TECHNICAL APPENDIX

Modification Application (Call Sign E100089)
Panasonic Avionics Corporation

I. Technical Description

This Technical Appendix describes the operational characteristics of the Panasonic Single-Panel Antenna ("SPA") earth station aboard aircraft ("ESAA") terminal with Panasonic's licensed eXConnect Ku-band broadband system ("eXConnect System"). The eXConnect System consists of a network of eXConnect ESAA terminals (the "ESAA Segment"), leased satellite capacity on commercial Ku-band FSS satellites (the "Space Segment") and iDirect hub earth stations and network management functionality (the "Ground Segment").

Because this application seeks authority to operate the SPA terminal with satellites previously authorized for Panasonic's ESAA operations and no other changes to the eXConnect System are proposed, consistent with the Commission's rules and policies this Technical Appendix only provides new or additional information relating to the proposed SPA operations.

1. ESAA Segment

In addition to the licensed MELCO and Panasonic Phased Array ("PPA") ESAA terminals, the ESAA Segment will include the SPA terminal and a previously described broadband controller. The SPA terminal was specifically designed for the aeronautical environment and compatibility with the eXConnect System.

1.1.1. SPA Antenna Sub-System

The SPA terminal antenna is a mechanically steered phased array antenna using CoMPA™ (Coherent Multi Plate Antenna) technology. It is comprised of a single dual-polarization panel with full receive and transmit bandwidth capability with an elevation range of 0º to 90º. The SPA terminal is shown in Figure 1.

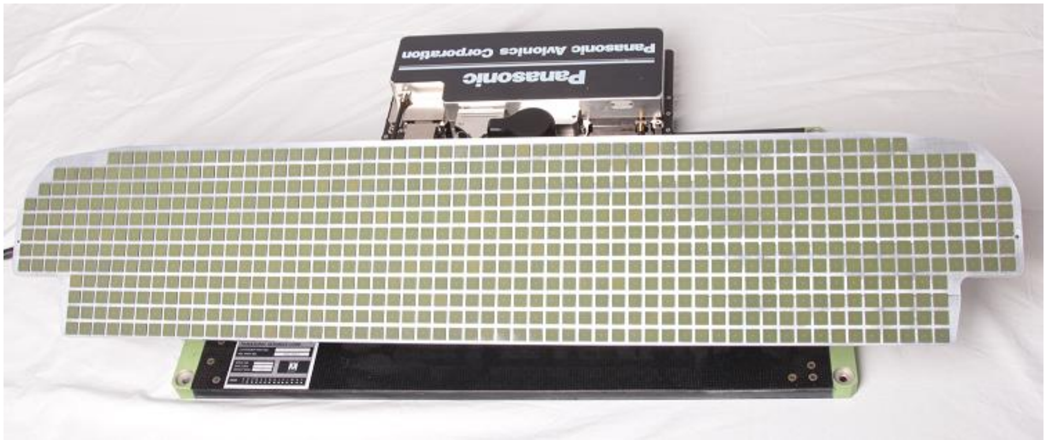


Figure 1. SPA Terminal.

The basic characteristics of the SPA terminal are summarized in Table 1 below.

Table 1. Summary of SPA Terminal Technical Parameters

Antenna diameter	37.4 inches (949mm)
Type of Antenna	Single-panel phased array
Peak Power (SSPA)	10 watts
Transmit Bandwidth	14.0 GHz to 14.5 GHz
Standard Receive Bands	Five Standard Switched Bands of 500 MHz: 10.70 to 11.20 GHz 11.20 to 11.70 GHz 11.70 to 12.20 GHz 12.25 to 12.75 GHz 12.20 to 12.70 GHz
Transmit Gain	35 dBi @14.250 GHz
EIRP	≥ 45 dBW
Transmit Polarization	Horizontal or Vertical
Receive G/T	12.5 dB/k
Transmit Max PSD (dBW/4kHz)	-8.657 dBW/4kHz
Transmit Azimuth Beamwidth	1.25 degrees
Transmit Elevation Beamwidth	7.25 degrees

1.1.2. Antenna Pointing

Pointing for the SPA terminal is accomplished via mechanical steering of the antenna and uses the aircraft attitude data (*i.e.*, yaw, roll, pitch and heading vector), together with location of the aircraft (latitude, longitude and altitude) to calculate the command vectors. This data, available from the ARINC 429 bus, is used in conjunction with the satellite coordinates to yield continuously updated steering commands for the antenna elevation, azimuth, and polarization.

As indicated in the attached Pointing Accuracy Report, which provides a detailed analysis of the SPA terminal's pointing characteristics, the pointing error of the terminal will be less than 0.20 deg 3-sigma. Pointing error is continuously monitored and emissions are automatically inhibited if the azimuth pointing error exceeds 0.5 degrees.

The basic pointing characteristics of the SPA terminal are summarized in Table 2 below.

Table 2. Summary of Antenna Control Parameters

Azimuth	360 degrees
Elevation	0 to 90 degrees
Position Accuracy	0.2 degrees, 3-sigma
Dynamic Tracking Capability	AZ 40 degrees/sec. velocity EL 20 degrees/sec. velocity

1.1. Waveforms

1.1.1. Description

The eXConnect System uses well established industry standard waveforms: DVB-S2 and iDirect D-TDMA. The iDirect forward link (hub to mobile terminal) will consist of a single DVB-S2 carrier that may occupy up to a full transponder and operate in saturation but in most cases will be operated in a partial transponder. DVB-S2 is a widely adopted standard for digital data and video broadcasting over satellite. Data may be multiplexed on this carrier for multiple terminals. The DVB-S2 standard supports Adaptive Coding and Modulation (ACM) with QPSK, 8PSK, and 16APSK modulations and Low Density Parity Check Coding rates between 0.25 and 0.9.

1.1.2. Out-of-Band Emissions

The SPA terminal will comply with the out-of-band emissions limitations in 47 C.F.R. §25.202(f). The SPA terminal antenna ceases transmission in the event of the following fault conditions:

- Loss of ARINC-429 data from the IRS.
- Invalid status message from the IRS.
- Loss of 10 MHz reference.
- Antenna out of position. If azimuth pointing error exceeds 0.5 degrees, the antenna ceases transmission within 100 ms and will not resume transmission until the pointing error is less than 0.2 degrees.
- Any critical fault detected by the antenna.

Furthermore, any event that results in the loss of modem lock to the DVB-S2 downlink will cause the modem to cease all transmission.

2. Protection of GSO FSS Services

The eXConnect System will protect GSO and NGSO FSS operations, space research, and radio astronomy service operations in the 14.0-14.5 GHz Band. Because coordination agreements and operational restrictions that are already applicable to the eXConnect System operations will protect other co-frequency services, the following discussion focuses on SPA terminal operational characteristics in the context of protecting primary GSO FSS operations.

2.1. Off-Axis EIRP Spectral Density Control

The SPA terminal protects GSO FSS uplink (satellite receive) operations by controlling the off-axis EIRP spectral density generated by a SPA terminal so that it is no greater than the levels of interference that have been accepted by the adjacent satellites in coordination or the levels for Ku-band ESAA terminals under FCC Part 25.

The U.S. off-axis limits on EIRP spectral density limits under FCC Part 25 are defined by 47 C.F.R. § 25.227, where N = 1 for TDMA, is given by:

15–25log10 (Θ)	dBW/4 kHz	For	1.5° ≤ Θ ≤ 7°
−6	dBW/4 kHz	For	7° < Θ ≤ 9.2°
18–25log10(Θ)	dBW/4 kHz	For	9.2° < Θ ≤ 48°
−24	dBW/4 kHz	For	48° < Θ ≤ 85°
−14	dBW/4 kHz	For	85° < Θ ≤ 180°

Off-axis EIRP spectral density is managed on an individual terminal basis. Only one SPA terminal transmits at a given time and in a given bandwidth. The eXConnect System does not use contention so management of aggregate emissions is not required. The off-axis EIRP spectral density of an individual eXConnect terminal is a function of its transmit signal bandwidth, input power to the antenna, the projection of the antenna gain pattern of the antenna along the geostationary arc, and antenna pointing error.

Input power to the SPA terminal is controlled by limiting the output power of the modem. A built in power meter in the antenna is used to calibrate the input power to the antenna accurately and remove any gain variation between the modem and the antenna. The input power limitations are specified on a satellite beam-by-satellite beam basis

The contribution of pointing error to off-axis EIRP spectral density is minimized by inhibiting pointing errors greater than 0.5 deg. and not resuming transmission until the pointing error is less than 0.2 deg. The SPA terminal has been proven to operate on an interference-free basis within these pointing parameters in test operations for more than a year. There have been no reported interference cases associated with SPA terminal operations.

Antenna gain and off-axis EIRP of the SPA terminal at various skew angles is shown in the attached Technical Annex. The off-axis EIRP spectral density ("ESD") values are based on the specific link parameters for two-degree compliant operations in the United States. The terminal off-axis ESD remains well below the 47 C.F.R. § 25.227 off-axis ESD limit for all off-axis ranges. Even with the pointing error of the terminal is included in the off-axis ESD, it remains below the off-axis ESD limit for a conforming and perfectly pointed terminal.

In addition to the extensive set of antenna gain plots and off-axis EIRP plots included in this Technical Appendix, a representative off-axis EIRP table is included for Commission review. Note that SPA terminal antenna performance varies with skew angle and frequency, and power levels may vary with serving satellite (*i.e.*, operations in two-degree versus three-degree spacing environments). As a result, it is not possible to provide plots and tables for all potential variable skew angles and frequencies. In addition, Panasonic is relying on satellite operator certifications to support the SPA terminal operational characteristics proposed herein.

Nonetheless, Panasonic has provided a range of skew angle data for consideration. Operations at other skew angles generally will have the same off-axis characteristics and vary only by power level to ensure compliance with levels coordinated with adjacent satellite operators within +/- 6 degrees of the serving satellite. Off-axis EIRP will be controlled to permissible two-degree spacing levels or the coordinated limits for the satellite, whichever is greater. Control will be achieved by limiting maximum EIRP spectral density and skew angle.

3. Space Segment

The Space Segment consists of satellite capacity leased on commercial Ku-band satellites from established providers. Uplinks from SPA terminals occur in permissible portions of the 14.0-14.5 GHz band and downlinks will occur in permissible portions of the 10.7-12.75 GHz band.

The eXConnect System may use whole or partial transponders and operated with single saturated carriers (forward link only) in a transponder or with multiple carriers. Forward and return links may be operated in the same or different transponders.

As provided in the Narrative Statement, below is the list of the proposed satellite points of communication for the SPA terminal.

Table 3. Proposed Satellite Points of Communication (SPA)

Satellite	Licensing Admin.	Orbital Location	Downlink Freq. (GHz)	ITU Satellite Network	ITU Region	Service to U.S.
Anik G1	Canada	107.3° W	11.7-12.2	CANSAT-34	2	No
Apstar 6	China	134° E	10.7-12.75	U.S. Market Access	3	No
Apstar 7	China	76.5° E	10.7-12.75	APSTAR-4	1, 3	No
AsiaSat 5	China	100.5° E	11.45-12.2	ASIASAT-EKX	1	No

Eutelsat 10A	France	10° E	11.7-12.2	EUTELSAT 2-10E / EUTELSAT 3-10E	1, 3	No
Eutelsat 70B	France	70.5° E	10.95-11.7 12.5-12.75	EUTELSAT 3-70.5E	1, 3	No
Eutelsat 115WB	Mexico	114.9° W	11.7-12.2	Permitted List	2	Yes
Eutelsat 117WA	Mexico	116.8° W	11.7-12.2	Permitted List	2	Yes
Eutelsat 172A	U.S.	172° E	10.95-11.2; 11.45-11.7	U.S.-licensed	2	Yes
IS-14	U.S.	45° W	11.45-11.95	U.S.-licensed	1, 2	No
IS-15	U.S.	85° E	12.25-12.75	U.S.-licensed	3	No
IS-29E	U.S.	50° W	10.95-12.5	U.S.-licensed	1, 2	Yes
JCSAT-5A	Japan	132° E	12.25-12.75	N-STAR-A	1	No
NSS-6	Netherlands	95° E	11.45-12.75; 12.5-12.75	NSS-9	3	No
Superbird C2	Japan	144° E	12.2-12.75	N-SAT2-144E	3	No
Telstar 11N	U.S.	37.5° W	11.45-12.2	U.S.-licensed	1, 2	Yes
Telstar 12V	U.S.	15° W	10.95-12.2	U.S.-licensed	1	No
Telstar 14R	Brazil	63° W	11.7-12.2	Permitted List	2	Yes
Yamal 300K	Netherlands	183° E	10.95-11.7	NSS-19	1, 2	Yes
Yamal 401	Russia	90° E	10.95-11.2; 11.45-12.75	EXPRESS-7C	1, 3	No

Each operator of the proposed satellite points of communications for the SPA terminal has certified that the operations proposed by Panasonic are consistent with the coordination agreements with satellite systems located within +/- 6 degrees of the serving satellites.

4. Ground Segment

The Ground Segment consists of hub earth stations that are leased at commercial teleport facilities, a DVB-S2 modulator and iDirect demodulator installed at each teleport facility, and connectivity to the Internet and network management facilities.

The eXConnect gateway earth stations associated with SPA terminal operations are listed in Table 4, below. Installed at each gateway facility will be DVB-S2 modulator cards for the forward link and iDirect demodulators cards for the return link. The eXConnect System will be connected to the Internet and other content providers at the gateway. eXConnect ground stations are separately licensed by the teleport operator and are not a part of this application.

Table 4. Gateway Earth Stations Table

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	Kofinou	Cyprus	Stellar	N/A
Asiasat 5	Asiasat	Kofinou	Cyprus	Stellar	N/A
Eutelsat 10A	Eutelsat	Cologne	Germany	Stellar	N/A
Eutelsat 70B	Eutelsat	Kofinou	Cyprus	Stellar	N/A
Eutelsat 115WB	Eutelsat Americas	Brewster, WA	U.S.	USEI	S2938
Eutelsat 117WA	Eutelsat Americas	Brewster, WA	U.S.	USEI	S2873
Eutelsat 172A (NP/SEP/SWP)	Eutelsat	Brewster, WA	U.S.	USEI	S2610
Eutelsat 172A (SP)	Eutelsat	Adelaide	Australia	SpeedCast	S2610

Satellite	Satellite Operator	Gateway Earth Station Location	Country	Gateway Operator	FCC Call Sign
IS-14	Intelsat	Cologne	Germany	Stellar	S2785
IS-15	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 – (CA/US)	Skynet	Cologne	Germany	Stellar	S2357
Telstar 11N (AO)	Skynet	Ellenwood, GA	U.S.	Intelsat	S2357
Telstar 12V (MW, MC, ME, MN)	Skynet	Mt. Jackson, VA	U.S.	Telesat	S2933
Telstar 12V (NS)	Skynet	Chalfont	U.K.	Arqiva	S2933
Telstar 14R	Telesat	Mt. Jackson, VA	U.S.	Telesat	S2821
Yamal 300K	Gazprom	Brewster, WA	U.S.	USEI	E120043
Yamal 401	Gazprom	Moscow	Russia	RuSat	N/A

Network control and monitoring of the earth stations and the eXConnect System will be provided by a Panasonic Mission Control Center (“MCC”) in Lake Forest, California on a 24/7 basis. The MCC makes use of the iDirect’s Network Management System (NMS) to provide complete control and visibility to all components the eXConnect network. The NMS system has the capability of shutting down any component in the system that is malfunctioning. The MCC can be reached at:

Primary: Hector Torres (Office) 1-949-672-2578; (Mobile) 1-949-421-7354

Secondary: MCC Supervisors
5am-1pm PST:

Mike Juffer: (Mobile) +1 (949) 300-9615
1pm-9pm PST:
Ray Hashmani: (Mobile) +1 (949) 562-9741
Manny Barela: (Mobile): +1 (949) 466-8583
9pm-5am PST:
Chris Maldonado: (Mobile): +1 (949) 276-1983

MCC direct line: 1-425-415-9800
Email: mcc@panasonic.aero

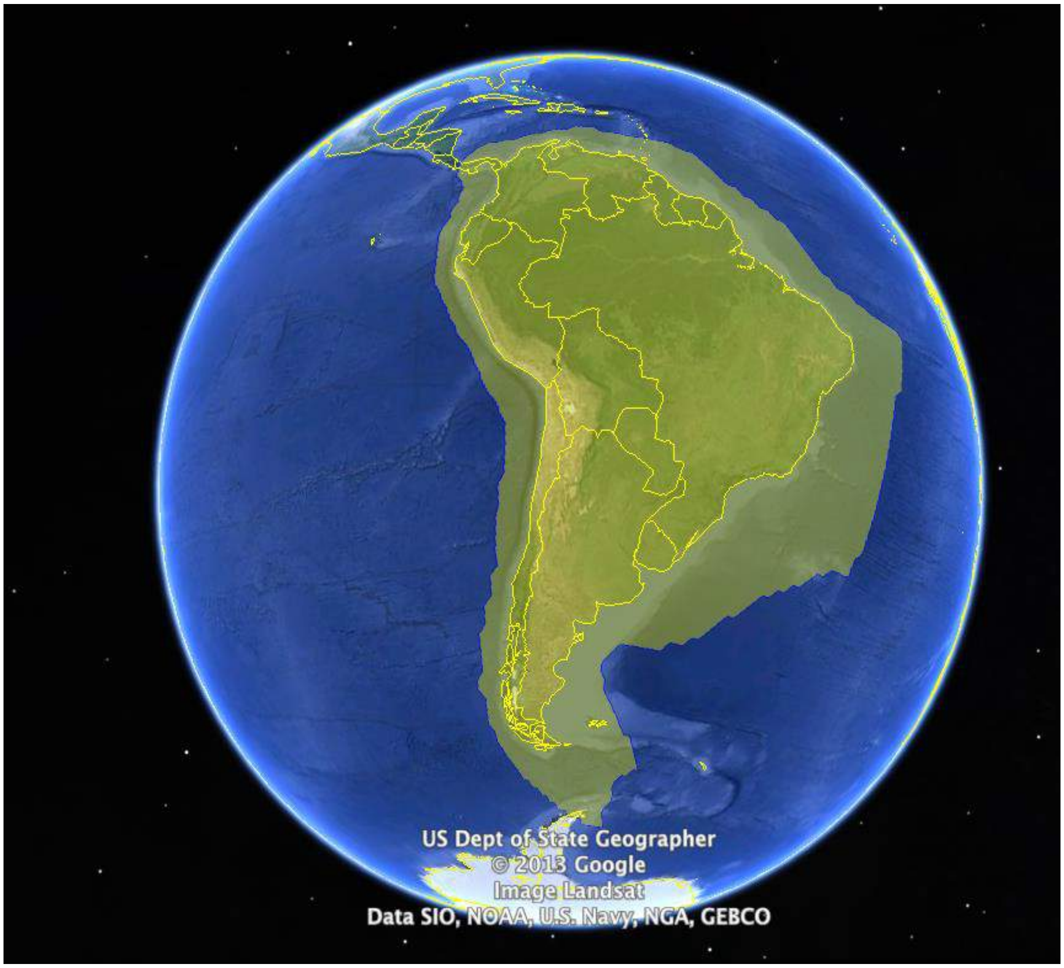
Address:
Panasonic Avionics Corporation
Attn: Mission Control Center
26200 Enterprise Way
Lake Forest, CA 92630 USA

II. SPA Terminal Proposed Satellite Points of Communication

i. **Coverage Maps**
ii. **Satellite Operator Certification Letters**
iii. **Link Budgets**

1. ANIK G1

Coverage Map



Satellite Operator Certification Letter

1601 Telesat Court
Ottawa, ON, Canada K1B 5P4

4 January 2016

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

Re: Engineering Certification of Telesat

To Whom It May Concern:

This letter certifies that Telesat is aware that Panasonic Avionics Corporation ("Panasonic") 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 Telstar 11N, Telstar 14R, Anik F1R, and Anik G1 satellites located at 37.55°W.L., 63°W.L., 107.3°W.L., and 107.3°W.L., respectively. Specifically, Telesat understands that in addition to Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's Part 25 rules, including Section 25.227.

Based on the information provided by Panasonic, Telesat understands the technical characteristics of the SPA and Telesat (i) recognizes that operation of these terminals at the power density levels provided to Telesat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from Telstar 11N, Telstar 14R, Anik F1R, and Anik G1; (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 Panasonic, Telesat will take into consideration the power density levels associated with such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely Yours,

BAHRAM BORNA
Satellite Spectrum Coordination Engineer
Telesat

Link Budget

Forward Link Budget

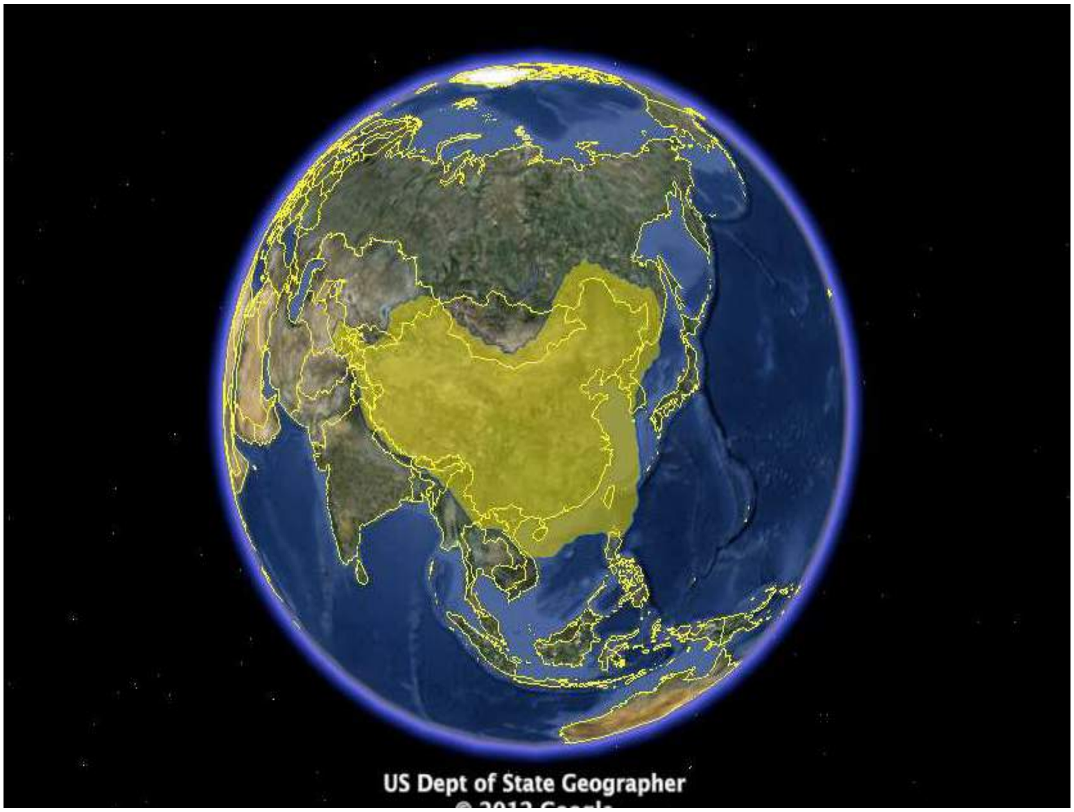
eXConnect Terminal		
Antenna Type	SPA	
Lat	-15.2	deg
Lon	-45.2	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Anik-G1	
Longitude	-107.3	deg
Hub Earth Station		
Site	Lima	
Lat	-12.092	deg
Lon	-77.027	deg
EIRP max	80.0	dBW
G/T	36.1	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.83	
Overhead Rate	0.93	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.56	bps/Hz
Data Rate	4.67E+07	bps
Information Rate (Data + Overhead)	5.00E+07	bps
Symbol Rate	3.00E+07	Hz
Chip Rate (Noise Bandwidth)	3.00E+07	Hz
Occupied Bandwidth	3.60E+07	Hz
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	5.6	dB
Uplink		
Frequency	14.300	GHz
Back off	8.7	dB
EIRP Spectral Density	32.5	dBW/4kHz
Slant Range	36942	km
Space Loss, Ls	206.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.4	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	2.0	dB/K
Thermal Noise, C/No	92.5	dBHz
C/(No+Io)	92.0	dBHz
Satellite		
Flux Density	-93.5	dBW/m2
SFD @ Hub	-90.0	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	39698	km
Space Loss, Ls	206.0	dB
Pointing Loss, Lpnt	0.1	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)	82.2	dBHz
End to End		
End to End C/(No+Io)	81.8	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	6.0	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	-15.2	deg
Lon	-45.2	deg
EIRP max	45.0	dBW
G/T	11.5	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	2	
Coding Rate	0.50	
Overhead Rate	0.74	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.18	bps/Hz
Data Rate	1.38E+06	bps
Information Rate (Data + Overhead)	1.88E+06	bps
Symbol Rate	3.75E+06	Hz
Chip Rate (Noise Bandwidth)	7.50E+06	Hz
Occupied Bandwidth	9.00E+06	Hz
Power Equivelent Bandwidth	5.52E+05	Hz
C/N Threshold	-2.3	dB
Uplink		
Frequency	14.140	GHz
Back off	0.0	dB
EIRP Spectral Density	12.3	dBW/4kHz
Slant Range	39698	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.2	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	68.5	dBHz
C/(No+Io)	68.0	dBHz
Satellite		
Flux Density	-118.6	dBW/m2
SFD @ Terminal	-94.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.5	dB
OBO	22.1	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	-3.9	dBW/4kHz
Carrier EIRP @ Beam Peak	28.8	dBW
Carrier EIRP @ Hub	24.9	dBW
Slant Range	36942	km
Space Loss, Ls	205.3	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.2	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	81.1	dBHz
C/(No+Io)	75.7075	dBHz
End to End		
End to End C/(No+Io)	67.3	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-1.4	dB
Link Margin	0.9	dB

2. APSTAR 6

Coverage Map



Satellite Operator Certification Letter

APSTAR
by APT Satellite
亞太通信衛星有限公司
APT SATELLITE COMPANY LIMITED
香港新界大埔工業村大貴街22號
22 Dai Kwai Street, Tai Po Industrial Estate, Tai Po, NT, Hong Kon
電話 Tel:(852)2600 2100 傳真 Fax:(852)2522 0419
www.apstar.com

January 21, 2016

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

To Whom It May Concern:

This letter certifies that APT Satellite Company Limited ("APT Satellite") is aware that Panasonic Avionics Corporation ("Panasonic") 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 APSTAR-6 Satellite at 134º E.L. and with the APSTAR-7 Satellite at 76.5º E.L. Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, APT Satellite understands the technical characteristics of the SPA 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 Panasonic, 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

Link Budget

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	21.9	deg
Lon	121.8	deg
EIRP max	45.0	dBW
G/T	11.5	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	0.83	
Overhead Rate	0.93	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	3.10	bps/Hz
Data Rate	9.29E+07	bps
Information Rate (Data + Overhead)	1.00E+08	bps
Symbol Rate	3.00E+07	Hz
Chip Rate (Noise Bandwidth)	3.00E+07	Hz
Occupied Bandwidth	3.60E+07	Hz
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	12.4	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	36488	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	89.8	dBHz
C/(No+Io)	89.1	dBHz
End to End		
End to End C/(No+Io)	88.8	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	13.0	dB
Link Margin	0.6	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	21.9	deg
Lon	121.8	deg
EIRP max	45.0	dBW
G/T	11.5	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	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.75	
Overhead Rate	0.82	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.23	bps/Hz
Data Rate	8.20E+06	bps
Information Rate (Data + Overhead)	1.00E+07	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	1.28E+06	Hz
C/N Threshold	5.9	dB
Uplink		
Frequency	14.063	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36488	km
Space Loss, Ls	206.7	dB
Pointing Loss, Lpnt	0.2	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	76.3	dBHz
C/(No+Io)	75.8	dBHz
Satellite		
Flux Density	-117.9	dBW/m2
SFD @ Terminal	-97.9	dBW/m2
Small Signal Gain (IBO/OBO)	2.5	dB
OBO	17.5	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	9.5	dBW/4kHz
Carrier EIRP @ Beam Peak	41.8	dBW
Carrier EIRP @ Hub	38.5	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	92.4	dBHz
C/(No+Io)	80.7281	dBHz
End to End		
End to End C/(No+Io)	74.6	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	6.3	dB
Link Margin	0.4	dB

3. APSTAR 7

Coverage Map

Satellite Operator Certification Letter

APSTAR
by APT Satellite
亞太通信衛星有限公司
APT SATELLITE COMPANY LIMITED
香港新界大埔工業村大貴街22號
22 Dai Kwai Street, Tai Po Industrial Estate, Tai Po, NT, Hong Kon
電話 Tel:(852)2600 2100 傳真 Fax:(852)2522 0419
www.apstar.com

January 21, 2016

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

To Whom It May Concern:

This letter certifies that APT Satellite Company Limited ("APT Satellite") is aware that Panasonic Avionics Corporation ("Panasonic") 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 APSTAR-6 Satellite at 134° E.L. and with the APSTAR-7 Satellite at 76.5° E.L. Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, APT Satellite understands the technical characteristics of the SPA 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 Panasonic, 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

Link Budget

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	15.0	deg
Lon	34.8	deg
EIRP max	45.0	dBW
G/T	11.5	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	0.83	
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 Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	5.6	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	37826	km
Space Loss, Ls	206.0	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	81.5	dBHz
C/(No+Io)	80.1	dBHz
End to End		
End to End C/(No+Io)	80.0	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	6.0	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	15.0	deg
Lon	34.8	deg
EIRP max	45.0	dBW
G/T	11.5	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	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	3.33E+06	Hz
Chip Rate (Noise Bandwidth)	6.66E+06	Hz
Occupied Bandwidth	7.99E+06	Hz
Power Equivelent Bandwidth	2.72E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.272	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	37826	km
Space Loss, Ls	207.1	dB
Pointing Loss, Lpnt	0.2	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	68.8	dBHz
C/(No+Io)	68.3	dBHz
Satellite		
Flux Density	-118.2	dBW/m2
SFD @ Terminal	-91.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	24.2	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	-8.5	dBW/4kHz
Carrier EIRP @ Beam Peak	23.8	dBW
Carrier EIRP @ Hub	23.8	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	81.0	dBHz
C/(No+Io)	73.3931	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	-1.1	dB
Link Margin	0.1	dB

4. ASIASAT 5

Coverage Map

Satellite Operator Certification Letter

ASIASAT
Reaching Further, Bringing You Closer

TM21-120116-001

12 January 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 Panasonic Avionics Corporation ("Panasonic") 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 Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, AsiaSat understands the technical characteristics of the SPA 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 Panasonic, AsiaSat will take into consideration the power density levels associated such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely,

YHChan

Yathung CHAN
Spectrum Management

Link Budget

Forward Link Budget

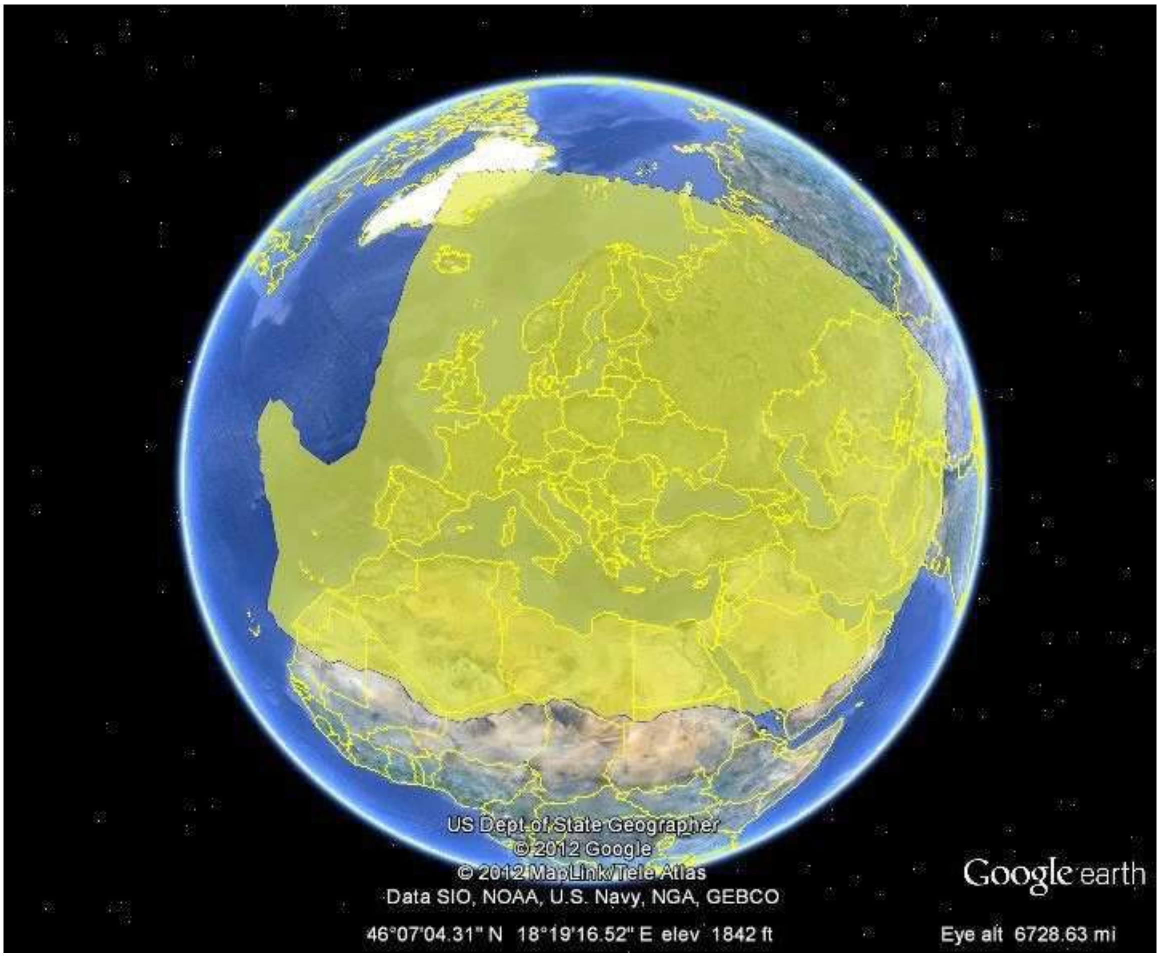
eXConnect Terminal		
Antenna Type	SPA	
Lat	25.8	deg
Lon	89.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Asiasat-5	
Longitude	100.5	deg
Hub Earth Station		
Site	Cyprus	
Lat	34.92	deg
Lon	33.64	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	DVB-S2	
Modulation	8PSK	
Bits per symbol	3	
Spread 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	4.14E+07	bps
Information Rate (Data + Overhead)	4.50E+07	bps
Symbol Rate	2.00E+07	Hz
Chip Rate (Noise Bandwidth)	2.00E+07	Hz
Occupied Bandwidth	2.40E+07	Hz
Power Equivelent Bandwidth	4.79E+07	Hz
C/N Threshold	8.5	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	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.3	dBHz
C/(No+Io)	83.0	dBHz
End to End		
End to End C/(No+Io)	82.7	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	8.7	dB
Link Margin	0.2	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	25.8	deg
Lon	89.9	deg
EIRP max	45.0	dBW
G/T	11.5	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	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 Equivelent Bandwidth	3.69E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.150	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36649	km
Space Loss, Ls	206.7	dB
Pointing Loss, Lpnt	0.2	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	70.2	dBHz
C/(No+Io)	69.7	dBHz
Satellite		
Flux Density	-117.9	dBW/m2
SFD @ Terminal	-90.3	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	24.6	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	-4.4	dBW/4kHz
Carrier EIRP @ Beam Peak	27.8	dBW
Carrier EIRP @ Hub	23.4	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	73.3	dBHz
C/(No+Io)	71.0208	dBHz
End to End		
End to End C/(No+Io)	67.3	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-0.9	dB
Link Margin	0.3	dB

5. EUTELSAT 10A

Coverage Map



Satellite Operator Certification Letter

eutelsat
communications via satellite

October 29th, 2015

Mark DeFazio
Manager, GCS Regulatory and Business Operations
Panasonic Avionics Corporation
26200 Enterprise Way
Lake Forest, CA 92630

Re: Engineering Certification of Eutelsat

Dear Mr. DeFazio,

This letter certify that Eutelsat is aware that Panasonic Avionics Corporation ("Panasonic") is planning to seek a special temporary authorization ("STA") and modification to its blanket authorization from the Federal Communication Commission ("FCC"), Call Sign E100089, to operate a new Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminal type, the Panasonic Single Panel Antenna ("SPA"). The SPA will operate with the Eutelsat 70B satellite at 70.5°E, the Eutelsat 10A satellite at 10°E and the Eutelsat 172A satellite at 172°E. Eutelsat understands that Panasonic will file the applications pursuant to the FCC rules governing ESAA operations, including Section 25.227.

Eutelsat confirms and hereby certifies the following with respect to the SPA terminal operations proposed by Panasonic:

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

If the FCC authorizes the operation proposed by Panasonic, Eutelsat will include the power density levels specified by Panasonic, 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
Head of the Resources Engineering Group

Link Budget

Forward Link Budget

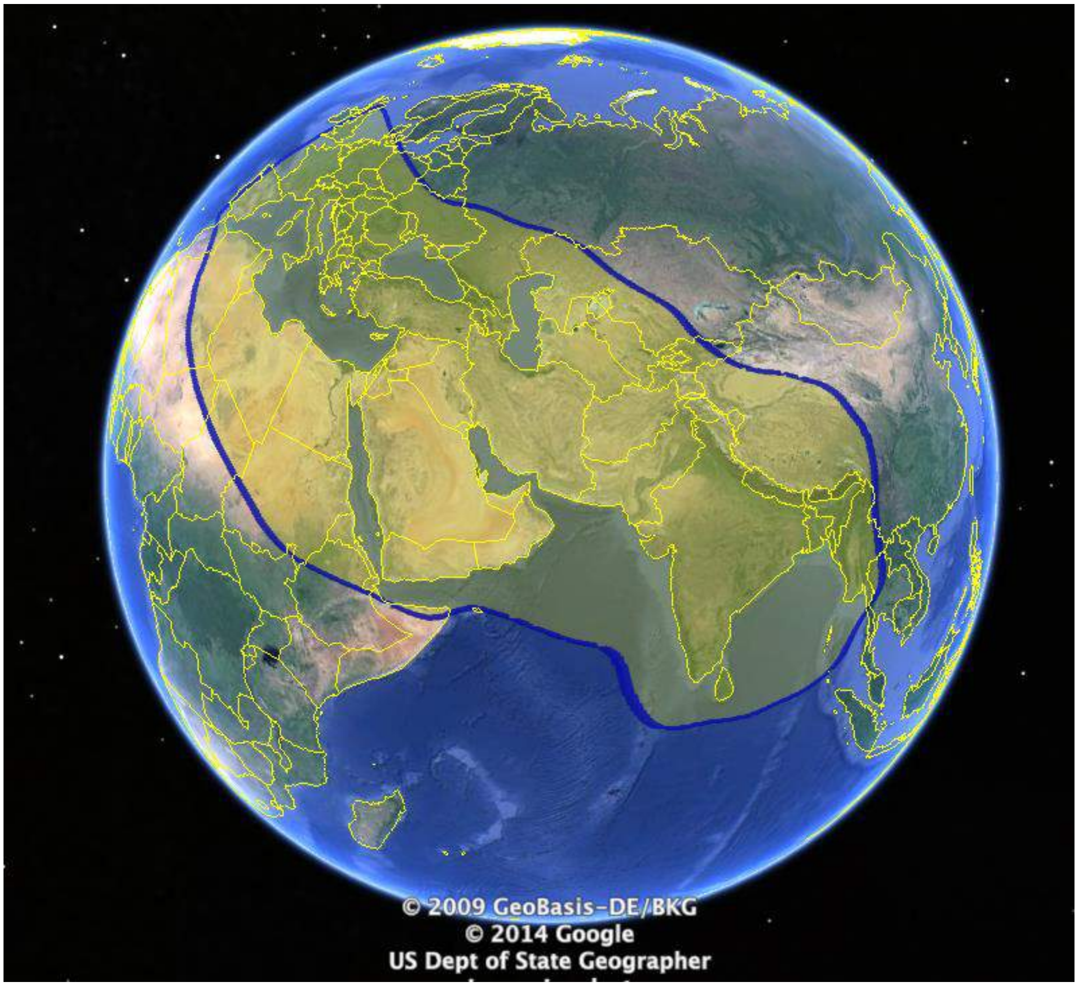
eXConnect Terminal		
Antenna Type	SPA	
Lat	42.0	deg
Lon	-0.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Eutelsat W2A	
Longitude	10.0	deg
Hub Earth Station		
Site	Cologne	
Lat	50.94	deg
Lon	6.96	deg
EIRP max	80.0	dBW
G/T	37.1	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.80	
Overhead Rate	0.92	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.47	bps/Hz
Data Rate	4.42E+07	bps
Information Rate (Data + Overhead)	4.80E+07	bps
Symbol Rate	3.00E+07	Hz
Chip Rate (Noise Bandwidth)	3.00E+07	Hz
Occupied Bandwidth	3.60E+07	Hz
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	5.1	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	37752	km
Space Loss, Ls	205.2	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	81.3	dBHz
C/(No+Io)	81.2	dBHz
End to End		
End to End C/(No+Io)	81.1	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	5.3	dB
Link Margin	0.2	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	42.0	deg
Lon	-0.1	deg
EIRP max	45.0	dBW
G/T	11.5	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	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 Equivelent Bandwidth	1.72E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.125	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	37752	km
Space Loss, Ls	207.0	dB
Pointing Loss, Lpnt	0.2	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	70.9	dBHz
C/(No+Io)	70.4	dBHz
Satellite		
Flux Density	-118.2	dBW/m2
SFD @ Terminal	-85.5	dBW/m2
Small Signal Gain (IBO/OBO)	2.3	dB
OBO	30.4	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	-13.6	dBW/4kHz
Carrier EIRP @ Beam Peak	18.6	dBW
Carrier EIRP @ Hub	17.6	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	74.1	dBHz
C/(No+Io)	69.9469	dBHz
End to End		
End to End C/(No+Io)	67.2	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-1.1	dB
Link Margin	0.1	dB

6. EUTELSAT 70B

Coverage Map



Satellite Operator Certification Letter

eutelsat
communications via satellite

October 29th, 2015

Mark DeFazio
Manager, GCS Regulatory and Business Operations
Panasonic Avionics Corporation
26200 Enterprise Way
Lake Forest, CA 92630

Re: Engineering Certification of Eutelsat

Dear Mr. DeFazio,

This letter certify that Eutelsat is aware that Panasonic Avionics Corporation ("Panasonic") is planning to seek a special temporary authorization ("STA") and modification to its blanket authorization from the Federal Communication Commission ("FCC"), Call Sign E100089, to operate a new Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminal type, the Panasonic Single Panel Antenna ("SPA"). The SPA will operate with the Eutelsat 70B satellite at 70.5°E, the Eutelsat 10A satellite at 10°E and the Eutelsat 172A satellite at 172°E. Eutelsat understands that Panasonic will file the applications pursuant to the FCC rules governing ESAA operations, including Section 25.227.

Eutelsat confirms and hereby certifies the following with respect to the SPA terminal operations proposed by Panasonic:

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

If the FCC authorizes the operation proposed by Panasonic, Eutelsat will include the power density levels specified by Panasonic, 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
Head of the Resources Engineering Group

Link Budget

Forward Link Budget

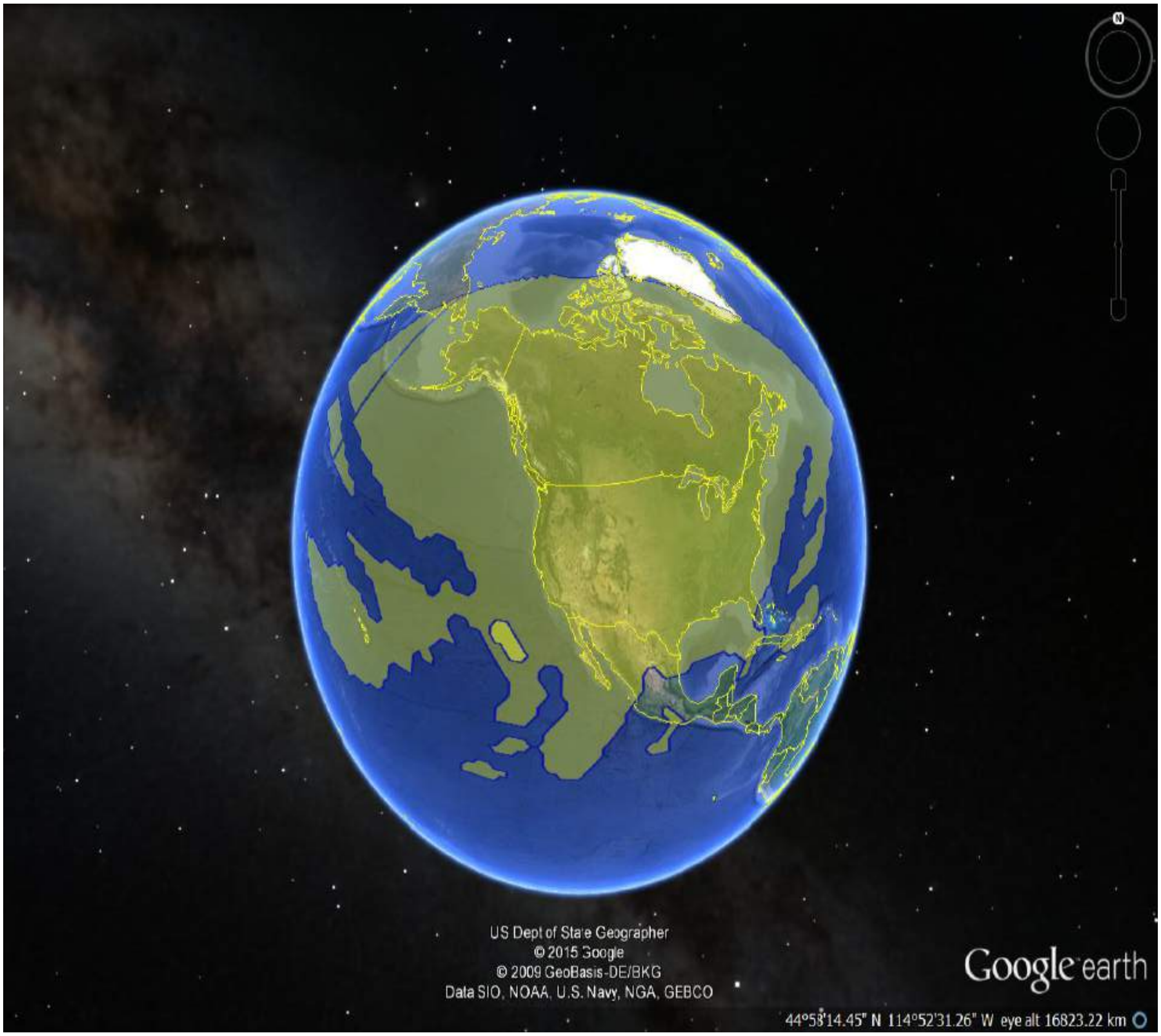
eXConnect Terminal		
Antenna Type	SPA	
Lat	24.8	deg
Lon	55.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	E70B	
Longitude	70.5	deg
Hub Earth Station		
Site	Cyprus	
Lat	34.92	deg
Lon	33.64	deg
EIRP max	77.8	dBW
G/T	37.4	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.67	
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 Equivelent Bandwidth	5.40E+07	Hz
C/N Threshold	3.5	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	36724	km
Space Loss, Ls	204.9	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	82.6	dBHz
C/(No+Io)	81.6	dBHz
End to End		
End to End C/(No+Io)	81.5	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	4.0	dB
Link Margin	0.5	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	24.8	deg
Lon	55.0	deg
EIRP max	45.0	dBW
G/T	11.5	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	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 Equivelent Bandwidth	5.01E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.208	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36724	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	3.8	dB/K
Thermal Noise, C/No	69.9	dBHz
C/(No+Io)	69.4	dBHz
Satellite		
Flux Density	-118.0	dBW/m2
SFD @ Terminal	-90.8	dBW/m2
Small Signal Gain (IBO/OBO)	1.9	dB
OBO	25.3	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	-7.5	dBW/4kHz
Carrier EIRP @ Beam Peak	24.7	dBW
Carrier EIRP @ Hub	23.7	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	79.6	dBHz
C/(No+Io)	74.8975	dBHz
End to End		
End to End C/(No+Io)	68.3	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	0.1	dB
Link Margin	1.3	dB

7. EUTELSAT 115WB

Coverage Map



Satellite Operator Certification Letter

eutelsat

Ciudad de México, April 27th, 2016.
DARI.2016.060

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

Re: Engineering Certification of Eutelsat Americas

To Whom It May Concern:

This letter certifies that Eutelsat Americas ("EAS") is aware that Panasonic Avionics Corporation ("Panasonic") 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 in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, EAS understands the technical characteristics of the SPA and EAS (i) recognizes that operation of these 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 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 Panasonic, EAS will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

Hector Fortis
Director of Regulatory and International Affairs
Satélites Mexicanos Sa de CV

Paseo de la Reforma 222
Piso 20 y 21 Col. Juárez
C.P. 06600, México D.F.
Teléfono + 52 (55)26295800

Link Budget

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	44.9	deg
Lon	-81.2	deg
EIRP max	45.0	dBW
G/T	11.5	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	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
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	8.5	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	38754	km
Space Loss, Ls	205.9	dB
Pointing Loss, Lpnt	0.1	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)	84.8	dBHz
End to End		
End to End C/(No+Io)	84.4	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	8.7	dB
Link Margin	0.2	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	44.9	deg
Lon	-81.2	deg
EIRP max	45.0	dBW
G/T	11.5	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	0.67	
Overhead Rate	0.77	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.51	bps/Hz
Data Rate	3.43E+06	bps
Information Rate (Data + Overhead)	4.45E+06	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	3.34E+06	Hz
C/N Threshold	2.4	dB
Uplink		
Frequency	14.350	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	38754	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.2	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	71.6	dBHz
C/(No+Io)	71.1	dBHz
Satellite		
Flux Density	-118.4	dBW/m2
SFD @ Terminal	-100.4	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	15.1	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	6.2	dBW/4kHz
Carrier EIRP @ Beam Peak	38.4	dBW
Carrier EIRP @ Hub	36.9	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	90.2	dBHz
C/(No+Io)	83.9168	dBHz
End to End		
End to End C/(No+Io)	70.9	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	2.6	dB
Link Margin	0.2	dB

8. EUTELSAT 117WA

Coverage Map

Satellite Operator Certification Letter

eutelsat

Ciudad de México, April 27th, 2016.
DARI.2016.060

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

Re: Engineering Certification of Eutelsat Americas

To Whom It May Concern:

This letter certifies that Eutelsat Americas ("EAS") is aware that Panasonic Avionics Corporation ("Panasonic") 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 in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, EAS understands the technical characteristics of the SPA and EAS (i) recognizes that operation of these 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 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 Panasonic, EAS will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

Hector Fortis
Director of Regulatory and International Affairs
Satélites Mexicanos Sa de CV

www.eutelsat.com

APOYAMOS EL PACTO MUNDIAL

EMPRESA SOCIALMENTE RESPONSABLE®

Paseo de la Reforma 222
Piso 20 y 21 Col. Juárez
C.P. 06600, México D.F.
Teléfono + 52 (55)26295800

Link Budget

Forward Link Budget

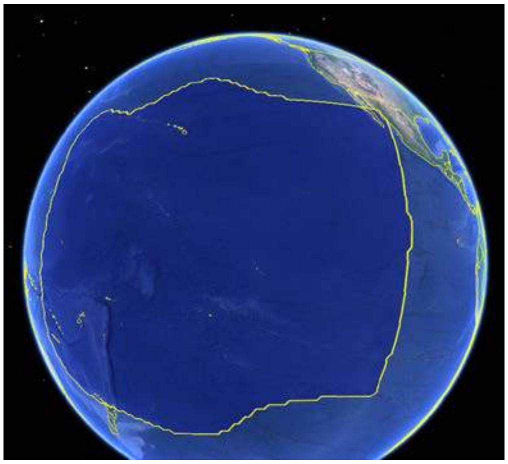
eXConnect Terminal		
Antenna Type	SPA	
Lat	28.9	deg
Lon	-82.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	STM8	
Longitude	-116.8	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	DVB-S2	
Modulation	8PSK	
Bits per symbol	3	
Spread Factor	1	
Coding Rate	0.67	
Overhead Rate	0.94	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.88	bps/Hz
Data Rate	5.64E+07	bps
Information Rate (Data + Overhead)	6.00E+07	bps
Symbol Rate	3.00E+07	Hz
Chip Rate (Noise Bandwidth)	3.00E+07	Hz
Occupied Bandwidth	3.60E+07	Hz
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	7.4	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	37844	km
Space Loss, Ls	205.6	dB
Pointing Loss, Lpnt	0.1	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)	83.7	dBHz
End to End		
End to End C/(No+Io)	83.6	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	7.8	dB
Link Margin	0.4	dB

Return Link Budget

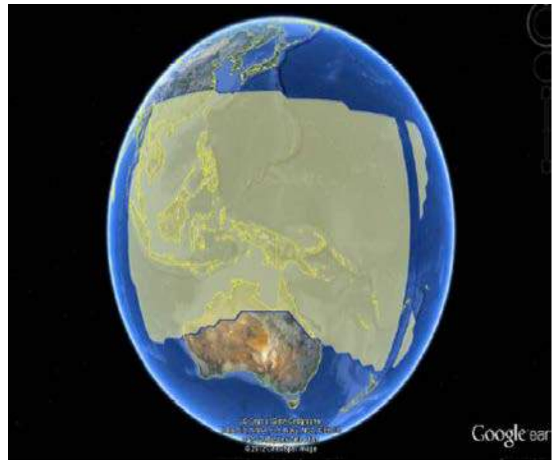
eXConnect Terminal		
Antenna Type	SPA	
Lat	28.9	deg
Lon	-82.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	STM8	
Longitude	-116.8	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	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 Equivelent Bandwidth	2.24E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.300	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	37844	km
Space Loss, Ls	207.1	dB
Pointing Loss, Lpnt	0.2	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	70.9	dBHz
C/(No+Io)	70.4	dBHz
Satellite		
Flux Density	-118.2	dBW/m2
SFD @ Terminal	-91.2	dBW/m2
Small Signal Gain (IBO/OBO)	1.3	dB
OBO	25.8	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	-6.3	dBW/4kHz
Carrier EIRP @ Beam Peak	25.9	dBW
Carrier EIRP @ Hub	23.2	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	81.6	dBHz
C/(No+Io)	72.8130	dBHz
End to End		
End to End C/(No+Io)	68.4	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	0.2	dB
Link Margin	1.4	dB

9. EUTELSAT 172A

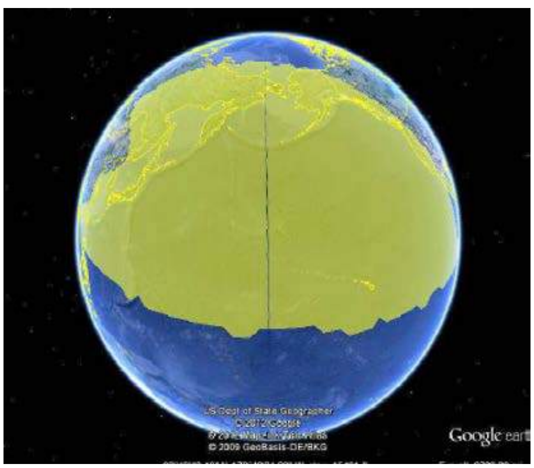
Coverage Maps



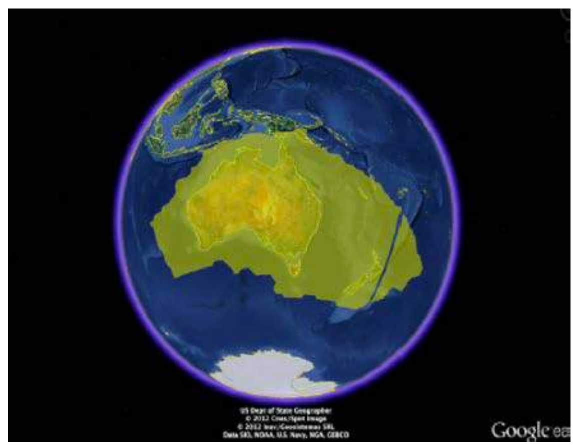
Southeast Pacific



Southwest Pacific



North Pacific



South Pacific

<u>**Satellite Operator Certification Letter**</u>

eutelsat
communications via satellite

October 29th, 2015

Mark DeFazio
Manager, GCS Regulatory and Business Operations
Panasonic Avionics Corporation
26200 Enterprise Way
Lake Forest, CA 92630

Re: Engineering Certification of Eutelsat

Dear Mr. DeFazio,

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Eutelsat confirms and hereby certifies the following with respect to the SPA terminal operations proposed by Panasonic:

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

If the FCC authorizes the operation proposed by Panasonic, Eutelsat will include the power density levels specified by Panasonic, 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
Head of the Resources Engineering Group

Link Budget

Forward Link Budget

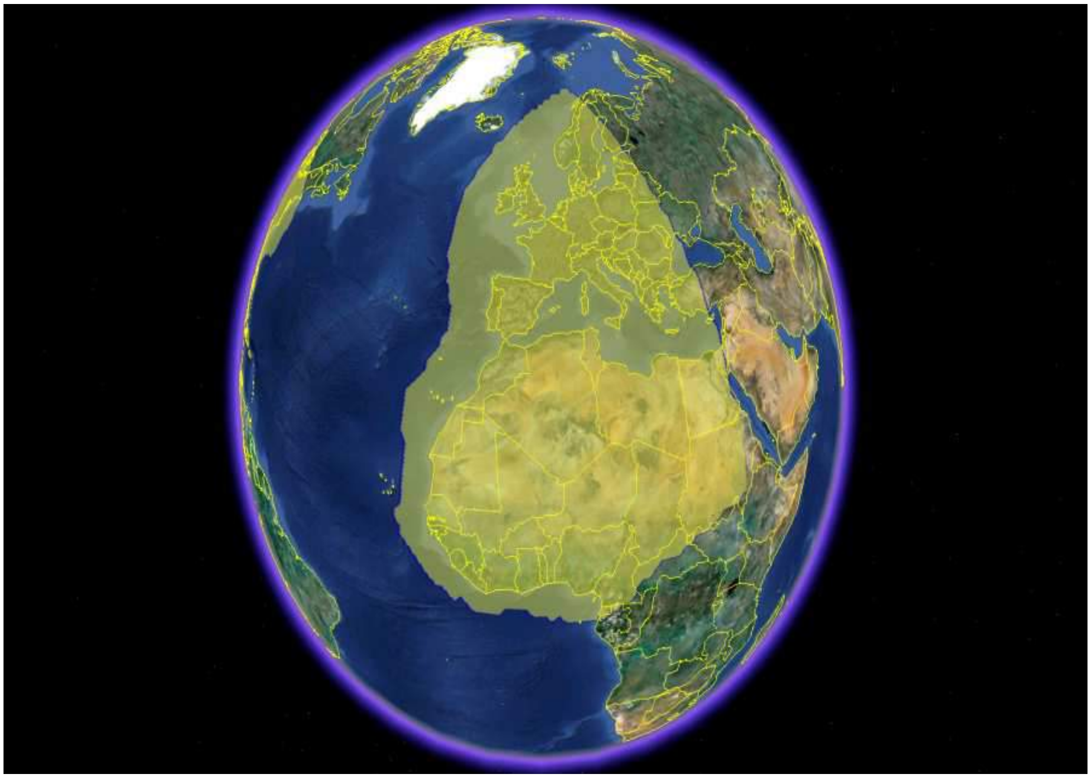
eXConnect Terminal		
Antenna Type	SPA	
Lat	25.8	deg
Lon	-125.2	deg
EIRP max	45.0	dBW
G/T	11.0	dB/K
Satellite		
Name	GE-23	
Longitude	172.0	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.89	
Overhead Rate	0.95	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.69	bps/Hz
Data Rate	2.53E+07	bps
Information Rate (Data + Overhead)	2.67E+07	bps
Symbol Rate	1.50E+07	Hz
Chip Rate (Noise Bandwidth)	1.50E+07	Hz
Occupied Bandwidth	1.80E+07	Hz
Power Equivelent Bandwidth	2.70E+07	Hz
C/N Threshold	6.6	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+Io)	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	39968	km
Space Loss, Ls	205.7	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	79.8	dBHz
C/(No+Io)	79.7	dBHz
End to End		
End to End C/(No+Io)	79.6	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	6.8	dB
Link Margin	0.2	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	25.8	deg
Lon	-125.2	deg
EIRP max	45.0	dBW
G/T	11.0	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	4	
Coding Rate	0.50	
Overhead Rate	0.74	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.09	bps/Hz
Data Rate	6.13E+05	bps
Information Rate (Data + Overhead)	8.34E+05	bps
Symbol Rate	1.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	9.71E+04	Hz
C/N Threshold	-5.6	dB
Uplink		
Frequency	14.039	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	39968	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.2	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	68.0	dBHz
C/(No+Io)	67.5	dBHz
Satellite		
Flux Density	-118.2	dBW/m2
SFD @ Terminal	-83.5	dBW/m2
Small Signal Gain (IBO/OBO)	1.9	dB
OBO	32.8	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	-17.3	dBW/4kHz
Carrier EIRP @ Beam Peak	14.9	dBW
Carrier EIRP @ Hub	12.2	dBW
Slant Range	41051	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.0	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	66.6	dBHz
C/(No+Io)	64.5460	dBHz
End to End		
End to End C/(No+Io)	62.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-5.5	dB
Link Margin	0.1	dB

10. IS-14

Coverage Map



Satellite Operator Certification Letter

INTELSAT
Envision. Connect. Transform.

28th April 2016

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

Re: Engineering Certification of Intelsat

To Whom It May Concern:

This letter certifies that Intelsat is aware that Panasonic Avionics Corporation ("Panasonic") 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 IS-14 satellite located at 45° W.L. and the IS-15 satellite located at 85° E.L. Specifically, we understand that in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, Intelsat understands the technical characteristics of the SPA and Intelsat (i) recognizes that operation of these terminals at the power density levels provided to Intelsat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-14 and IS-15; (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 Panasonic, Intelsat will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

Alan Yates
Senior Manager, Spectrum Engineering
Intelsat

Link Budget

Forward Link Budget

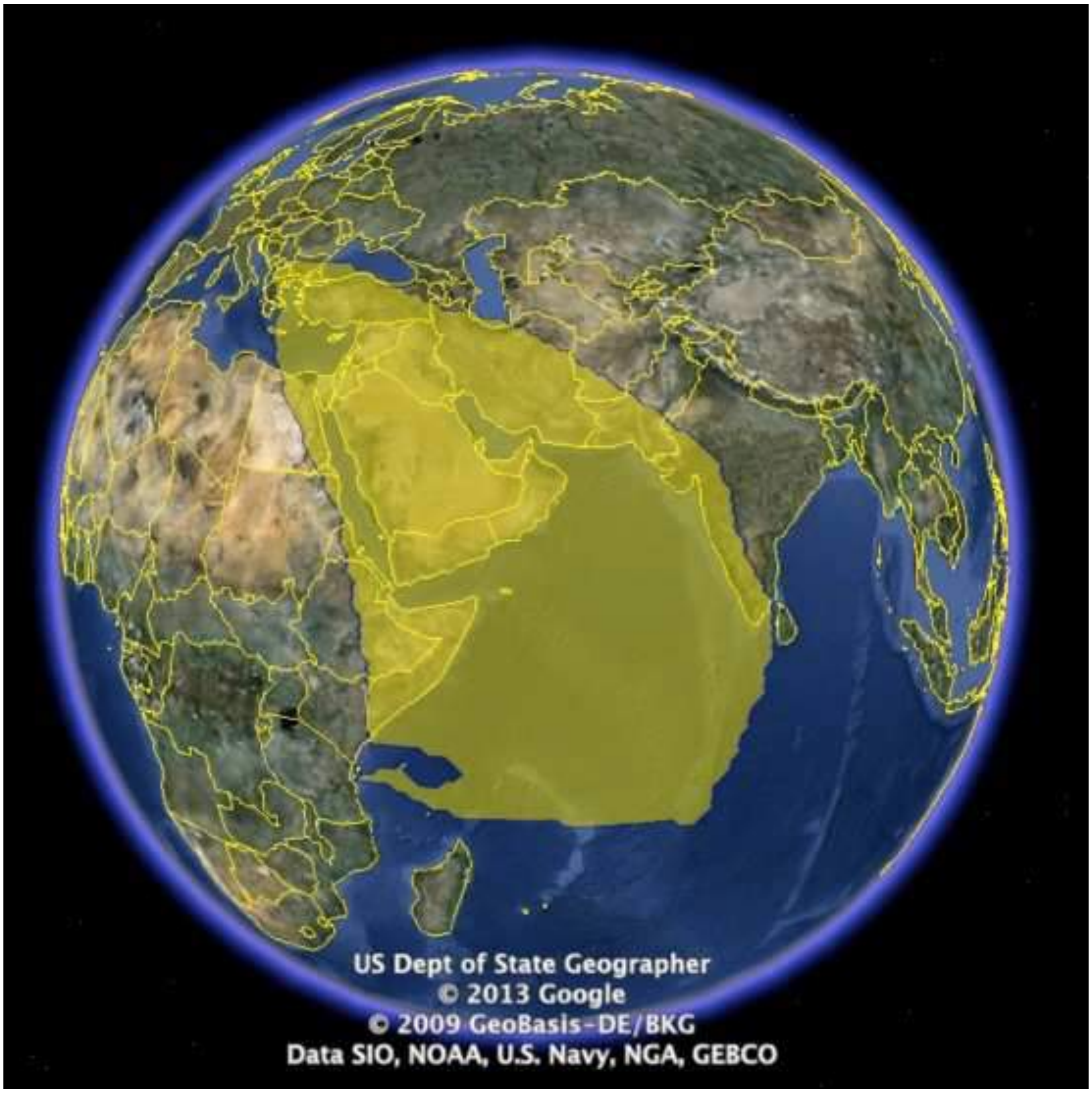
eXConnect Terminal		
Antenna Type	SPA	
Lat	9.8	deg
Lon	7.8	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS-14	
Longitude	-45.0	deg
Hub Earth Station		
Site	Cologne	
Lat	50.94	deg
Lon	6.96	deg
EIRP max	80.0	dBW
G/T	37.4	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread 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	3.84E+07	bps
Information Rate (Data + Overhead)	4.18E+07	bps
Symbol Rate	2.61E+07	Hz
Chip Rate (Noise Bandwidth)	2.61E+07	Hz
Occupied Bandwidth	3.13E+07	Hz
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	5.1	dB
Uplink		
Frequency	14.100	GHz
Back off	8.1	dB
EIRP Spectral Density	33.7	dBW/4kHz
Slant Range	40122	km
Space Loss, Ls	207.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.9	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	1.2	dB/K
Thermal Noise, C/No	90.3	dBHz
C/(No+Io)	89.8	dBHz
Satellite		
Flux Density	-95.1	dBW/m2
SFD @ Hub	-92.1	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	1.0	dB
Downlink		
Frequency	11.550	GHz
Transponder Sat. EIRP @ Beam Peak	54.0	dBW
Transponder Sat. EIRP @ Terminal	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	14.8	dBW/4kHz
Carrier EIRP @ Beam Peak	53.0	dBW
Carrier EIRP @ Terminal	52.0	dBW
Slant Range	38710	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	86.0	dBHz
C/(No+Io)	81.1	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	5.4	dB
Link Margin	0.3	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	9.8	deg
Lon	7.8	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS-14	
Longitude	-45.0	deg
Hub Earth Station		
Site	Cologne	
Lat	50.94	deg
Lon	6.96	deg
EIRP max	80.0	dBW
G/T	37.4	dB/K
Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	1	
Coding Rate	0.67	
Overhead Rate	0.72	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.48	bps/Hz
Data Rate	3.22E+06	bps
Information Rate (Data + Overhead)	4.45E+06	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	5.07E+05	Hz
C/N Threshold	2.0	dB
Uplink		
Frequency	14.202	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	38710	km
Space Loss, Ls	207.3	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	8.2	dB/K
Thermal Noise, C/No	73.9	dBHz
C/(No+Io)	73.4	dBHz
Satellite		
Flux Density	-118.4	dBW/m2
SFD @ Terminal	-90.8	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	25.6	dB
Downlink		
Frequency	11.652	GHz
Transponder Sat. EIRP @ Beam Peak	54.0	dBW
Transponder Sat. EIRP @ Hub	47.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	-3.9	dBW/4kHz
Carrier EIRP @ Beam Peak	28.4	dBW
Carrier EIRP @ Hub	21.4	dBW
Slant Range	40122	km
Space Loss, Ls	205.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.3	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	77.2	dBHz
C/(No+Io)	73.8754	dBHz
End to End		
End to End C/(No+Io)	70.6	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	2.4	dB
Link Margin	0.4	dB

11. IS-15

Coverage Map



Satellite Operator Certification Letter

INTELSAT
Envision. Connect. Transform.

28th April 2016

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

Re: Engineering Certification of Intelsat

To Whom It May Concern:

This letter certifies that Intelsat is aware that Panasonic Avionics Corporation ("Panasonic") 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 IS-14 satellite located at 45° W.L. and the IS-15 satellite located at 85° E.L. Specifically, we understand that in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, Intelsat understands the technical characteristics of the SPA and Intelsat (i) recognizes that operation of these terminals at the power density levels provided to Intelsat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-14 and IS-15; (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 Panasonic, Intelsat will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

Alan Yates
Senior Manager, Spectrum Engineering
Intelsat

Intelsat Corporation
7900 Tysons One Place, McLean, VA 22102-5972 USA **www.intelsat.com** T +1 703-559-6800

Link Budget

Forward Link Budget

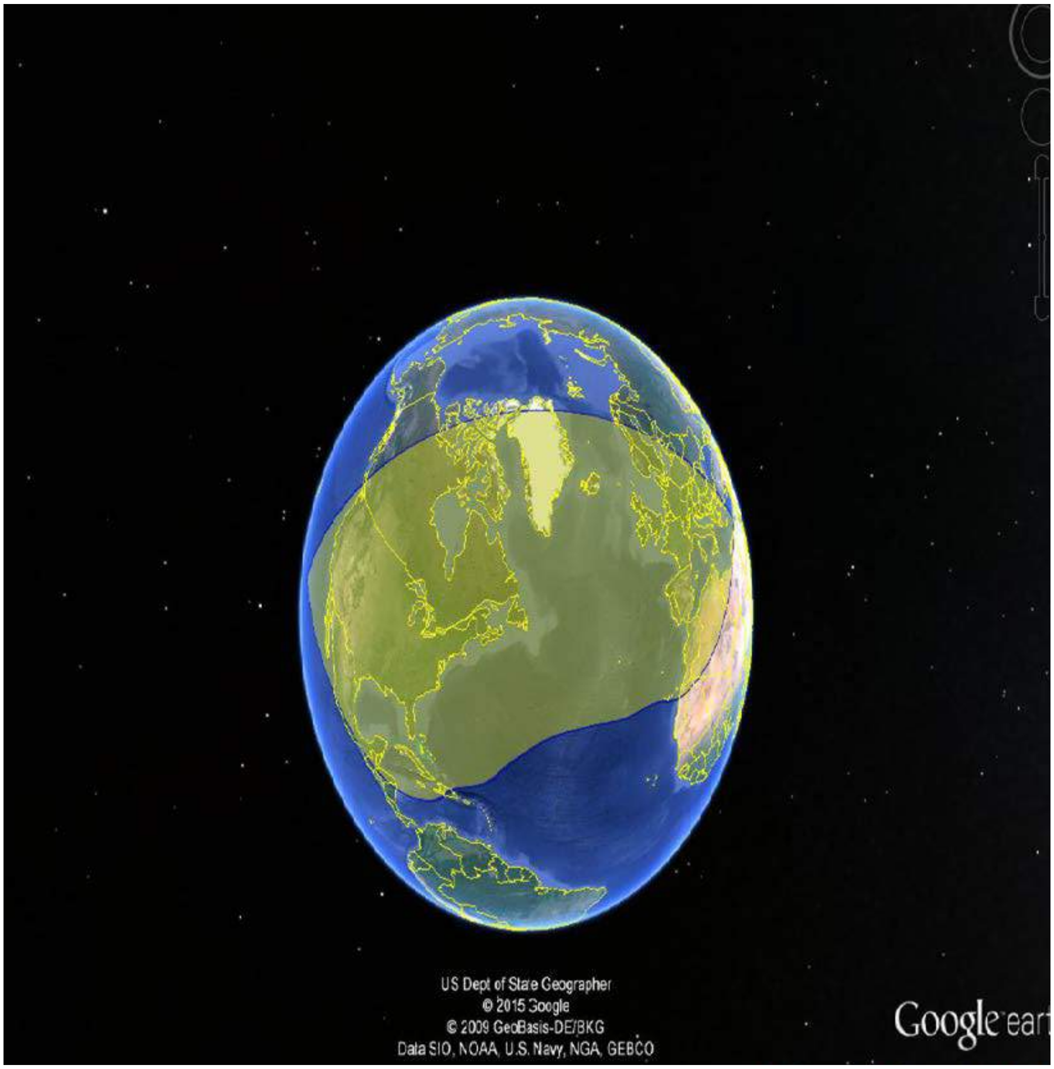
eXConnect Terminal		
Antenna Type	SPA	
Lat	20.9	deg
Lon	61.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS-15	
Longitude	85.2	deg
Hub Earth Station		
Site	Cyprus	
Lat	34.92	deg
Lon	33.64	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.67	
Overhead Rate	0.94	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.26	bps/Hz
Data Rate	2.09E+07	bps
Information Rate (Data + Overhead)	2.22E+07	bps
Symbol Rate	1.67E+07	Hz
Chip Rate (Noise Bandwidth)	1.67E+07	Hz
Occupied Bandwidth	2.00E+07	Hz
Power Equivelent Bandwidth	3.28E+07	Hz
C/N Threshold	3.5	dB
Uplink		
Frequency	14.048	GHz
Back off	14.8	dB
EIRP Spectral Density	29.0	dBW/4kHz
Slant Range	39297	km
Space Loss, Ls	207.3	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.4	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	1.7	dB/K
Thermal Noise, C/No	84.8	dBHz
C/(No+Io)	84.3	dBHz
Satellite		
Flux Density	-101.1	dBW/m2
SFD @ Hub	-92.7	dBW/m2
Small Signal Gain (IBO/OBO)	1.5	dB
OBO	6.9	dB
Downlink		
Frequency	12.538	GHz
Transponder Sat. EIRP @ Beam Peak	52.7	dBW
Transponder Sat. EIRP @ Terminal	51.7	dBW
DL PSD Limit	16.0	dBW/4kHz
DL PSD @ Beam Peak	9.6	dBW/4kHz
Carrier EIRP @ Beam Peak	45.8	dBW
Carrier EIRP @ Terminal	44.8	dBW
Slant Range	36888	km
Space Loss, Ls	205.8	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	78.5	dBHz
C/(No+Io)	78.1	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	3.9	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	20.9	deg
Lon	61.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS-15	
Longitude	85.2	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	1	
Coding Rate	0.50	
Overhead Rate	0.78	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.39	bps/Hz
Data Rate	2.59E+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 Equivelent Bandwidth	1.34E+06	Hz
C/N Threshold	1.2	dB
Uplink		
Frequency	14.048	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36888	km
Space Loss, Ls	206.7	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	4.7	dB/K
Thermal Noise, C/No	70.9	dBHz
C/(No+Io)	70.4	dBHz
Satellite		
Flux Density	-118.0	dBW/m2
SFD @ Terminal	-95.7	dBW/m2
Small Signal Gain (IBO/OBO)	1.5	dB
OBO	20.8	dB
Downlink		
Frequency	12.538	GHz
Transponder Sat. EIRP @ Beam Peak	52.7	dBW
Transponder Sat. EIRP @ Hub	48.7	dBW
DL PSD Limit	16.0	dBW/4kHz
DL PSD @ Beam Peak	-0.3	dBW/4kHz
Carrier EIRP @ Beam Peak	31.9	dBW
Carrier EIRP @ Hub	27.9	dBW
Slant Range	39297	km
Space Loss, Ls	206.3	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.6	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	82.9	dBHz
C/(No+Io)	78.7712	dBHz
End to End		
End to End C/(No+Io)	69.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	1.6	dB
Link Margin	0.4	dB

12. IS-29E

Coverage Map



Satellite Operator Certification Letter

INTELSAT
Envision. Connect. Transform.

November 6, 2015

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

Re: Engineering Certification of Intelsat for G-16, G-17 and IS-29e Satellites

To Whom It May Concern:

This letter certify that Intelsat is aware that Panasonic Avionics Corporation ("Panasonic") is planning to seek a special temporary authorization ("STA") and modification to its blanket authorization from the Federal Communication Commission ("FCC"), Call Sign E100089, to operate a new Ku-band transmit/receive earth stations aboard aircraft ("ESAA") terminal type, the Panasonic Single Panel Antenna ("SPA"). The SPA will operate with the Galaxy 16 satellite at 99°W, the Galaxy 17 satellite at 91°W and the IS-29e satellite to be located at 50°W. Intelsat understands that Panasonic will file the applications pursuant to the FCC rules governing ESAA operations, including Section 25.227.

Intelsat confirms and hereby certifies that the power density levels of the proposed operations are consistent with existing satellite coordination agreements with the satellites with +/-6 degrees of the Galaxy 16, Galaxy 17 IS-29e satellites' orbit locations, and that the proposed operation of Panasonic's SPA ESAA terminal has the potential to create and receive harmful interference from adjacent satellite networks that may be unacceptable.

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

Sincerely,

Armand Kadrichu
Senior Technical Advisor, Spectrum Strategy
INTELSAT
7900 Tysons One Place, McLean, VA 22102-5972
T +1 703-559-7525 M +1 202-445-4377
armand.kadrichu@intelsat.com

Link Budget

Forward Link Budget

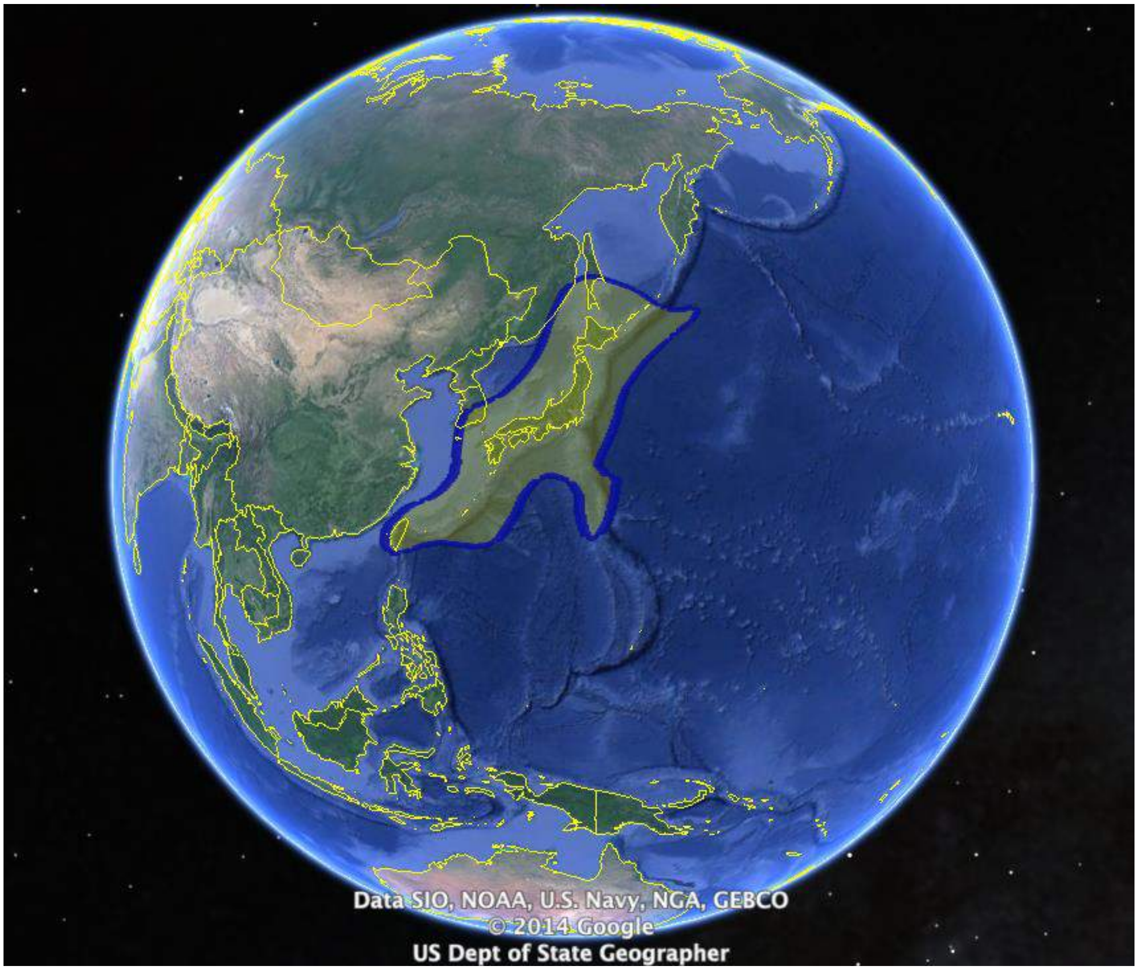
eXConnect Terminal		
Antenna Type	SPA	
Lat	32.0	deg
Lon	-107.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS29e	
Longitude	-50.0	deg
Hub Earth Station		
Site	Mountainside	
Lat	39.6	deg
Lon	-77.76	deg
EIRP max	88.0	dBW
G/T	40.5	dB/K
Signal		
Waveform	DVB-S2	
Modulation	8PSK	
Bits per symbol	3	
Spread Factor	1	
Coding Rate	0.67	
Overhead Rate	0.94	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.88	bps/Hz
Data Rate	3.45E+07	bps
Information Rate (Data + Overhead)	3.67E+07	bps
Symbol Rate	1.83E+07	Hz
Chip Rate (Noise Bandwidth)	1.83E+07	Hz
Occupied Bandwidth	2.20E+07	Hz
Power Equivelent Bandwidth	1.08E+07	Hz
C/N Threshold	7.4	dB
Uplink		
Frequency	6.172	GHz
Back off	17.5	dB
EIRP Spectral Density	33.9	dBW/4kHz
Slant Range	38106	km
Space Loss, Ls	199.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.5	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	4.0	dB/K
Thermal Noise, C/No	102.7	dBHz
C/(No+Io)	102.2	dBHz
Satellite		
Flux Density	-92.7	dBW/m2
SFD @ Hub	-77.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	13.7	dB
Downlink		
Frequency	12.092	GHz
Transponder Sat. EIRP @ Beam Peak	64.3	dBW
Transponder Sat. EIRP @ Terminal	63.3	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	14.0	dBW/4kHz
Carrier EIRP @ Beam Peak	50.6	dBW
Carrier EIRP @ Terminal	49.6	dBW
Slant Range	39627	km
Space Loss, Ls	206.1	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.1	dBHz
C/(No+Io)	81.6	dBHz
End to End		
End to End C/(No+Io)	81.6	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	7.9	dB
Link Margin	0.5	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	32.0	deg
Lon	-107.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS29e	
Longitude	-50.0	deg
Hub Earth Station		
Site	Mountainside	
Lat	39.6	deg
Lon	-77.76	deg
EIRP max	88.0	dBW
G/T	40.5	dB/K
Signal		
Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.86	
Overhead Rate	0.87	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.49	bps/Hz
Data Rate	9.94E+06	bps
Information Rate (Data + Overhead)	1.14E+07	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	2.35E+06	Hz
C/N Threshold	7.5	dB
Uplink		
Frequency	14.344	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	39627	km
Space Loss, Ls	207.5	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	17.3	dB/K
Thermal Noise, C/No	82.7	dBHz
C/(No+Io)	82.2	dBHz
Satellite		
Flux Density	-118.6	dBW/m2
SFD @ Terminal	-90.3	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	26.3	dB
Downlink		
Frequency	12.350	GHz
Transponder Sat. EIRP @ Beam Peak	52.7	dBW
Transponder Sat. EIRP @ Hub	52.7	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	-5.9	dBW/4kHz
Carrier EIRP @ Beam Peak	26.4	dBW
Carrier EIRP @ Hub	26.4	dBW
Slant Range	38106	km
Space Loss, Ls	205.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.3	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	85.3	dBHz
C/(No+Io)	79.9713	dBHz
End to End		
End to End C/(No+Io)	77.9	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	9.7	dB
Link Margin	2.2	dB

13. JCSAT-5A

Coverage Map



Satellite Operator Certification Letter

SKY Perfect JSAT Corporation

SKY Perfect JSAT Corporation
1-14-14, Akasaka, Minato-ku
Tokyo 107-0052, Japan
TEL +81-3-5571-7800

Ref# MD-A-15-035

January 12, 2016

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

Re: Engineering Certification of Panasonic SPA and Superbird-C2 and JCSAT-5A

To Whom It May Concern:

This letter certifies that SKY Perfect JSAT Corporation ("JSAT") is aware that Panasonic Avionics Corporation ("Panasonic") 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 JCSAT-5A satellite at 132° E.L and the Superbird C2 satellite at 144° E.L. Specifically, we understand that in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, JSAT understands the technical characteristics of the SPA and JSAT (i) recognizes that operation of these terminals at the power density levels provided to JSAT is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from the JCSAT-5A and Superbird C2 nominal positions; (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 Panasonic, JSAT will take into consideration the power density levels associated such operations in all future satellite network coordinations with other adjacent satellite operators.

Sincerely,

SKY Perfect JSAT Corporation

M. Ishii 12. Jan. 2016

Mitsuru Ishii *Date*

General Manager
Mobile Business Division
Space & Satellite Group

Link Budget

Forward Link Budget

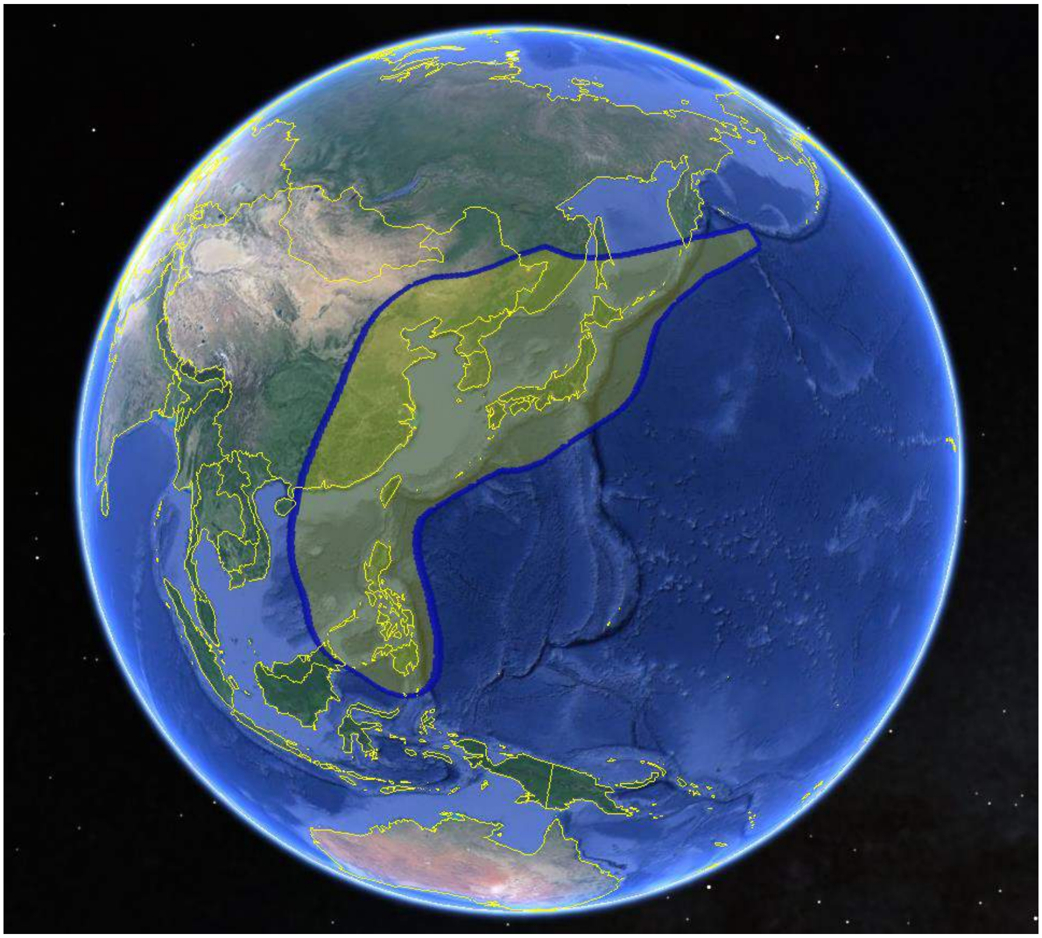
eXConnect Terminal		
Antenna Type	SPA	
Lat	34.9	deg
Lon	135.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	JCSAT-5A	
Longitude	132.0	deg
Hub Earth Station		
Site	Yokohama	
Lat	35.5	deg
Lon	139.51	deg
EIRP max	75.0	dBW
G/T	32.5	dB/K
Signal		
Waveform	DVB-S2	
Modulation	8PSK	
Bits per symbol	3	
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	2.76E+07	bps
Information Rate (Data + Overhead)	3.00E+07	bps
Symbol Rate	1.33E+07	Hz
Chip Rate (Noise Bandwidth)	1.33E+07	Hz
Occupied Bandwidth	1.60E+07	Hz
Power Equivelent Bandwidth	2.20E+07	Hz
C/N Threshold	8.5	dB
Uplink		
Frequency	14.089	GHz
Back off	17.7	dB
EIRP Spectral Density	22.1	dBW/4kHz
Slant Range	37212	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.3	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	11.0	dB/K
Thermal Noise, C/No	86.8	dBHz
C/(No+Io)	86.3	dBHz
Satellite		
Flux Density	-108.4	dBW/m2
SFD @ Hub	-97.0	dBW/m2
Small Signal Gain (IBO/OBO)	4.0	dB
OBO	7.4	dB
Downlink		
Frequency	12.341	GHz
Transponder Sat. EIRP @ Beam Peak	57.5	dBW
Transponder Sat. EIRP @ Terminal	57.0	dBW
DL PSD Limit	19.5	dBW/4kHz
DL PSD @ Beam Peak	14.9	dBW/4kHz
Carrier EIRP @ Beam Peak	50.1	dBW
Carrier EIRP @ Terminal	49.6	dBW
Slant Range	37124	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.4	dBHz
C/(No+Io)	82.3	dBHz
End to End		
End to End C/(No+Io)	80.8	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	8.6	dB
Link Margin	0.1	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	34.9	deg
Lon	135.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	JCSAT-5A	
Longitude	132.0	deg
Hub Earth Station		
Site	Yokohama	
Lat	35.5	deg
Lon	139.51	deg
EIRP max	75.0	dBW
G/T	32.5	dB/K
Signal		
Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.86	
Overhead Rate	0.87	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.49	bps/Hz
Data Rate	9.94E+06	bps
Information Rate (Data + Overhead)	1.14E+07	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	2.98E+06	Hz
C/N Threshold	7.5	dB
Uplink		
Frequency	14.089	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	37124	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	12.0	dB/K
Thermal Noise, C/No	78.1	dBHz
C/(No+Io)	77.6	dBHz
Satellite		
Flux Density	-118.1	dBW/m2
SFD @ Terminal	-98.0	dBW/m2
Small Signal Gain (IBO/OBO)	4.0	dB
OBO	16.1	dB
Downlink		
Frequency	12.341	GHz
Transponder Sat. EIRP @ Beam Peak	57.5	dBW
Transponder Sat. EIRP @ Hub	56.0	dBW
DL PSD Limit	19.5	dBW/4kHz
DL PSD @ Beam Peak	9.2	dBW/4kHz
Carrier EIRP @ Beam Peak	41.4	dBW
Carrier EIRP @ Hub	39.9	dBW
Slant Range	37212	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.4	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	92.0	dBHz
C/(No+Io)	83.9059	dBHz
End to End		
End to End C/(No+Io)	76.7	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	8.4	dB
Link Margin	0.9	dB

14. NSS-6

Coverage Map



Satellite Operator Certification Letter

SES

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

11th August 2016

Subject: Engineering Certification for NSS-6

SES World Skies Singapore
Pte Ltd.
501 Orchard Road,
#18-00 Wheelock Place
238880 Singapore
Tel. + 65 6593 3600
Fax + 65 6593 3610
www.ses.com

Company Registration Number
(UEN) 200914437G

To Whom It May Concern:

This letter confirms that SES is aware that Panasonic Avionics Corporation ("Panasonic"), licensed by the Federal Communications Commission ("FCC") as Panasonic Avionics Corporation, has filed an application seeking a modification to its blanket authorization (the "Modification Application") to operate Ku-band Earth Stations Aboard Aircraft ("ESAA") transmit/receive terminals (Call Sign E100089) pursuant to ITU RR 5.504A and Section 25.227 of the Commission's rules, on domestic and international flights. Among other changes, the Modification Application is seeking authority for Panasonic's ESAA terminals to communicate with the NSS-6 satellite at 95°E.L. under the current ESAA rules, including Section 25.227.

Based upon the contents of the Modification Application and the representations made to SES by Panasonic concerning how it will operate on NSS-6 according to its letter dated 20 July 2016.

SES acknowledges that the proposed operation of the Panasonic ESAA terminals has the potential to create harmful interference to satellite networks adjacent to NSS-6 that may be unacceptable.

SES certifies that it has completed coordination as required under the FCC's rules and that the power density levels specified by Panasonic are consistent with any existing coordination agreements to which SES is a party to adjacent satellite operators within +/- 6 degrees of orbital separation from NSS-6.

If the FCC authorizes the operations proposed by Panasonic, SES will include the power density levels specified by Panasonic in all future satellite network coordination with other operators of satellites adjacent to NSS-6.

SES has also reviewed the discussion in the Modification Application regarding the off-axis EIRP density of Panasonic antennas communicating with NSS-6 in directions other than along the GSO plane. SES is of the view that the non-compliant emissions would not create interference to Ku-band geostationary satellites.

Yours sincerely,

for

Kevin Seow
VP Spectrum Management & Development – APAC
SES

Link Budget

Forward Link Budget

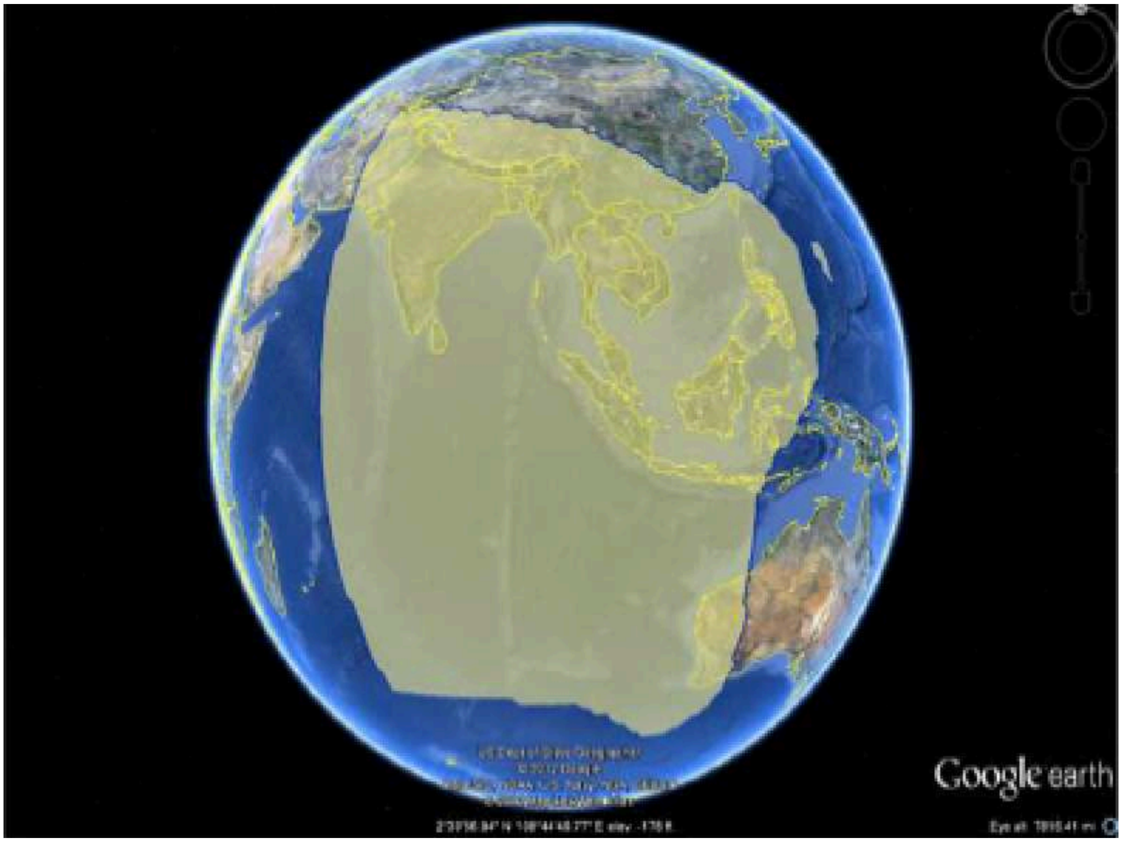
eXConnect Terminal		
Antenna Type	SPA	
Lat	36.9	deg
Lon	139.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	NSS-6	
Longitude	95.0	deg
Hub Earth Station		
Site	Cyprus	
Lat	34.92	deg
Lon	33.64	deg
EIRP max	80.0	dBW
G/T	36.0	dB/K
Signal		
Waveform	DVB-S2	
Modulation	16APSK	
Bits per symbol	4	
Spread 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 Equivelent Bandwidth	3.58E+07	Hz
C/N Threshold	9.6	dB
Uplink		
Frequency	13.891	GHz
Back off	0.7	dB
EIRP Spectral Density	40.5	dBW/4kHz
Slant Range	40090	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	5.8	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	5.0	dB/K
Thermal Noise, C/No	99.7	dBHz
C/(No+Io)	99.2	dBHz
Satellite		
Flux Density	-89.6	dBW/m2
SFD @ Hub	-85.6	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	1.0	dB
Downlink		
Frequency	12.647	GHz
Transponder Sat. EIRP @ Beam Peak	54.5	dBW
Transponder Sat. EIRP @ Terminal	54.0	dBW
DL PSD Limit	14.7	dBW/4kHz
DL PSD @ Beam Peak	14.7	dBW/4kHz
Carrier EIRP @ Beam Peak	53.5	dBW
Carrier EIRP @ Terminal	53.0	dBW
Slant Range	38847	km
Space Loss, Ls	206.3	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	86.2	dBHz
C/(No+Io)	85.9	dBHz
End to End		
End to End C/(No+Io)	85.7	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	9.9	dB
Link Margin	0.3	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	36.9	deg
Lon	139.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	NSS-6	
Longitude	95.0	deg
Hub Earth Station		
Site	Cyprus	
Lat	34.92	deg
Lon	33.64	deg
EIRP max	80.0	dBW
G/T	36.0	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 Equivelent Bandwidth	7.44E+05	Hz
C/N Threshold	3.3	dB
Uplink		
Frequency	14.390	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	38847	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.2	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	73.5	dBHz
C/(No+Io)	73.0	dBHz
Satellite		
Flux Density	-118.5	dBW/m2
SFD @ Terminal	-95.6	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	19.8	dB
Downlink		
Frequency	11.594	GHz
Transponder Sat. EIRP @ Beam Peak	50.0	dBW
Transponder Sat. EIRP @ Hub	50.0	dBW
DL PSD Limit	14.7	dBW/4kHz
DL PSD @ Beam Peak	-2.1	dBW/4kHz
Carrier EIRP @ Beam Peak	30.2	dBW
Carrier EIRP @ Hub	30.2	dBW
Slant Range	40090	km
Space Loss, Ls	205.8	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	82.6	dBHz
C/(No+Io)	77.0615	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	3.3	dB
Link Margin	0.0	dB

15. SUPERBIRD C2

Coverage Map



Satellite Operator Certification Letter

SKY Perfect JSAT Corporation

SKY Perfect JSAT Corporation
1-14-14, Akasaka, Minato-ku
Tokyo 107-0052, Japan
TEL +81-3-5571-7800

Ref# MD-A-15-035

January 12, 2016

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

Re: Engineering Certification of Panasonic SPA and Superbird-C2 and JCSAT-5A

To Whom It May Concern:

This letter certifies that SKY Perfect JSAT Corporation ("JSAT") is aware that Panasonic Avionics Corporation ("Panasonic") 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 JCSAT-5A satellite at 132° E.L and the Superbird C2 satellite at 144° E.L. Specifically, we understand that in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

Based on the information provided by Panasonic, JSAT understands the technical characteristics of the SPA and JSAT (i) recognizes that operation of these terminals at the power density levels provided to JSAT is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from the JCSAT-5A and Superbird C2 nominal positions; (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 Panasonic, JSAT will take into consideration the power density levels associated such operations in all future satellite network coordinations with other adjacent satellite operators.

Sincerely,

SKY Perfect JSAT Corporation

M. Ishii ______________________ 12. Jan. 2016 ______________

Mitsuru Ishii *Date*

General Manager
Mobile Business Division
Space & Satellite Group

Link Budget

Forward Link Budget

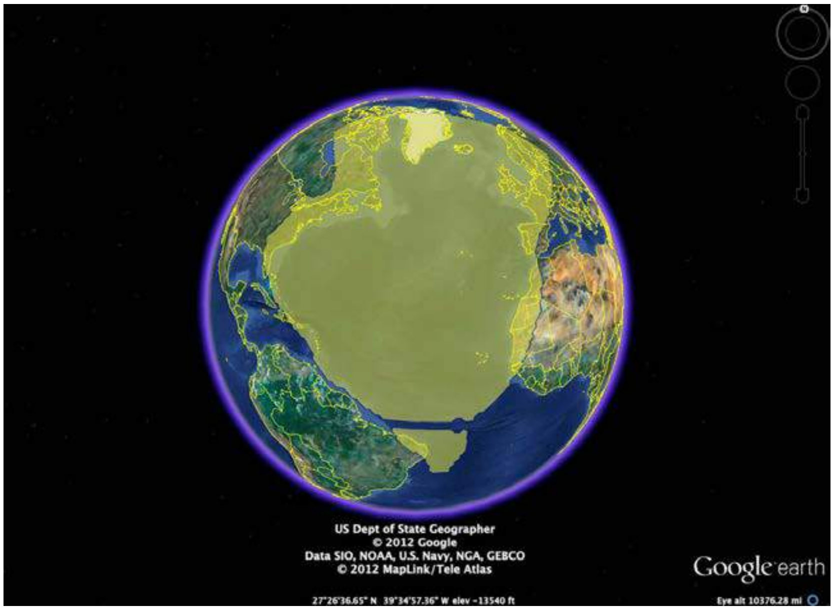
eXConnect Terminal		
Antenna Type	SPA	
Lat	25.0	deg
Lon	79.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	SB-C2	
Longitude	144.0	deg
Hub Earth Station		
Site	Hong Kong	
Lat	22.45	deg
Lon	114.18	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread 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	1.86E+07	bps
Information Rate (Data + Overhead)	2.25E+07	bps
Symbol Rate	2.25E+07	Hz
Chip Rate (Noise Bandwidth)	2.25E+07	Hz
Occupied Bandwidth	2.70E+07	Hz
Power Equivelent Bandwidth	2.70E+07	Hz
C/N Threshold	0.9	dB
Uplink		
Frequency	14.433	GHz
Back off	3.4	dB
EIRP Spectral Density	39.1	dBW/4kHz
Slant Range	37251	km
Space Loss, Ls	207.1	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.1	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	-4.0	dB/K
Thermal Noise, C/No	88.1	dBHz
C/(No+Io)	87.6	dBHz
Satellite		
Flux Density	-91.9	dBW/m2
SFD @ Hub	-89.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.4	dB
OBO	0.5	dB
Downlink		
Frequency	12.703	GHz
Transponder Sat. EIRP @ Beam Peak	46.0	dBW
Transponder Sat. EIRP @ Terminal	45.0	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	8.0	dBW/4kHz
Carrier EIRP @ Beam Peak	45.5	dBW
Carrier EIRP @ Terminal	44.5	dBW
Slant Range	40072	km
Space Loss, Ls	206.6	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	77.4	dBHz
C/(No+Io)	77.4	dBHz
End to End		
End to End C/(No+Io)	77.0	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	2.5	dB
Link Margin	1.6	dB

Return Link Budget

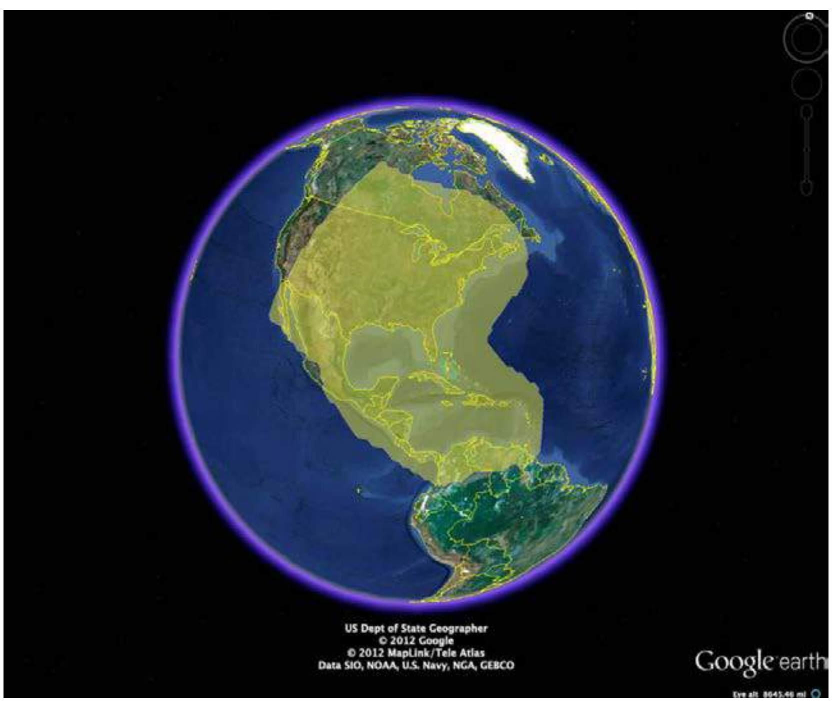
eXConnect Terminal		
Antenna Type	SPA	
Lat	25.0	deg
Lon	79.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	SB-C2	
Longitude	144.0	deg
Hub Earth Station		
Site	Hong Kong	
Lat	22.45	deg
Lon	114.18	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	4	
Coding Rate	0.67	
Overhead Rate	0.72	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.12	bps/Hz
Data Rate	8.04E+05	bps
Information Rate (Data + Overhead)	1.11E+06	bps
Symbol Rate	1.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.66E+06	Hz
Occupied Bandwidth	7.99E+06	Hz
Power Equivelent Bandwidth	5.69E+05	Hz
C/N Threshold	-4.2	dB
Uplink		
Frequency	14.120	GHz
Back off	0.2	dB
EIRP Spectral Density	12.6	dBW/4kHz
Slant Range	40072	km
Space Loss, Ls	207.5	dB
Pointing Loss, Lpnt	0.2	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	66.2	dBHz
C/(No+Io)	65.7	dBHz
Satellite		
Flux Density	-118.9	dBW/m2
SFD @ Terminal	-95.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.4	dB
OBO	21.5	dB
Downlink		
Frequency	12.390	GHz
Transponder Sat. EIRP @ Beam Peak	46.0	dBW
Transponder Sat. EIRP @ Hub	42.0	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	-7.7	dBW/4kHz
Carrier EIRP @ Beam Peak	24.5	dBW
Carrier EIRP @ Hub	20.5	dBW
Slant Range	37251	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.8	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	73.9	dBHz
C/(No+Io)	71.9777	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	-3.5	dB
Link Margin	0.7	dB

16. TELSTAR 11N

<u>Coverage Maps</u>



Atlantic Ocean



North and Central America

<u>Satellite Operator Certification Letter</u>

1601 Telesat Court
Ottawa, ON, Canada K1B 5P4

4 January 2016

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

Re: Engineering Certification of Telesat

To Whom It May Concern:

This letter certifies that Telesat is aware that Panasonic Avionics Corporation ("Panasonic") 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 Telstar 11N, Telstar 14R, Anik F1R, and Anik G1 satellites located at 37.55°W.L., 63°W.L., 107.3°W.L., and 107.3°W.L., respectively. Specifically, Telesat understands that in addition to Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's Part 25 rules, including Section 25.227.

Based on the information provided by Panasonic, Telesat understands the technical characteristics of the SPA and Telesat (i) recognizes that operation of these terminals at the power density levels provided to Telesat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from Telstar 11N, Telstar 14R, Anik F1R, and Anik G1; (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 Panasonic, Telesat will take into consideration the power density levels associated with such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely Yours,

BAHRAM BORNA
Satellite Spectrum Coordination Engineer
Telesat

Link Budget

Forward Link Budget

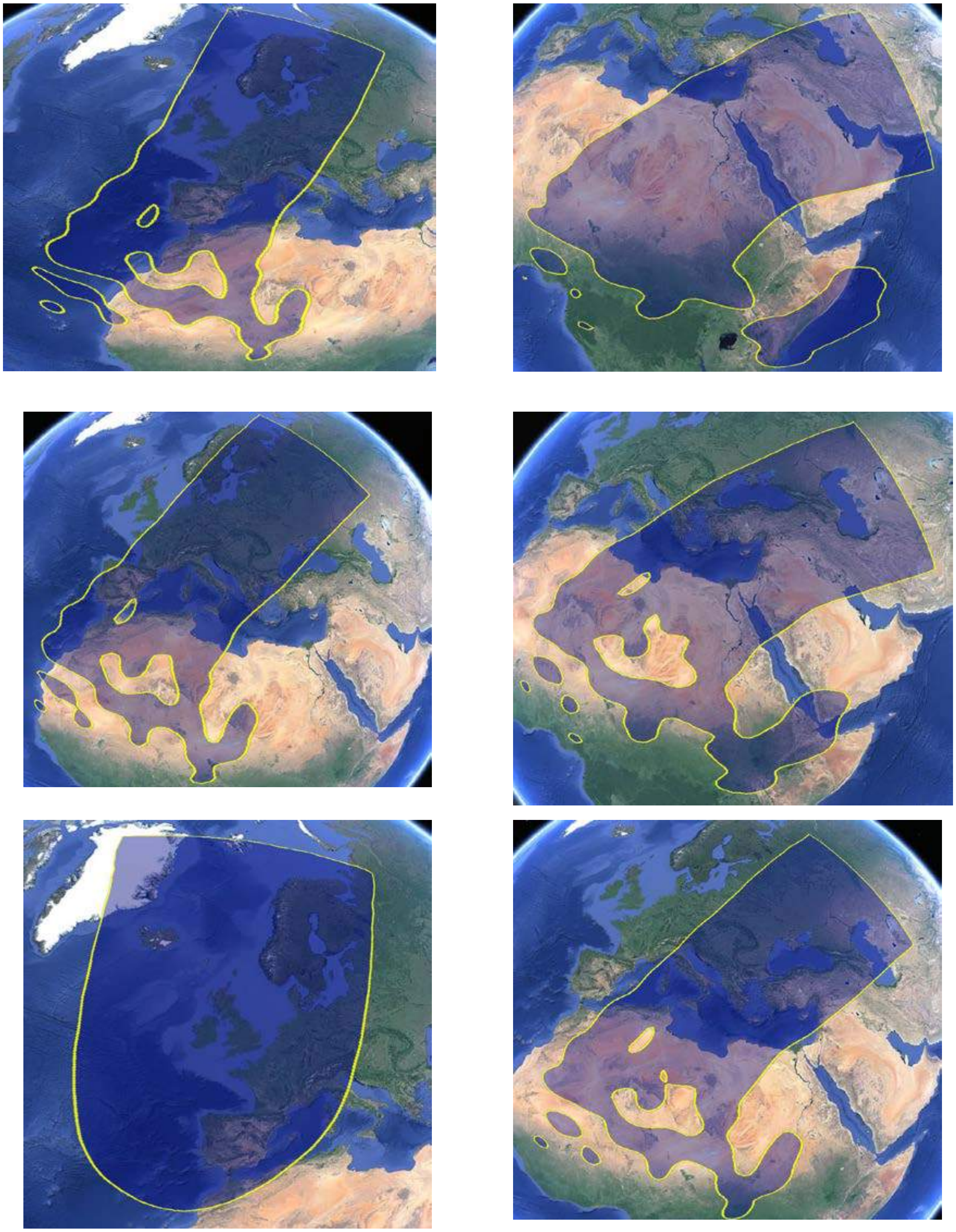
eXConnect Terminal		
Antenna Type	SPA	
Lat	11.9	deg
Lon	-80.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Telstar 11N	
Longitude	-37.6	deg
Hub Earth Station		
Site	Cologne	
Lat	50.94	deg
Lon	6.96	deg
EIRP max	80.0	dBW
G/T	34.4	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
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	4.67E+07	bps
Information Rate (Data + Overhead)	5.00E+07	bps
Symbol Rate	3.00E+07	Hz
Chip Rate (Noise Bandwidth)	3.00E+07	Hz
Occupied Bandwidth	3.60E+07	Hz
Power Equivelent Bandwidth	5.40E+07	Hz
C/N Threshold	5.6	dB
Uplink		
Frequency	14.090	GHz
Back off	7.9	dB
EIRP Spectral Density	33.4	dBW/4kHz
Slant Range	39711	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.2	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	7.0	dB/K
Thermal Noise, C/No	97.1	dBHz
C/(No+Io)	96.6	dBHz
Satellite		
Flux Density	-94.0	dBW/m2
SFD @ Hub	-91.5	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	0.5	dB
Downlink		
Frequency	11.790	GHz
Transponder Sat. EIRP @ Beam Peak	51.0	dBW
Transponder Sat. EIRP @ Terminal	50.0	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	11.7	dBW/4kHz
Carrier EIRP @ Beam Peak	50.5	dBW
Carrier EIRP @ Terminal	49.5	dBW
Slant Range	37828	km
Space Loss, Ls	205.4	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.6	dBHz
C/(No+Io)	82.1	dBHz
End to End		
End to End C/(No+Io)	81.9	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	6.2	dB
Link Margin	0.6	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	11.9	deg
Lon	-80.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Telstar 11N	
Longitude	-37.6	deg
Hub Earth Station		
Site	Cologne	
Lat	50.94	deg
Lon	6.96	deg
EIRP max	80.0	dBW
G/T	34.4	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)	3.33E+06	bps
Symbol Rate	6.66E+06	Hz
Chip Rate (Noise Bandwidth)	6.66E+06	Hz
Occupied Bandwidth	7.99E+06	Hz
Power Equivelent Bandwidth	3.57E+05	Hz
C/N Threshold	0.5	dB
Uplink		
Frequency	14.029	GHz
Back off	1.2	dB
EIRP Spectral Density	11.6	dBW/4kHz
Slant Range	37828	km
Space Loss, Ls	206.9	dB
Pointing Loss, Lpnt	0.2	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	70.8	dBHz
C/(No+Io)	70.3	dBHz
Satellite		
Flux Density	-119.4	dBW/m2
SFD @ Terminal	-92.6	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	24.8	dB
Downlink		
Frequency	12.529	GHz
Transponder Sat. EIRP @ Beam Peak	52.0	dBW
Transponder Sat. EIRP @ Hub	52.0	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	-5.0	dBW/4kHz
Carrier EIRP @ Beam Peak	27.2	dBW
Carrier EIRP @ Hub	27.2	dBW
Slant Range	39711	km
Space Loss, Ls	206.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.0	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	79.8	dBHz
C/(No+Io)	73.9971	dBHz
End to End		
End to End C/(No+Io)	68.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	0.5	dB
Link Margin	0.0	dB

17. TELSTAR 12V

Coverage Maps



Satellite Operator Certification Letter

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

13 January 2016

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

Re: Engineering Certification of Telesat

To Whom It May Concern:

This letter certifies that Telesat is aware that Panasonic Avionics Corporation ("Panasonic") 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 Telstar 12 VANTAGE (T12V) satellite located at 15°W.L. Specifically, Telesat understands that Panasonic seeks to operate Panasonic Phased Array ("PPA") antenna as well as Panasonic Single Panel Antenna ("SPA") with this satellite for commercial purposes consistent with the FCC's Part 25 rules, including Section 25.227.

Based on the information provided by Panasonic, Telesat understands the technical characteristics of the above-mentioned antennas and Telesat (i) recognizes that operation of these terminals at the power density levels provided to Telesat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from T12V; (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 Panasonic, Telesat will take into consideration the power density levels associated with such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely Yours,

BAHRAM BORNA
Satellite Spectrum Coordination Engineer
Telesat

Link Budget

Forward Link Budget

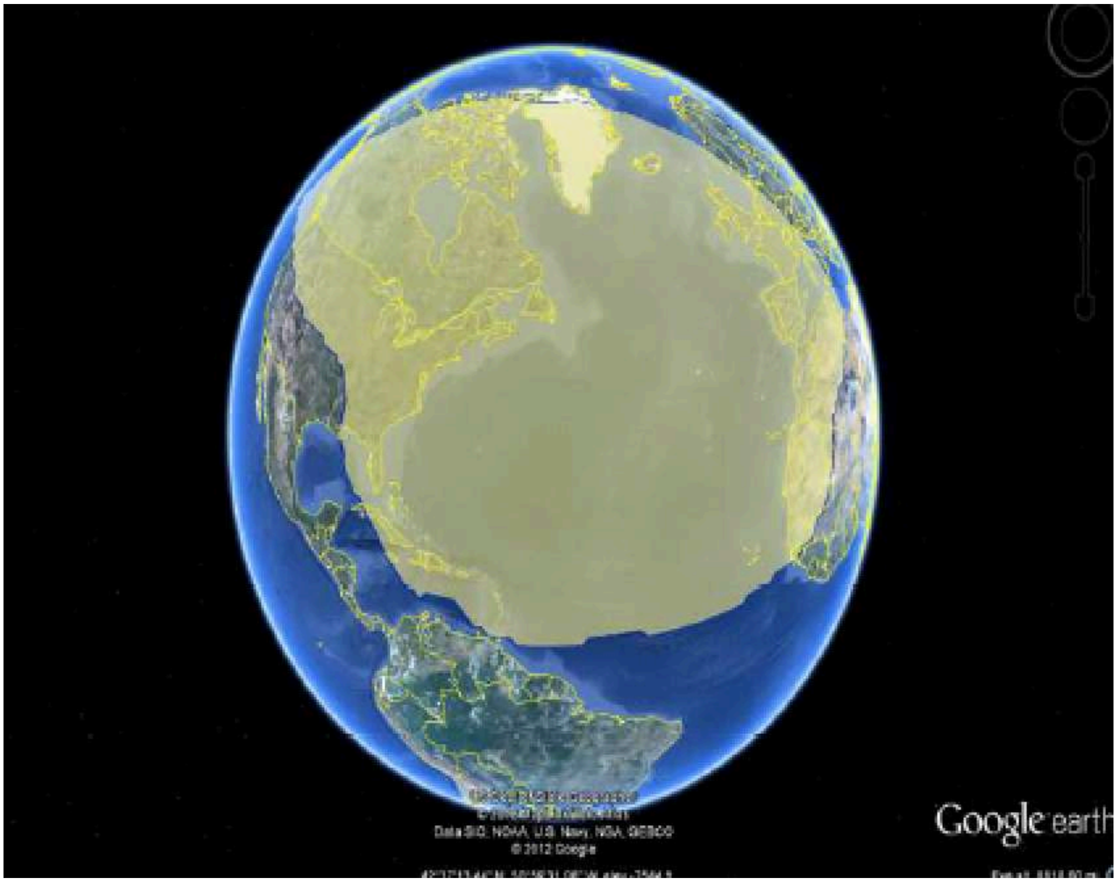
eXConnect Terminal		
Antenna Type	SPA	
Lat	28.0	deg
Lon	45.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	T12V	
Longitude	-15.0	deg
Hub Earth Station		
Site	Mt. Jackson	
Lat	38.746	deg
Lon	-78.653	deg
EIRP max	90.0	dBW
G/T	39.0	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
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	7.01E+07	bps
Information Rate (Data + Overhead)	7.50E+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	4.55E+07	Hz
C/N Threshold	5.6	dB
Uplink		
Frequency	29.810	GHz
Back off	9.3	dB
EIRP Spectral Density	40.2	dBW/4kHz
Slant Range	40403	km
Space Loss, Ls	214.1	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	22.3	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	18.2	dB/K
Thermal Noise, C/No	91.1	dBHz
C/(No+Io)	90.6	dBHz
Satellite		
Flux Density	-104.7	dBW/m2
SFD @ Hub	-95.8	dBW/m2
Small Signal Gain (IBO/OBO)	1.1	dB
OBO	7.8	dB
Downlink		
Frequency	11.138	GHz
Transponder Sat. EIRP @ Beam Peak	59.4	dBW
Transponder Sat. EIRP @ Terminal	58.4	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	11.0	dBW/4kHz
Carrier EIRP @ Beam Peak	51.5	dBW
Carrier EIRP @ Terminal	50.5	dBW
Slant Range	39765	km
Space Loss, Ls	205.4	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	84.6	dBHz
C/(No+Io)	84.3	dBHz
End to End		
End to End C/(No+Io)	83.4	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	5.9	dB
Link Margin	0.3	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	28.0	deg
Lon	45.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	T12V	
Longitude	-15.0	deg
Hub Earth Station		
Site	Mt. Jackson	
Lat	38.746	deg
Lon	-78.653	deg
EIRP max	90.0	dBW
G/T	39.0	dB/K
Signal		
Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.80	
Overhead Rate	0.87	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.39	bps/Hz
Data Rate	9.25E+06	bps
Information Rate (Data + Overhead)	1.07E+07	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	4.23E+06	Hz
C/N Threshold	6.6	dB
Uplink		
Frequency	14.188	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	39765	km
Space Loss, Ls	207.5	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	11.8	dB/K
Thermal Noise, C/No	77.3	dBHz
C/(No+Io)	76.8	dBHz
Satellite		
Flux Density	-118.7	dBW/m2
SFD @ Terminal	-89.8	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	26.8	dB
Downlink		
Frequency	18.488	GHz
Transponder Sat. EIRP @ Beam Peak	63.6	dBW
Transponder Sat. EIRP @ Hub	63.6	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	4.5	dBW/4kHz
Carrier EIRP @ Beam Peak	36.8	dBW
Carrier EIRP @ Hub	36.8	dBW
Slant Range	40403	km
Space Loss, Ls	209.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	12.6	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	81.9	dBHz
C/(No+Io)	80.5878	dBHz
End to End		
End to End C/(No+Io)	75.3	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	7.0	dB
Link Margin	0.4	dB

18. TELSTAR 14R

Coverage Map



Satellite Operator Certification Letter

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

4 January 2016

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

Re: Engineering Certification of Telesat

To Whom It May Concern:

This letter certifies that Telesat is aware that Panasonic Avionics Corporation ("Panasonic") 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 Telstar 11N, Telstar 14R, Anik F1R, and Anik G1 satellites located at 37.55°W.L., 63°W.L., 107.3°W.L., and 107.3°W.L., respectively. Specifically, Telesat understands that in addition to Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's Part 25 rules, including Section 25.227.

Based on the information provided by Panasonic, Telesat understands the technical characteristics of the SPA and Telesat (i) recognizes that operation of these terminals at the power density levels provided to Telesat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from Telstar 11N, Telstar 14R, Anik F1R, and Anik G1; (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 Panasonic, Telesat will take into consideration the power density levels associated with such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely Yours,

BAHRAM BORNA
Satellite Spectrum Coordination Engineer
Telesat

Link Budget

Forward Link Budget

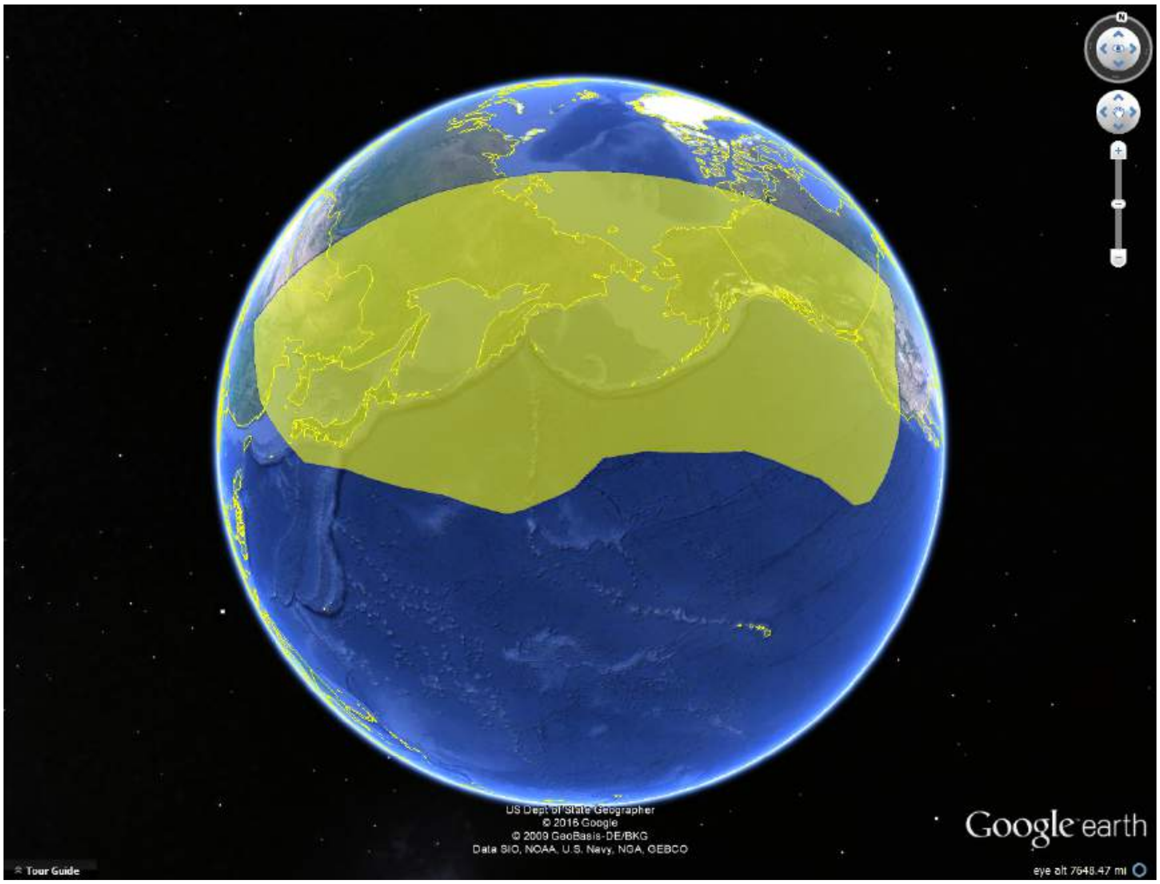
eXConnect Terminal		
Antenna Type	SPA	
Lat	38.0	deg
Lon	-75.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Telstar 14R	
Longitude	-63.1	deg
Hub Earth Station		
Site	Mt. Jackson	
Lat	38.73	deg
Lon	-78.658	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K
Signal		
Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	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	2.63E+07	bps
Information Rate (Data + Overhead)	2.86E+07	bps
Symbol Rate	1.79E+07	Hz
Chip Rate (Noise Bandwidth)	1.79E+07	Hz
Occupied Bandwidth	2.14E+07	Hz
Power Equivelent Bandwidth	3.60E+07	Hz
C/N Threshold	5.1	dB
Uplink		
Frequency	13.934	GHz
Back off	5.3	dB
EIRP Spectral Density	38.2	dBW/4kHz
Slant Range	37613	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.9	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	0.0	dB/K
Thermal Noise, C/No	93.6	dBHz
C/(No+Io)	93.1	dBHz
Satellite		
Flux Density	-90.6	dBW/m2
SFD @ Hub	-87.1	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	1.5	dB
Downlink		
Frequency	11.634	GHz
Transponder Sat. EIRP @ Beam Peak	48.7	dBW
Transponder Sat. EIRP @ Terminal	47.0	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	10.6	dBW/4kHz
Carrier EIRP @ Beam Peak	47.2	dBW
Carrier EIRP @ Terminal	45.5	dBW
Slant Range	37474	km
Space Loss, Ls	205.2	dB
Pointing Loss, Lpnt	0.1	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+Io)	79.2	dBHz
End to End		
End to End C/(No+Io)	79.0	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	5.5	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	38.0	deg
Lon	-75.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Telstar 14R	
Longitude	-63.1	deg
Hub Earth Station		
Site	Mt. Jackson	
Lat	38.73	deg
Lon	-78.658	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 Equivelent Bandwidth	3.66E+05	Hz
C/N Threshold	-4.2	dB
Uplink		
Frequency	14.104	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	37474	km
Space Loss, Ls	206.9	dB
Pointing Loss, Lpnt	0.2	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	65.0	dBHz
C/(No+Io)	64.5	dBHz
Satellite		
Flux Density	-118.1	dBW/m2
SFD @ Terminal	-93.2	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	22.9	dB
Downlink		
Frequency	11.804	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	-7.2	dBW/4kHz
Carrier EIRP @ Beam Peak	25.1	dBW
Carrier EIRP @ Hub	25.1	dBW
Slant Range	37613	km
Space Loss, Ls	205.4	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	81.9	dBHz
C/(No+Io)	74.6073	dBHz
End to End		
End to End C/(No+Io)	64.1	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-4.1	dB
Link Margin	0.1	dB

19. YAMAL 300K

Coverage Map



Satellite Operator Certification Letter

ОТКРЫТОЕ
АКЦИОНЕРНОЕ ОБЩЕСТВО
«ГАЗПРОМ КОСМИЧЕСКИЕ СИСТЕМЫ»

(ОАО «Газпром космические системы»)
а/я 1860, ОПС Щелково-12, Московская область, Российская Федерация, 141112
Тел.: (495) 5042906, (495) 5042907, факс: (495) 5042911
E-mail: info@gazprom-spacesystems.ru, www.gazprom-spacesystems.ru

JOINT STOCK COMPANY
«GAZPROM SPACE SYSTEMS»

(JSC Gazprom Space Systems)
Box 1860, Shchelkovo Post Office-12, Moscow Region, Russian Federation, 141112
Tel.: +7 (495) 5042906, +7 (495) 5042907, fax: +7 (495) 5042911
E-mail: info@gazprom-spacesystems.ru, www.gazprom-spacesystems.ru

19. 01. 2016 № ИК-06/380/118

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

Re: Engineering Certification of Gazprom Space Systems.

To Whom It May Concern:

This letter certifies that Gazprom Space Systems. ("GSS") is aware that Panasonic Avionics Corporation ("Panasonic") is planning to seek a modification to its blanket authorization from the Federal Communications Commission ("FCC") to operate technically identical Ku-band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E100089, with the Yamal-401 satellite at 90°E and the Yamal-300K satellite at 183°E. Specifically, we understand that in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

GSS certifies that the proposed operation of the SPA transmit/receive terminals at the power density levels specified in the application is consistent with existing operator-to-operator coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from the Yamal-401 and Yamal-300K satellites. GSS also acknowledges that the proposed operation of the Panasonic ESAA terminal has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable. If the FCC authorizes the operations proposed by Panasonic, GSS will endeavor to include the power density levels specified by Panasonic in all future satellite network coordinations with other adjacent satellite operators.

Best regards,

Igor Kot,
Deputy Director General

Link Budget

Forward Link Budget

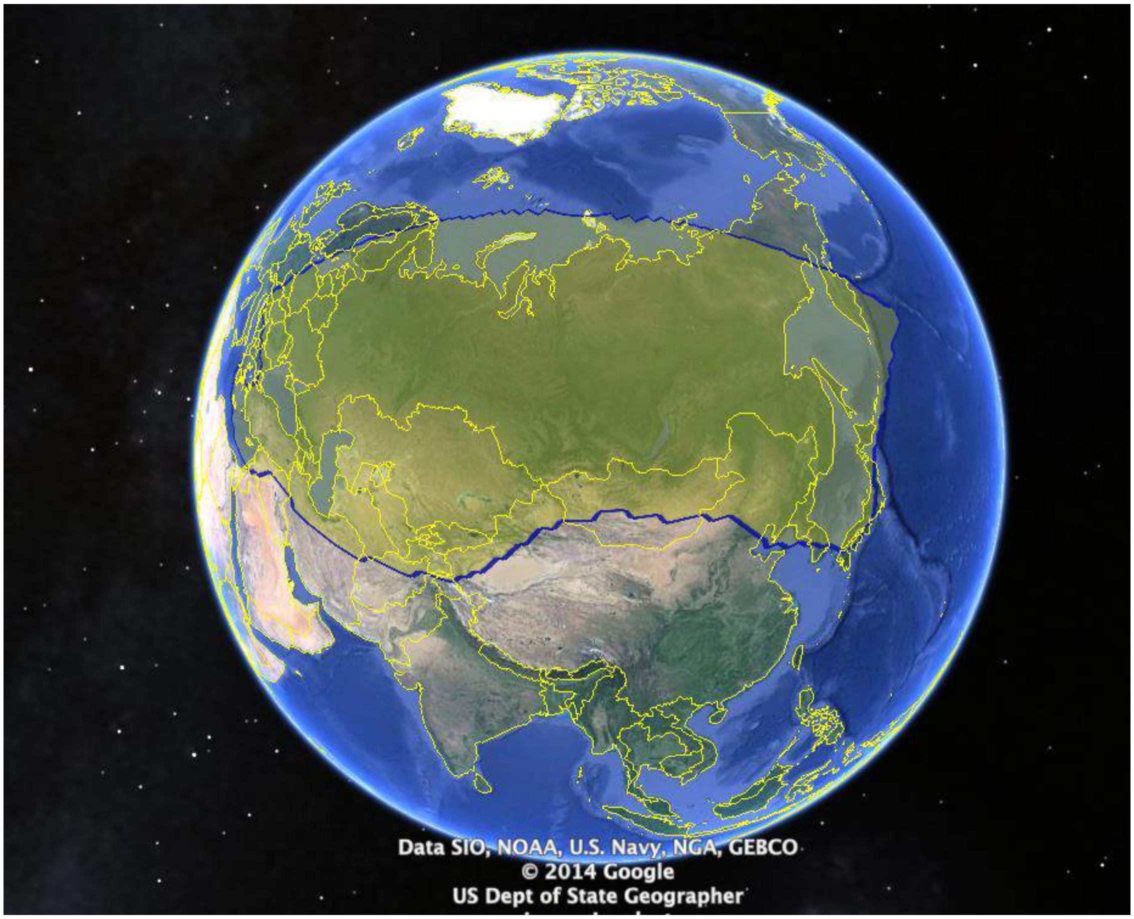
eXConnect Terminal		
Antenna Type	SPA	
Lat	47.9	deg
Lon	-129.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Yamal-300K	
Longitude	183.0	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	36.8	dB/K
Signal		
Waveform	DVB-S2	
Modulation	16APSK	
Bits per symbol	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	6.49E+07	bps
Information Rate (Data + Overhead)	6.93E+07	bps
Symbol Rate	2.60E+07	Hz
Chip Rate (Noise Bandwidth)	2.60E+07	Hz
Occupied Bandwidth	3.12E+07	Hz
Power Equivelent Bandwidth	6.46E+07	Hz
C/N Threshold	9.6	dB
Uplink		
Frequency	14.380	GHz
Back off	5.1	dB
EIRP Spectral Density	36.7	dBW/4kHz
Slant Range	40299	km
Space Loss, Ls	207.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.2	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	5.0	dB/K
Thermal Noise, C/No	97.5	dBHz
C/(No+Io)	97.0	dBHz
Satellite		
Flux Density	-91.5	dBW/m2
SFD @ Hub	-87.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	1.5	dB
Downlink		
Frequency	11.580	GHz
Transponder Sat. EIRP @ Beam Peak	53.6	dBW
Transponder Sat. EIRP @ Terminal	53.5	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	14.0	dBW/4kHz
Carrier EIRP @ Beam Peak	52.1	dBW
Carrier EIRP @ Terminal	52.0	dBW
Slant Range	39714	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	85.8	dBHz
C/(No+Io)	85.6	dBHz
End to End		
End to End C/(No+Io)	85.3	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	10.1	dB
Link Margin	0.5	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	47.9	deg
Lon	-129.1	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Yamal-300K	
Longitude	183.0	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	36.8	dB/K
Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	1	
Coding Rate	0.50	
Overhead Rate	0.78	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.39	bps/Hz
Data Rate	2.59E+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 Equivelent Bandwidth	4.82E+05	Hz
C/N Threshold	1.2	dB
Uplink		
Frequency	14.210	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	39714	km
Space Loss, Ls	207.5	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	6.5	dB/K
Thermal Noise, C/No	72.0	dBHz
C/(No+Io)	71.5	dBHz
Satellite		
Flux Density	-118.6	dBW/m2
SFD @ Terminal	-90.9	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	24.7	dB
Downlink		
Frequency	11.160	GHz
Transponder Sat. EIRP @ Beam Peak	53.6	dBW
Transponder Sat. EIRP @ Hub	52.0	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	-3.4	dBW/4kHz
Carrier EIRP @ Beam Peak	28.9	dBW
Carrier EIRP @ Hub	27.3	dBW
Slant Range	40299	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	3.3	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.9	dBHz
C/(No+Io)	75.9563	dBHz
End to End		
End to End C/(No+Io)	70.2	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	1.9	dB
Link Margin	0.7	dB

20. YAMAL 401

Coverage Map



Satellite Operator Certification Letter

ОТКРЫТОЕ
АКЦИОНЕРНОЕ ОБЩЕСТВО
«ГАЗПРОМ КОСМИЧЕСКИЕ СИСТЕМЫ»

(ОАО «Газпром космические системы»)
а/я 1860, ОПС Щелково-12, Московская область, Российская Федерация, 141112
Тел.: (495) 5042906, (495) 5042907, факс: (495) 5042911
E-mail: info@gazprom-spacesystems.ru, www.gazprom-spacesystems.ru

JOINT STOCK COMPANY
«GAZPROM SPACE SYSTEMS»

(JSC Gazprom Space Systems)
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Tel.: +7 (495) 5042906, +7 (495) 5042907, fax: +7 (495) 5042911
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19. 01. 2016 №ИК-06/380/118

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

Re: Engineering Certification of Gazprom Space Systems.

To Whom It May Concern:

This letter certifies that Gazprom Space Systems. ("GSS") is aware that Panasonic Avionics Corporation ("Panasonic") is planning to seek a modification to its blanket authorization from the Federal Communications Commission ("FCC") to operate technically identical Ku-band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E100089, with the Yamal-401 satellite at 90°E and the Yamal-300K satellite at 183°E. Specifically, we understand that in addition to the previously authorized Panasonic Phased Array ("PPA") and MELCO Ku-band antenna systems, Panasonic seeks to operate the new Panasonic Single Panel Antenna ("SPA") with these satellites for commercial purposes consistent with the FCC's ESAA rules, including Section 25.227.

GSS certifies that the proposed operation of the SPA transmit/receive terminals at the power density levels specified in the application is consistent with existing operator-to-operator coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from the Yamal-401 and Yamal-300K satellites. GSS also acknowledges that the proposed operation of the Panasonic ESAA terminal has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable. If the FCC authorizes the operations proposed by Panasonic, GSS will endeavor to include the power density levels specified by Panasonic in all future satellite network coordinations with other adjacent satellite operators.

Best regards,

Igor Kot,
Deputy Director General

ОАО "ГАЗПРОМ"
ОАО "ГАЗПРОМ КОСМИЧЕСКИЕ СИСТЕМЫ"

Link Budget

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	49.8	deg
Lon	39.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Yamal-401	
Longitude	90.0	deg
Hub Earth Station		
Site	Moscow	
Lat	55.8	deg
Lon	37.6	deg
EIRP max	80.0	dBW
G/T	38.5	dB/K
Signal		
Waveform	DVB-S2	
Modulation	8PSK	
Bits per symbol	3	
Spread Factor	1	
Coding Rate	0.67	
Overhead Rate	0.94	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.88	bps/Hz
Data Rate	3.76E+07	bps
Information Rate (Data + Overhead)	4.00E+07	bps
Symbol Rate	2.00E+07	Hz
Chip Rate (Noise Bandwidth)	2.00E+07	Hz
Occupied Bandwidth	2.40E+07	Hz
Power Equivelent Bandwidth	7.20E+07	Hz
C/N Threshold	7.4	dB
Uplink		
Frequency	14.380	GHz
Back off	6.8	dB
EIRP Spectral Density	36.2	dBW/4kHz
Slant Range	40424	km
Space Loss, Ls	207.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.8	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	5.0	dB/K
Thermal Noise, C/No	94.2	dBHz
C/(No+Io)	93.7	dBHz
Satellite		
Flux Density	-94.8	dBW/m2
SFD @ Hub	-88.8	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	3.0	dB
Downlink		
Frequency	11.580	GHz
Transponder Sat. EIRP @ Beam Peak	52.1	dBW
Transponder Sat. EIRP @ Terminal	51.5	dBW
DL PSD Limit	14.2	dBW/4kHz
DL PSD @ Beam Peak	12.1	dBW/4kHz
Carrier EIRP @ Beam Peak	49.1	dBW
Carrier EIRP @ Terminal	48.5	dBW
Slant Range	39954	km
Space Loss, Ls	205.8	dB
Pointing Loss, Lpnt	0.1	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)	82.1	dBHz
End to End		
End to End C/(No+Io)	81.8	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	7.8	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	49.8	deg
Lon	39.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	Yamal-401	
Longitude	90.0	deg
Hub Earth Station		
Site	Moscow	
Lat	55.8	deg
Lon	37.6	deg
EIRP max	80.0	dBW
G/T	38.5	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 Equivelent Bandwidth	3.07E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.460	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	39954	km
Space Loss, Ls	207.7	dB
Pointing Loss, Lpnt	0.2	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	70.2	dBHz
C/(No+Io)	69.7	dBHz
Satellite		
Flux Density	-118.7	dBW/m2
SFD @ Terminal	-89.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	26.7	dB
Downlink		
Frequency	11.660	GHz
Transponder Sat. EIRP @ Beam Peak	52.1	dBW
Transponder Sat. EIRP @ Hub	51.5	dBW
DL PSD Limit	14.2	dBW/4kHz
DL PSD @ Beam Peak	-6.8	dBW/4kHz
Carrier EIRP @ Beam Peak	25.4	dBW
Carrier EIRP @ Hub	24.8	dBW
Slant Range	40424	km
Space Loss, Ls	205.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	5.2	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	80.8	dBHz
C/(No+Io)	73.7714	dBHz
End to End		
End to End C/(No+Io)	68.3	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	0.0	dB
Link Margin	1.2	dB

III. SPA Terminal Off-Axis EIRP Spectral Density & Gain Data

PANASONIC AVIONICS

Single Panel Antenna ("SPA")

Annex 2
Representative Off-Axis EIRP Spectral Density
(20° and 50° Skew Angles)

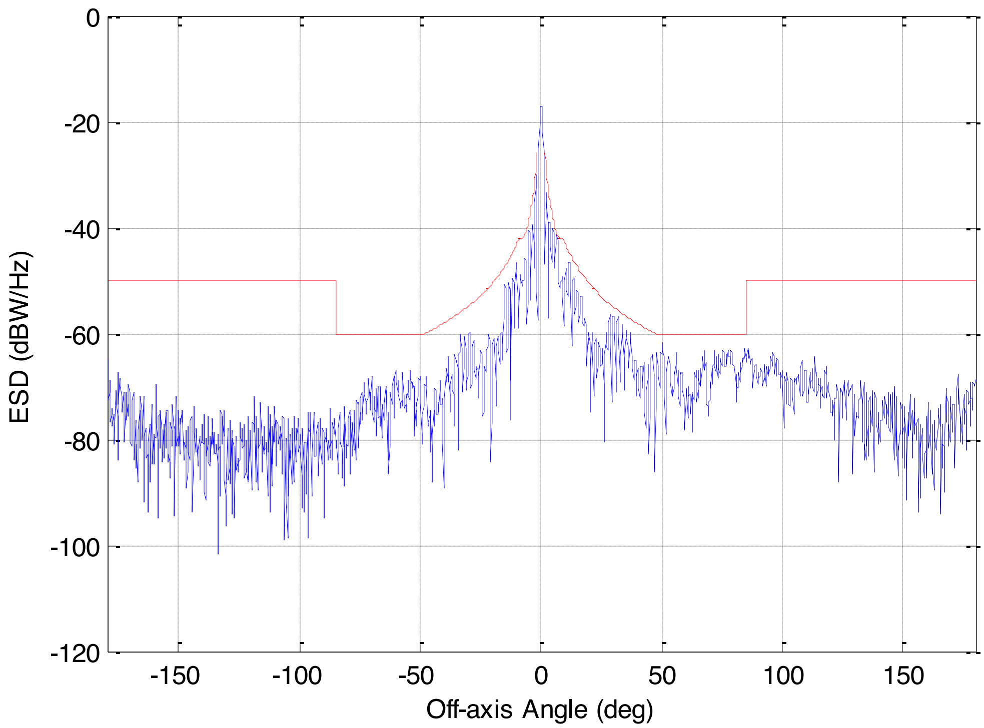

Figure 10. Tx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 20°
Bandwith: 8.36e-03 MHz

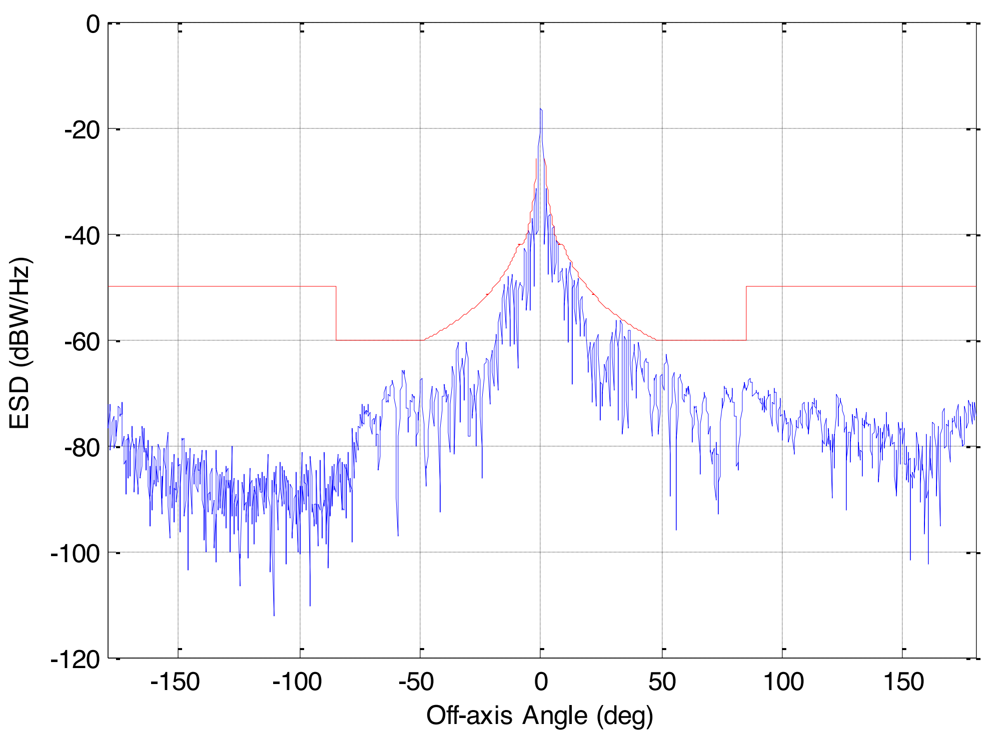

Figure 11. Tx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 20°
Bandwith: 1.09e-02 MHz

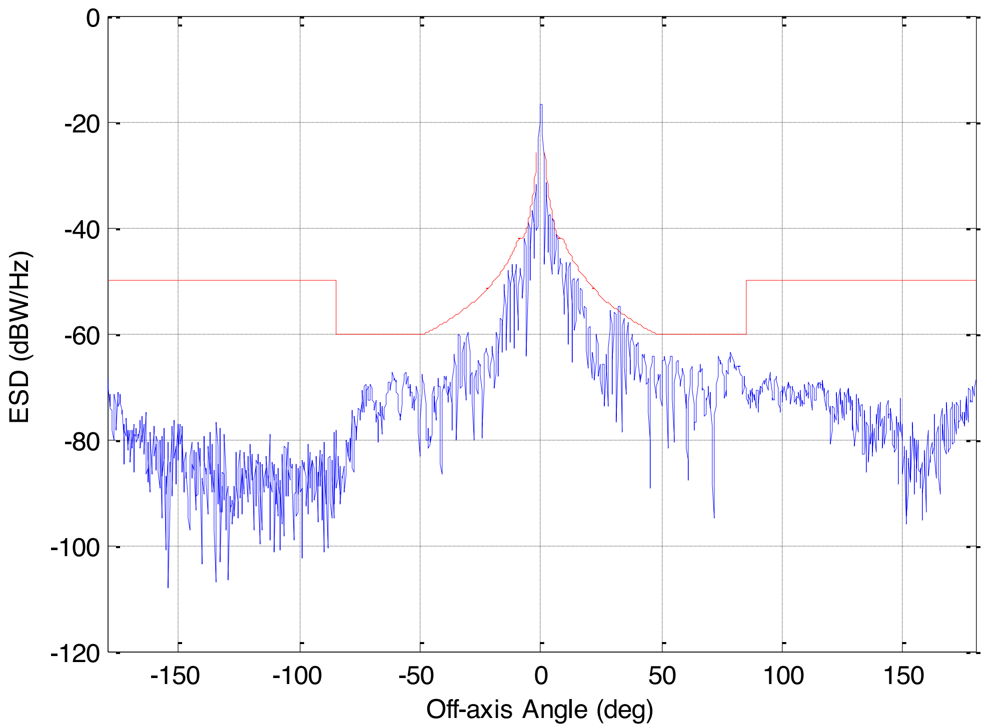

Figure 12. Tx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 20°
Bandwith: 6.09e-03 MHz

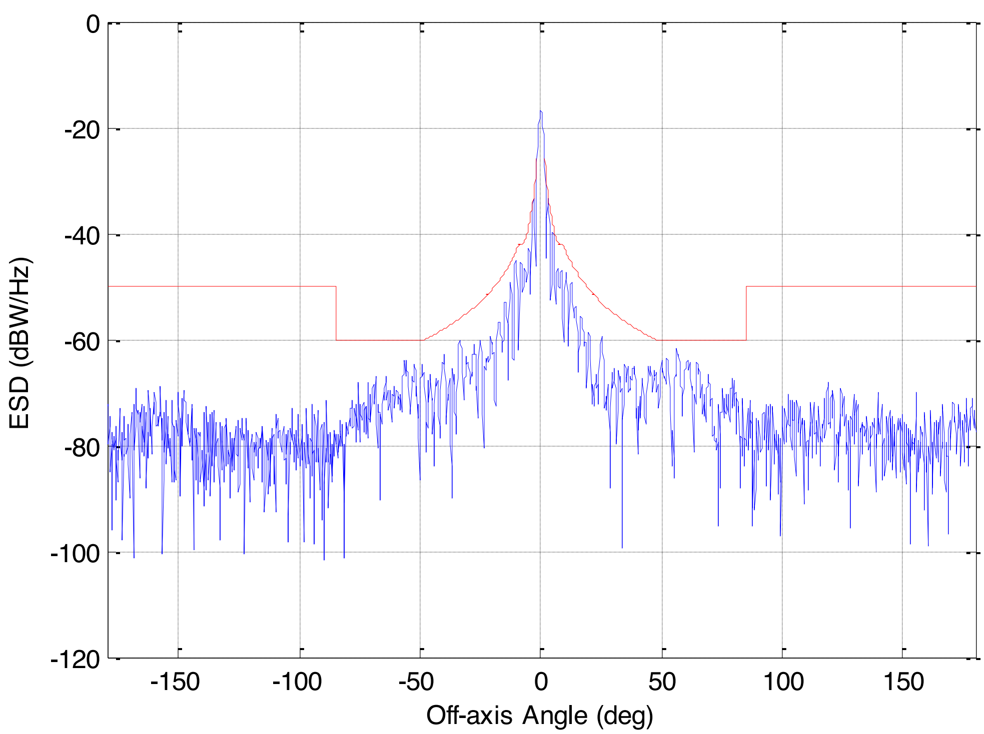

Figure 28. Tx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 50°
Bandwith: 4.29e-02 MHz

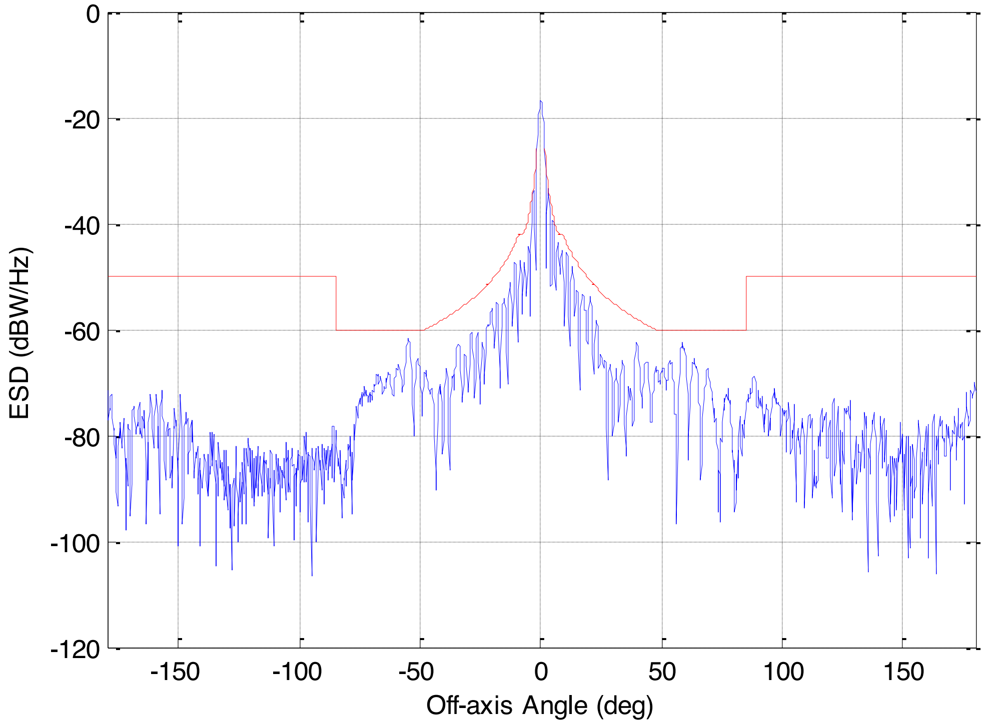

Figure 29. Tx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 50°
Bandwith: 4.07e-02 MHz

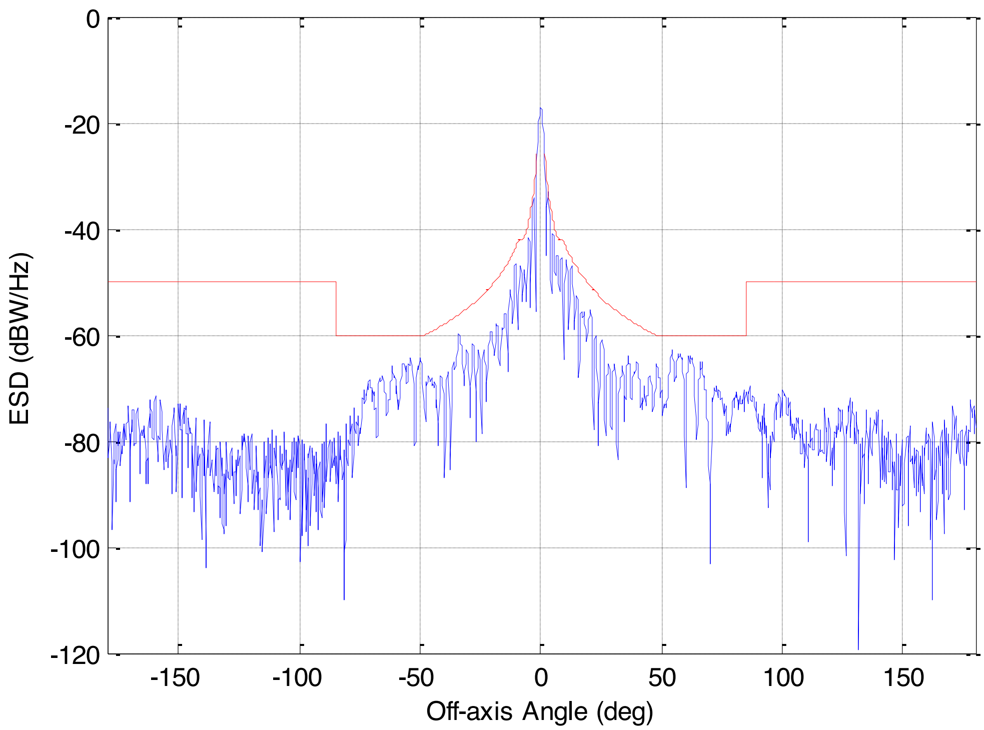

Figure 30. Tx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 50°
Bandwith: 5.16e-02 MHz

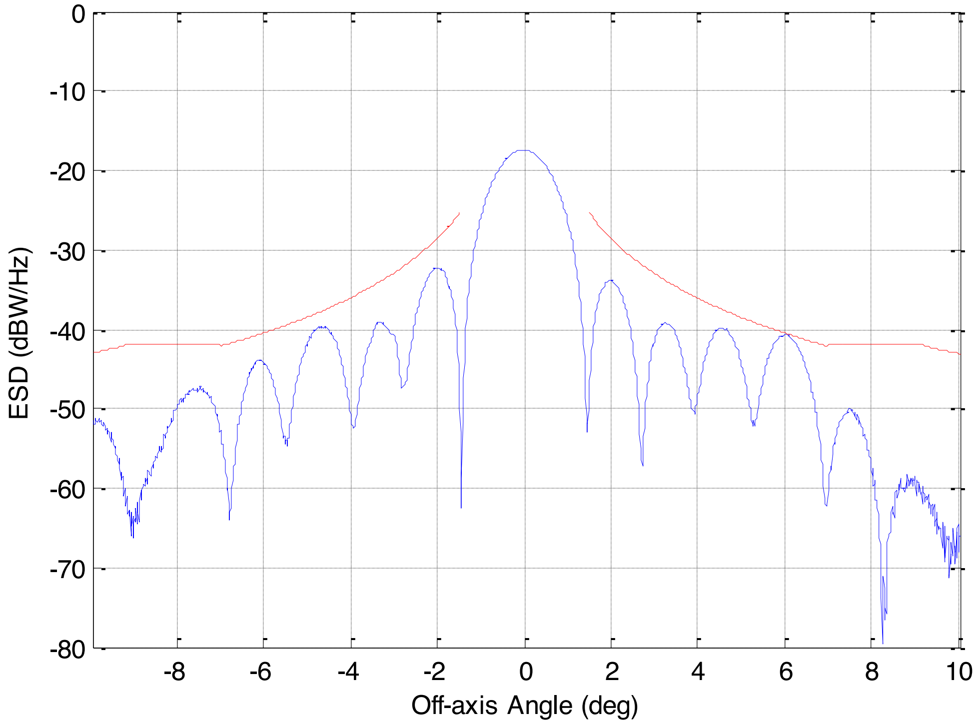

Figure 58. Tx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 0°
Bandwith: 1.13e-02 MHz

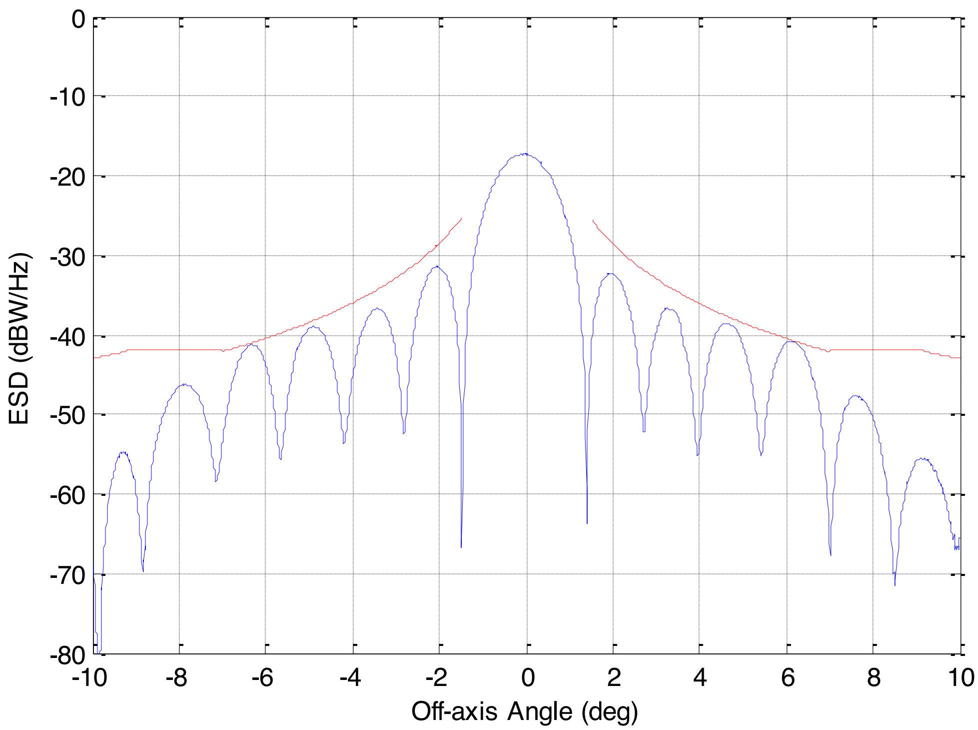

Figure 59. Tx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 0°
Bandwith: 9.85e-03 MHz

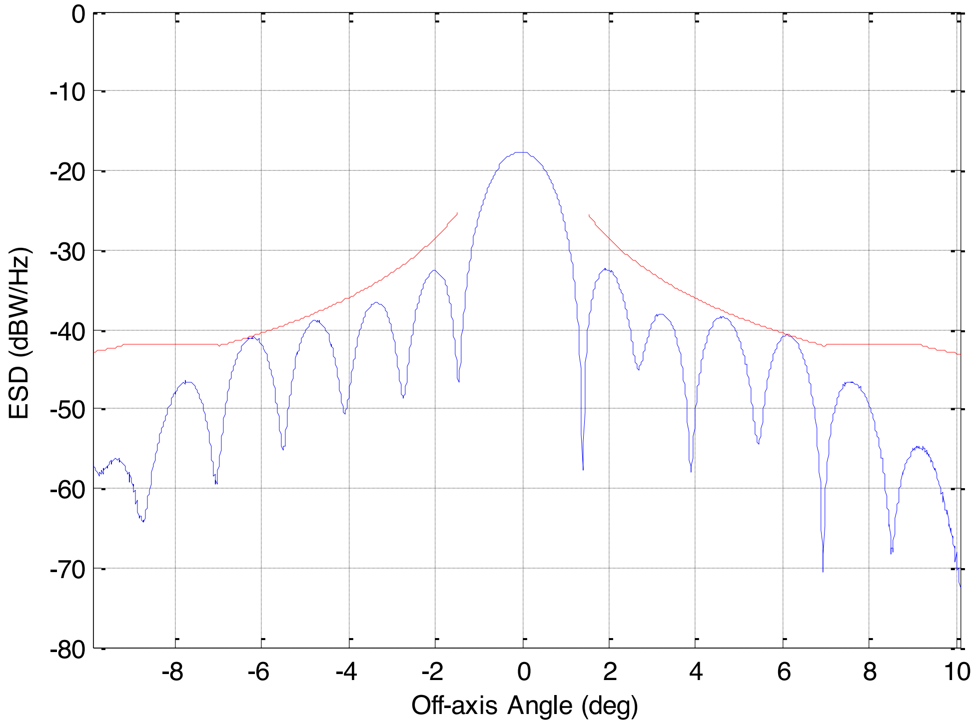

Figure 60. Tx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 0°
Bandwith: 1.11e-02 MHz

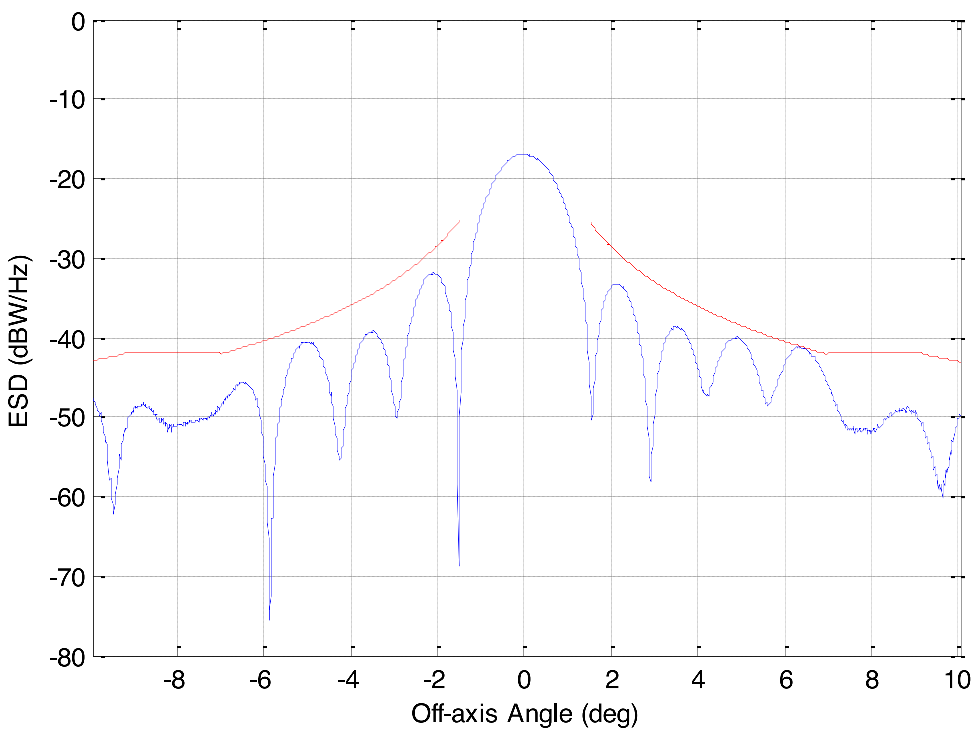

Figure 67. Tx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 20°
Bandwith: 7.51e-03 MHz

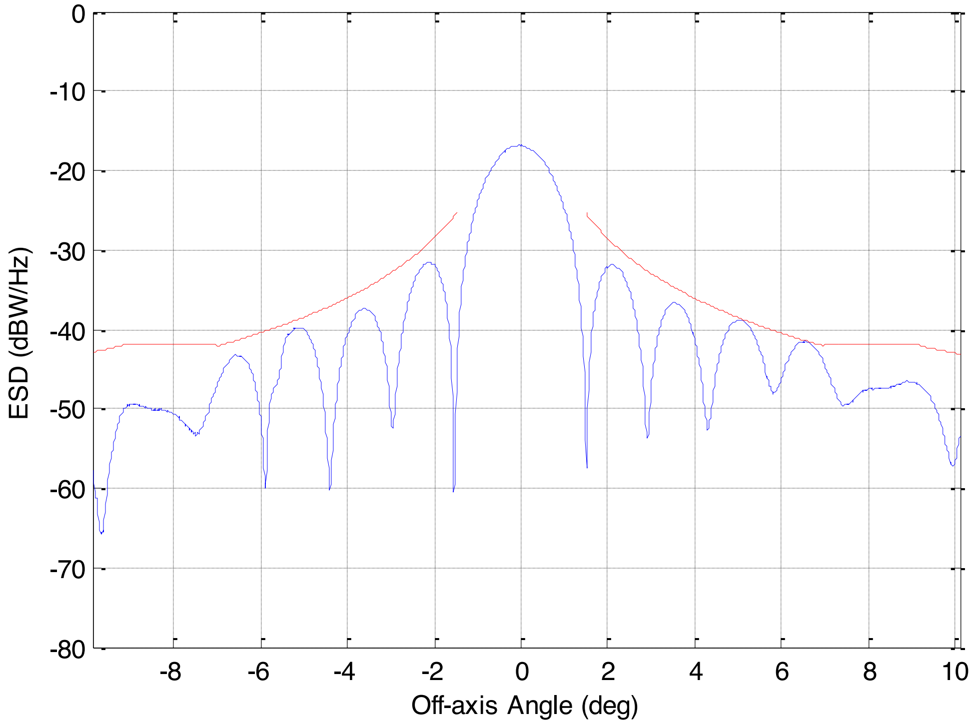

Figure 68. Tx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 20°
Bandwith: 6.80e-03 MHz

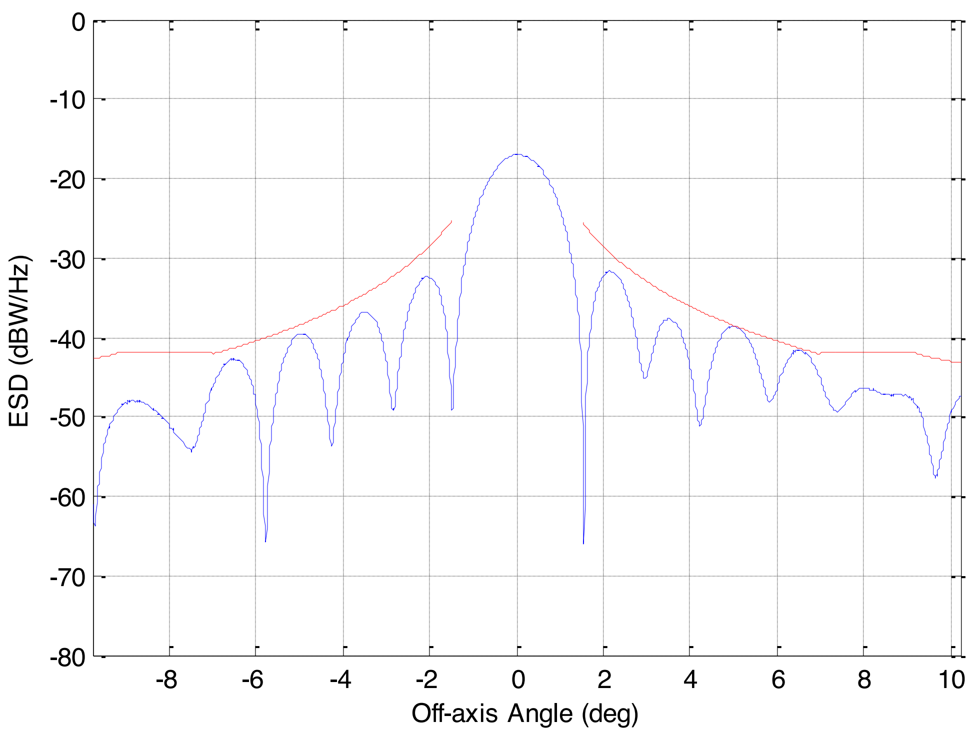

Figure 69. Tx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 20°
Bandwith: 1.37e-02 MHz

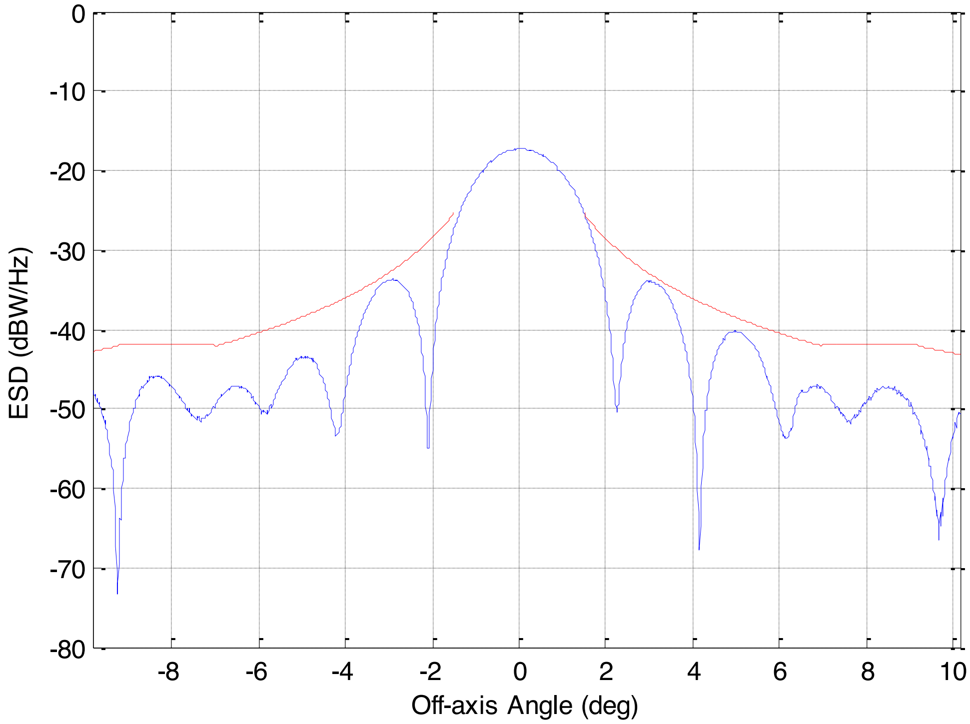

Figure 85. Tx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 50°
Bandwith: 3.39e-01 MHz

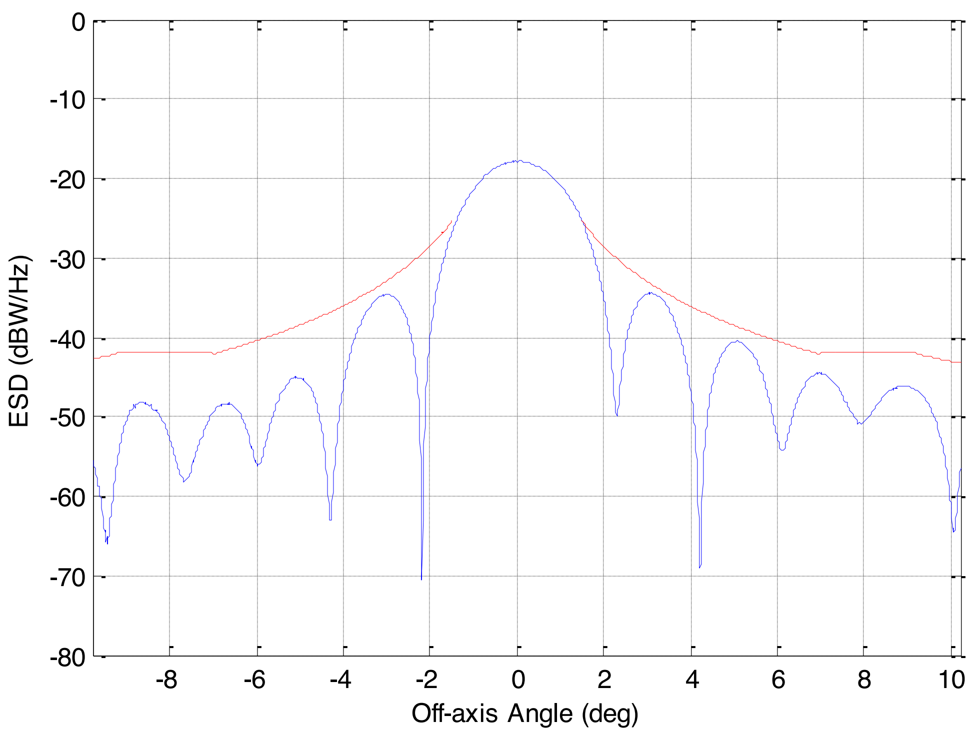

Figure 86. Tx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 50°
Bandwith: 4.14e-01 MHz

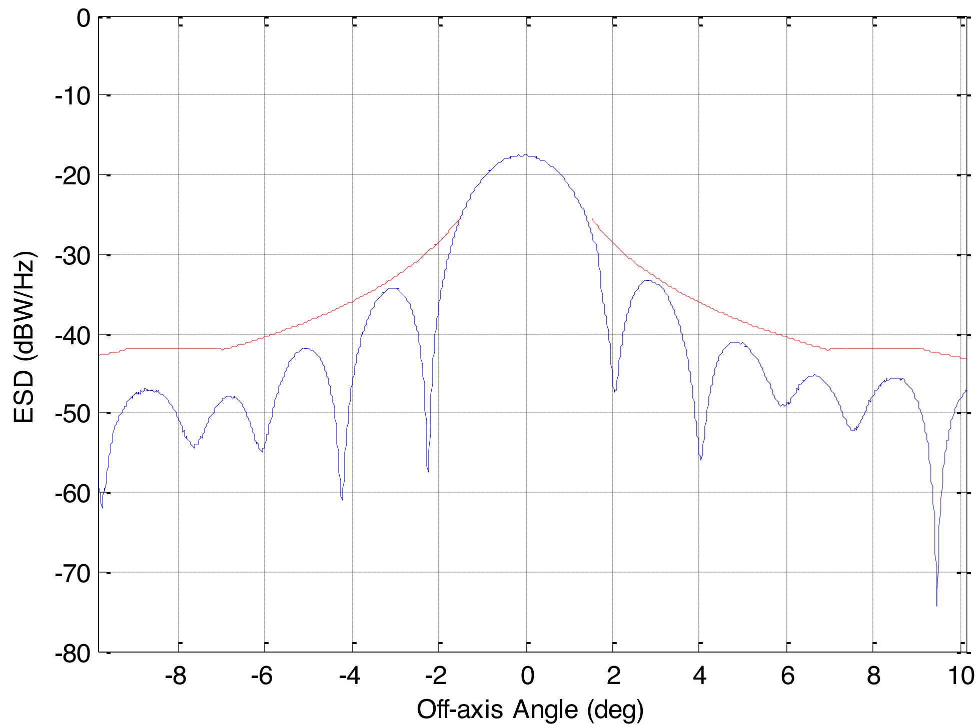

Figure 87. Tx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 50°
Bandwith: 3.68e-01 MHz

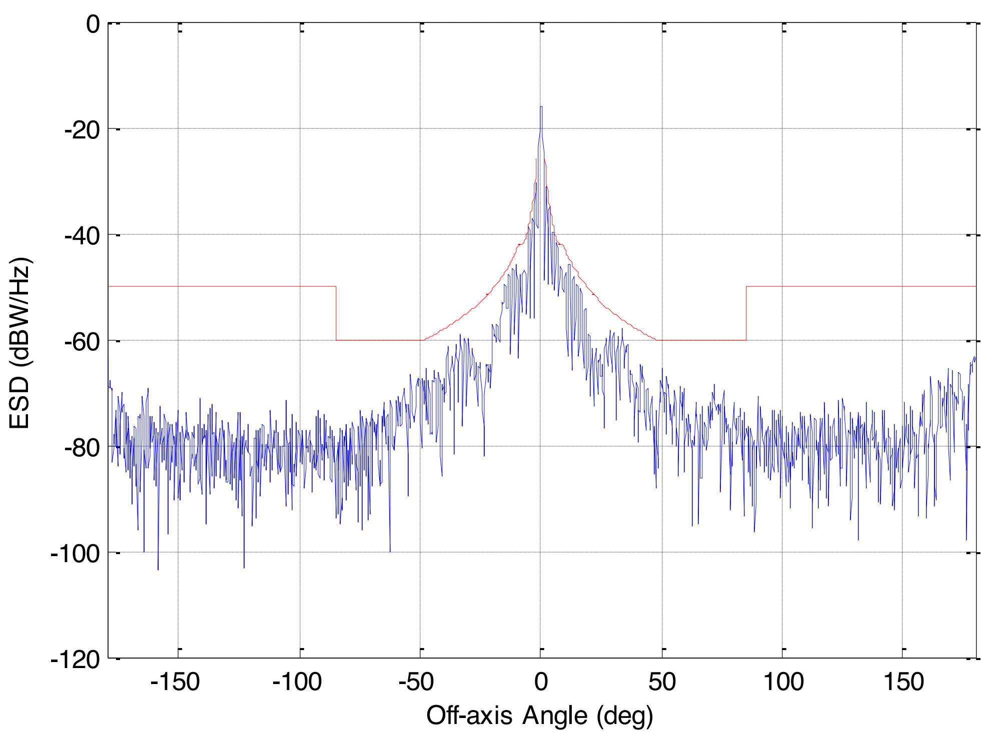

Figure 124. Tx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 20°
Bandwith: 2.23e-02 MHz

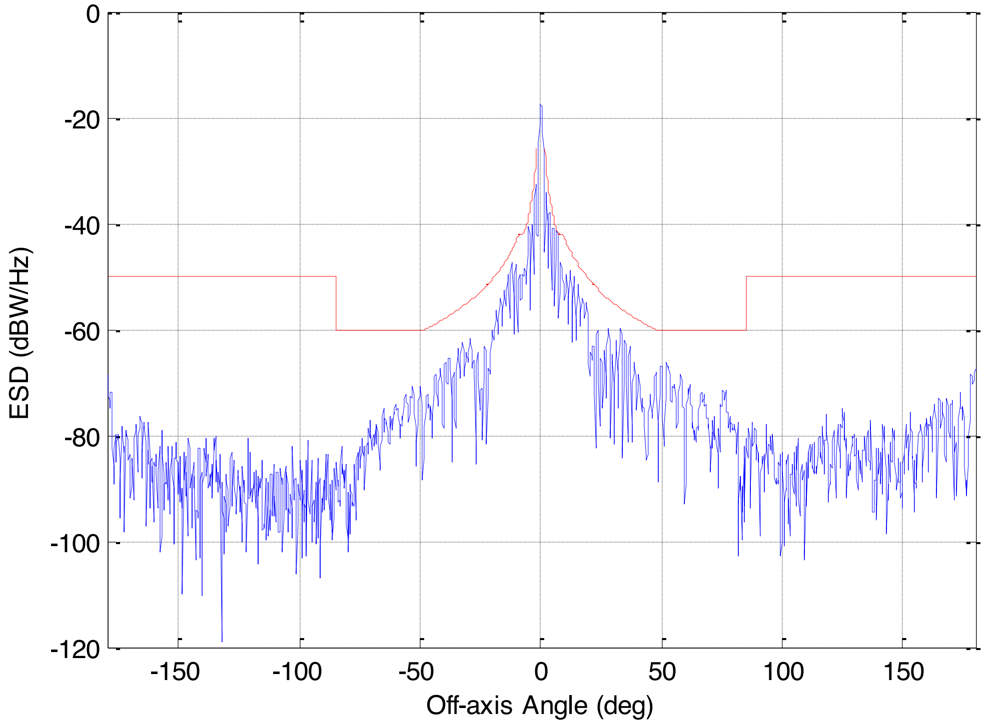

Figure 125. Tx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 20°
Bandwith: 1.03e-02 MHz

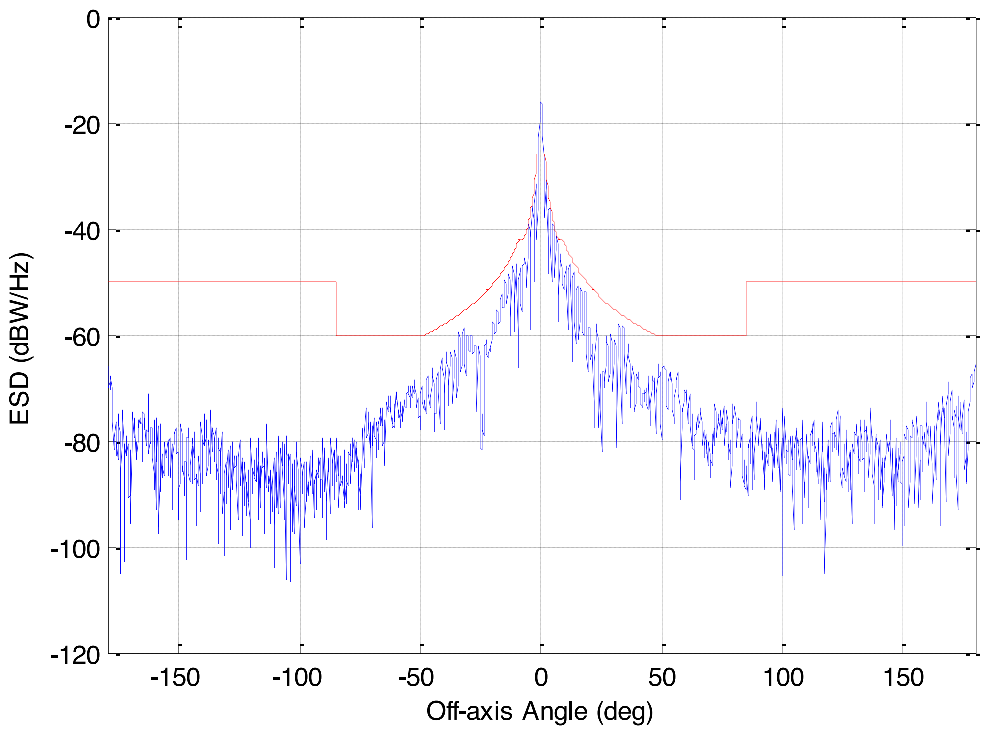

Figure 126. Tx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 20°
Bandwith: 5.01e-03 MHz

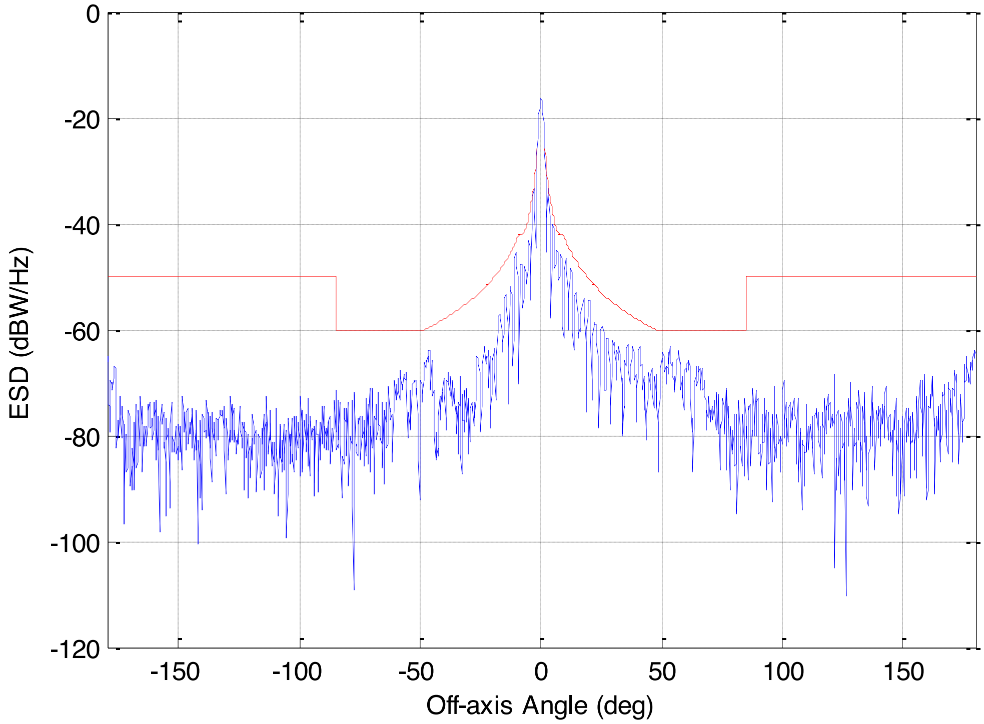

Figure 142. Tx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 50°
Bandwith: 3.75e-02 MHz

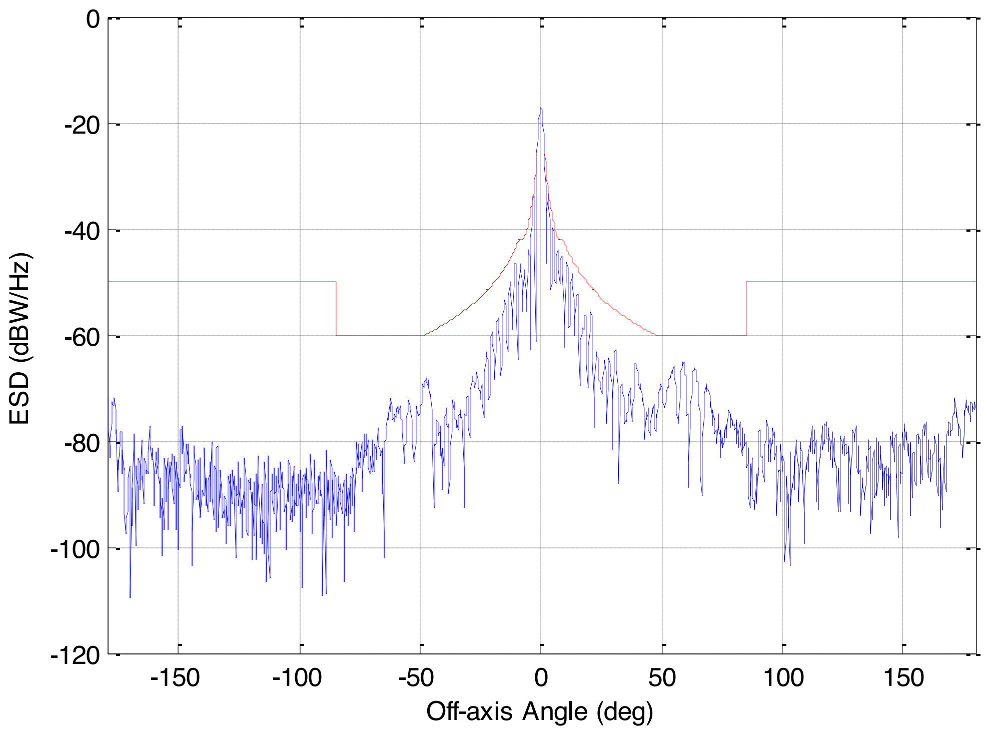

Figure 143. Tx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 50°
Bandwith: 2.87e-01 MHz

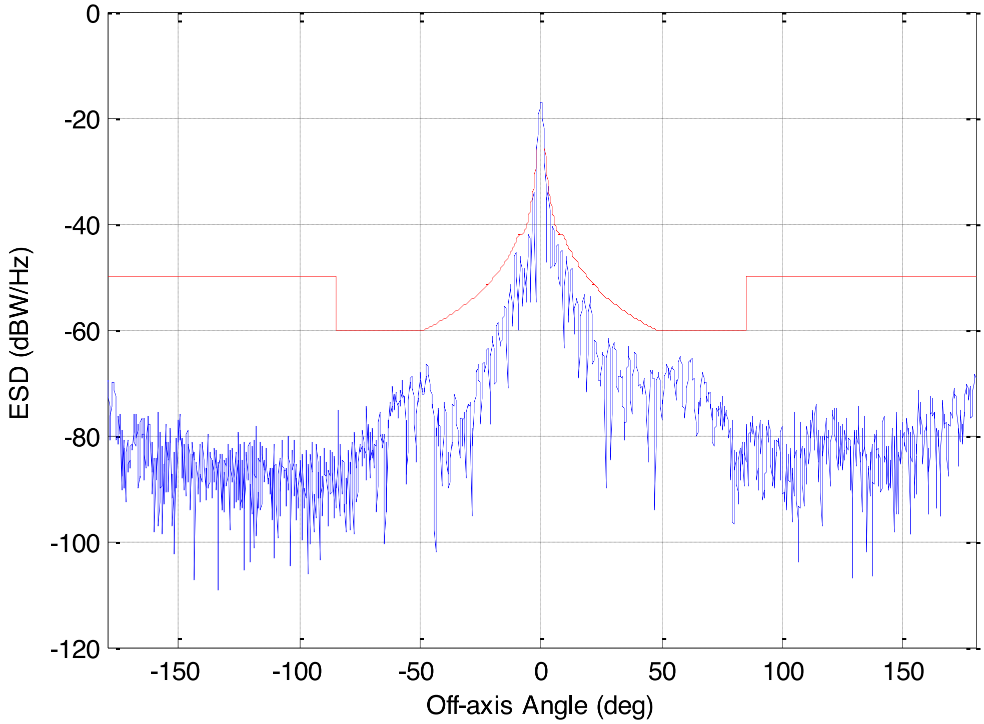

Figure 144. Tx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 50°
Bandwith: 4.64e-02 MHz

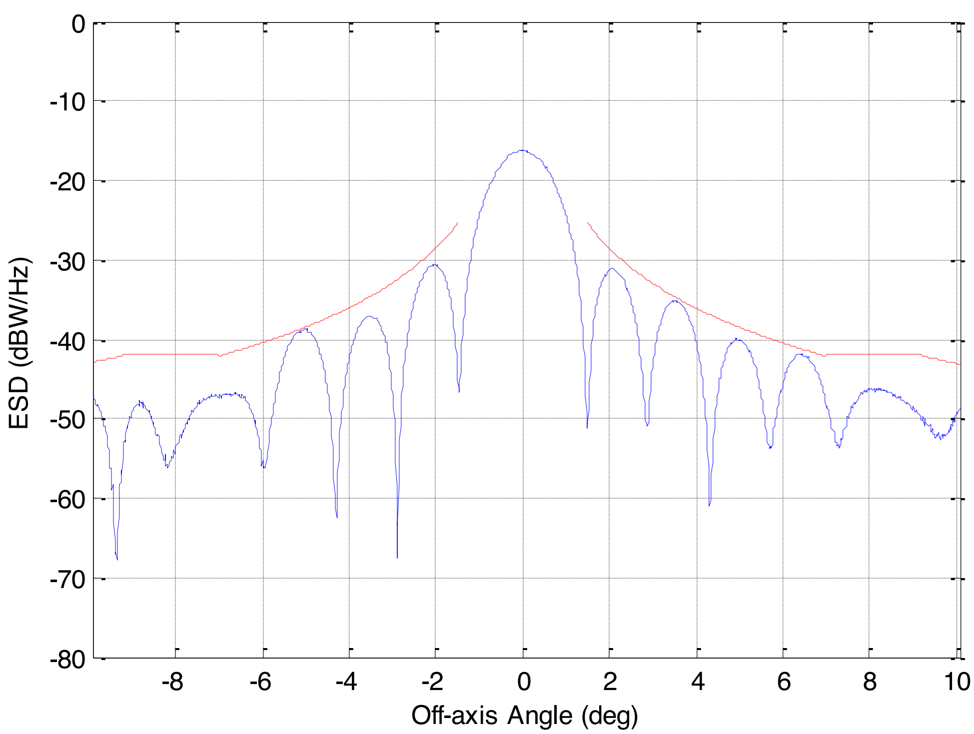

Figure 181. Tx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 20°
Bandwith: 1.00e-02 MHz

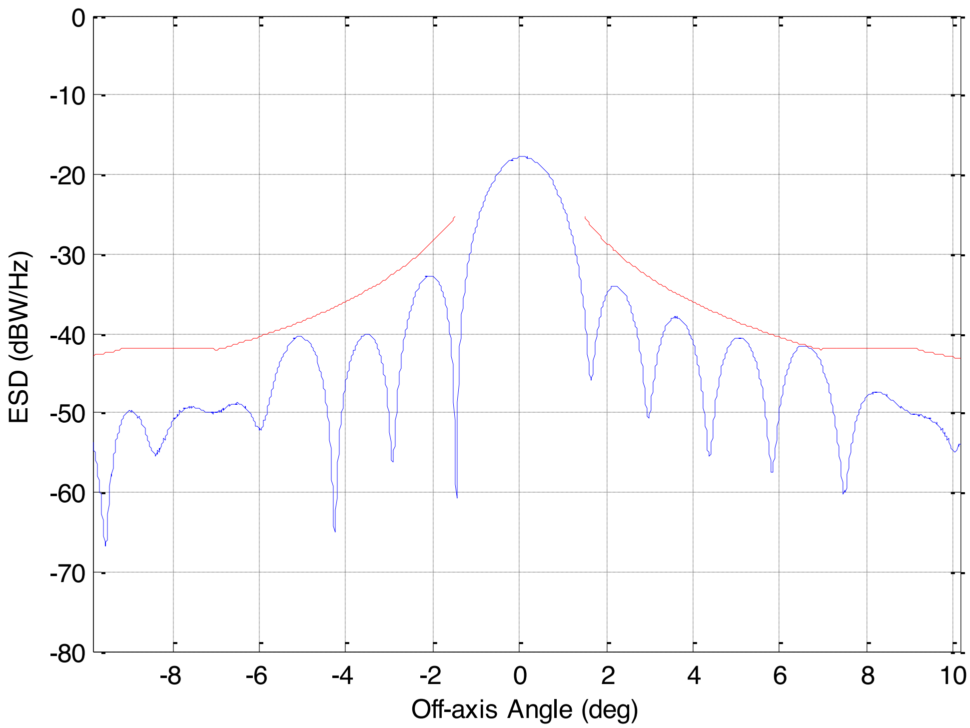

Figure 182. Tx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 20°
Bandwith: 1.04e-02 MHz

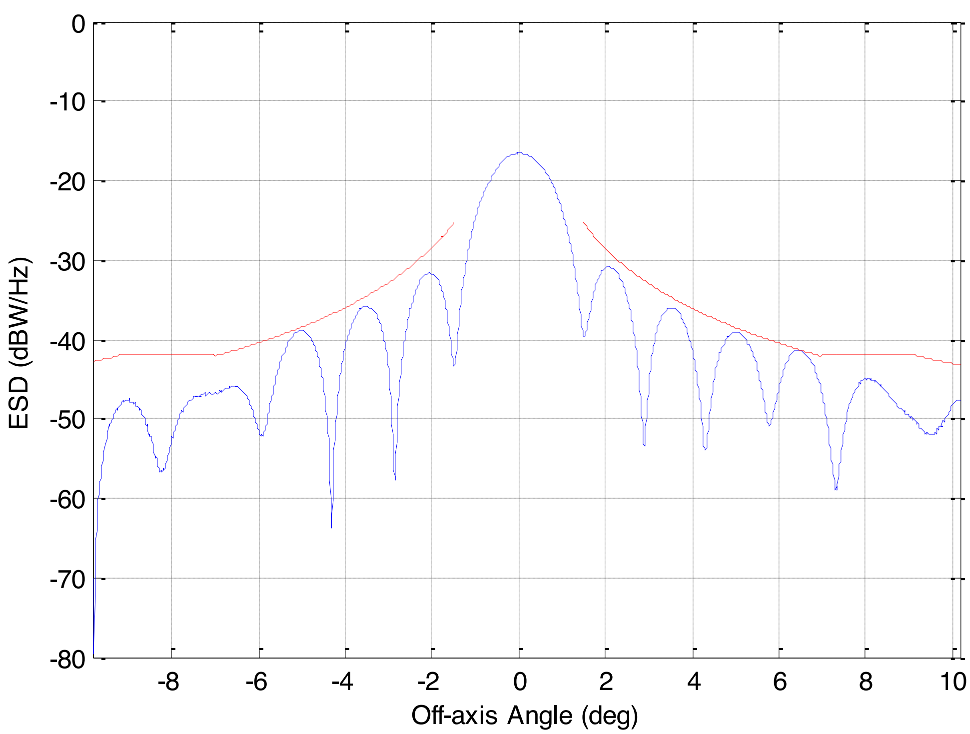

Figure 183. Tx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 20°
Bandwith: 5.80e-03 MHz

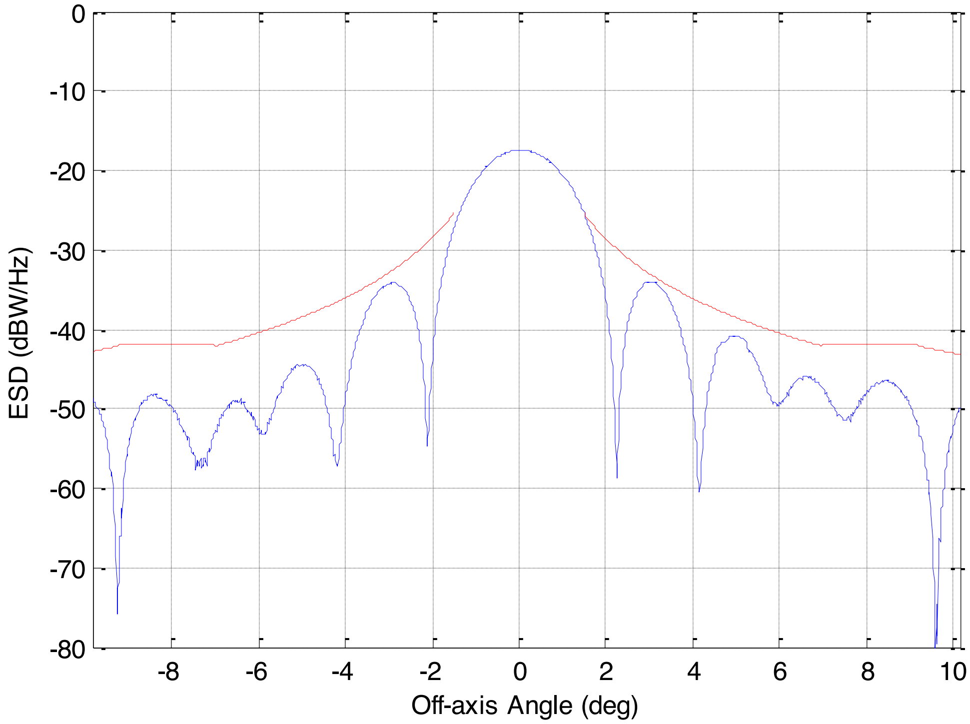

Figure 199. Tx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 50°
Bandwith: 3.68e-01 MHz

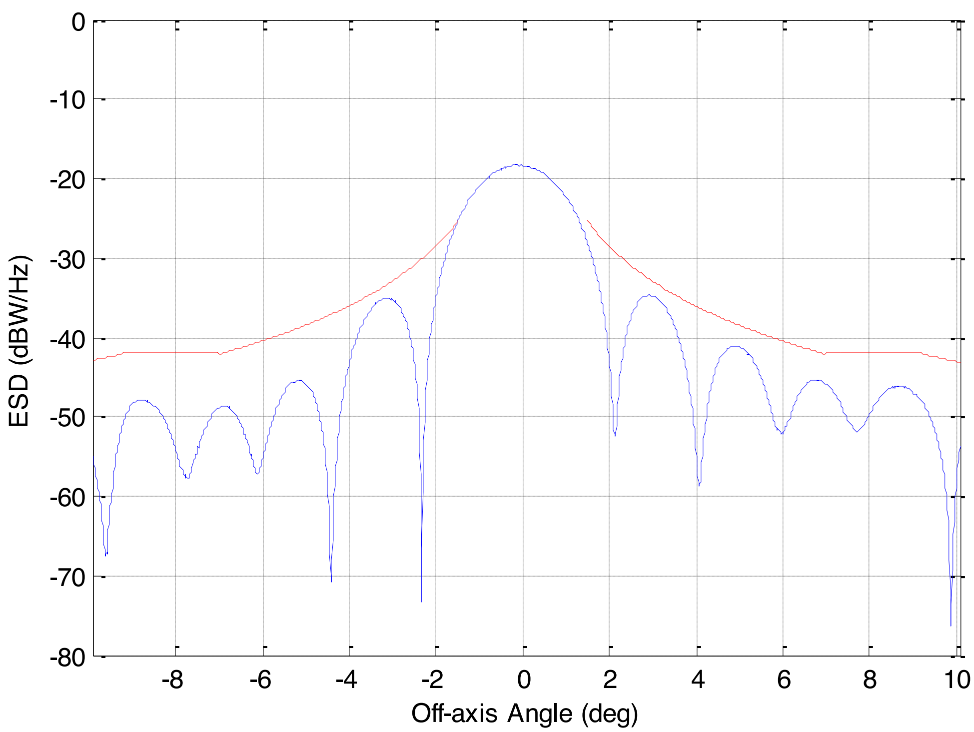

Figure 200. Tx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 50°
Bandwith: 5.31e-01 MHz

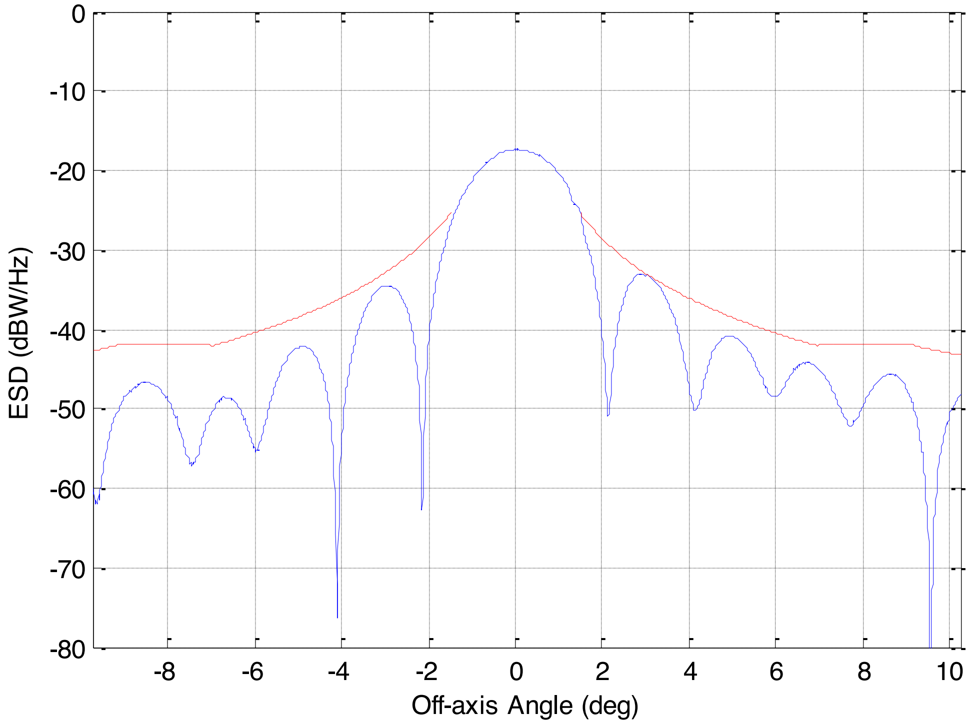

Figure 201. Tx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 50°
Bandwith: 5.39e-02 MHz

PANASONIC AVIONICS

Single Panel Antenna ("SPA")

Annex 3
Representative Antenna Gain
(20° and 50° Skew Angles)

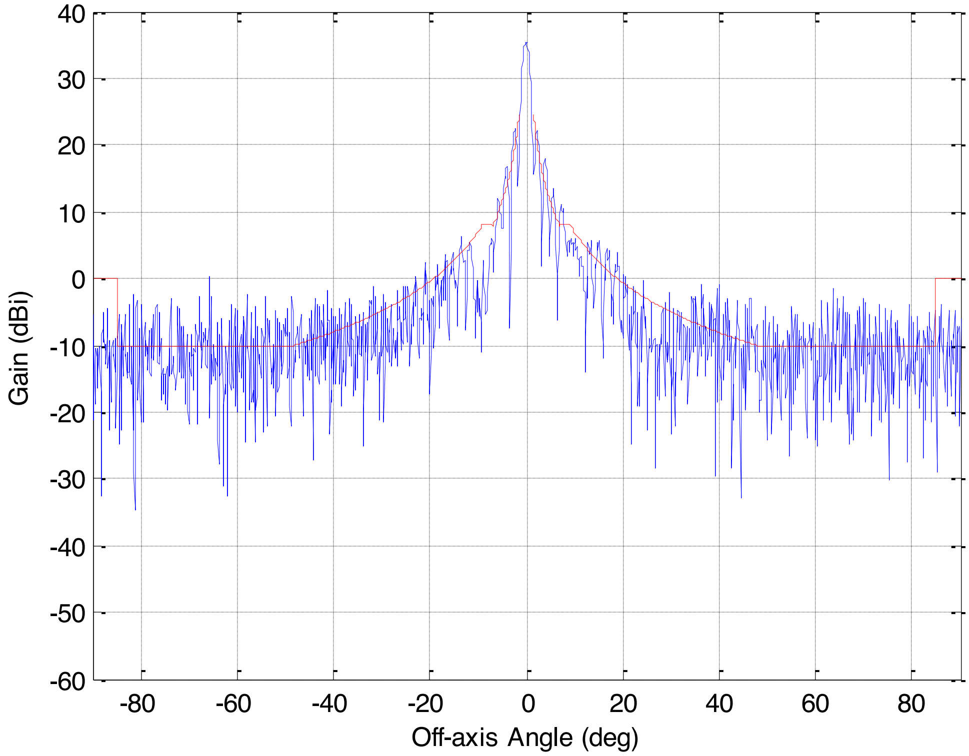

Figure 19. Rx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 20°

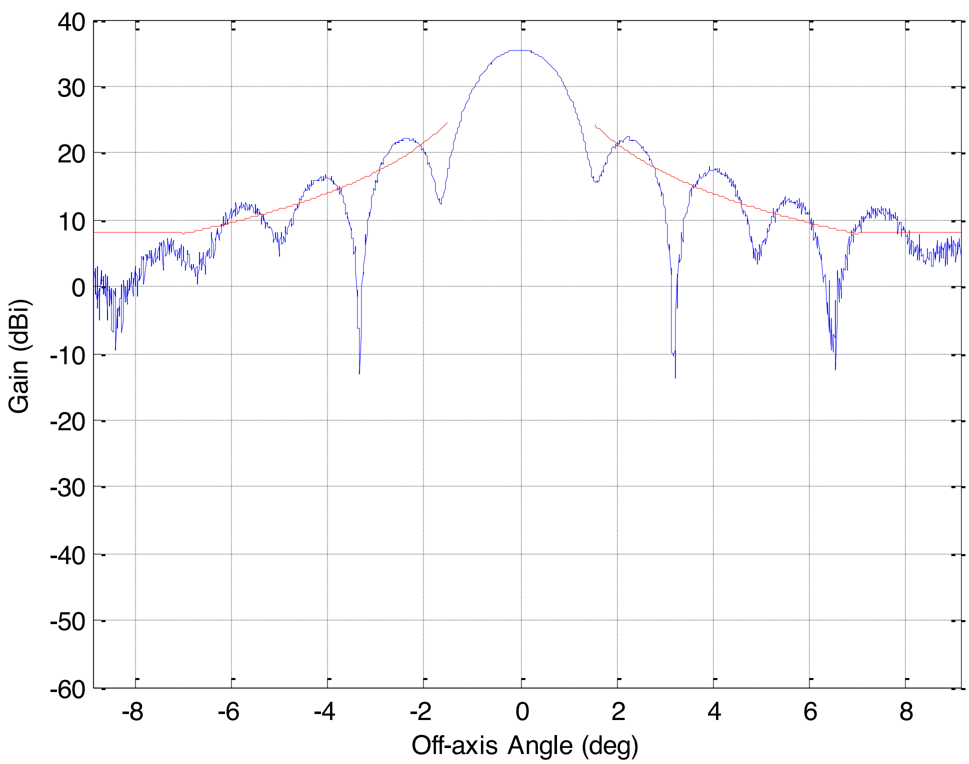

Figure 20. Rx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 20°

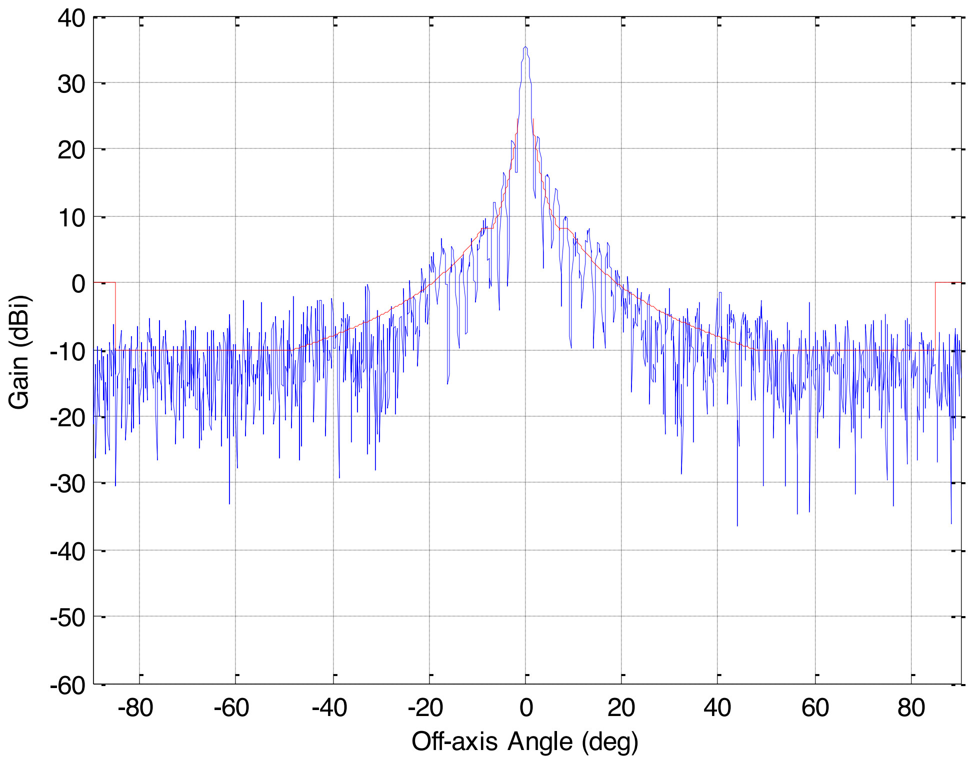

Figure 21. Rx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 20°

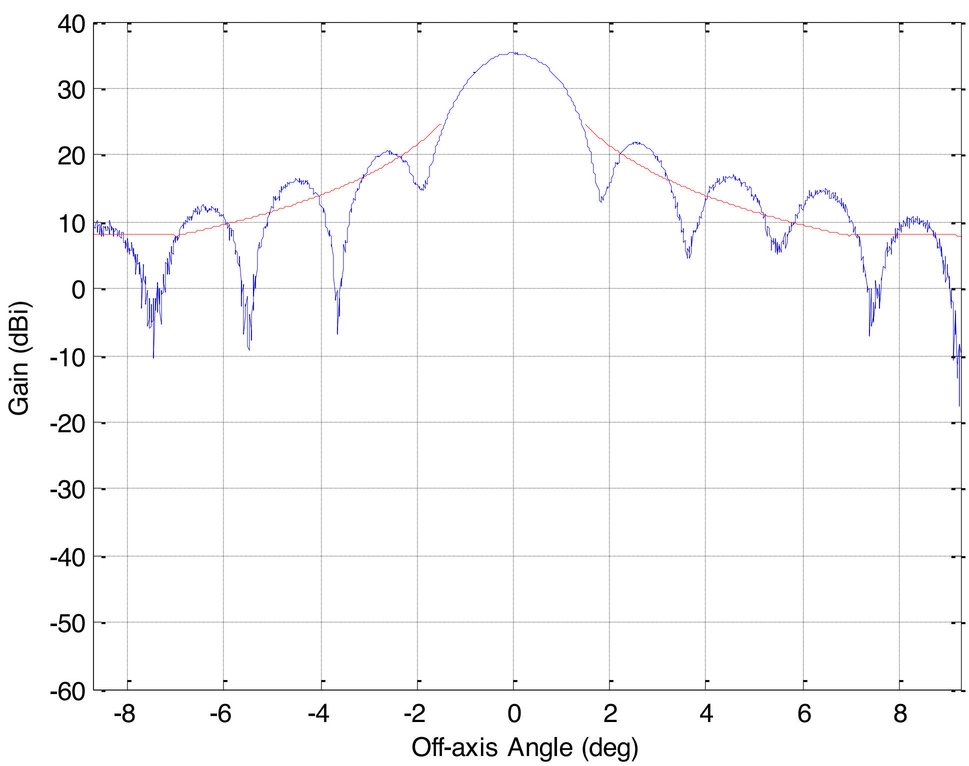

Figure 22. Rx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 20°

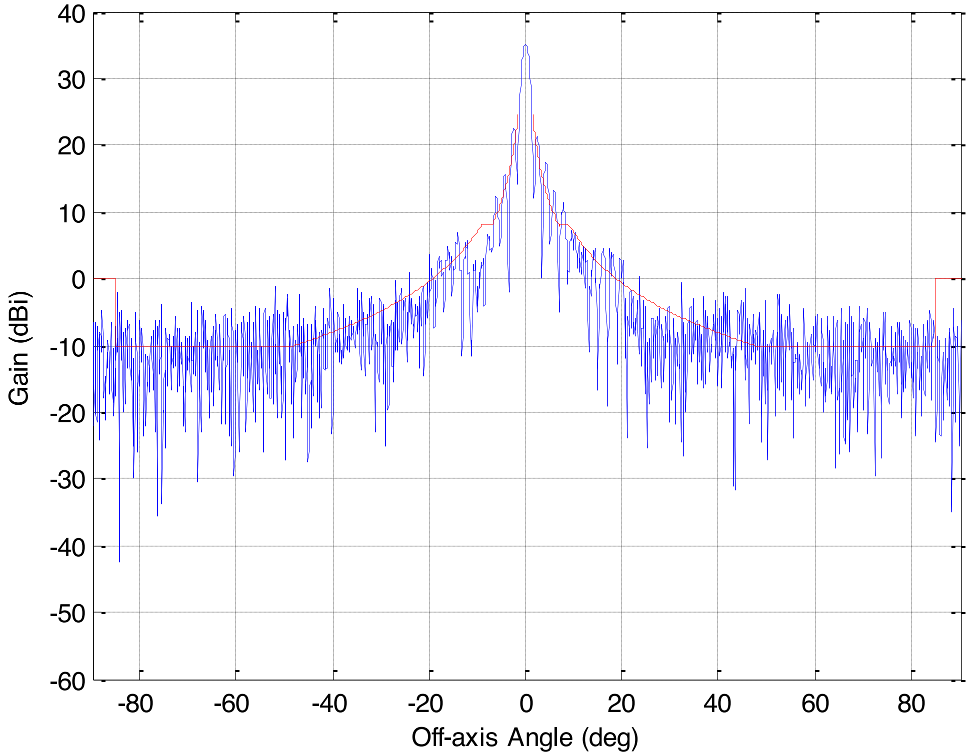

Figure 23. Rx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 20°

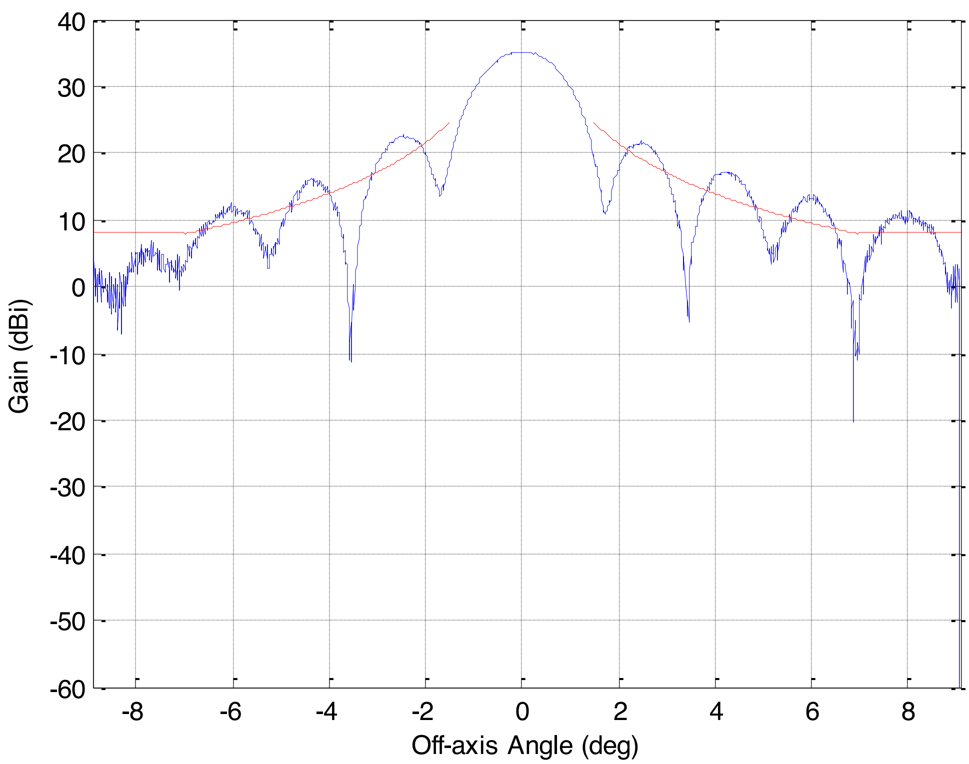

Figure 24. Rx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 20°

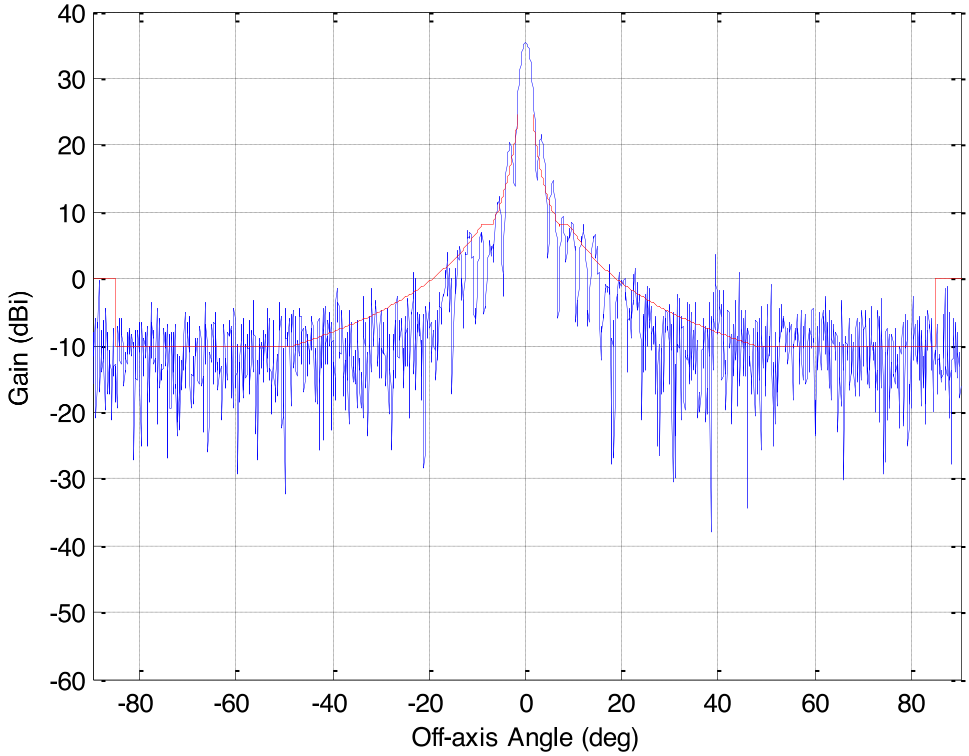

Figure 55. Rx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 50°

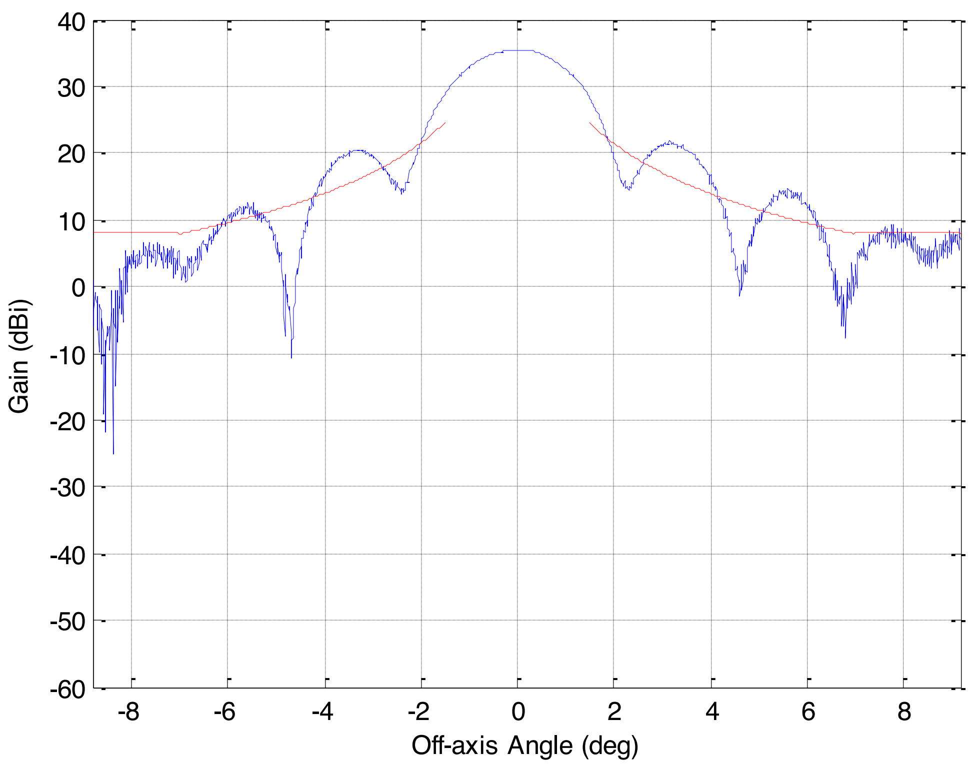

Figure 56. Rx Pattern @ 14.450 GHz, Polarity: H, Plane: Co, Skew: 50°

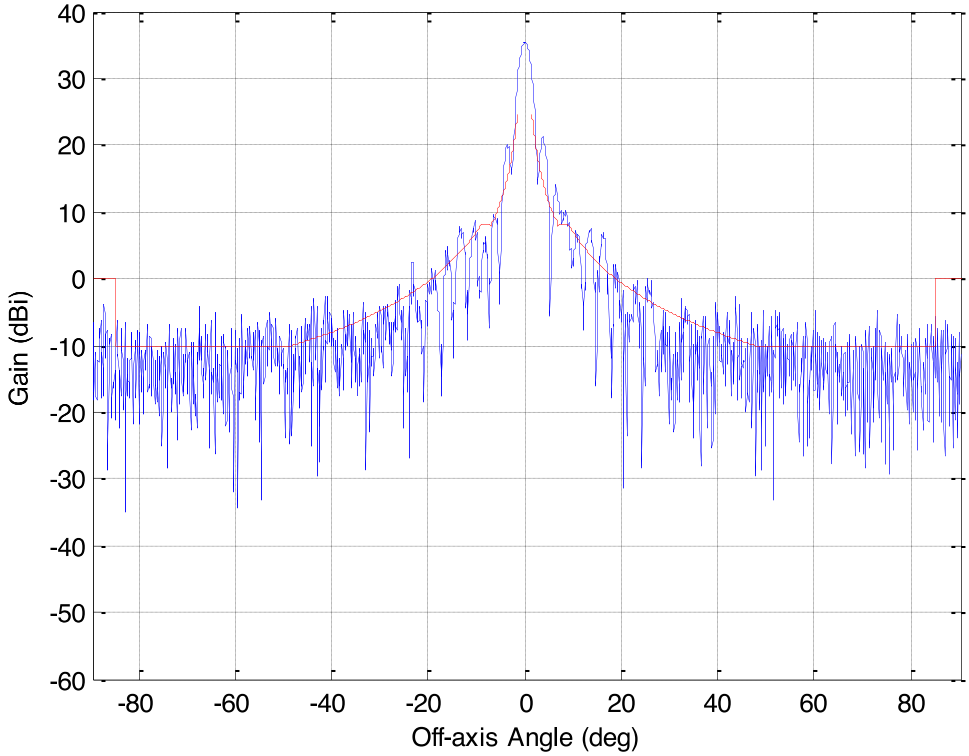

Figure 57. Rx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 50°

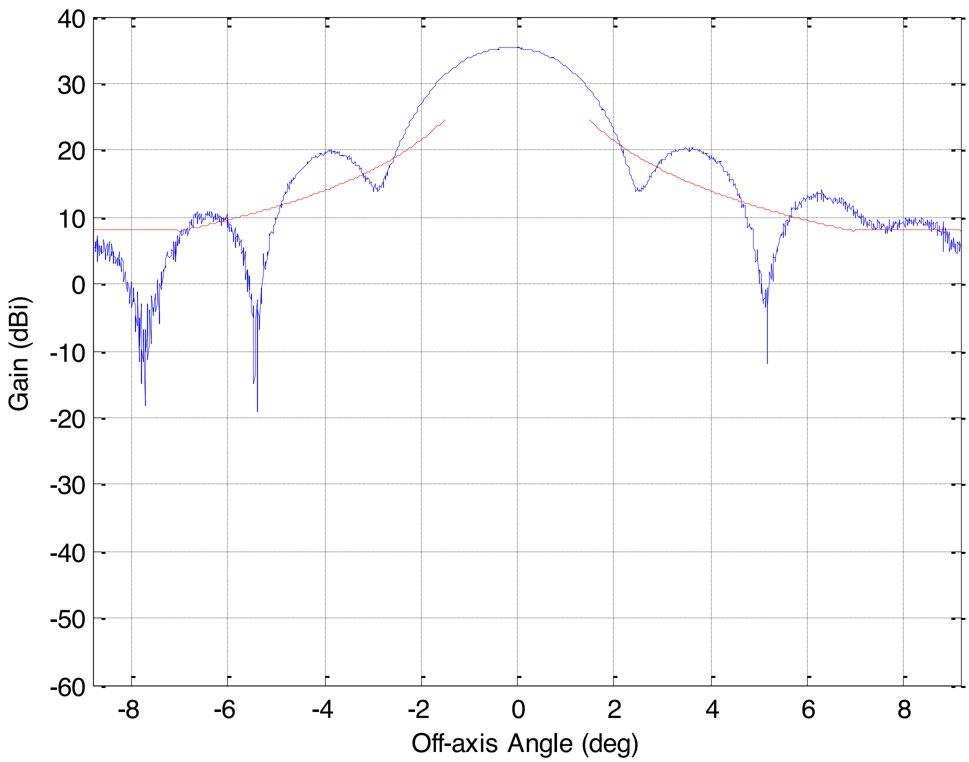

Figure 58. Rx Pattern @ 14.050 GHz, Polarity: H, Plane: Co, Skew: 50°

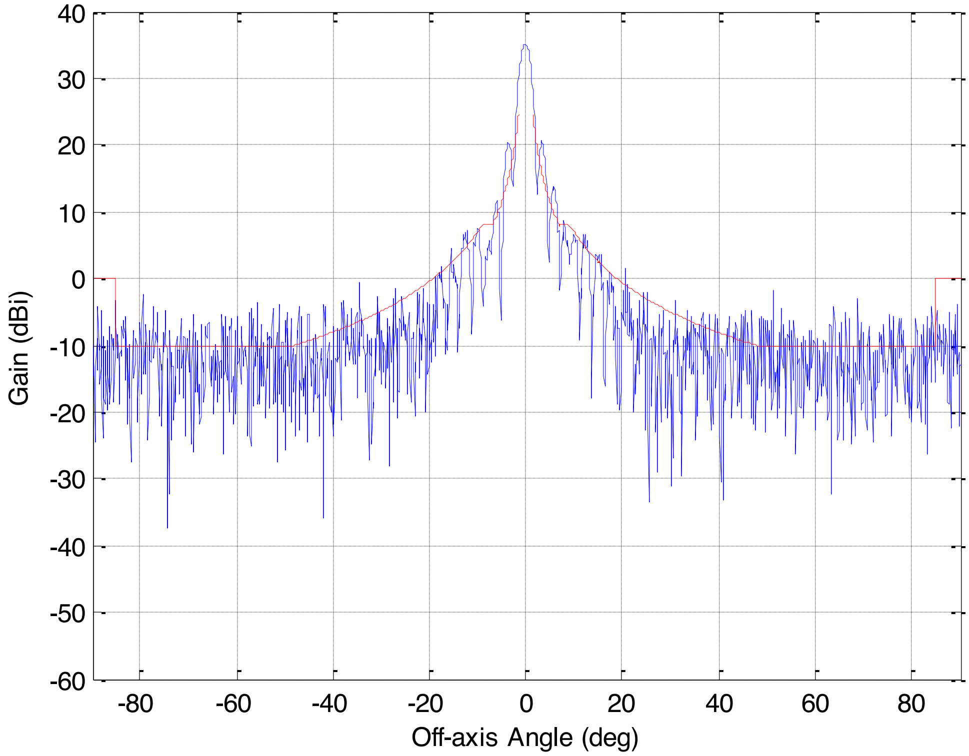

Figure 59. Rx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 50°

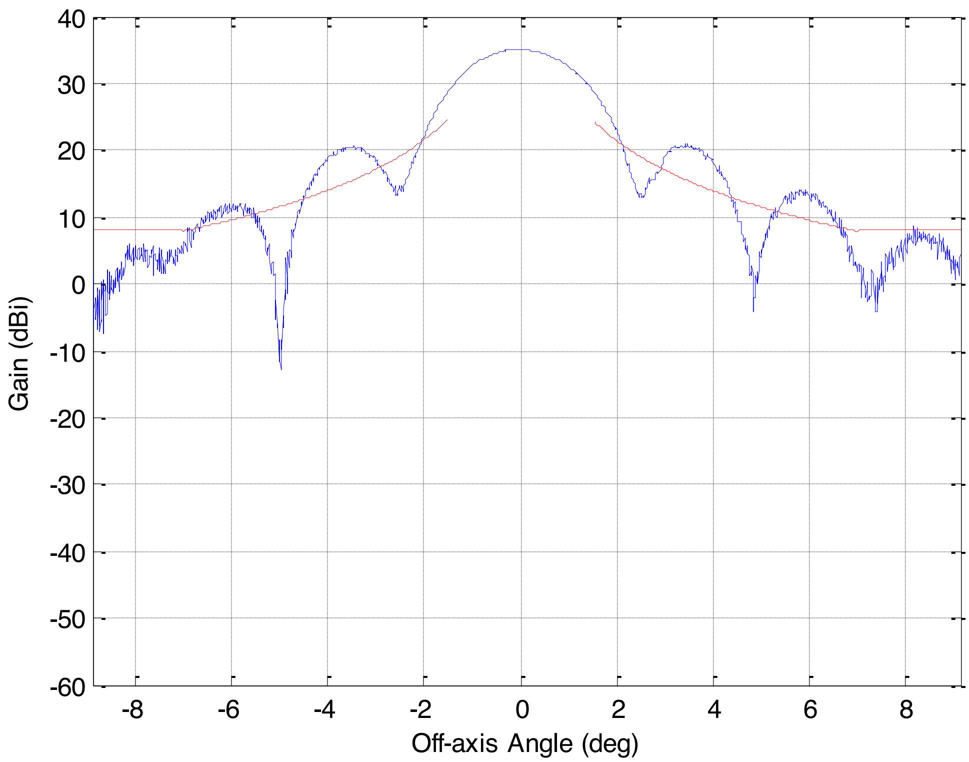

Figure 60. Rx Pattern @ 14.250 GHz, Polarity: H, Plane: Co, Skew: 50°

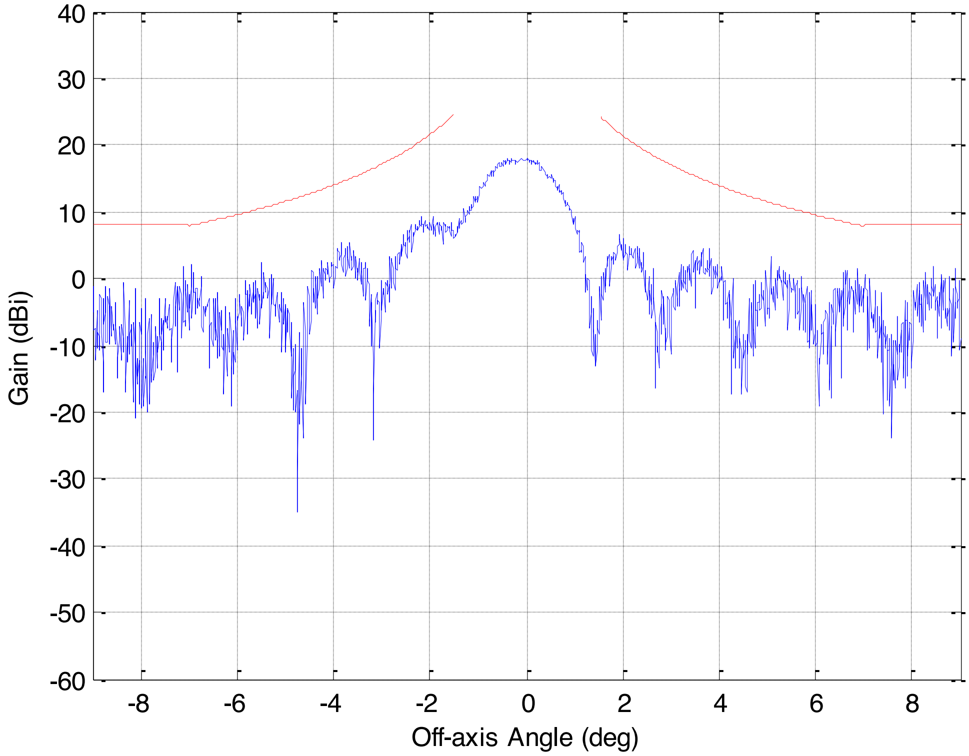

Figure 124. Rx Pattern @ 14.450 GHz, Polarity: H, Plane: Cross, Skew: 20°

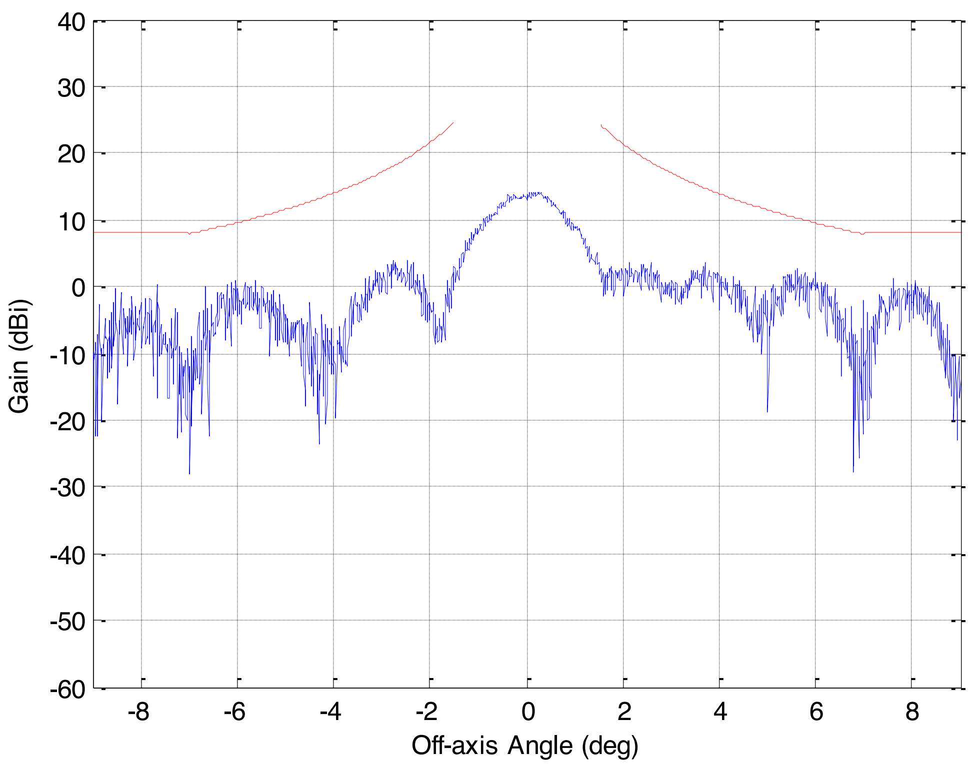

Figure 125. Rx Pattern @ 14.050 GHz, Polarity: H, Plane: Cross, Skew: 20°

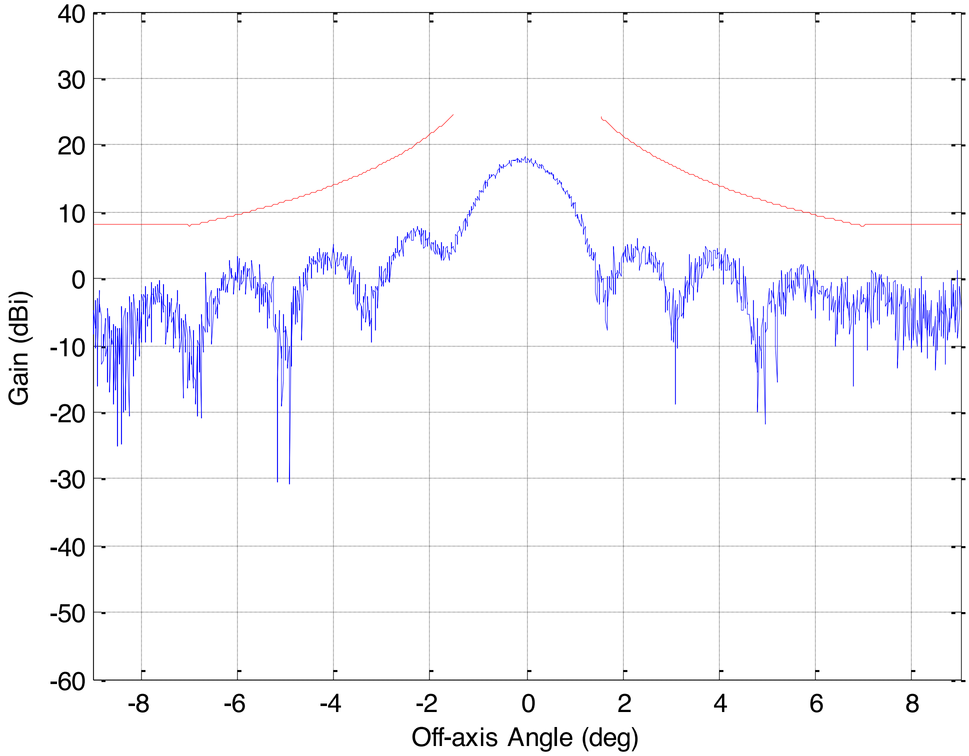

Figure 126. Rx Pattern @ 14.250 GHz, Polarity: H, Plane: Cross, Skew: 20°

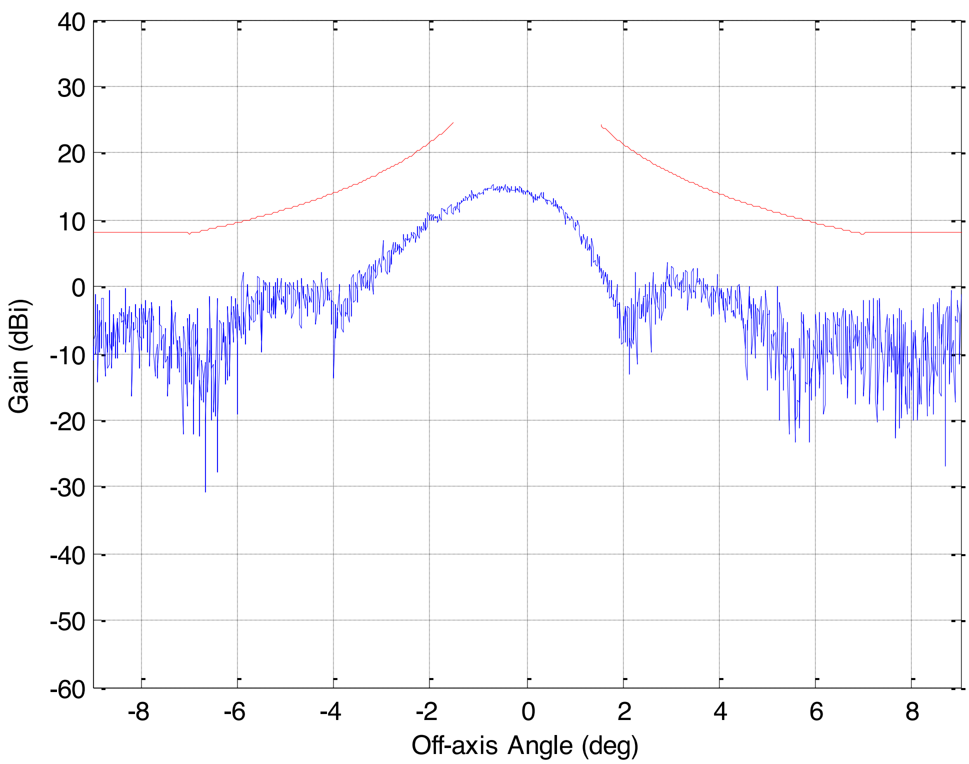

Figure 142. Rx Pattern @ 14.450 GHz, Polarity: H, Plane: Cross, Skew: 50°

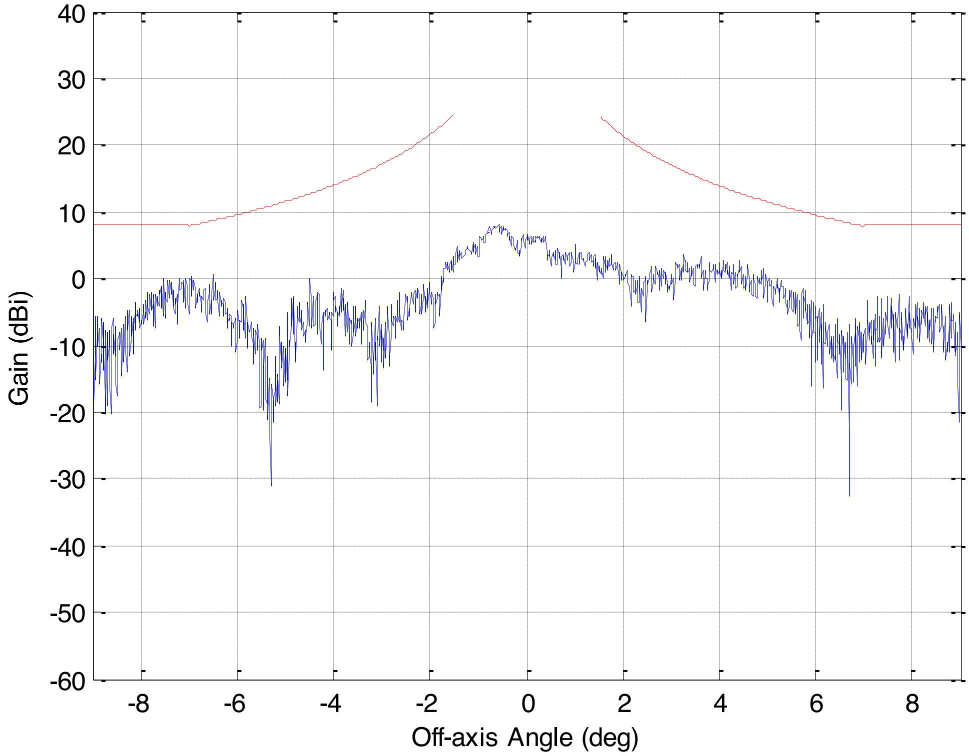

Figure 143. Rx Pattern @ 14.050 GHz, Polarity: H, Plane: Cross, Skew: 50°

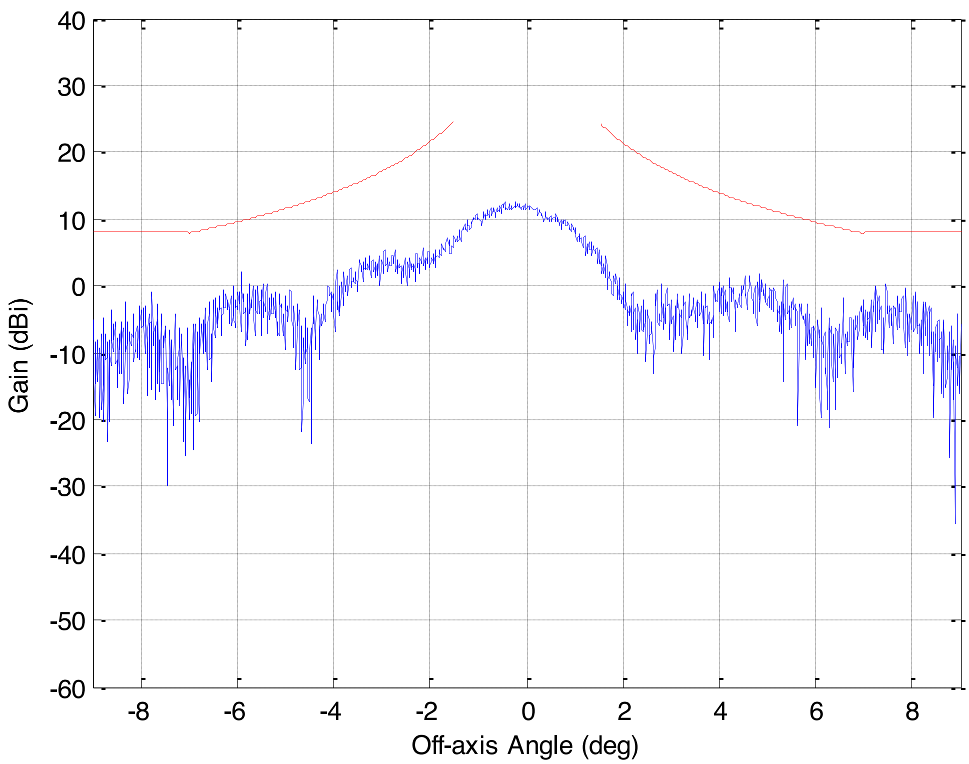

Figure 144. Rx Pattern @ 14.250 GHz, Polarity: H, Plane: Cross, Skew: 50°

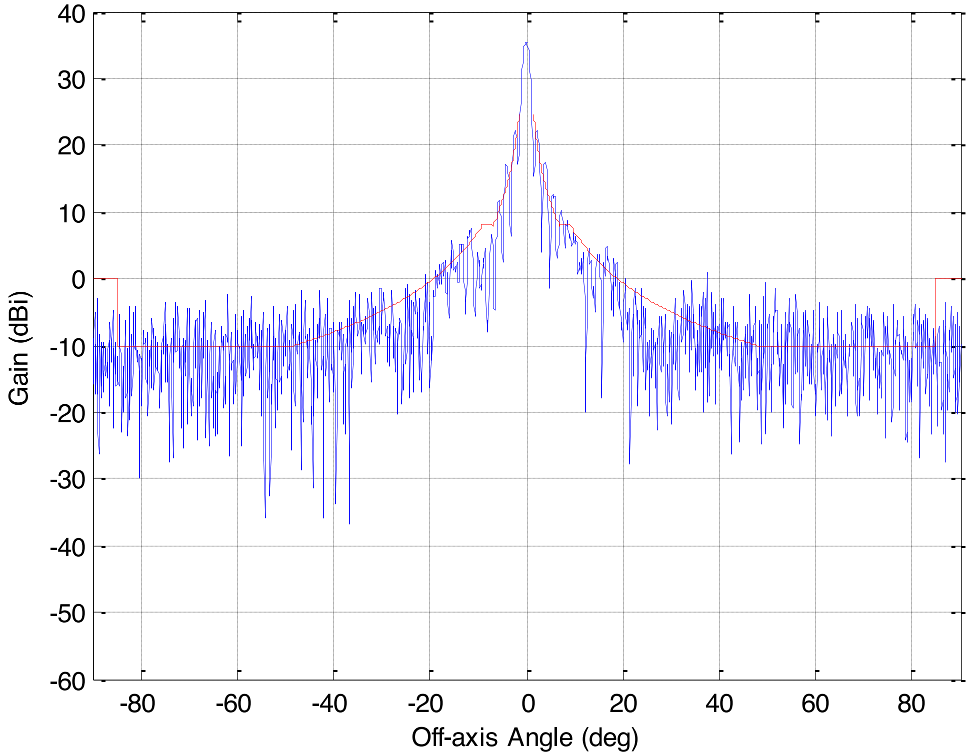

Figure 190. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 20°

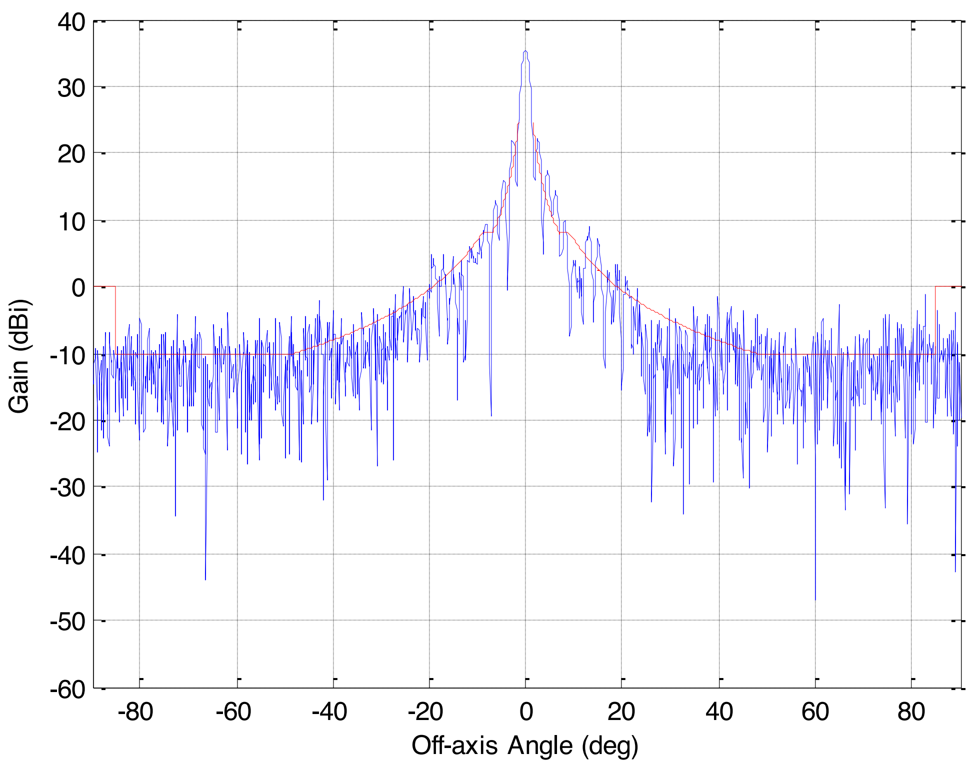

Figure 191. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 20°

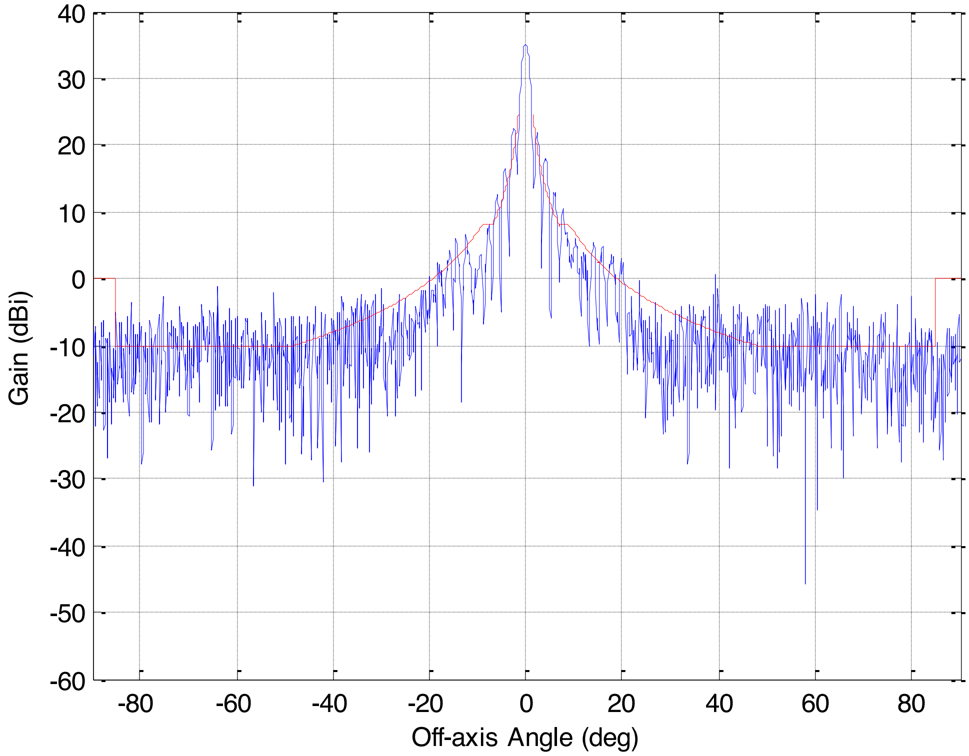

Figure 192. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 20°

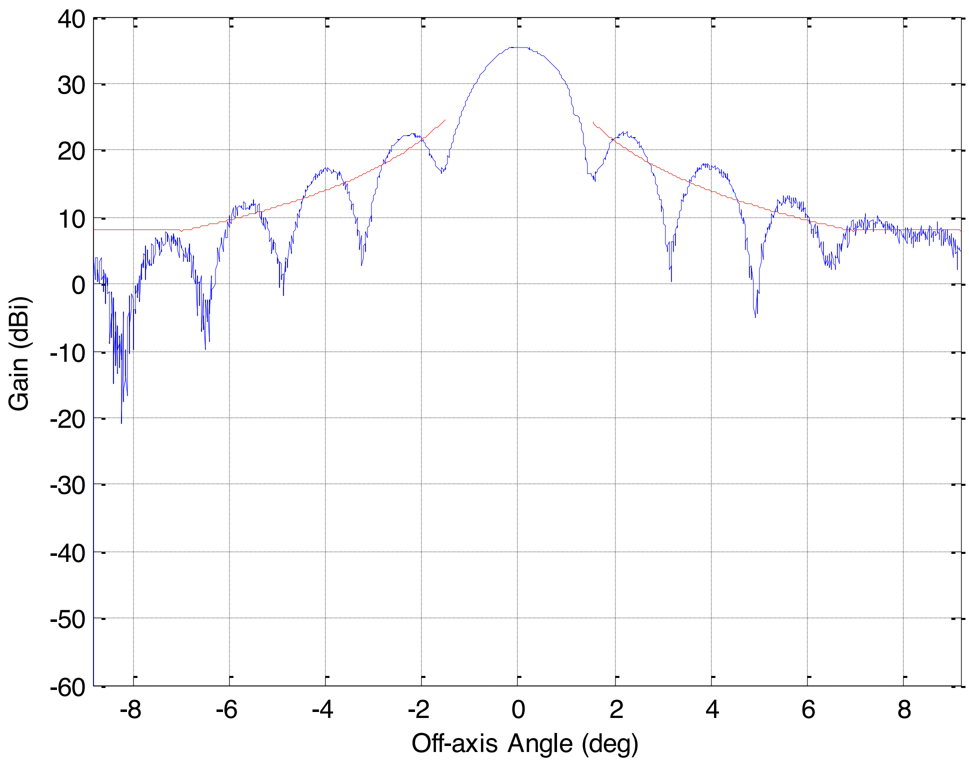

Figure 193. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 20°

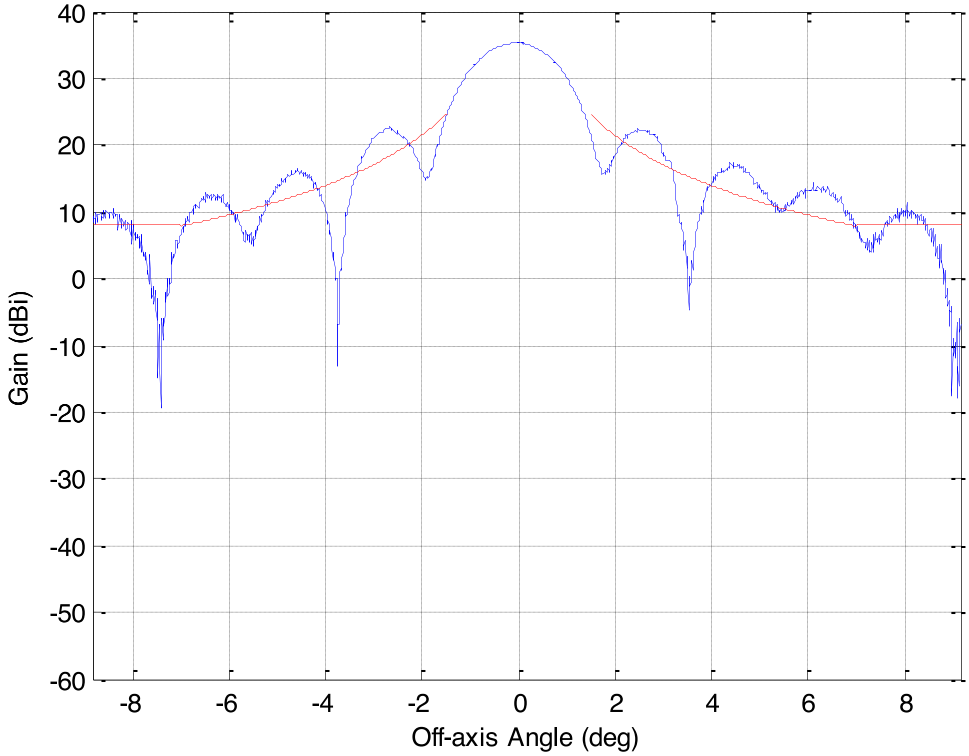

Figure 194. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 20°

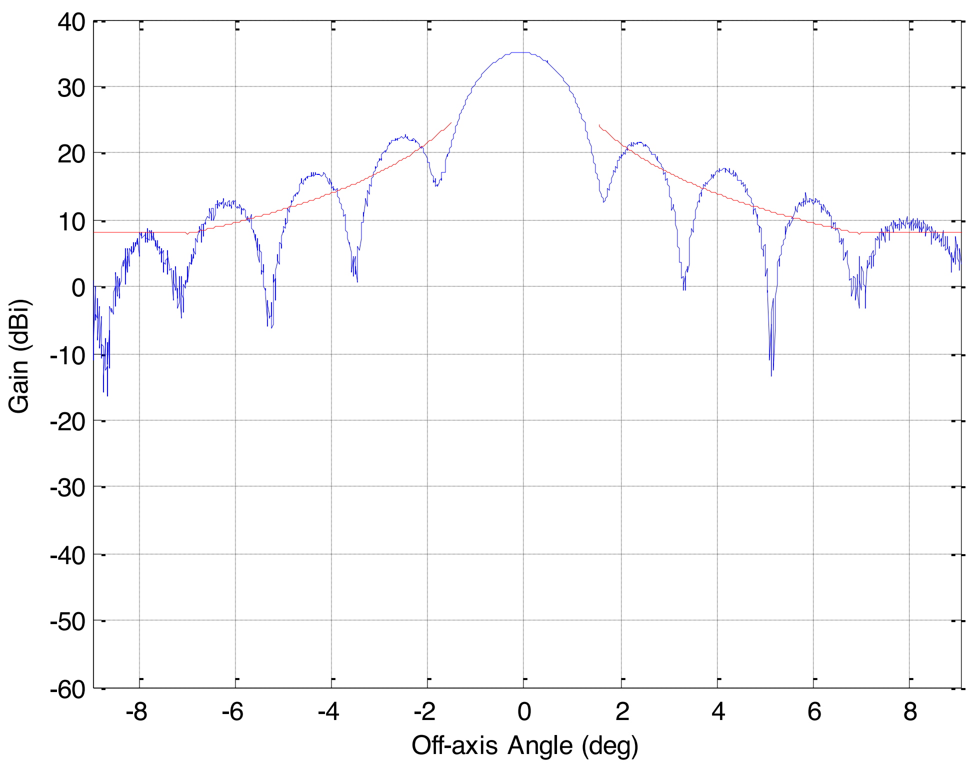

Figure 195. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 20°

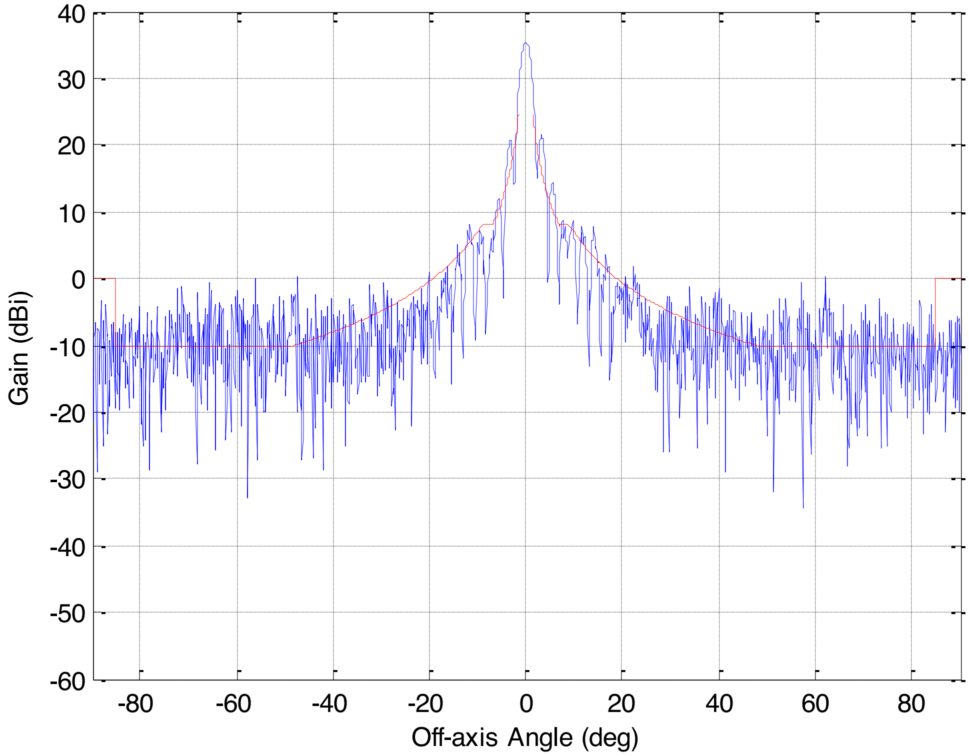

Figure 226. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 50°

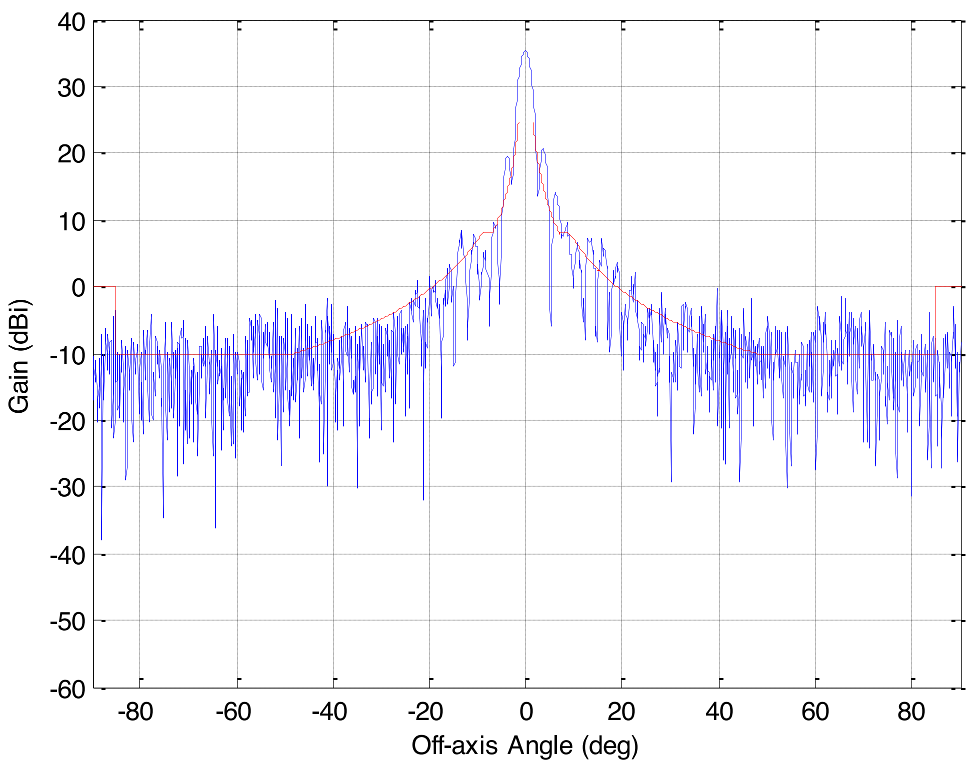

Figure 227. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 50°

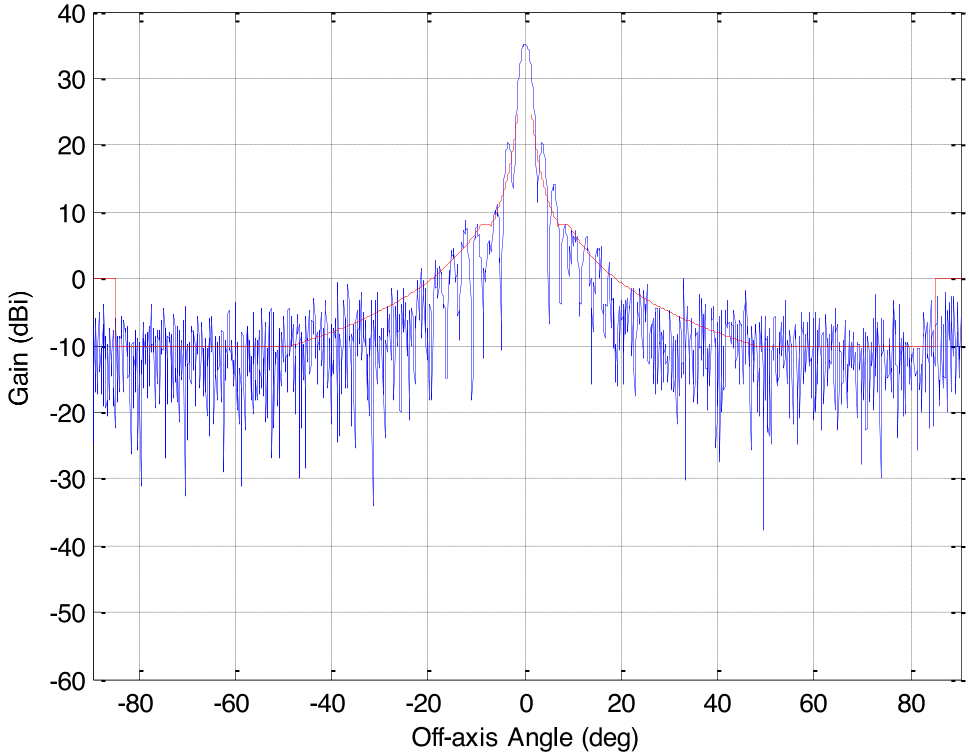

Figure 228. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 50°

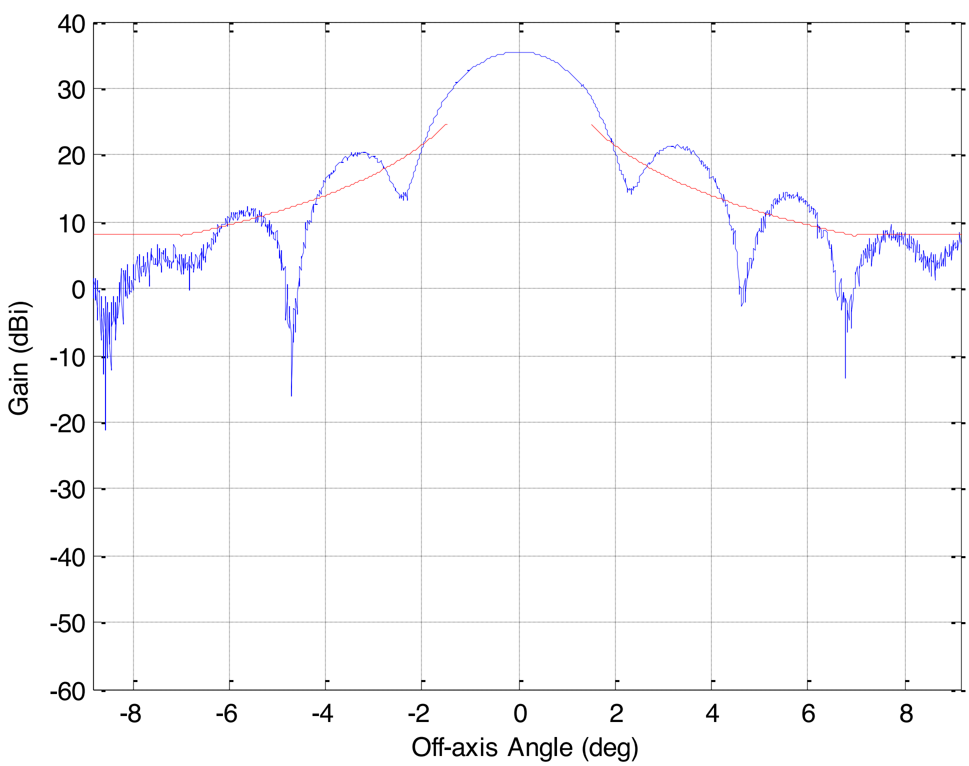

Figure 229. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 50°

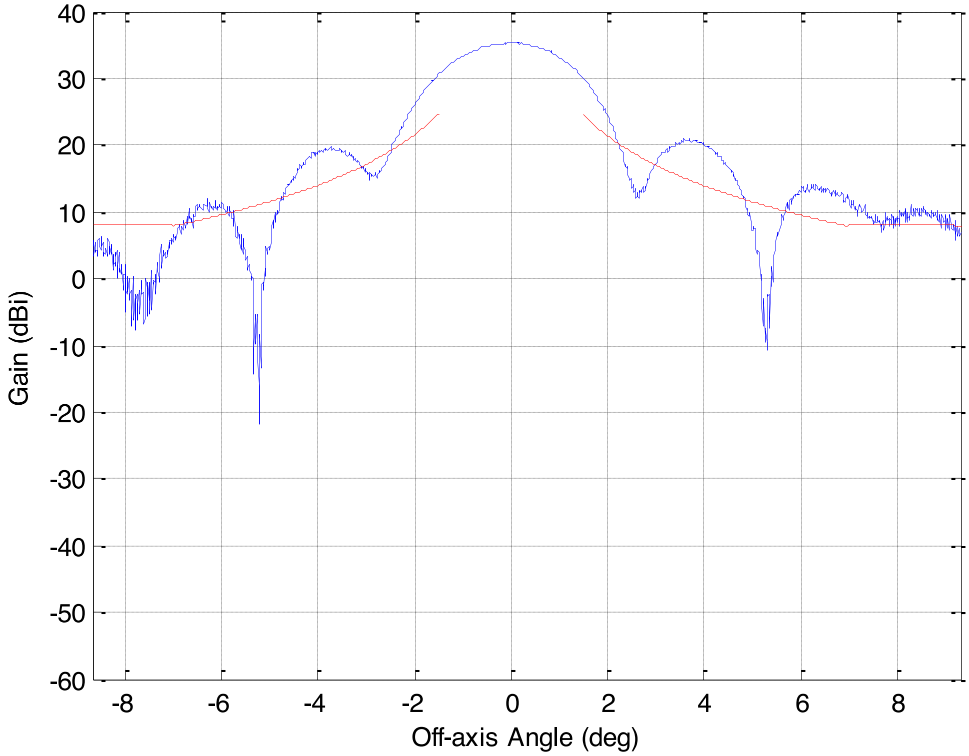

Figure 230. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 50°

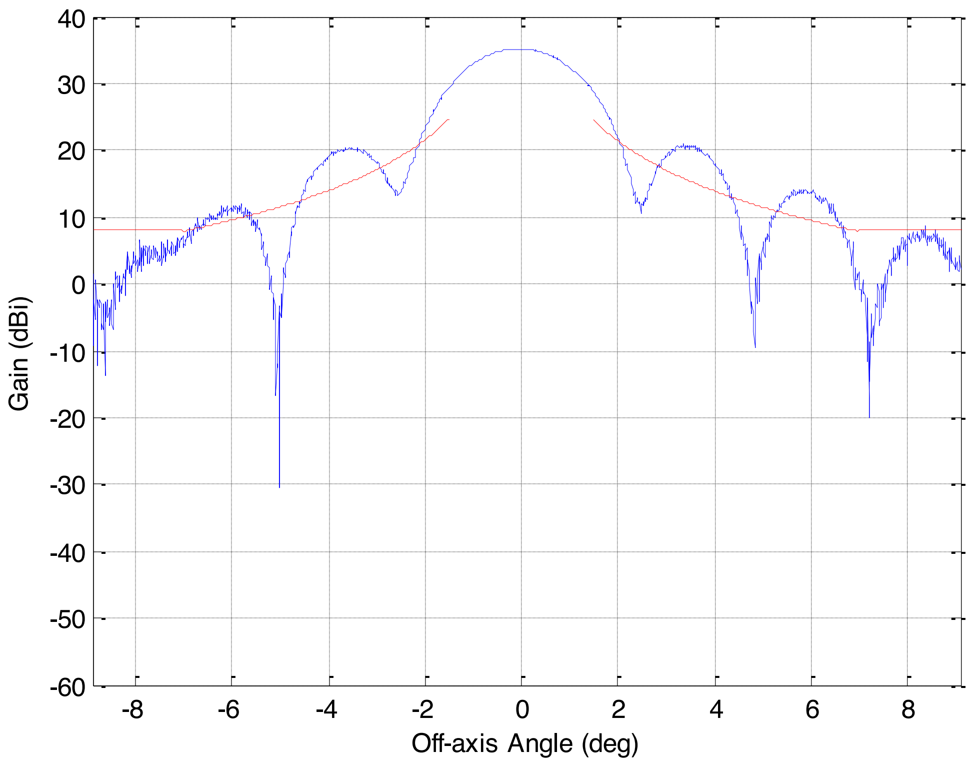

Figure 231. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 50°

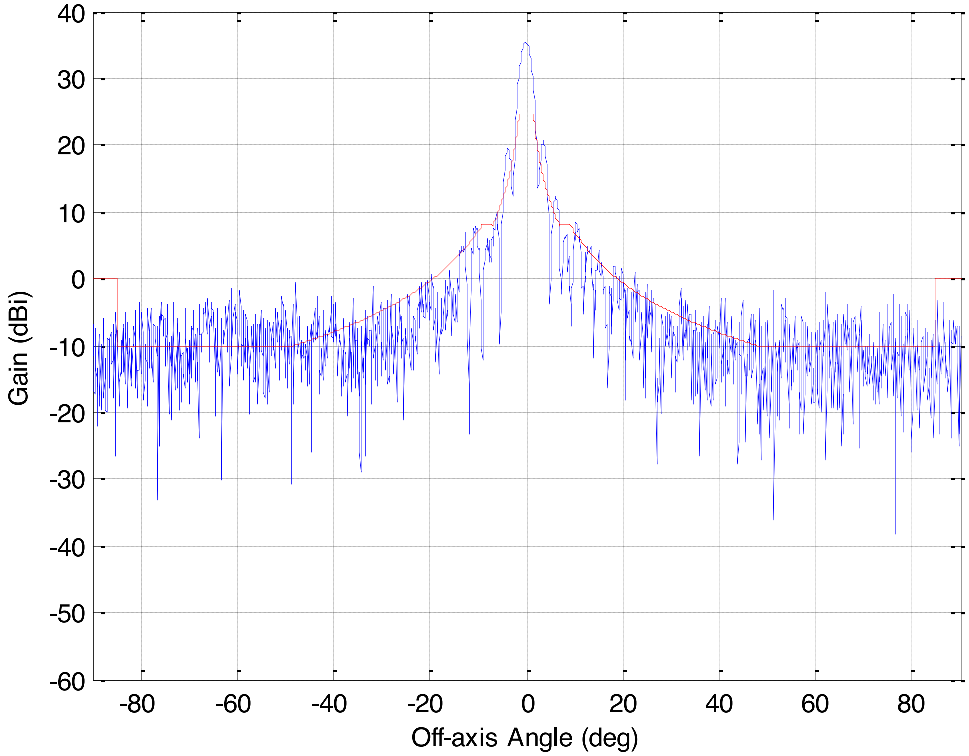

Figure 232. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Co, Skew: 55°

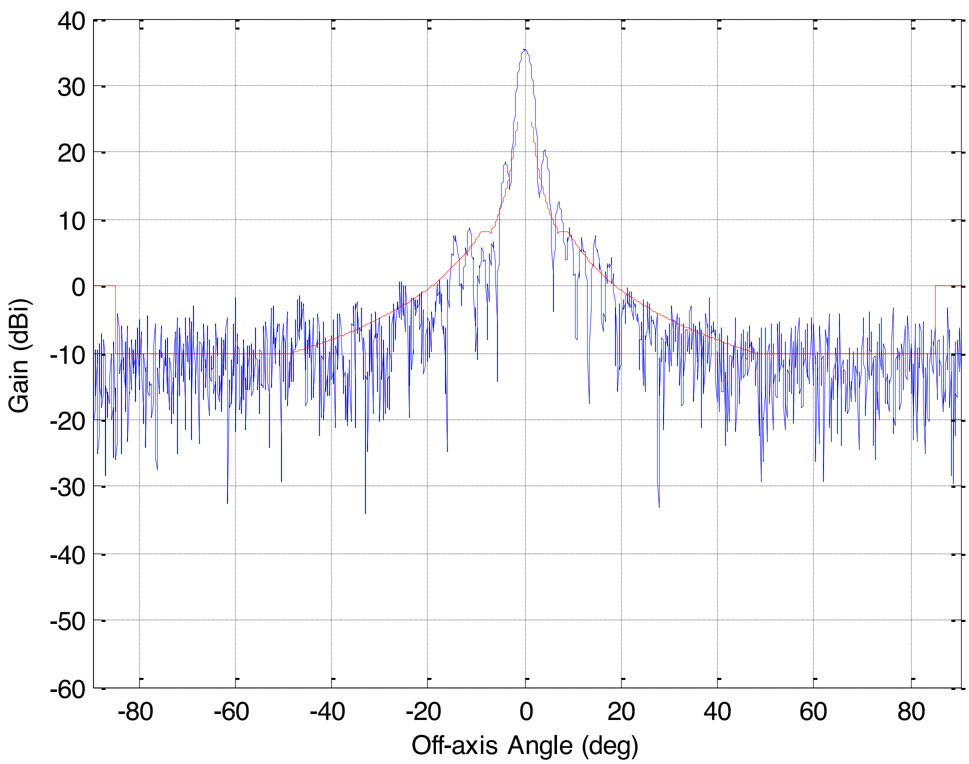

Figure 233. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Co, Skew: 55°

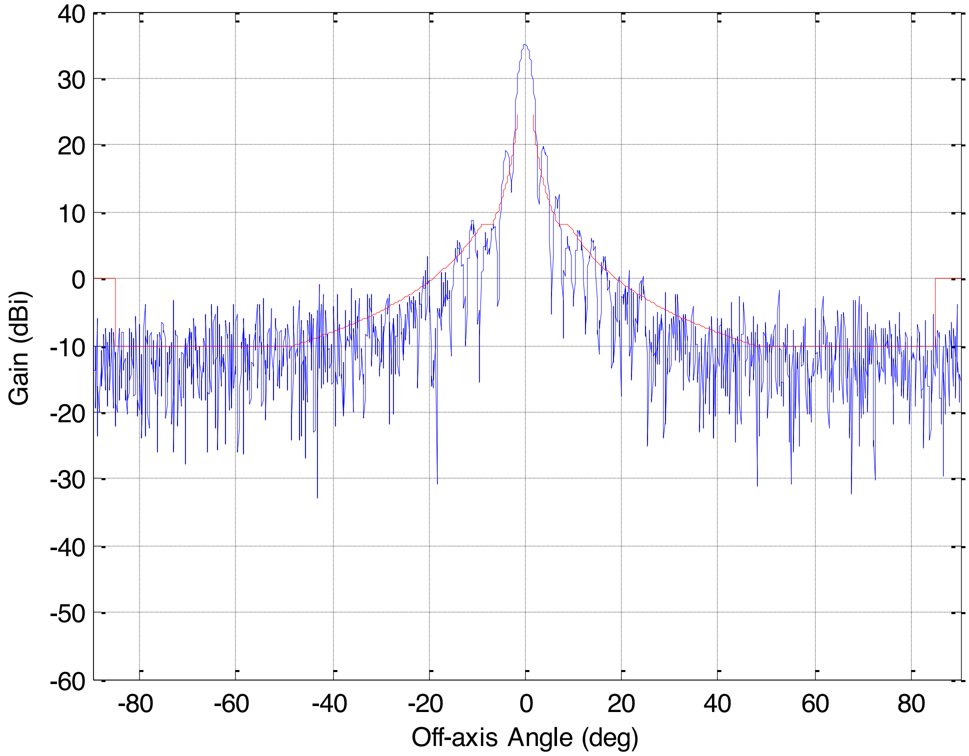

Figure 234. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Co, Skew: 55°

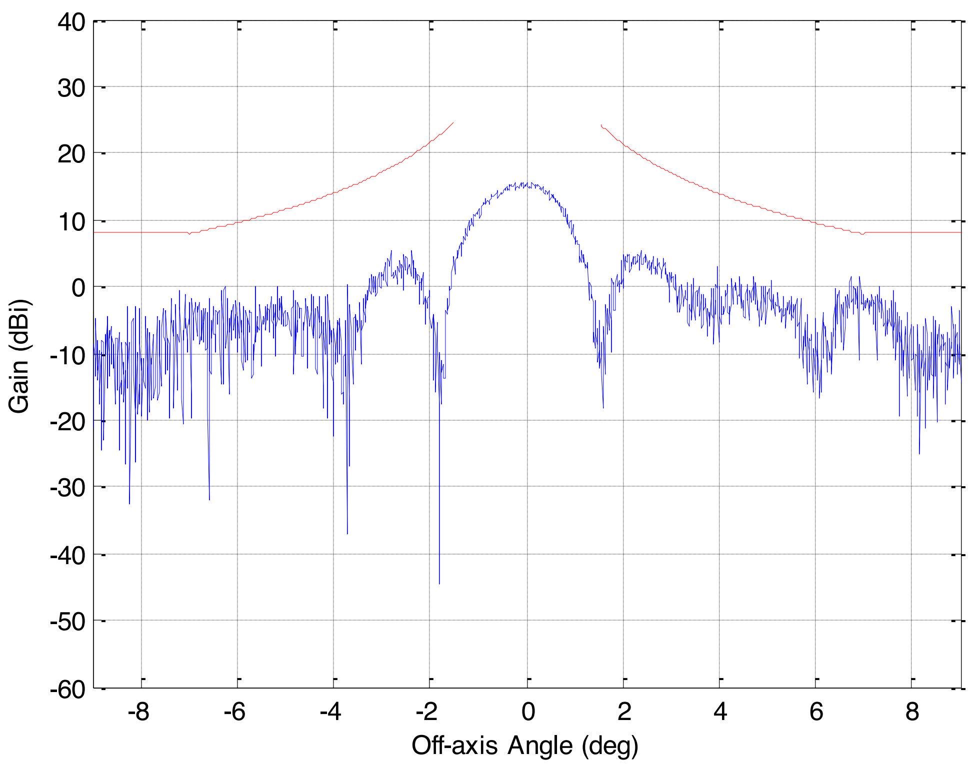

Figure 295. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Cross, Skew: 20°

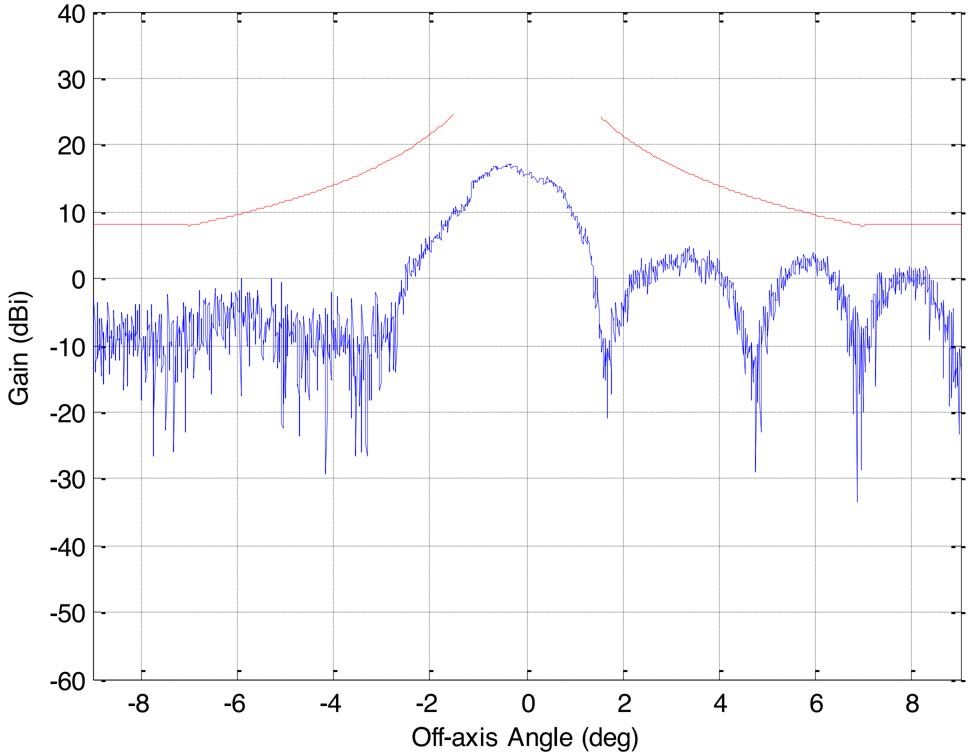

Figure 296. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Cross, Skew: 20°

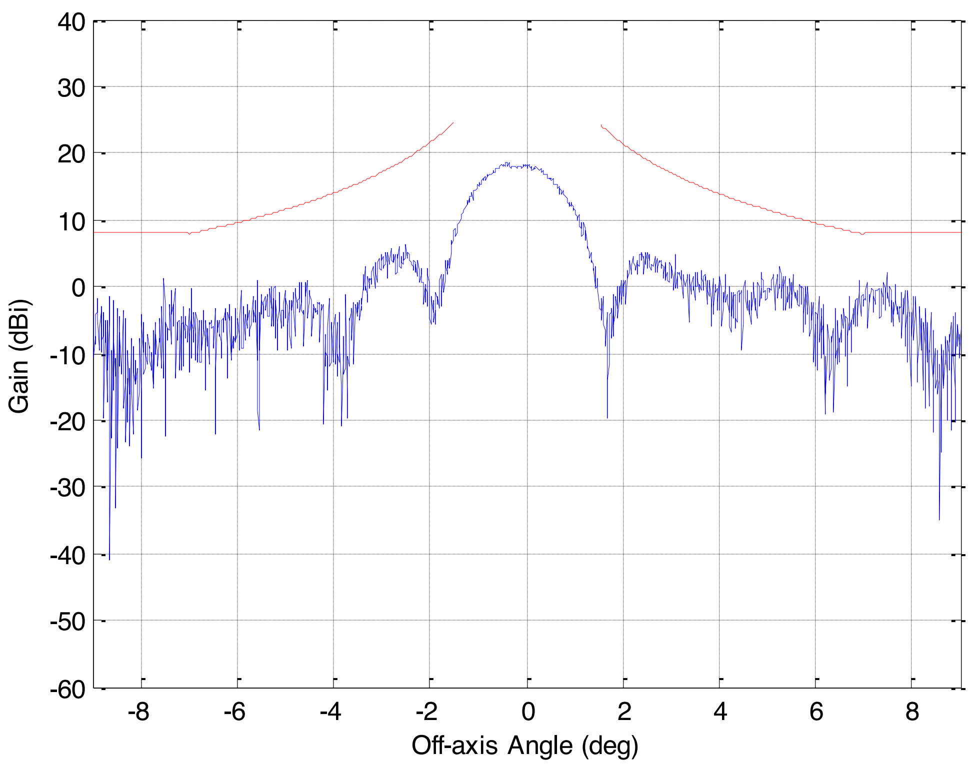

Figure 297. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Cross, Skew: 20°

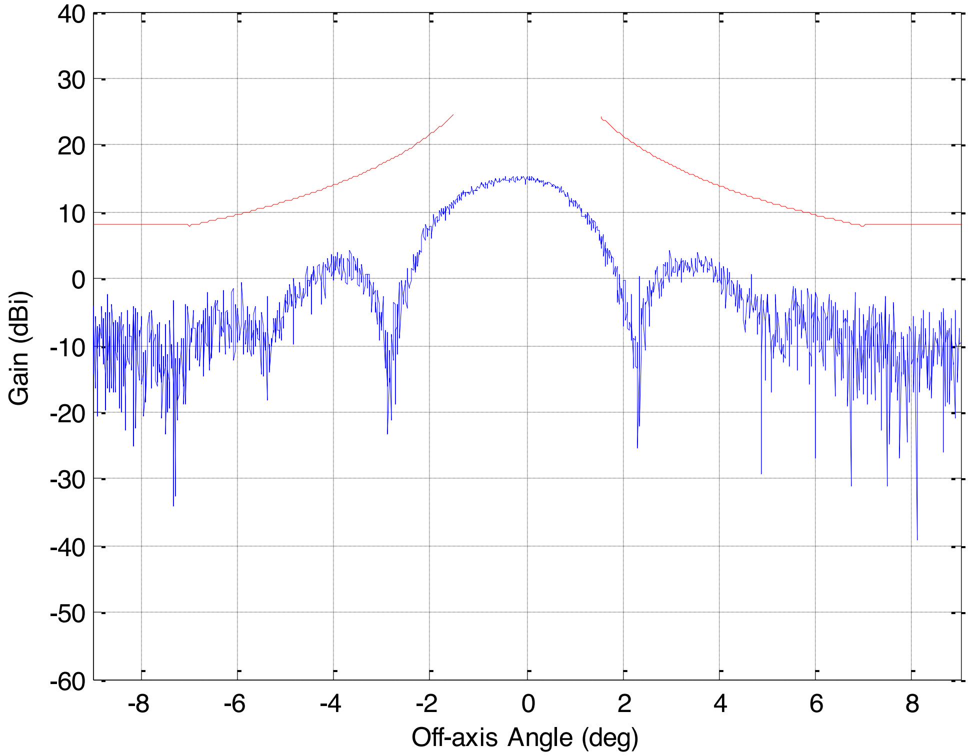

Figure 313. Rx Pattern @ 14.450 GHz, Polarity: V, Plane: Cross, Skew: 50°

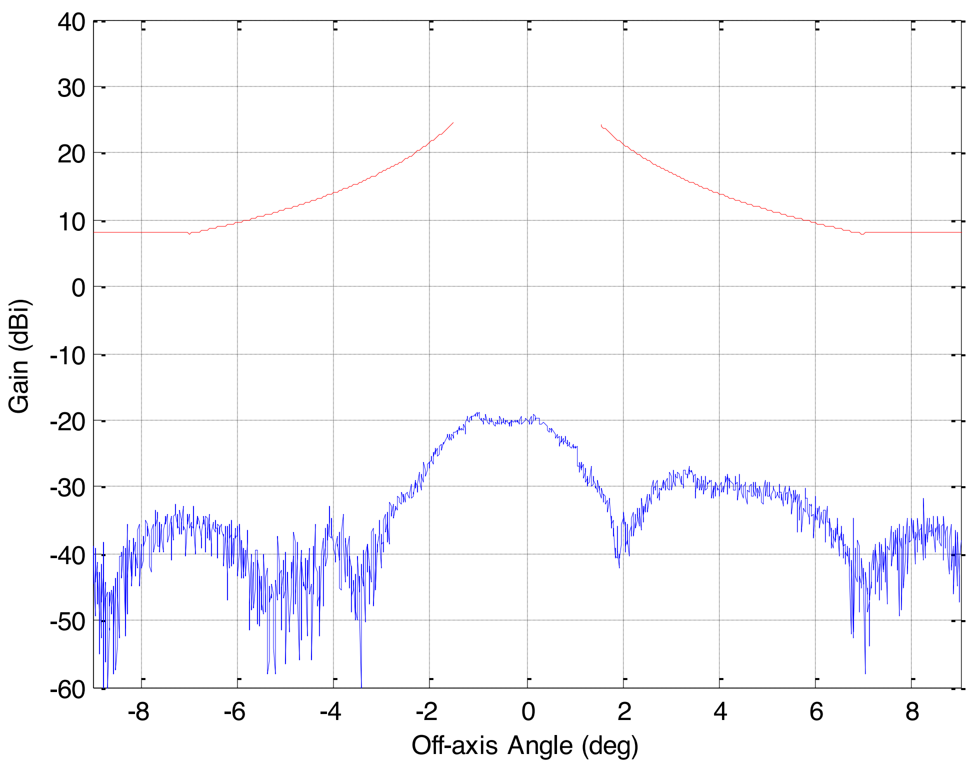

Figure 314. Rx Pattern @ 14.050 GHz, Polarity: V, Plane: Cross, Skew: 50°

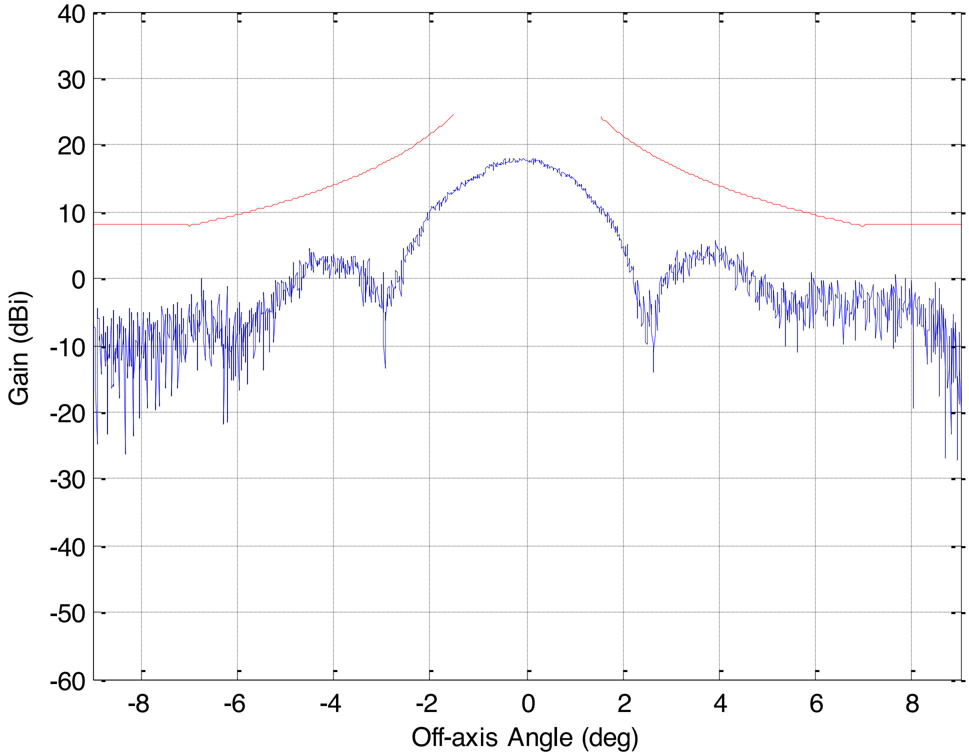

Figure 315. Rx Pattern @ 14.250 GHz, Polarity: V, Plane: Cross, Skew: 50°

IV. SPA Terminal Radiation Hazard Study

Radiation Hazard Analysis for Panasonic Single-Panel Antenna

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

Bulletin No. 65 specifies that there are two separate tiers of exposure limits that are depending on the area of exposure and/or the status of the individuals who are subject to the exposure -- the General Population/ Uncontrolled Environment and the Controlled Environment, where the general population cannot access.

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

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

Near Field Exposure

The Panasonic Single-Panel Antenna potentially exceeds MPE limits in the near field within the rectangular volume directly in front of the panel (9.0 mW/cm^2). For this calculation, it was assumed that all 16 watts from the SSPA modules are uniformly distributed across the surface area of the panel. This is a reasonable assumption for a flat panel waveguide fed phased array with uniform excitation.

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

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

10.7 meters

Where D is the width of the panel (0.95 meters)

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

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

5.7 mW/ cm^2

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

In normal operation, this antenna is mounted on the fuselage of an aircraft or rooftop with the main beam pointed toward the sky at a minimum elevation angle of 5 degrees such that human exposure in the near field is not possible. Furthermore, normal TDMA operation uses a duty cycle of 10% or less, reducing maximum near field exposure by an order of magnitude to 0.57 mW/cm^2. Additionally, in normal operation, any blockage in the near field will cause the transmitter to be disabled within seconds as the system does not transmit unless it can receive the downlink carrier from the satellite. Therefore, prolonged exposure in the near field is not possible in normal operation.

Far Field Exposure (in main beam)

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

26 m

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

0.4 mW/ cm^2

At a distance of 26 meters (far-field boundary), the power density of the antenna is 0.4 mW/cm^2, which is well within the limits of General Population/Uncontrolled Exposure (MPE) even in the direction of the main beam of the antenna. There is no RF hazard to personnel in the far field of the antenna (26 m). The limit of 1 mW/cm^2 for the General Population/Uncontrolled Exposure in the main beam of the antenna occurs in the transition region, which is described below.

Transition Region Exposure (in main beam)

At a distance of 18 m from the antenna, maximum exposure in the main beam is 3.2 mW/cm^2. This assumes that PFD decreases linearly from 5.7 mW/cm^2 to 0.4 mW/cm^2 in this region between the near field and far field (10.7 m to 26 m from the antenna). At a distance of **25 m** from the antenna, maximum exposure in the main beam is **0.8 mW/cm^2**.

Exposure to personnel located below antenna height

The antenna will be mounted at a height above personnel/public locations. In this case, the worst case exposure is due to the first elevation sidelobe at a level of -13 dB. For the Panasonic Single-Panel Antenna, the far field distance in the elevation plane is approximately 1.0 m. The 5 mW/cm^2 threshold is reached at a distance of 1.6 m and the 1 mW/cm^2 threshold is reached at a distance of 3.5 m. Observing the safe radius distance noted above during transmit operations will ensure that the threshold will not be exceeded.

Table 1: Parameters Used for Determining PFD (Panasonic Single-Panel Antenna)

Antenna Width	37.362	in	0.949	m
Antenna Height	7.276	in	0.185	m
Antenna Surface Area			0.175	m^2
Frequency			14250	MHz
Wavelength			0.021	m
Transmit Power			10	W
Antenna Gain			35	dBi
Antenna Gain			3162	
EIRP			45	dBW
Far Field Boundary (Azimuth)			26.0	m
Power Density at far field boundary (Azimuth)			0.4	mW/cm^2
Near Field Distance (Azimuth)			10.7	m
Near Field Power Density (Azimuth)			5.7	mW/cm^2
Elevation sidelobe level			-13.0	dB
Far Field Boundary (Elevation)			1.0	m
Power Density at far field boundary (Elevation)			13.3	mW/cm^2
Safe Far Field Distance (Elevation)			1.6	m
Power Density			4.9	mW/cm^2
Safe Far Field Distance (Elevation)			3.5	m
Power Density			1.0	mW/cm^2

Conclusions

The worse-case radiation hazards exist along the main beam axis. In the case of the proposed operations, it is highly unlikely that the antenna axis will be aligned with any uncontrolled area since the antenna will be mounted on an aircraft fuselage and transmit operations will only be conducted with a clear field of view towards the serving satellite. In this case, the safety radius outside the aircraft where the General Population/ Uncontrolled Exposure limits are satisfied is 3.5 meters. The general public does not have access to this area.

In addition, commissioning and testing of the Panasonic Single-Panel Antenna will only be conducted by trained personnel in a controlled environment. By maintaining an adequate safety radius during transmit operations, it can be guaranteed that the General Population/Uncontrolled Exposure limits will not be exceeded under any conditions. As required by Special Condition 90053, Panasonic will utilize appropriate labeling warning about the radiation hazard, including a diagram showing the regions around the terminal where the radiation levels could exceed 1.0 mW/cm^2.

V. SPA Terminal Pointing Accuracy Report

Panasonic

Panasonic Avionics Corporation

Antenna Development Center

SPA Pointing Accuracy Report

Document Number: DRD-PR000017-14-1985

Prepared by Raviv Kiron Date __________

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Approved by Eran Borenstein/Ilan Bitton Date __________

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Approved by Josef Blumberger Date __________

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1 Introduction

This report presents a dynamic pointing accuracy analysis of the Panasonic Single Panel Antenna (“SPA”). The SPA was placed on a motion table and a laser beam was pointed to the antenna panel and reflected back to a target using a mirror attached to the antenna panel. The target is sized to indicate a 0.2° offset from the intended target (i.e., the serving satellite). The motion table was programmed for various changes in yaw, pitch and roll to reflect extreme changes in aircraft attitude relative to the target. The location of the laser beam relative to the 0.2° target during these movements was used to determine the pointing accuracy of the SPA.

2 Set Up

Figures 1 and 2 depict the test setup. The SPA was placed on 3-axis motion table, controlled by a PC and a motion controller (Motion Controller 1). On the table itself there are:

- 3 incremental encoders, which measure the 3-axis angles and their velocities.
- 3-axis accelerometers, which measure the initial angles (in stationary mode) in roll and pitch
- A motion controller (Motion Controller 2), which reads all sensors measurements, translates the motion into the antenna system and transmits the data in ARINC429 format to the SPA.

The PC also controls Motion Controller 2 for calibration purposes.

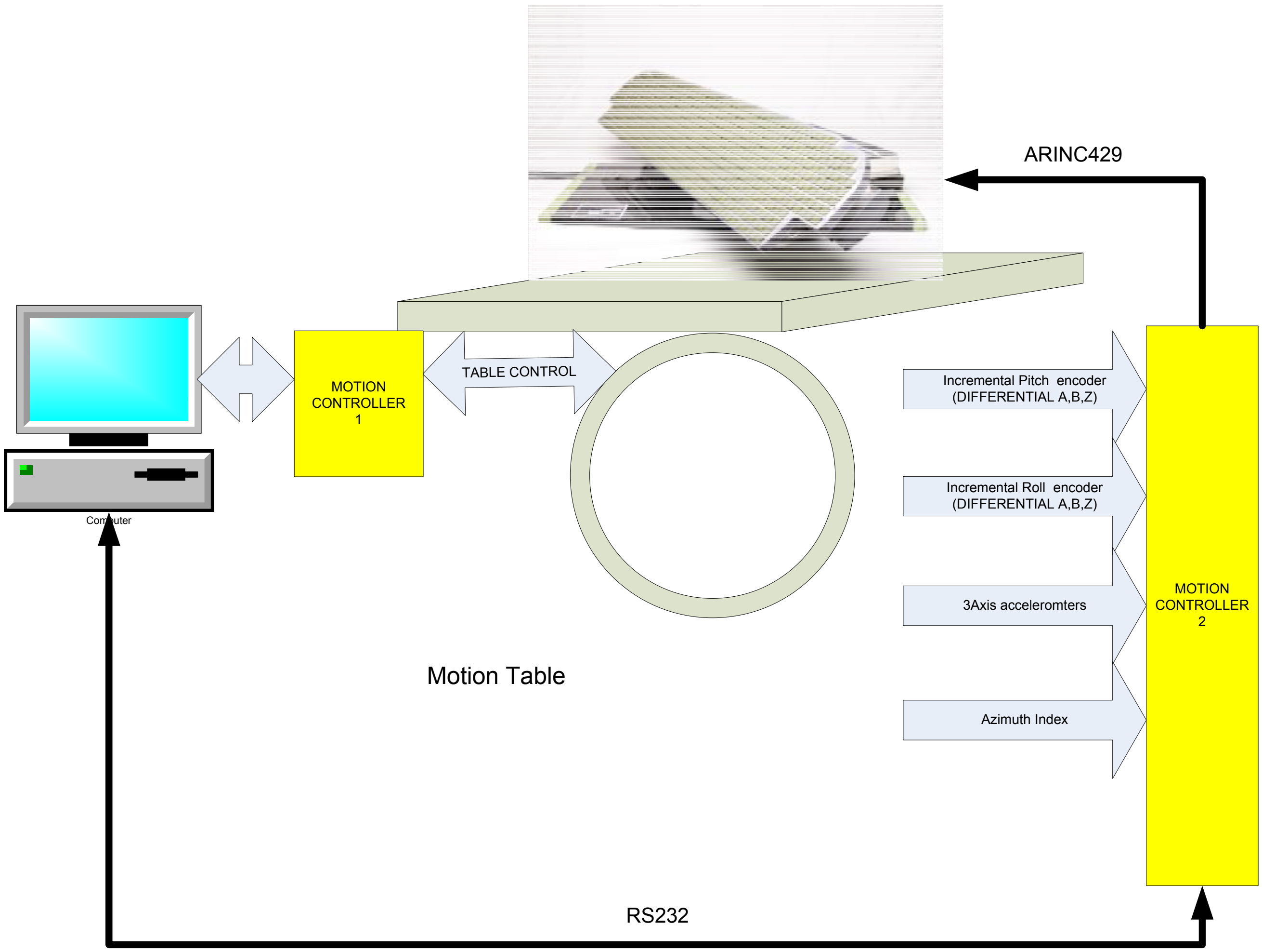


Figure 1: Motion table setup

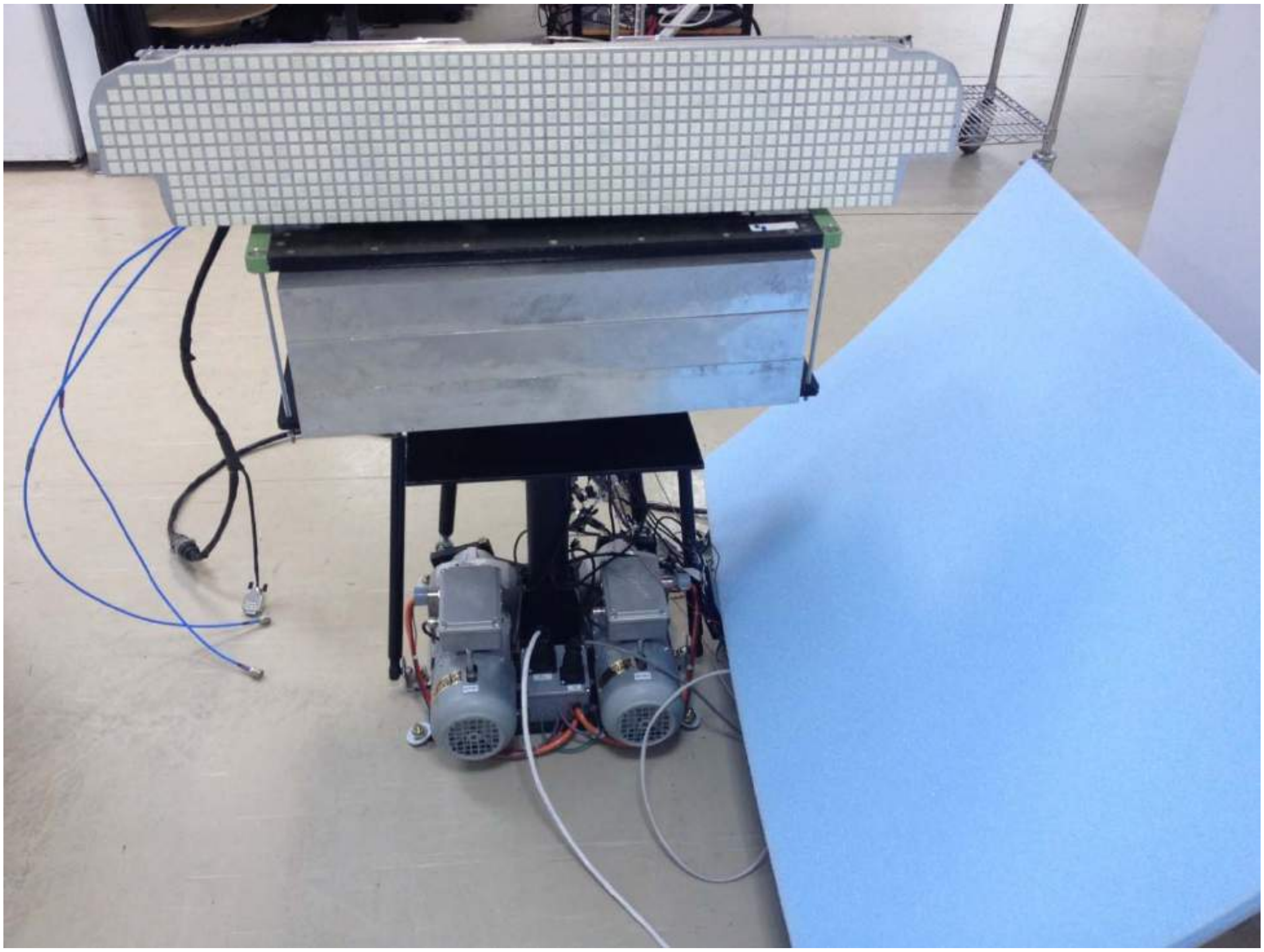


Figure 2 : Motion table

A laser source is mounted on the wall, and reflected back to the wall by the SPA panel (using a mirror) as shown in Figure 3.

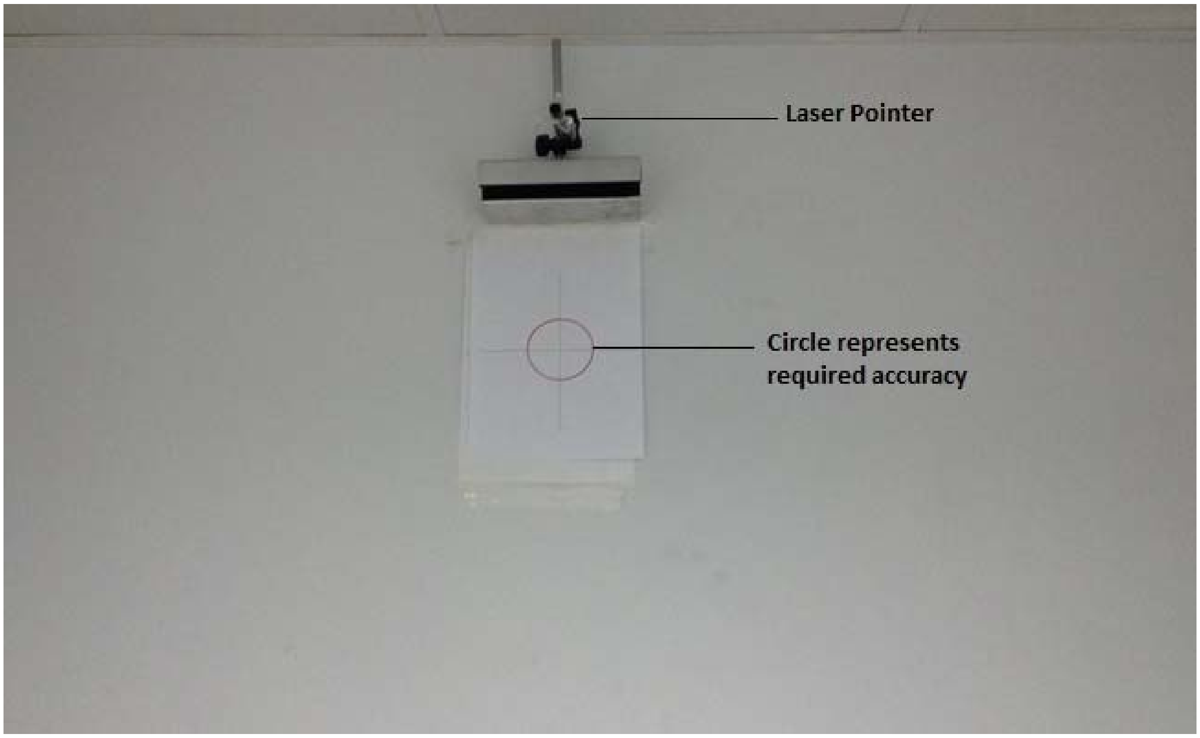


Figure 3 :LASER source & the reflection area

3 Calibration

3.1 Mounting calibration

When the SPA is mounted on the motion table, there are offsets between the antenna itself and the motion table. These offsets are being compensated by measuring the antenna tilt angles (using inclinometer) and the accelerometers readings and inserting these differences into the accelerometers memory.

3.2 Zero calibration

The purpose of this calibration is to set the laser beam in the center of the circle, see Figure 3. This is done by:

1. Averaging the accelerometers for 10 seconds to achieve accurate initial angles.
2. Initialize the azimuth axis by rotate the motion table until the beam is in its zero position, while the SPA is fixed (point mode).
3. Initialize the elevation axis by changing the SPA latitude (when satellite and SPA longitude are fixed).

3.3 Boundary radius calibration

While the laser beam is in the center of the circle, the azimuth and elevation were set to +/- 0.2°. The locations of the beam in each time determine the target circle radius.

4 Test Course

The SPA satellite and terminal longitude were set to 30°E and the SPA latitude was set to 65°S. The following tests were conducted:

The motion of the table was set to sine waves for the yaw, roll and pitch axes in the following combinations:

a. Each axis was set to 12°/sec while the other two are stationary.

b. Two axes were set to 8.5°/sec simultaneously while the third axis is stationary (yaw & pitch, yaw & roll, pitch & roll)

c. All three axes were set to 7°/sec simultaneously.

The behavior of the motion table in Test II is shown in Figures 4 and 5.

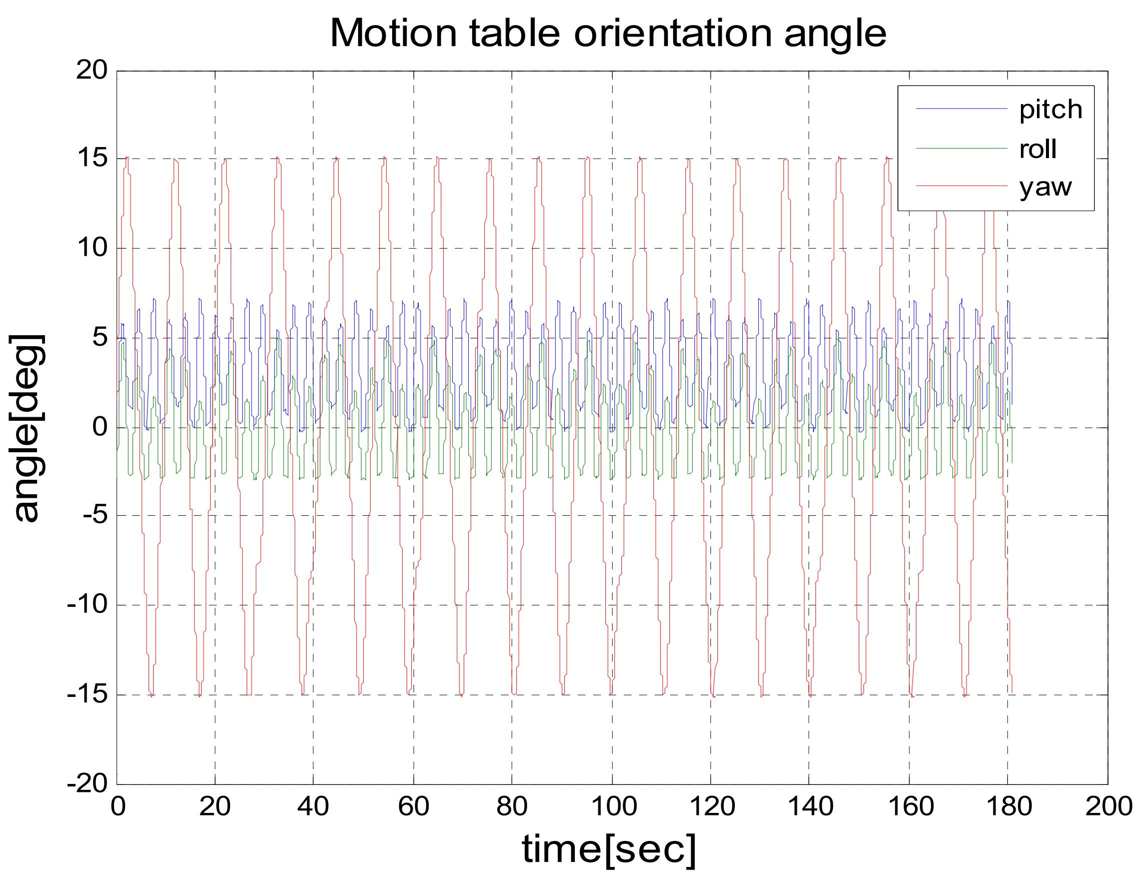


Figure 4 Motion table angles

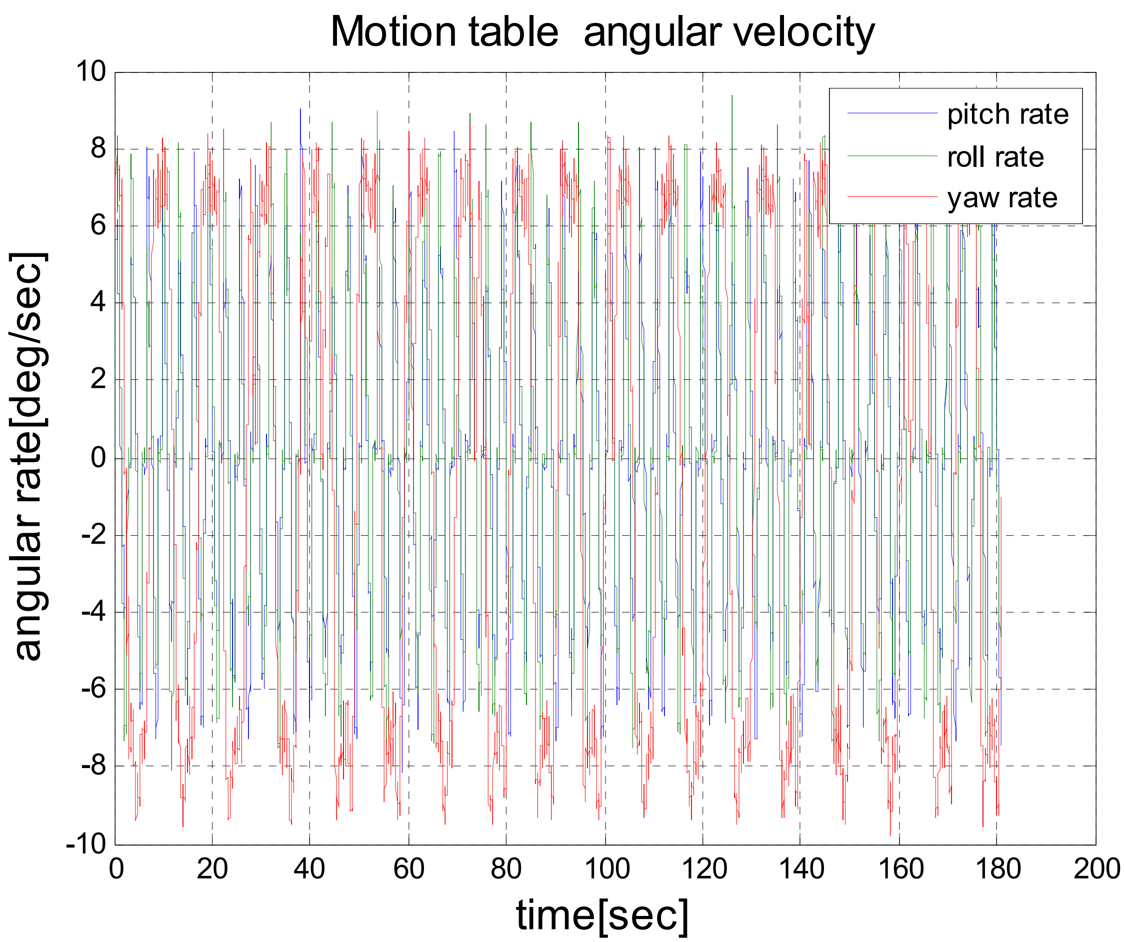


Figure 5 : Motion table angular velocity

5 Test Results

The SPA has a mechanism of knowing the setting angle vs. the actual angle. The difference is the antenna error angles. Antenna error angles for constellation 4.I.c (7°/sec for all axes) are shown in Figure 6.

Applicable document [2] shows the laser beam moving inside the circle.

The statistics of all test constellations are shown in Figures 7-19 and Tables 1-7:

- The frequency at the histograms y axis refers to the percentage of samples
- Accuracy = azimuth err * cos(skew angle) + elevation err *sin(skew err)

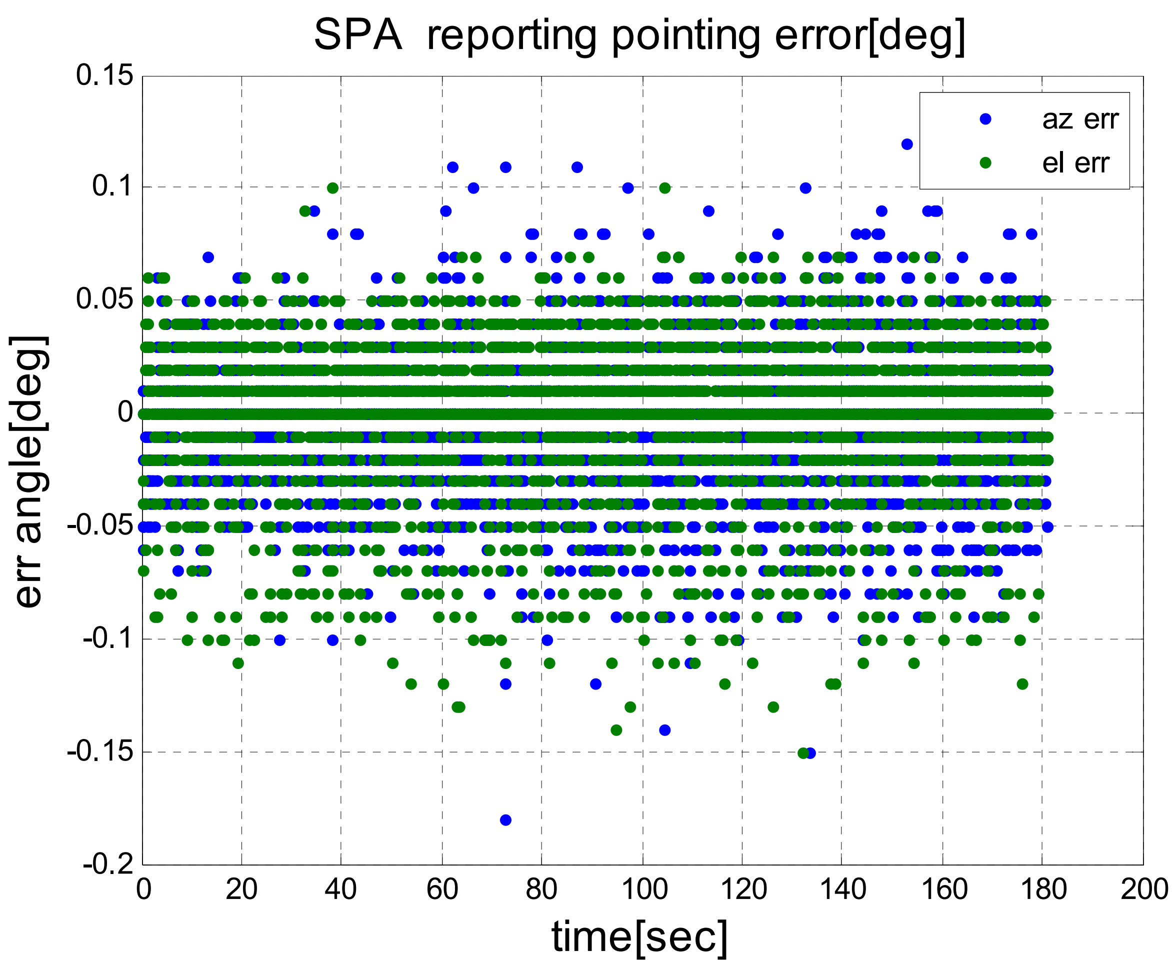


Figure 6: Antenna error report

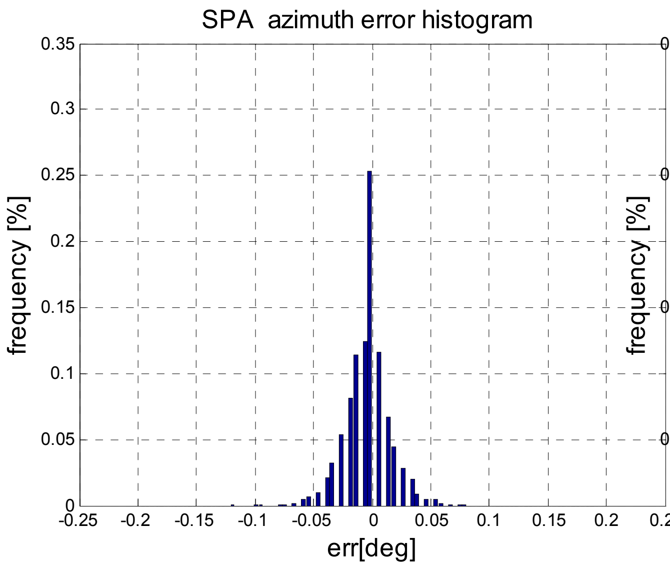


Figure 8: 3 axes@7deg/sec az err histogram

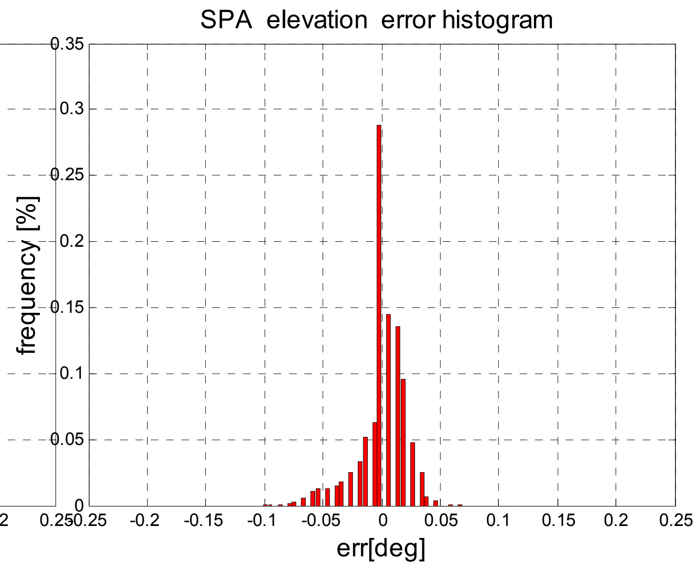


Figure 7: 3 axes@7deg/sec el err histogram

Yaw,BRollB&BPitchBratesB@B7°/secB		
BB	azBerr[°]B	elBerr[°]B
MeanB	*-0.01*	*0*
STDev3σB	*0.09*	*0.09*
MinB	*-0.18*	*-0.15*
MaxB	*0.12*	*0.1*
AccuracyB(45°)B3σB	*0.12*	

Table 1: Yaw, roll & pitch @ 7°/sec statistics

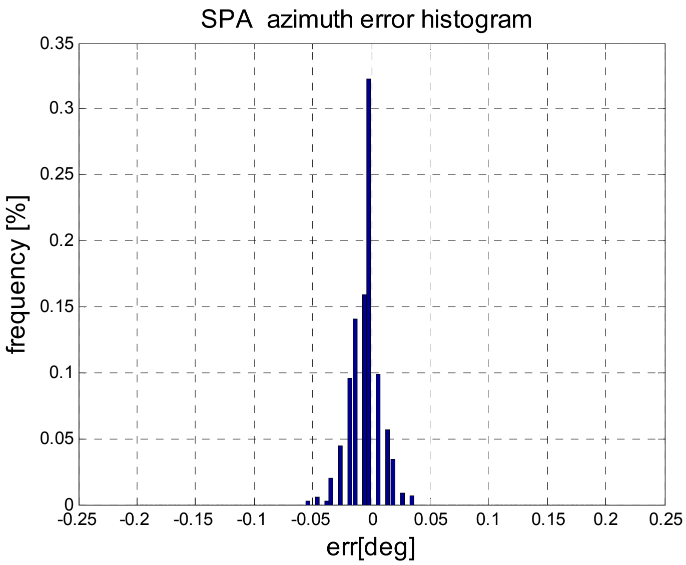


Figure 8: Yaw & pitch @8.5deg/sec az err histogram

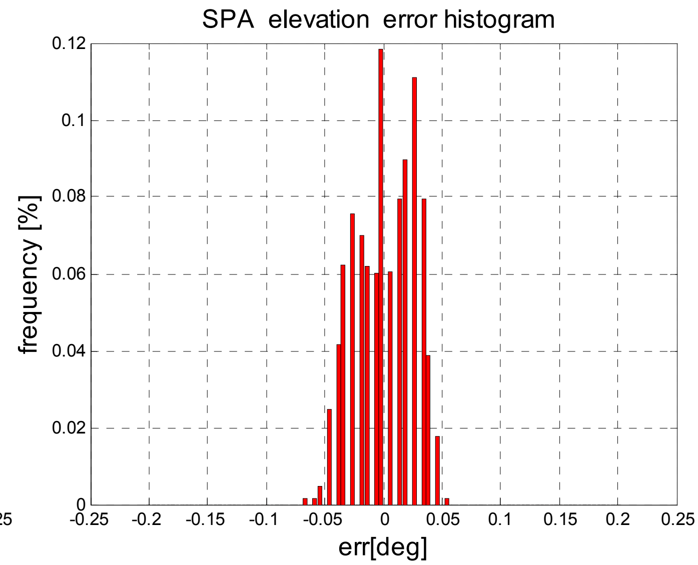


Figure 9: Yaw & pitch @8.5deg/sec el err histogram

Yaw & Pitch rates @ 8.5°/sec (Roll stationary)		
	az err[°]	el err[°]
Mean	*-0.01*	*0*
STDev3σ	*0.06*	*0.11*
Min	*-0.08*	*-0.1*
Max	*0.05*	*0.08*
Accuracy (45°) 3σ	*0.12*	

Table 2: Yaw & pitch @ 8.5°/sec statistics

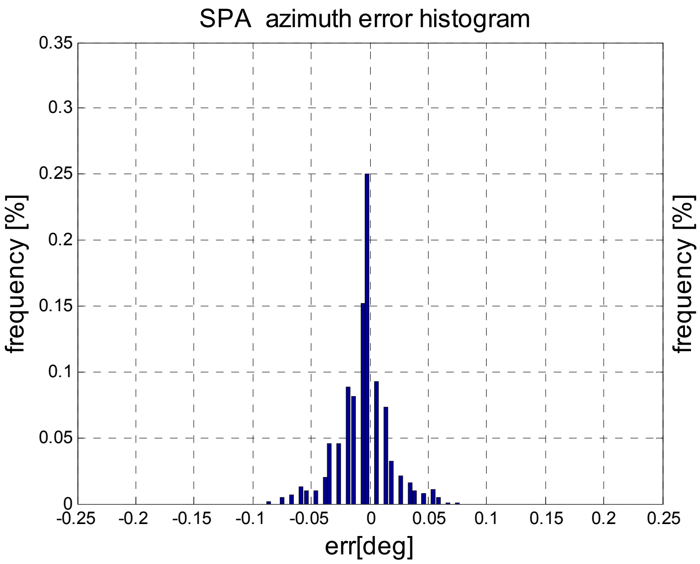


Figure 10: Yaw & roll @8.5deg/sec az err histogram

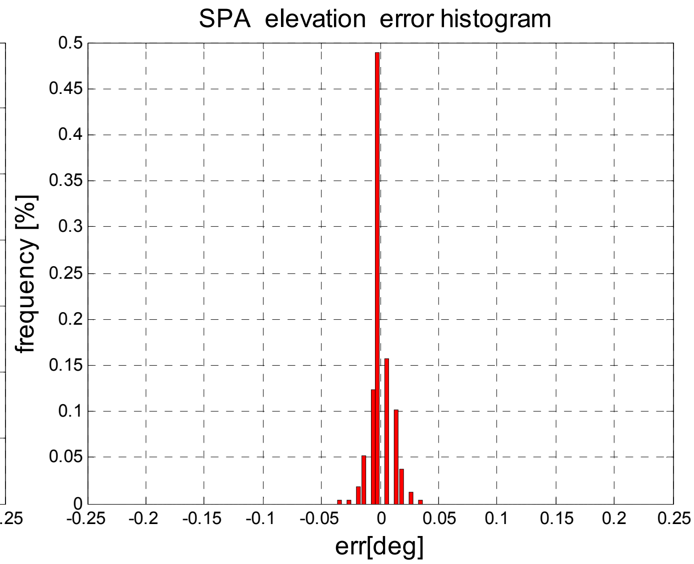


Figure 11: Yaw & roll @8.5deg/sec el err histogram

Yaw & Roll rates @ 8.5°/sec (Pitch stationary)		
	az err [°]	el err [°]
Mean	*-0.01*	*0*
STDev 3σ	*0.1*	*0.04*
Min	*-0.13*	*-0.05*
Max	*0.11*	*0.05*
Accuracy (45°) 3σ	*0.1*	

Table 3: Yaw & roll @ 8.5°/sec statistics

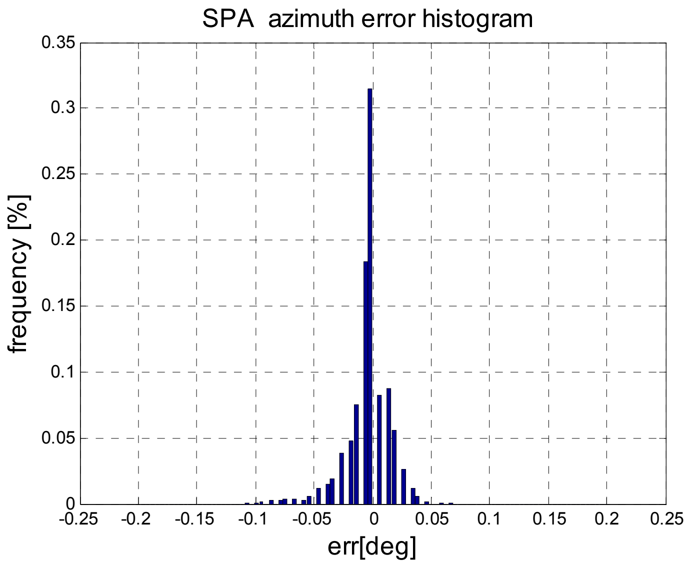


Figure 13: Pitch & roll @8.5deg/sec az err histogram

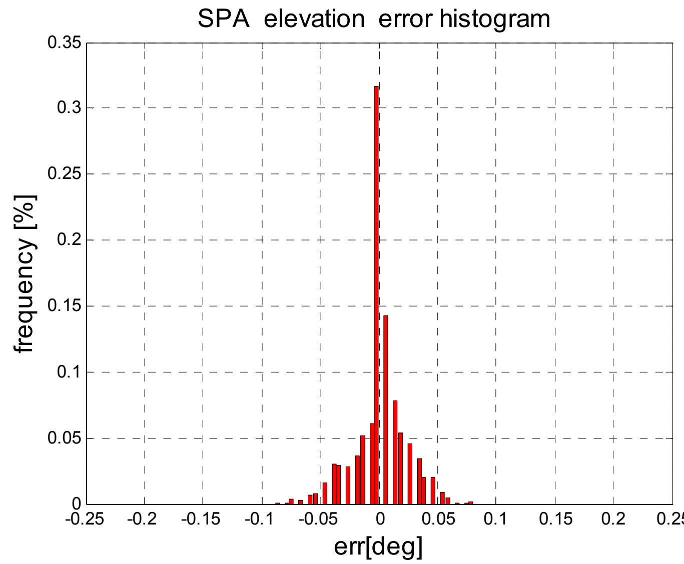


Figure 12: Pitch & roll @8.5deg/sec el err histogram

PitchB& RollBratesB@B8.5°/sec (YawBstationary)B		
BB	azBerr[°]B	elBerr[°]B
MeanB	*0*	*0*
STDev3σB	*0.08*	*0.10*
MinB	*-0.16*	*-0.13*
MaxB	*0.10*	*0.12*
AccuracyB(45°)B3σB	*0.13*	

Table 4 : Pitch & Roll @ 8.5°/sec statistics

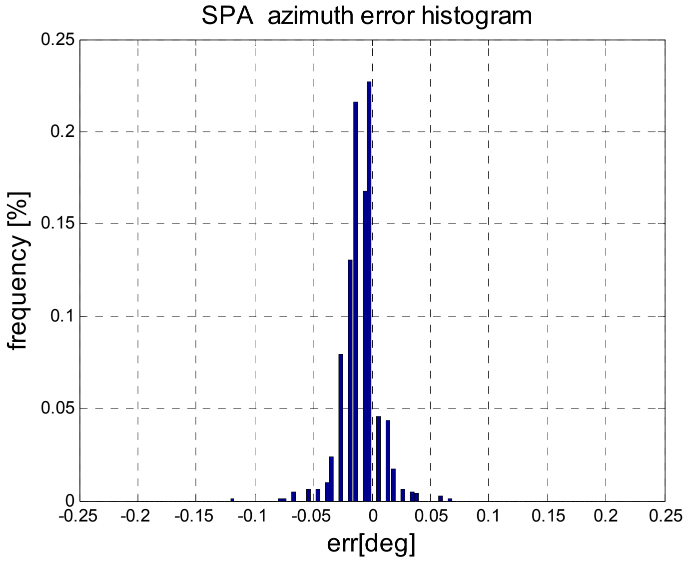


Figure 14: Yaw @12deg/sec az err histogram

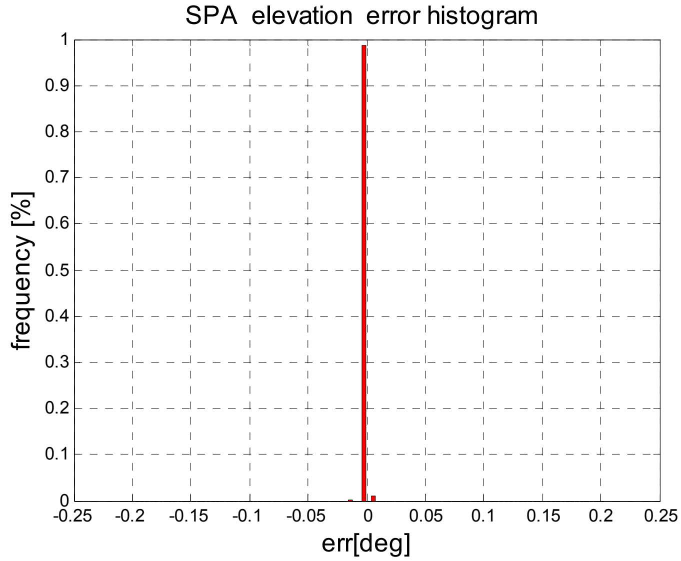


Figure 15: Yaw @12deg/sec el err histogram

YawBrateB@12°/sec (PitchBandBRollBstationary)B		
BB	azBerr[°]B	elBerr[°]B
MeanB	*-0.01*	*0*
STDev3σB	*0.07*	*0*
MinB	*-0.18*	*-0.02*
MaxB	*0.1*	*0.01*
AccuracyB(45°)B3σB	*0.05*	

Table 5 : Yaw @ 12°/sec statistics

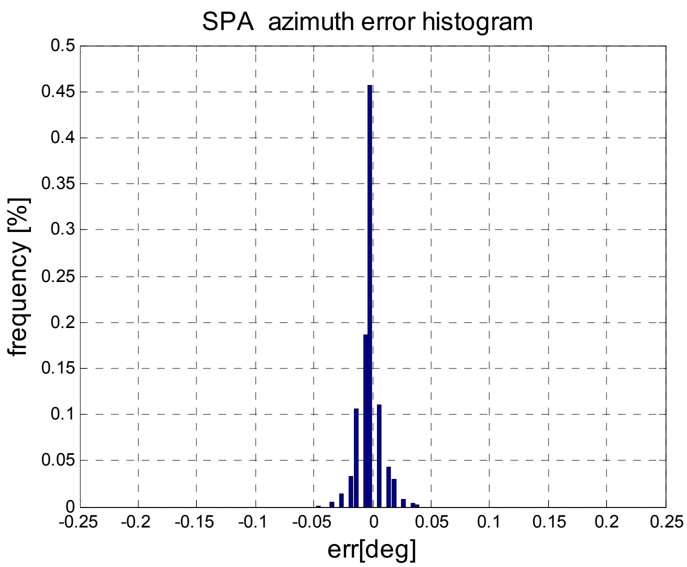


Figure 16: Pitch @12deg/sec az err histogram

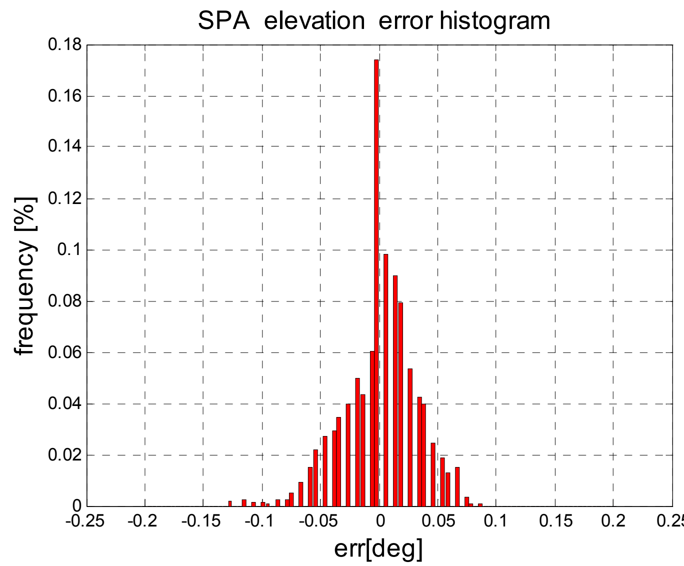


Figure 17: Pitch @12deg/sec el err histogram

PitchBrateBB@12°/sec (RollB&BYawBstationary)B		
BB	azBerr[°]B	elBerr[°]B
MeanB	*0*	*0*
STDev3σB	*0.04*	*0.14*
MinB	*-0.07*	*-0.19*
MaxB	*0.06*	*0.13*
AccuracyB(45°)B3σB	*0.13*	

Table 6 Pitch @ 12°/sec statistics

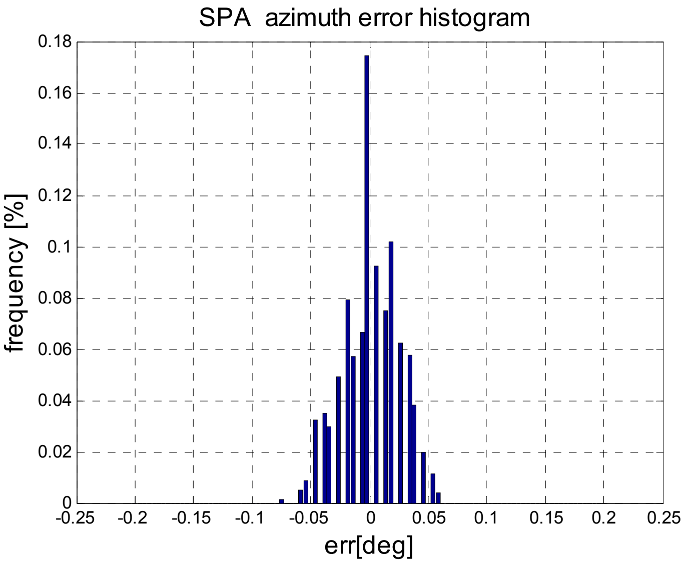


Figure 18: Roll @12deg/sec az err histogram

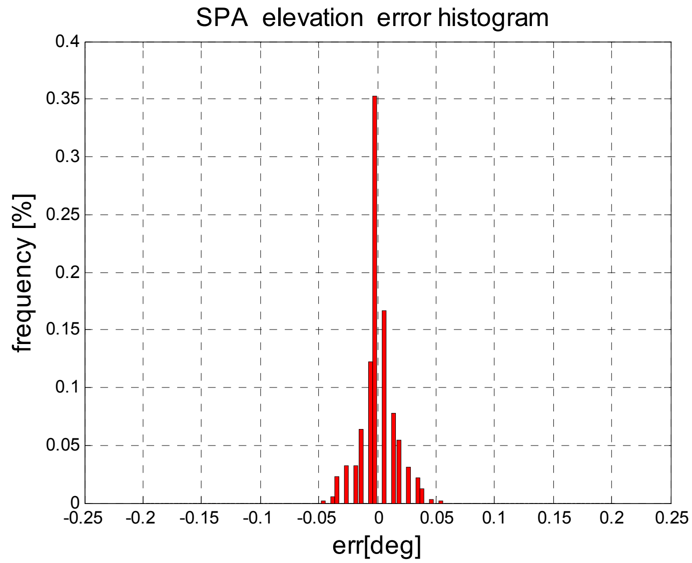


Figure 19: Roll @12deg/sec el err histogram

Roll rate @12°/sec (Pitch and Yaw stationary)		
	az err[°]	el err[°]
Mean	*0*	*0*
STDev 3σ	*0.11*	*0.06*
Min	*-0.11*	*-0.07*
Max	*0.09*	*0.08*
Accuracy (45°) 3σ	*0.12*	

Table 7: Roll @ 12°/sec statistics

6 Conclusion

As shown in figures 6-19 and tables 1-7, the SPA meets the requirement of pointing accuracy of 0.2° 3σ in azimuth and elevation axes, and the projected total error at target satellite. A snapshot from the movie showing the laser beam within the boundary circle of 0.2 °radius is attached below:

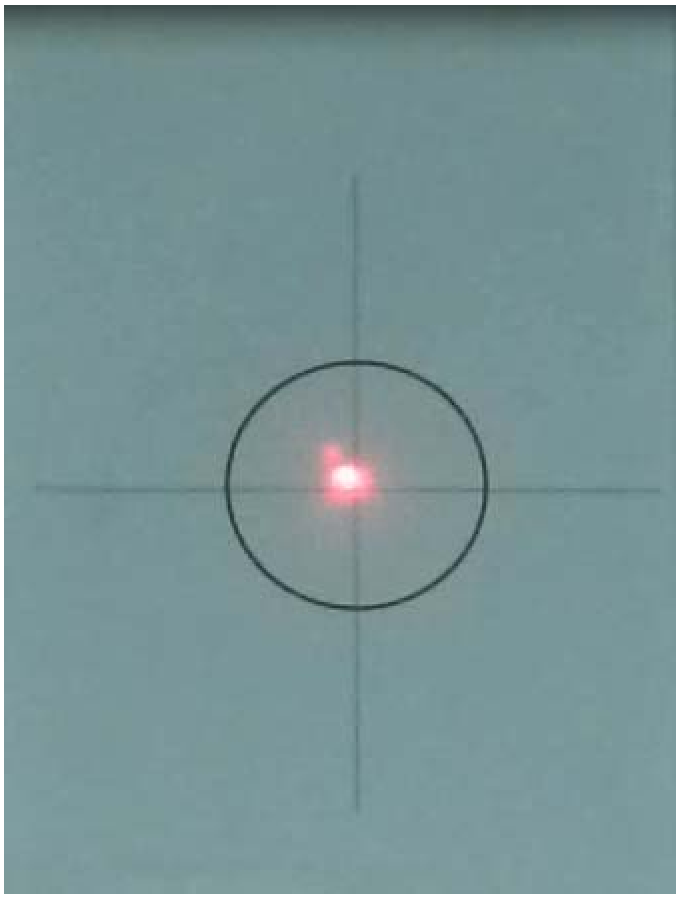
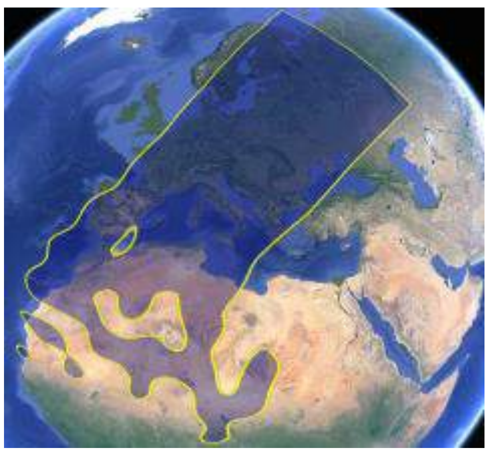


Figure 20 : Laser Beam within 0.2° Boundary

VI. PPA Terminal Proposed Satellite Point of Communication

- **i. Coverage Maps**
- **ii. Satellite Operator Certification Letter**
- **iii. Link Budget**

Telstar 12V Coverage Maps



Telstar 12V Satellite Operator Certification Letter

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

13 January 2016

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

Re: Engineering Certification of Telesat

To Whom It May Concern:

This letter certifies that Telesat is aware that Panasonic Avionics Corporation ("Panasonic") 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 Telstar 12 VANTAGE (T12V) satellite located at 15°W.L. Specifically, Telesat understands that Panasonic seeks to operate Panasonic Phased Array ("PPA") antenna as well as Panasonic Single Panel Antenna ("SPA") with this satellite for commercial purposes consistent with the FCC's Part 25 rules, including Section 25.227.

Based on the information provided by Panasonic, Telesat understands the technical characteristics of the above-mentioned antennas and Telesat (i) recognizes that operation of these terminals at the power density levels provided to Telesat is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from T12V; (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 Panasonic, Telesat will take into consideration the power density levels associated with such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely Yours,

BAHRAM BORNA
Satellite Spectrum Coordination Engineer
Telesat

Telstar 12V Link Budget

Forward Link Budget

eXConnect Terminal		
Antenna Type	AURA LE	
Lat	45.0	deg
Lon	10.0	deg
EIRP max	46.3	dBW
G/T	9.7	dB/K
Satellite		
Name	T12V	
Longitude	-15.0	deg
Hub Earth Station		
Site	Mount Jackson	
Lat	38.73	deg
Lon	-78.658	deg
EIRP max	90.0	dBW
G/T	40.0	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	6.24E+07	bps
Information Rate (Data + Overhead)	6.75E+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	4.47E+07	Hz
C/N Threshold	4.4	dB
Uplink		
Frequency	29.438	GHz
Back off	8.3	dB
EIRP Spectral Density	41.2	dBW/4kHz
Slant Range	40403	km
Space Loss, Ls	214.0	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	21.9	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	18.2	dB/K
Thermal Noise, C/No	92.6	dBHz
C/(No+Io)	92.1	dBHz
Satellite		
Flux Density	-103.4	dBW/m2
SFD @ Hub	-94.4	dBW/m2
Small Signal Gain (IBO/OBO)	1.7	dB
OBO	7.3	dB
Downlink		
Frequency	11.014	GHz
Transponder Sat. EIRP @ Beam Peak	58.8	dBW
Transponder Sat. EIRP @ Terminal	57.8	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	11.0	dBW/4kHz
Carrier EIRP @ Beam Peak	51.5	dBW
Carrier EIRP @ Terminal	50.5	dBW
Slant Range	38395	km
Space Loss, Ls	205.0	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.3	dBHz
C/(No+Io)	82.5	dBHz
End to End		
End to End C/(No+Io)	82.0	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	4.5	dB
Link Margin	0.1	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	AURA LE	
Lat	45.0	deg
Lon	10.0	deg
EIRP max	46.3	dBW
G/T	9.7	dB/K
Satellite		
Name	T12V	
Longitude	-15.0	deg
Hub Earth Station		
Site	Mount Jackson	
Lat	38.73	deg
Lon	-78.658	deg
EIRP max	90.0	dBW
G/T	40.0	dB/K
Signal		
Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.86	
Overhead Rate	0.87	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.49	bps/Hz
Data Rate	9.94E+06	bps
Information Rate (Data + Overhead)	1.14E+07	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	6.10E+06	Hz
C/N Threshold	7.5	dB
Uplink		
Frequency	14.064	GHz
Back off	0.0	dB
EIRP Spectral Density	14.1	dBW/4kHz
Slant Range	38395	km
Space Loss, Ls	207.1	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	11.8	dB/K
Thermal Noise, C/No	78.9	dBHz
C/(No+Io)	78.4	dBHz
Satellite		
Flux Density	-117.1	dBW/m2
SFD @ Terminal	-89.8	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	25.3	dB
Downlink		
Frequency	18.364	GHz
Transponder Sat. EIRP @ Beam Peak	63.6	dBW
Transponder Sat. EIRP @ Hub	63.6	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	6.1	dBW/4kHz
Carrier EIRP @ Beam Peak	38.3	dBW
Carrier EIRP @ Hub	38.3	dBW
Slant Range	40403	km
Space Loss, Ls	209.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	12.9	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	84.1	dBHz
C/(No+Io)	82.0898	dBHz
End to End		
End to End C/(No+Io)	76.9	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	8.6	dB
Link Margin	1.1	dB

VII. Section 25.227 Certifications

CERTIFICATIONS

Panasonic Avionics Corporation ("Panasonic"), pursuant to Section 25.227 of the FCC's Rules, hereby certifies the following:

1. In accordance with Section 25.227(a)(15), as the operator of an ESAA system operating over international waters, Panasonic has confirmed with its target space station operators that its existing and proposed operations are within coordinated parameters for adjacent satellites up to six degrees away (+/- 6°) on the geostationary arc.

2. In accordance with Section 25.227(b)(7), Panasonic certifies that its existing and proposed operations comply with the following requirements of Section 25.227:
   - Per Section 25.227(a)(6), for each ESAA transmitter, Panasonic will time annotate and maintain a record for a period of not less than one year of the vehicle location (i.e., latitude/longitude/altitude), transmit frequency, channel bandwidth and satellite used. Records will be recorded at time intervals no greater than one (1) minute while the ESAA is transmitting. Panasonic will make this data available in the requisite format within 24 hours of a request from the Commission, NTIA, or a frequency coordinator for purposes of resolving harmful interference events.
   - Per Section 25.227(a)(9), each ESAA terminal will automatically cease transmitting within 100 milliseconds upon loss of reception of the satellite downlink signal or when it detects that unintended satellite tracking has happened or is about to happen.
   - Per Section 25.227(a)(10), each ESAA terminal will be subject to the monitoring and control by an NCMC. Each terminal will be able to receive "enable transmission" and "disable transmission" commands from the NCMC and must automatically cease transmissions immediately on receiving any "parameter change command", which may cause harmful interference during the change, until it receives an "enable transmission" command from its NCMC. In addition, the NCMC will be able to monitor the operation of an ESAA terminal to determine if it is malfunctioning.
   - Per Section 25.227(a)(11), each ESAA terminal shall be self-monitoring and, should a fault which can cause harmful interference to FSS networks be detected, the terminal will automatically cease transmissions.

By:

Mark DeFazio
Manager, GCS Regulatory and Business Operations
Panasonic Avionics Corporation

August 17, 2016

VIII. FCC § 25.227 Compliance Matrix

Rule	Text	Application Citation
§ 25.227	§ 25.227 Blanket Licensing provisions for Earth Stations Aboard Aircraft (ESAAs) receiving in the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), and 11.7-12.2 GHz (space-to-Earth) frequency bands and transmitting in the 14.0-14.5 GHz (Earth-to-space) frequency band, operating with Geostationary Satellites in the Fixed-Satellite Service.	
§ 25.227(a)	(a) The following ongoing requirements govern all ESAA licensees and operations in the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 GHz (Earth-to-space) frequency bands receiving from and transmitting to geostationary orbit satellites in the Fixed-Satellite Service. ESAA licensees shall comply with the requirements in either paragraph (a)(1), (a)(2) or (a)(3) of this section and all of the requirements set forth in paragraphs (a)(4)-(a)(16) and paragraphs (c), (d), and (e) of this section. Paragraph (b) of this section identifies items that shall be included in the application for ESAA operations to demonstrate that these ongoing requirements will be met.	*See* Application, File No. SES-LIC-20100805-00992, Technical Appendix; File No. SES-MFS-20120913-00818, Technical Appendix (prior grant for PPA and MELCO ESAAs).
§ 25.227(a)(1)	(1) The following requirements shall apply to an ESAA that uses transmitters with off-axis EIRP spectral-densities lower than or equal to the levels in paragraph (a)(1)(i) of this subsection. ESAA licensees operating under this subsection shall provide a detailed demonstration as described in paragraph (b)(1) of this section. The ESAA transmitter also shall comply with the antenna pointing and cessation of emission requirements in paragraphs (a)(1)(ii) and (a)(1)(iii) of this subsection.	N/A. Authority requested under § 25.227(a)(2) (satellite operator certification)
§ 25.227(a)(1)(i)	(i) An ESAA licensee shall not exceed the off-axis EIRP spectral-density limits and conditions defined in paragraphs (a)(1)(A)-(D) of this subsection.	*Id.*

§ 25.227(a)(1)(i)(A)	(A) The off-axis EIRP spectral-density for co-polarized signals emitted from the ESAA, in the plane of the geostationary satellite orbit (GSO) as it appears at the particular earth station location, shall not exceed the following values: 15 - 10 log10(N) - 25 log10θ dBW/4 kHz For 1.5° ≤ θ ≤ 7° -6 - 10 log10(N) dBW/4 kHz For 7° < θ ≤ 9.2° 18 - 10 log10(N) - 25 log10θ dBW/4 kHz For 9.2° < θ ≤ 48° -24 - 10 log10(N) dBW/4 kHz For 48° < θ ≤ 85° -14 - 10 log10(N) dBW/4 kHz For 85° < θ ≤ 180° where theta (θ) is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite in the plane of the GSO. The plane of the GSO is determined by the focal point of the antenna and the line tangent to the arc of the GSO at the orbital location of the target satellite. For ESAA networks using frequency division multiple access (FDMA) or time division multiple access (TDMA) techniques, N is equal to one. For ESAA networks using multiple co-frequency transmitters that have the same EIRP density, N is the maximum expected number of co-frequency simultaneously transmitting ESV earth stations in the same satellite receiving beam. For the purpose of this subsection, the peak EIRP density of an individual sidelobe shall not exceed the envelope defined above for θ between 1.5° and 7.0°. For θ greater than 7.0°, the envelope shall be exceeded by no more than 10% of the sidelobes, provided no individual sidelobe exceeds the envelope given above by more than 3 dB.	*Id.*
§ 25.227(a)(1)(i)(B)	(B) In all directions other than along the GSO, the off-axis EIRP spectral-density for co-polarized signals emitted from the ESAA shall not exceed the following values: 18 - 10 log10(N)- 25log log10θ dBW/4 kHz For 3.0° ≤ θ ≤ 48° -24 - 10 log10(N) dBW/4 kHz For 48° < θ ≤ 85° -14- 10 log10(N) dBW/4kHz For 85° < θ ≤ 180° where θ and N are defined in (a)(1)(i)(A). This off-axis EIRP spectral-density applies in any plane that includes the line connecting the focal point of the antenna to the orbital location of the target satellite with the exception of the plane of the GSO as defined in paragraph (a)(1)(i)(A) of this section. For the purpose of this subsection, the envelope shall be exceeded by no more than 10% of the sidelobes provided no individual sidelobe exceeds the EIRP density envelope given above by more than 6 dB. The region of the main reflector spillover energy is to be interpreted as a single lobe and shall not exceed the envelope by more than 6 dB.	*Id.* (prior authority to operate conditioned on coordination with Ku-band NGSO systems).

§ 25.227(a)(1)(i)(C)	(C) The off-axis EIRP spectral-density for cross-polarized signals emitted from the ESAA shall not exceed the following values: In the plane of the geostationary satellite orbit as it appears at the particular earth station location: 5 - 10 log10(N)- 25log10θ dBW/4kHz For 1.8° < θ ≤ 7° -16 - 10 log10(N) dBW/4kHz For 7° < θ ≤ 9.2° where θ and N are defined in (a)(1)(i)(A).	*Id.*
§ 25.227(a)(1)(ii)	(ii) Each ESAA transmitter shall meet one of the following antenna pointing requirements: (A) Each ESAA transmitter shall maintain a pointing error of less than or equal to 0.2° between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna; or (B) Each ESAA transmitter shall declare a maximum antenna pointing error that may be greater than 0.2° provided that the ESAA does not exceed the off-axis EIRP spectral-density limits in paragraph (a)(1)(i) of this section, taking into account the antenna pointing error.	*Id.* (ESAAs comply)
§ 25.227(a)(1)(iii)	(iii) Each ESAA transmitter shall meet one of the following cessation of emission requirements: (A) For ESAAs operating under paragraph (a)(1)(ii)(A) of this section, all emissions from the ESAA shall 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 ESAA antenna exceeds 0.5°, and transmission shall not resume until such angle is less than or equal to 0.2°, or (B) For ESAA transmitters operating under paragraph (a)(1)(ii)(B) of this section, all emissions from the ESAA shall 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 ESAA antenna exceeds the declared maximum antenna pointing error and shall not resume transmissions until such angle is less than or equal to the declared maximum antenna pointing error.	*Id.*

25.227(a)(2)	(2) The following requirements shall apply to an ESAA, or ESAA system, that uses off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(1)(i) of this section. An ESAA, or ESAA network, operating under this subsection shall file certifications and provide a detailed demonstration as described in paragraph (b)(2) of this section. (i) The ESAA shall transmit only to the target satellite system(s) referred to in the certifications required by paragraph (b)(2) of this section. (ii) If a good faith agreement cannot be reached between the target satellite operator and the operator of a future satellite that is located within 6 degrees longitude of the target satellite, the ESAA operator shall accept the power-density levels that would accommodate that adjacent satellite. (iii) The ESAA shall operate in accordance with the off-axis EIRP spectral-densities that the ESAA supplied to the target satellite operator in order to obtain the certifications listed in paragraph (b)(2) of this section. The ESAA shall automatically cease emissions within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator and transmission shall not resume until ESAA conforms to the off-axis EIRP spectral densities supplied to the target satellite operator. (iv) In the event that a coordination agreement discussed in paragraph (b)(2)(ii) of this section is reached, but that coordination agreement does not address protection from interference for the earth station, that earth station will be protected from interference to the same extent that an earth station that meets the requirements of §25.209 of this title would be protected from interference.	Panasonic complies (no separate certification required); *see also* Section 25.227(b)(2).
§ 25.227(a)(3)(i)	(3) The following requirements shall apply to an ESAA system that uses variable power-density control of individual simultaneously transmitting co-frequency ESAA earth stations in the same satellite receiving beam. An ESAA system operating under this subsection shall provide a detailed demonstration as described in paragraph (b)(3) of this section. (i) The effective aggregate EIRP density from all terminals shall be at least 1 dB below the off-axis EIRP density limits defined in paragraph (a)(1)(i)(A)-(C), with the value of N=1. In this context the term "effective" means that the resultant co-polarized and cross-polarized EIRP density experienced by any GSO or non-GSO satellite shall not exceed that produced by a single transmitter operating 1 dB below the limits defined in paragraph (a)(1)(i)(A)-(C). The individual ESAA transmitter shall automatically cease emissions within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP density limits minus 1 dB specified above. If one or more ESAA transmitters causes the aggregate off-axis EIRP-densities to exceed the off-axis EIRP density limits minus 1dB specified above, then the transmitter or transmitters shall cease or reduce emissions within 100 milliseconds of receiving a command from the system's network control and monitoring center. An ESAA system operating under this subsection shall provide a detailed demonstration as described in paragraph (b)(3)(i) of this section.	N/A

§ 25.227(a)(3)(ii)	(ii) The following requirements shall apply to an ESAA that uses off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(3)(i) of this section. An ESAA system operating under this subsection shall file certifications and provide a detailed demonstration as described in paragraphs (b)(3)(ii) and (b)(3)(iii) of this section. (A) If a good faith agreement cannot be reached between the target satellite operator and the operator of a future satellite that is located within 6 degrees longitude of the target satellite, the ESAA shall operate at an EIRP density defined in (a)(3)(i) of this section. (B) The ESAA shall operate in accordance with the off-axis EIRP spectral-densities that the ESAA supplied to the target satellite operator in order to obtain the certifications listed in paragraph (b)(3)(ii) of this section. The individual ESAA terminals shall automatically cease emissions within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator. The overall system shall be capable of shutting off an individual transmitter or the entire system if the aggregate off-axis EIRP spectral-densities exceed those supplied to the target satellite operator. (C) The ESAA shall transmit only to the target satellite system(s) referred to in the certifications required by paragraph (b)(3) of this section.	*Id.*
§ 25.227(a)(4)	(4) An applicant filing to operate an ESAA terminal or system and planning to use a contention protocol shall certify that its contention protocol use will be reasonable.	*Id.*
§ 25.227(a)(5)	(5) There shall be a point of contact in the United States, with phone number and address, available 24 hours a day, seven days a week, with authority and ability to cease all emissions from the ESAA.	*See* Technical Appendix, I.
§ 25.227(a)(6)	(6) For each ESAA transmitter, a record of the vehicle location (i.e., latitude/longitude/altitude), transmit frequency, channel bandwidth and satellite used shall be time annotated and maintained for a period of not less than one year. Records shall be recorded at time intervals no greater than one (1) minute while the ESAA is transmitting. The ESAA operator shall make this data available, in the form of a comma delimited electronic spreadsheet, within 24 hours of a request from the Commission, NTIA, or a frequency coordinator for purposes of resolving harmful interference events. A description of the units (i.e., degrees, minutes, MHz ….) in which the records values are recorded will be supplied along with the records.	*See* Technical Appendix, VII.
§ 25.227(a)(7)	(7) In the 10.95-11.2 GHz (space-to-Earth) and 11.45-11.7 GHz (space-to-Earth) frequency bands ESAAs shall not claim protection from interference from any authorized terrestrial stations to which frequencies are either already assigned, or may be assigned in the future.	Applicable regulatory status and protection provision. Panasonic complies.
§ 25.227(a)(8)	(8) An ESAA terminal receiving in the 11.7-12.2 GHz (space-to-Earth) bands shall receive protection from interference caused by space stations other than the target space station only to the degree to which harmful interference would not be expected to be caused to an earth station employing an antenna conforming to the referenced patterns defined in paragraphs (a) and (b) of section 25.209 and stationary at the location at which any interference occurred.	Applicable regulatory status and protection provision. Panasonic complies.

§ 25.227(a)(9)	(9) Each ESAA terminal shall automatically cease transmitting within 100 milliseconds upon loss of reception of the satellite downlink signal or when it detects that unintended satellite tracking has happened or is about to happen.	*See* Technical Appendix, VII.
§ 25.227(a)(10)	(10) Each ESAA terminal should be subject to the monitoring and control by an NCMC or equivalent facility. Each terminal must be able to receive at least "enable transmission" and "disable transmission" commands from the NCMC and must automatically cease transmissions immediately on receiving any "parameter change command", which may cause harmful interference during the change, until it receives an "enable transmission" command from its NCMC. In addition, the NCMC must be able to monitor the operation of an ESAA terminal to determine if it is malfunctioning.	*Id.*
§ 25.227(a)(11)	(11) Each ESAA terminal shall be self-monitoring and, should a fault which can cause harmful interference to FSS networks be detected, the terminal must automatically cease transmissions.	*Id.*
§ 25.227(a)(12)	(12) Unless otherwise stated all ESAA system that comply with the off-axis EIRP spectral-density limits in (a)(1)(i) may request ALSAT authority.	Applicable regulatory status and protection provision.
§ 25.227(a)(13)	(13) ESAA providers operating in the international airspace within line-of-sight of the territory of a foreign administration where fixed service networks have primary allocation in this band, the maximum power flux density (pfd) produced at the surface of the Earth by emissions from a single aircraft carrying an ESAA terminal should not exceed the following values unless the foreign Administration has imposed other conditions for protecting its fixed service stations: $-132+0.5 \cdot \theta$ dB(W/(m2 · MHz)) For $\theta \leq 40°$ -112 dB(W/(m2 · MHz)) For $40° < \theta \leq 90°$ Where: θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal) and the aforementioned limits relate to the pfd and angles of arrival would be obtained under free-space propagation conditions.	Applicable regulatory status and protection provision.
§ 25.227(a)(14)	(14) All ESAA terminals operated in U.S. airspace, whether on U.S.-registered civil aircraft or non-U.S.-registered civil aircraft, must be licensed by the Commission. All ESAA terminals on U.S.-registered civil aircraft operating outside of U.S. airspace must be licensed by the Commission, except as provided by Section 303(t) of the Communications Act.	Applicable regulatory status and protection provision.
§ 25.227(a)(15)	(15) For ESAA systems operating over international waters, ESAA operators will certify that their target space station operators have confirmed that proposed ESAA operations are within coordinated parameters for adjacent satellites up to 6 degrees away on the geostationary arc.	*See* Technical Appendix, VII.
§ 25.227(a)(16)	(16) Prior to operations within the foreign nation's airspace, the ESAA operator will ascertain whether the relevant administration has operations that could be affected by ESAA terminals, and will determine whether that administration has adopted specific requirements concerning ESAA operations. When the aircraft enters	Panasonic complies (no specific certification required).

	foreign airspace, the ESAA terminal would be required to operate under the Commission's rules, or those of the foreign administration, whichever is more constraining. To the extent that all relevant administrations have identified geographic areas from which ESAA operations would not affect their radio operations, ESAA operators would be free to operate within those identified areas without further action. To the extent that the foreign administration has not adopted requirements regarding ESAA operations, ESAA operators would be required to coordinate their operations with any potentially affected operations.	
§ 25.227(b)	(b) Applications for ESAA operation in the 14.0-14.5 GHz (Earth-to-space) band to GSO satellites in the Fixed-Satellite Service shall include, in addition to the particulars of operation identified on Form 312, and associated Schedule B, the applicable technical demonstrations in paragraphs (b)(1), (b)(2) or (b)(3) and the documentation identified in paragraphs (b)(4) through (b)(8) of this section.	
§ 25.227(b)(1)	(1) An ESAA applicant proposing to implement a transmitter under paragraph (a)(1) of this section shall demonstrate that the transmitter meets the off-axis EIRP spectral-density limits contained in paragraph (a)(1)(i) of this section. To provide this demonstration, the application shall include the tables described in paragraph (b)(1)(i) of this section or the certification described in paragraph (b)(1)(ii) of this section. The ESAA applicant also shall provide the value N described in paragraph (a)(1)(i)(A) of this section. An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(A) of this section shall provide the certifications identified in paragraph (b)(1)(iii) of this section. An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(B) of this section shall provide the demonstrations identified in paragraph (b)(1)(iv) of this section.	N/A
§ 25.227(b)(1)(i)	(i) Any ESAA applicant filing an application pursuant to paragraph (a)(1) of this section shall file three tables and/or graphs depicting off-axis EIRP density masks defined by 25.227(a) and measured off-axis EIRP density levels of the proposed earth station antenna in the direction of the plane of the GSO; the co-polarized EIRP density in the elevation plane, that is, the plane perpendicular to the plane of the GSO; and cross-polarized EIRP density. Each table shall provide the EIRP density level at increments of 0.1° for angles between 0° and 10° off-axis, and at increments of 5° for angles between 10° and 180° off-axis. (A) For purposes of the off-axis EIRP density table in the plane of the GSO, the off-axis angle is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite, and the plane of the GSO is determined by the focal point of the antenna and the line tangent to the arc of the GSO at the orbital position of the target satellite. (B) For purposes of the off-axis co-polarized EIRP density table in the elevation plane, the off-axis angle is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite, and the elevation plane is defined as the plane perpendicular to the plane of the GSO defined in paragraph (b)(1)(i)(A) of this section. (C) For purposes of the cross-polarized EIRP density table, the off-axis angle is the angle in degrees from the line connecting the focal point of the antenna to the orbital location of the target satellite and the plane of the GSO as defined in paragraph (b)(1)(i)(A) of this section will be used.	*Id.*
§ 25.227(b)(1)(ii)	(ii) An ESAA applicant shall include a certification, in Schedule B, that the ESAA antenna conforms to the gain pattern criteria of § 25.209(a) and (b), that, combined with the maximum input power density calculated from the EIRP density less the antenna gain, which is entered in Schedule B, demonstrates that the off-axis EIRP spectral density envelope set forth in paragraphs (a)(1)(i)(A) through (a)(1)(i)(C) of this section will be	*Id.*

	met under the assumption that the antenna is pointed at the target satellite.	
§ 25.227(b)(1)(iii)	(iii) An ESAA applicant proposing to implement a transmitter under paragraphs (a)(1)(ii)(A) of this section shall: (A) demonstrate that the total tracking error budget of their antenna is within 0.2º or less between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna. As part of the engineering analysis, the ESAA applicant must show that the antenna pointing error is within three sigma (б) from the mean value, *i.e.,* that there is a 0.997 probability the antenna maintains a pointing error within 0.2º; and (B) demonstrate that the antenna tracking system is capable of ceasing emissions within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds 0.5°.	*Id.* (ESAAs comply)
§ 25.227(b)(1)(iv)	(iv) An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(B) of this section shall: (A) declare, in its application, a maximum antenna pointing error and demonstrate that the maximum antenna pointing error can be achieved without exceeding the off-axis EIRP spectral-density limits in paragraph (a)(1)(i) of this section; and (B) demonstrate that the ESAA transmitter can detect if the transmitter exceeds the declared maximum antenna pointing error and can cease transmission within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds the declared maximum antenna pointing error, and will not resume transmissions until the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna is less than or equal to the declared maximum antenna pointing error.	*Id.*
§ 25.227(b)(2)	(2) An ESAA applicant proposing to implement a transmitter under paragraph (a)(2) of this section and using off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(1)(i) of this section shall provide the following certifications and demonstration as exhibits to its earth station application: (i) A statement from the target satellite operator certifying that the proposed operation of the ESAA has the potential to create harmful interference to satellite networks adjacent to the target satellite(s) that may be unacceptable. (ii) A statement from the target satellite operator certifying that the power density levels that the ESAA applicant provided to the target satellite operator are consistent with the existing coordination agreements between its satellite(s) and the adjacent satellite systems within 6° of orbital separation from its satellite(s). (iii) A statement from the target satellite operator certifying that it will include the power-density levels of the ESAA applicant in all future coordination agreements. (iv) A demonstration from the ESAA operator that the ESAA system will comply with all coordination agreements reached by the satellite operator and is capable of detecting and automatically ceasing emissions within 100 milliseconds when the transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator.	*See* Technical Appendix, VII.

§ 25.227(b)(3)(i)	(3) An ESAA applicant proposing to implement an ESAA system under paragraph (a)(3) of this section and using variable power-density control of individual simultaneously transmitting co-frequency ESAA earth stations in the same satellite receiving beam shall provide the following certifications and demonstration as exhibits to its earth station application: (i) The applicant shall make a detailed showing of the measures it intends to employ to maintain the effective aggregate EIRP density from all simultaneously transmitting cofrequency terminals operating with the same satellite transponder at least 1 dB below the off-axis EIRP density limits defined in paragraph (a)(1)(i)(A) through (C) of this section. In this context, the term "effective" means that the resultant co-polarized and crosspolarized EIRP density experienced by any GSO or non-GSO satellite shall not exceed that produced by a single ESAA transmitter operating at 1 dB below the limits defined in paragraphs (a)(1)(i)(A) through (C) of this section. The ESAA applicant shall provide a detailed showing that an individual ESAA terminal is self-monitoring and capable of shutting itself off automatically within 100 milliseconds if the ESAA transmitter exceeds the off-axis EIRP-density limit specified in paragraph (a)(3)(i) of this section. The ESAA applicant also shall provide a detailed showing that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command from the system's network control and monitoring center that the aggregate off-axis EIRP spectral-densities of the transmitter or transmitters exceed the off-axis EIRP-density limits specified in paragraph (a)(3)(i) of this section. The International Bureau will place this showing on public notice along with the application.	N/A
§ 25.227(b)(3)(ii)	(ii) An applicant proposing to implement an ESAA system under paragraph (a)(3)(ii) of this section that uses off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(3)(i) of this section shall provide the following certifications, demonstration and list of satellites as exhibits to its earth station application: (A) A detailed showing of the measures the applicant intends to employ to maintain the effective aggregate EIRP density from all simultaneously transmitting co-frequency terminals operating with the same satellite transponder at the EIRP density limits supplied to the target satellite operator. The International Bureau will place this showing on Public Notice along with the application. (B) A statement from the target satellite operator certifying that the proposed operation of the ESAA has the potential to create harmful interference to satellite networks adjacent to the target satellite(s) that may be unacceptable. (C) A statement from the target satellite operator certifying that the aggregate power-density levels that the ESAA applicant provided to the target satellite operator are consistent with the existing coordination agreements between its satellite(s) and the adjacent satellite systems within 6° of orbital separation from its satellite(s). (D) A statement from the target satellite operator certifying that it will include the aggregate power-density levels of the ESAA applicant in all future coordination agreements. (E) A demonstration from the ESAA operator that the ESAA system is capable of detecting and automatically ceasing emissions within 100 milliseconds when an individual transmitter exceeds the off-axis EIRP spectral-densities supplied to the target satellite operator and that the overall system is capable of shutting off an individual transmitter or the entire system if the aggregate off-axis EIRP spectral-densities exceed those supplied to the target satellite operator. (F) An identification of the specific satellite or satellites with which the ESAA system will operate.	*Id.*

§ 25.227(b)(4)	(4) There shall be an exhibit included with the application describing the geographic area(s) in which the ESAA will operate.	*See* Technical Appendix, VIII.
§ 25.227(b)(5)	(5) Any ESAA applicant filing for an ESAA terminal or system and planning to use a contention protocol shall include in its application a certification that will comply with the requirements of paragraph (a)(4) of this section.	N/A
§ 25.227(b)(6)	(6) The point of contact referred to in paragraph (a)(5) of this section shall be included in the application.	*See* Technical Appendix, I.
§ 25.227(b)(7)	(7) Any ESAA applicant filing for an ESAA terminal or system shall include in its application a certification that will comply with the requirements of paragraph (a)(6), (a)(9), (a)(10), (a)(11) of this section.	*See* Technical Appendix, VII.
§ 25.227(b)(8)	(8) All ESAA applicants shall submit a radio frequency hazard analysis determining via calculation, simulation, or field measurement whether ESAA terminals, or classes of terminals, will produce power densities that will exceed the Commission's radio frequency exposure criteria. ESAA applicants with ESAA terminals that will exceed the guidelines in Section 1.1310 for radio frequency radiation exposure shall	*See* Technical Appendix, V.

	provide, with their environmental assessment, a plan for mitigation of radiation exposure to the extent required to meet those guidelines. All ESAA licensees shall ensure installation of ESAA terminals on aircraft by qualified installers who have an understanding of the antenna's radiation environment and the measures best suited to maximize protection of the general public and persons operating the vehicle and equipment. An ESAA terminal exhibiting radiation exposure levels exceeding 1.0 mW/cm² in accessible areas, such as at the exterior surface of the radome, shall have a label attached to the surface of the terminal warning about the radiation hazard and shall include thereon a diagram showing the regions around the terminal where the radiation levels could exceed 1.0 mW/cm².	
§ 25.227(c)	(c) (1) Operations of ESAAs in the 14.0-14.2 GHz (Earth-to-space) frequency band in the radio line-of- sight of the NASA TDRSS facilities on Guam (latitude 13° 36' 55" N, longitude 144° 51' 22" E) or White Sands, New Mexico (latitude 32° 20' 59" N, longitude 106° 36' 31" W and latitude 32° 32' 40" N, longitude 106° 36' 48" W) are subject to coordination with the National Aeronautics and Space Administration (NASA) through the National Telecommunications and Information Administration (NTIA) Interdepartment Radio Advisory Committee (IRAC). Licensees shall notify the International Bureau once they have completed coordination. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. (2) When NTIA seeks to provide similar protection to future TDRSS sites that have been coordinated through the IRAC Frequency Assignment Subcommittee process, NTIA will notify the Commission's International Bureau that the site is nearing operational status. Upon public notice from the International Bureau, all Ku-band ESAA licensees shall cease operations in the 14.0-14.2 GHz band within radio line-of-sight of the new TDRSS site until the licensees complete coordination with NTIA/IRAC for the new TDRSS facility. Licensees shall notify the International Bureau once they have completed coordination for the new TDRSS site. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. The ESAA licensee then will be permitted to commence operations in the 14.0-14.2 GHz band within radio line-of-sight of the new TDRSS site, subject to any operational constraints developed in the coordination process.	*See* Section 1.65 Letter, File Nos. SES-LIC-20100805-00992, SES-AMD-20100914-01163 and SES-AMD-20101115-01432 (Call Sign E100089) (Notice of NASA Coordination Agreement dated Feb. 1, 2011).

§ 25.227(d)	(d) (1) Operations of ESAA in the 14.47-14.5 GHz (Earth-to-space) frequency band in the radio line-of- sight of radio astronomy service (RAS) observatories observing in the 14.47-14.5 GHz band are subject to coordination with the National Science Foundation (NSF). The appropriate NSF contact point to initiate coordination is Electromagnetic Spectrum Manager, NSF, 4201 Wilson Blvd., Suite 1045, Arlington VA 22203, fax 703-292-9034, email esm@nsf.gov. Licensees shall notify the International Bureau once they have completed coordination. Upon receipt of the coordination agreement from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. (2) A list of applicable RAS sites and their locations can be found in 25.226(d)(2) Table 1. (3) When NTIA seeks to provide similar protection to future RAS sites that have been coordinated through the IRAC Frequency Assignment Subcommittee process, NTIA will notify the Commission's International Bureau that the site is nearing operational status. Upon public notice from the International Bureau, all Ku-band ESAA licensees shall cease operations in the 14.47-14.5 GHz band within the relevant geographic zone of the new RAS site until the licensees complete coordination for the new RAS facility. Licensees shall notify the International Bureau once they have completed coordination for the new RAS site and shall submit the coordination agreement to the Commission. Upon receipt of such notification from a licensee, the International Bureau will issue a public notice stating that the licensee may commence operations within the coordination zone in 30 days if no party has opposed the operations. The ESAA licensee then will be permitted to commence operations in the 14.47-14.5 GHz band within the relevant coordination distance around the new RAS site, subject to any operational constraints developed in the coordination process.	*See* Application, File No. SES-LIC-20100805-00992, Technical Appendix at Att. C.

IX. Technical Certification

I, Paul Sarraffe, hereby certify that I am the technically qualified person responsible for the preparation of the technical information contained in the Panasonic Avionics Corporation modification application for ESAA operating authority and the accompanying Technical Appendix, that I am familiar with Part 25 of the Commission's Rules (47 C.F.R. Part 25), and that I have either prepared or reviewed the technical information submitted in this application and found it to be complete and accurate to the best of my knowledge and belief.

Paul R. Sarraffe

Paul Sarraffe
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Panasonic Avionics Corporation

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