.4 dBW/m2
SFD @ Hub	-89.0 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	5.5 dB
Downlink	
Frequency	11.563 GHz
Transponder Sat. EIRP @ Beam Peak	47.4 dBW
Transponder Sat. EIRP @ Terminal	47.0 dBW
DL PSD Limit	9.0 dBW/4kHz
DL PSD @ Beam Peak	9.0 dBW/4kHz
Carrier EIRP @ Beam Peak	41.9 dBW
Carrier EIRP @ Terminal	41.5 dBW
Slant Range	39096 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	75.0 dBHz
C/(No+lo)	73.6 dBHz
End to End	
End to End C/(No+lo)	73.4 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	3.5 dB
Link Margin	0.0 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	4.9 deg
Lon	114.8 deg
EIRP max	42.0 dBW
G/T	11.0 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Brewster
Lat	47 deg
Lon	-122 deg
EIRP max	80.0 dBW
G/T	35.0 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	8
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.06 bps/Hz
Data Rate	4.02E+05 bps
Information Rate (Data + Overhead)	5.55E+05 bps
Symbol Rate	8.33E+05 Hz
Chip Rate (Noise Bandwidth)	6.66E+06 Hz
Occupied Bandwidth	7.99E+06 Hz
Power Equivalent Bandwidth	2.60E+05 Hz
C/N Threshold	-7.2 dB
Uplink	
Frequency	14.119 GHz
Back off	0.0 dB
EIRP Spectral Density	9.8 dBW/4kHz
Slant Range	39096 km
Space Loss, Ls	207.3 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	2.0 dB/K
Thermal Noise, C/No	64.7 dBHz
C/(No+lo)	64.2 dBHz
Satellite	
Flux Density	-121.4 dBW/m2
SFD @ Terminal	-91.0 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	28.5 dB
Downlink	
Frequency	11.069 GHz
Transponder Sat. EIRP @ Beam Peak	46.0 dBW
Transponder Sat. EIRP @ Hub	46.0 dBW
DL PSD Limit	9.0 dBW/4kHz
DL PSD @ Beam Peak	-14.7 dBW/4kHz
Carrier EIRP @ Beam Peak	17.5 dBW
Carrier EIRP @ Hub	17.5 dBW
Slant Range	40858 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.6 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	68.9 dBHz
C/(No+lo)	67.4161 dBHz
End to End	
End to End C/(No+lo)	62.5 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-5.7 dB
Link Margin	1.5 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	-27.0 deg
Lon	153.8 deg
EIRP max	41.9 dBW
G/T	11.3 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Adelaide
Lat	-35 deg
Lon	138 deg
EIRP max	80.0 dBW
G/T	34.0 dB/K
Signal	
Waveform	DVB-S2
Modulation	8PSK
Bits per symbol	3
Spread Factor	1
Coding Rate	0.60
Overhead Rate	0.94
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.69 bps/Hz
Data Rate	3.35E+07 bps
Information Rate (Data + Overhead)	3.57E+07 bps
Symbol Rate	1.98E+07 Hz
Chip Rate (Noise Bandwidth)	1.98E+07 Hz
Occupied Bandwidth	2.38E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	6.3 dB
Uplink	
Frequency	14.319 GHz
Back off	14.7 dB
EIRP Spectral Density	28.4 dBW/4kHz
Slant Range	38125 km
Space Loss, Ls	207.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.2 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	3.0 dB/K
Thermal Noise, C/No	87.5 dBHz
C/(No+Io)	87.0 dBHz
Satellite	
Flux Density	-99.5 dBW/m2
SFD @ Hub	-93.5 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	4.1 dB
Downlink	
Frequency	12.571 GHz
Transponder Sat. EIRP @ Beam Peak	53.2 dBW
Transponder Sat. EIRP @ Terminal	53.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	12.1 dBW/4kHz
Carrier EIRP @ Beam Peak	49.1 dBW
Carrier EIRP @ Terminal	48.9 dBW
Slant Range	36931 km
Space Loss, Ls	205.8 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	82.5 dBHz
C/(No+Io)	81.6 dBHz
End to End	
End to End C/(No+Io)	80.5 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	6.5 dB
Link Margin	0.2 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	-27.0 deg
Lon	153.8 deg
EIRP max	41.9 dBW
G/T	11.3 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Adelaide
Lat	-35 deg
Lon	138 deg
EIRP max	80.0 dBW
G/T	34.0 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	2
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.24 bps/Hz
Data Rate	1.61E+06 bps
Information Rate (Data + Overhead)	2.22E+06 bps
Symbol Rate	3.34E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	5.11E+05 Hz
C/N Threshold	-1.2 dB
Uplink	
Frequency	14.319 GHz
Back off	0.0 dB
EIRP Spectral Density	9.7 dBW/4kHz
Slant Range	36931 km
Space Loss, Ls	206.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	6.0 dB/K
Thermal Noise, C/No	69.0 dBHz
C/(No+Io)	68.5 dBHz
Satellite	
Flux Density	-121.0 dBW/m2
SFD @ Terminal	-96.5 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	22.6 dB
Downlink	
Frequency	12.571 GHz
Transponder Sat. EIRP @ Beam Peak	53.2 dBW
Transponder Sat. EIRP @ Hub	53.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-1.6 dBW/4kHz
Carrier EIRP @ Beam Peak	30.6 dBW
Carrier EIRP @ Hub	30.4 dBW
Slant Range	38125 km
Space Loss, Ls	206.1 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.8 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	84.1 dBHz
C/(No+Io)	76.2118 dBHz
End to End	
End to End C/(No+Io)	67.9 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-0.4 dB
Link Margin	0.8 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	-0.2 deg
Lon	-140.2 deg
EIRP max	41.7 dBW
G/T	11.1 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Brewster
Lat	47 deg
Lon	-122 deg
EIRP max	80.0 dBW
G/T	35.0 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.83
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.83 bps/Hz
Data Rate	3.62E+06 bps
Information Rate (Data + Overhead)	4.38E+06 bps
Symbol Rate	4.38E+06 Hz
Chip Rate (Noise Bandwidth)	4.38E+06 Hz
Occupied Bandwidth	5.25E+06 Hz
Power Equivalent Bandwidth	8.90E+06 Hz
C/N Threshold	0.9 dB
Uplink	
Frequency	14.453 GHz
Back off	9.4 dB
EIRP Spectral Density	40.2 dBW/4kHz
Slant Range	40858 km
Space Loss, Ls	207.9 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.8 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	1.0 dB/K
Thermal Noise, C/No	85.5 dBHz
C/(No+Io)	85.0 dBHz
Satellite	
Flux Density	-99.4 dBW/m2
SFD @ Hub	-88.1 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	8.8 dB
Downlink	
Frequency	11.653 GHz
Transponder Sat. EIRP @ Beam Peak	46.5 dBW
Transponder Sat. EIRP @ Terminal	45.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	7.3 dBW/4kHz
Carrier EIRP @ Beam Peak	37.7 dBW
Carrier EIRP @ Terminal	36.2 dBW
Slant Range	38178 km
Space Loss, Ls	205.4 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	69.9 dBHz
C/(No+Io)	69.3 dBHz
End to End	
End to End C/(No+Io)	69.2 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	1.7 dB
Link Margin	0.8 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	-0.2 deg
Lon	-140.2 deg
EIRP max	41.7 dBW
G/T	11.1 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Brewster
Lat	47 deg
Lon	-122 deg
EIRP max	80.0 dBW
G/T	35.0 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	8
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.06 bps/Hz
Data Rate	4.02E+05 bps
Information Rate (Data + Overhead)	5.55E+05 bps
Symbol Rate	8.33E+05 Hz
Chip Rate (Noise Bandwidth)	6.66E+06 Hz
Occupied Bandwidth	7.99E+06 Hz
Power Equivalent Bandwidth	1.78E+05 Hz
C/N Threshold	-7.2 dB
Uplink	
Frequency	14.199 GHz
Back off	0.0 dB
EIRP Spectral Density	9.5 dBW/4kHz
Slant Range	38178 km
Space Loss, Ls	207.1 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	1.0 dB/K
Thermal Noise, C/No	63.7 dBHz
C/(No+Io)	63.2 dBHz
Satellite	
Flux Density	-121.4 dBW/m2
SFD @ Terminal	-88.8 dBW/m2
Small Signal Gain (IBO/OBO)	2.5 dB
OBO	30.1 dB
Downlink	
Frequency	11.149 GHz
Transponder Sat. EIRP @ Beam Peak	46.0 dBW
Transponder Sat. EIRP @ Hub	46.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-16.3 dBW/4kHz
Carrier EIRP @ Beam Peak	15.9 dBW
Carrier EIRP @ Hub	15.9 dBW
Slant Range	40858 km
Space Loss, Ls	205.6 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.7 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	67.2 dBHz
C/(No+Io)	65.7091 dBHz
End to End	
End to End C/(No+Io)	61.3 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-7.0 dB
Link Margin	0.2 dB

Forward Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	19.8 deg
Lon	-135.2 deg
EIRP max	41.9 dBW
G/T	11.1 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.80
Overhead Rate	0.92
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.47 bps/Hz
Data Rate	2.21E+07 bps
Information Rate (Data + Overhead)	2.40E+07 bps
Symbol Rate	1.50E+07 Hz
Chip Rate (Noise Bandwidth)	1.50E+07 Hz
Occupied Bandwidth	1.80E+07 Hz
Power Equivalent Bandwidth	2.70E+07 Hz
C/N Threshold	5.1 dB
Uplink	
Frequency	14.303 GHz
Back off	0.8 dB
EIRP Spectral Density	43.4 dBW/4kHz
Slant Range	41051 km
Space Loss, Ls	207.8 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.7 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	1.0 dB/K
Thermal Noise, C/No	94.2 dBHz
C/(No+lo)	93.7 dBHz
Satellite	
Flux Density	-90.8 dBW/m2
SFD @ Hub	-87.9 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	1.0 dB
Downlink	
Frequency	11.503 GHz
Transponder Sat. EIRP @ Beam Peak	47.7 dBW
Transponder Sat. EIRP @ Terminal	47.0 dBW
DL PSD Limit	12.5 dBW/4kHz
DL PSD @ Beam Peak	10.9 dBW/4kHz
Carrier EIRP @ Beam Peak	46.7 dBW
Carrier EIRP @ Terminal	46.0 dBW
Slant Range	38896 km
Space Loss, Ls	205.5 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	79.7 dBHz
C/(No+lo)	78.3 dBHz
End to End	
End to End C/(No+lo)	78.2 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	5.4 dB
Link Margin	0.3 dB

Return Link Budget

eXConnect Terminal	
Antenna Type	HR129
Lat	19.8 deg
Lon	-135.2 deg
EIRP max	41.9 dBW
G/T	11.1 dB/K
Satellite	
Name	GE-23
Longitude	172.0 deg
Hub Earth Station	
Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	37.3 dB/K
Signal	
Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	16
Coding Rate	0.67
Overhead Rate	0.72
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.03 bps/Hz
Data Rate	2.01E+05 bps
Information Rate (Data + Overhead)	2.78E+05 bps
Symbol Rate	4.17E+05 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	1.03E+05 Hz
C/N Threshold	-9.9 dB
Uplink	
Frequency	14.039 GHz
Back off	0.0 dB
EIRP Spectral Density	9.7 dBW/4kHz
Slant Range	38896 km
Space Loss, Ls	207.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.5 dB
Transponder G/T @ Terminal	-1.0 dB/K
Thermal Noise, C/No	61.8 dBHz
C/(No+lo)	61.3 dBHz
Satellite	
Flux Density	-121.4 dBW/m2
SFD @ Terminal	-87.0 dBW/m2
Small Signal Gain (IBO/OBO)	1.9 dB
OBO	32.5 dB
Downlink	
Frequency	10.989 GHz
Transponder Sat. EIRP @ Beam Peak	47.7 dBW
Transponder Sat. EIRP @ Hub	45.0 dBW
DL PSD Limit	12.5 dBW/4kHz
DL PSD @ Beam Peak	-17.1 dBW/4kHz
Carrier EIRP @ Beam Peak	15.2 dBW
Carrier EIRP @ Hub	12.5 dBW
Slant Range	41051 km
Space Loss, Ls	205.5 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	6.1 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	66.8 dBHz
C/(No+lo)	64.7749 dBHz
End to End	
End to End C/(No+lo)	59.7 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-8.6 dB
Link Margin	1.3 dB