TECHNICAL APPENDIX

Modification Application (Call Sign E100089)
Panasonic Avionics Corporation

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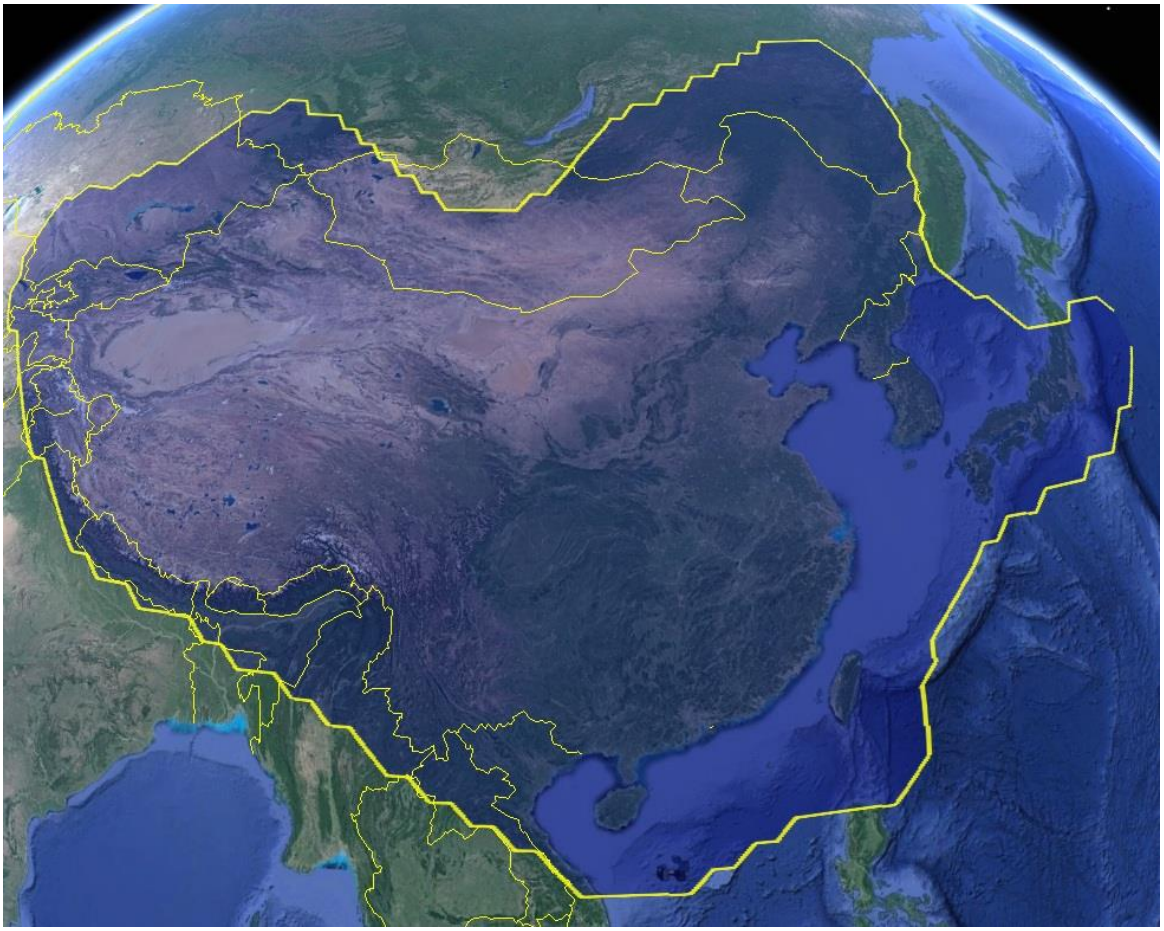
I. Proposed Satellite Points of Communication

1. AsiaSat-7

i. Coverage Map



ii. Satellite Operator Certification Letter

ASIASAT
Reaching Further, Bringing You Closer

TM21-281216-116

28 December 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 7 satellite located at 105.5°E.L.. Specifically, we understand that in addition to the previously authorized Panasonic Single Panel Antenna ("SPA") and Panasonic Phased Array ("PPA") terminals (FCC Call Sign E100089) for AsiaSat 5 satellite located at 100.5°E.L., Panasonic seeks to operate the PPA and SPA terminals with AsiaSat 7 satellite 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 PPA terminals 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 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, AsiaSat will take into consideration the power density levels associated such operations in all future satellite network coordination with adjacent satellite operators.

Sincerely,

Yathung CHAN
Spectrum Management

Asia Satellite Telecommunications Company Limited
12/F, Harbour Centre
25 Harbour Road, Wanchai, Hong Kong
T (852) 2500 0888
F (852) 2576 4111
www.asiasat.com

iii. AsiaSat-7 Link Budgets

Forward Link Budget

eXConnect Terminal		
Antenna Type	DPA	
Lat	22.9	deg
Lon	112.0	deg
EIRP max	47.5	dBW
G/T	11.5	dB/K
Satellite		
Name	A7	
Longitude	105.5	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	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	8.46E+07	bps
Information Rate (Data + Overhead)	9.00E+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	7.4	dB
Uplink		
Frequency	14.330	GHz
Back off	4.2	dB
EIRP Spectral Density	35.3	dBW/4kHz
Slant Range	36435	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	5.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	7.0	dB/K
Thermal Noise, C/No	99.0	dBHz
C/(No+Io)	98.5	dBHz
Satellite		
Flux Density	-92.0	dBW/m2
SFD @ Hub	-89.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	1.0	dB
Downlink		
Frequency	12.582	GHz
Transponder Sat. EIRP @ Beam Peak	53.6	dBW
Transponder Sat. EIRP @ Terminal	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	12.0	dBW/4kHz
Carrier EIRP @ Beam Peak	52.5	dBW
Carrier EIRP @ Terminal	52.0	dBW
Slant Range	36425	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)	85.5	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	7.8	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	DPA	
Lat	22.9	deg
Lon	112.0	deg
EIRP max	47.5	dBW
G/T	11.5	dB/K
Satellite		
Name	A7	
Longitude	105.5	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	1.00E+06	Hz
C/N Threshold	5.9	dB
Uplink		
Frequency	14.192	GHz
Back off	0.0	dB
EIRP Spectral Density	15.2	dBW/4kHz
Slant Range	36425	km
Space Loss, Ls	206.7	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	7.0	dB/K
Thermal Noise, C/No	75.7	dBHz
C/(No+Io)	75.2	dBHz
Satellite		
Flux Density	-115.4	dBW/m2
SFD @ Terminal	-92.1	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	20.3	dB
Downlink		
Frequency	12.444	GHz
Transponder Sat. EIRP @ Beam Peak	53.6	dBW
Transponder Sat. EIRP @ Hub	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	1.0	dBW/4kHz
Carrier EIRP @ Beam Peak	33.2	dBW
Carrier EIRP @ Hub	32.7	dBW
Slant Range	36435	km
Space Loss, Ls	205.6	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.5	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	86.5	dBHz
C/(No+Io)	82.9755	dBHz
End to End		
End to End C/(No+Io)	74.5	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	6.3	dB
Link Margin	0.4	dB

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	22.9	deg
Lon	112.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	A7	
Longitude	105.5	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	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	8.46E+07	bps
Information Rate (Data + Overhead)	9.00E+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	7.4	dB
Uplink		
Frequency	14.330	GHz
Back off	4.2	dB
EIRP Spectral Density	35.3	dBW/4kHz
Slant Range	36435	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	5.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	7.0	dB/K
Thermal Noise, C/No	99.0	dBHz
C/(No+Io)	98.5	dBHz
Satellite		
Flux Density	-92.0	dBW/m2
SFD @ Hub	-89.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	1.0	dB
Downlink		
Frequency	12.582	GHz
Transponder Sat. EIRP @ Beam Peak	53.6	dBW
Transponder Sat. EIRP @ Terminal	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	12.0	dBW/4kHz
Carrier EIRP @ Beam Peak	52.5	dBW
Carrier EIRP @ Terminal	52.0	dBW
Slant Range	36425	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)	85.5	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	7.8	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	22.9	deg
Lon	112.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	A7	
Longitude	105.5	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	0.50	
Overhead Rate	0.83	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.83	bps/Hz
Data Rate	5.55E+06	bps
Information Rate (Data + Overhead)	6.67E+06	bps
Symbol Rate	6.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	5.66E+05	Hz
C/N Threshold	3.6	dB
Uplink		
Frequency	14.192	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36425	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	7.0	dB/K
Thermal Noise, C/No	73.2	dBHz
C/(No+Io)	72.7	dBHz
Satellite		
Flux Density	-117.9	dBW/m2
SFD @ Terminal	-92.1	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	22.8	dB
Downlink		
Frequency	12.444	GHz
Transponder Sat. EIRP @ Beam Peak	53.6	dBW
Transponder Sat. EIRP @ Hub	53.0	dBW
DL PSD Limit	15.0	dBW/4kHz
DL PSD @ Beam Peak	-1.5	dBW/4kHz
Carrier EIRP @ Beam Peak	30.8	dBW
Carrier EIRP @ Hub	30.2	dBW
Slant Range	36435	km
Space Loss, Ls	205.6	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.5	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	84.0	dBHz
C/(No+Io)	80.4985	dBHz
End to End		
End to End C/(No+Io)	72.0	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	3.8	dB
Link Margin	0.2	dB

2. Galaxy 16 (SPA only)

i. Coverage Map

ii. 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

iii. Galaxy 16 Link Budget

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	27.9	deg
Lon	-81.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	G-16	
Longitude	-99.0	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.1	dBW
G/T	33.4	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	14.420	GHz
Back off	3.2	dB
EIRP Spectral Density	38.1	dBW/4kHz
Slant Range	38509	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	2.9	dB/K
Thermal Noise, C/No	99.5	dBHz
C/(No+Io)	99.0	dBHz
Satellite		
Flux Density	-87.4	dBW/m2
SFD @ Hub	-84.9	dBW/m2
Small Signal Gain (IBO/OBO)	1.5	dB
OBO	1.0	dB
Downlink		
Frequency	12.120	GHz
Transponder Sat. EIRP @ Beam Peak	52.3	dBW
Transponder Sat. EIRP @ Terminal	51.3	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	12.5	dBW/4kHz
Carrier EIRP @ Beam Peak	51.3	dBW
Carrier EIRP @ Terminal	50.3	dBW
Slant Range	36971	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	84.3	dBHz
C/(No+Io)	83.4	dBHz
End to End		
End to End C/(No+Io)	83.3	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	7.6	dB
Link Margin	0.2	dB

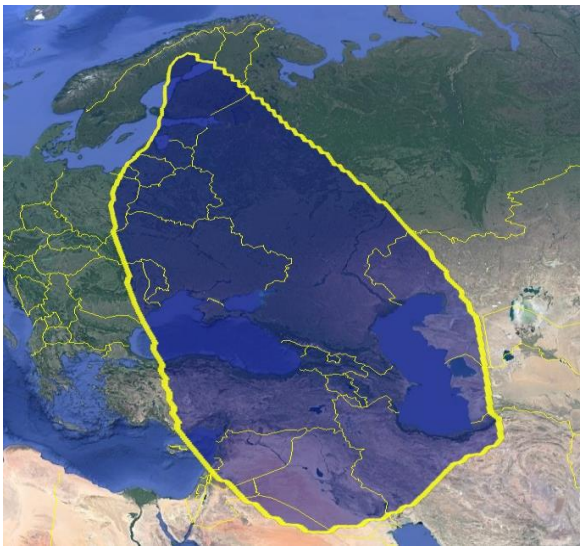
Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	27.9	deg
Lon	-81.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	G-16	
Longitude	-99.0	deg
Hub Earth Station		
Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.1	dBW
G/T	33.4	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	8.58E+05	Hz
C/N Threshold	1.2	dB
Uplink		
Frequency	14.240	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36971	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	4.9	dB/K
Thermal Noise, C/No	71.0	dBHz
C/(No+Io)	70.5	dBHz
Satellite		
Flux Density	-118.0	dBW/m2
SFD @ Terminal	-95.8	dBW/m2
Small Signal Gain (IBO/OBO)	2.5	dB
OBO	19.7	dB
Downlink		
Frequency	11.940	GHz
Transponder Sat. EIRP @ Beam Peak	52.3	dBW
Transponder Sat. EIRP @ Hub	50.3	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	0.3	dBW/4kHz
Carrier EIRP @ Beam Peak	32.6	dBW
Carrier EIRP @ Hub	30.6	dBW
Slant Range	38509	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	85.2	dBHz
C/(No+Io)	82.0063	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

3. IS-33E

i. Coverage Maps

K31 Beam



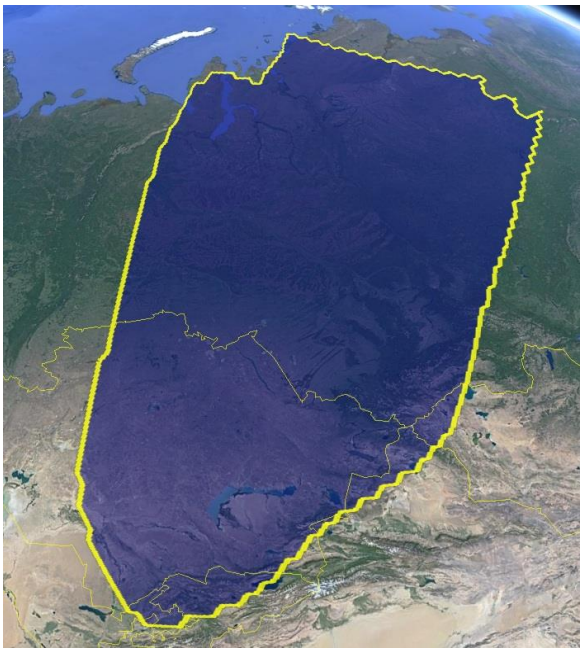
K34 Beam

K41 Beam

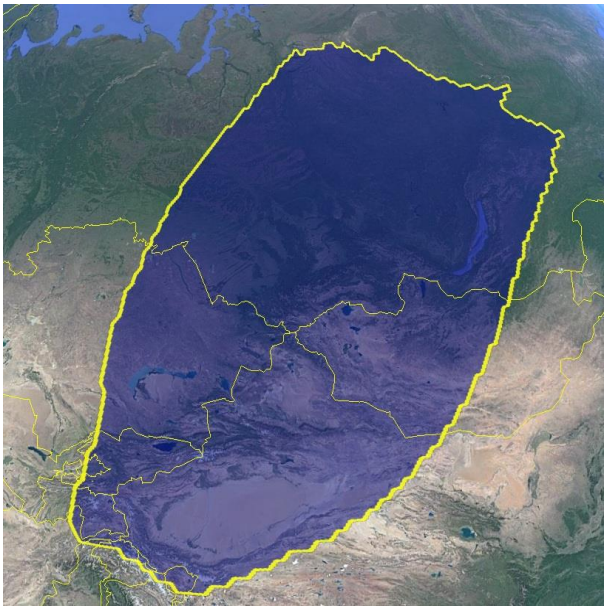
K48 Beam

i. Coverage Maps (Cont.)

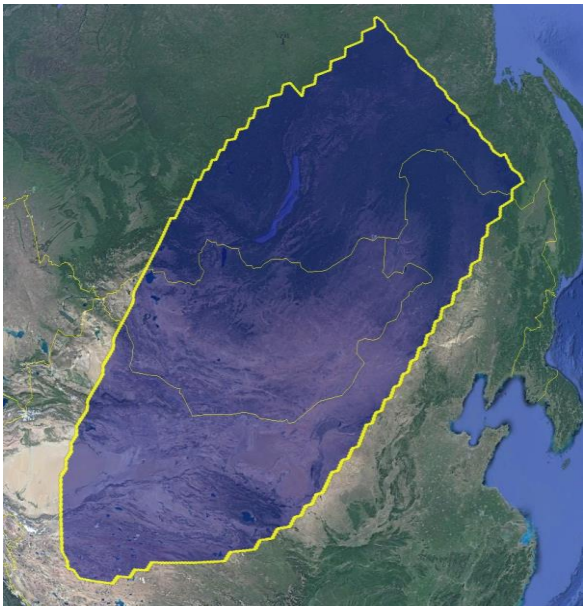
K49 Beam



K52 Beam



K53 Beam



K63 Beam

ii. Satellite Operator Certification Letter

INTELSAT
Envision. Connect. Transform.

January 3, 2017

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

Re: Engineering Certification of Intelsat for IS-33e Satellite

To Whom It May Concern:

This letter certifies that Intelsat is aware that Panasonic Avionics Corporation ("Panasonic") is planning to modify its blanket authorization from the Federal Communication Commission ("FCC), Call Sign E100089, to include IS-33e as a point of communication for its PPA and SPA Remotes. The PPA and SPA Remotes will operate in addition to the already authorized Galaxy 16 satellite at 99°W, the Galaxy 17 satellite at 91°W and the IS-29e satellite at 50°W also with IS-33e at 60°E. Intelsat understands that Panasonic will file the modification application 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 IS-33e satellite's orbit location, and that the proposed operation of Panasonic's PPA and SPA Remotes have 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,

Alexander Gerdenitsch
Manager, Spectrum Policy, Americas
Intelsat

1/3/2017
Date

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

iii. IS-33E Link Budgets

Forward Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	26.0	deg
Lon	52.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS-33e	
Longitude	60.0	deg
Hub Earth Station		
Site	Cologne	
Lat	50.9424	deg
Lon	7.0292	deg
EIRP max	80.0	dBW
G/T	37.5	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	9.32E+07	bps
Information Rate (Data + Overhead)	1.01E+08	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	8.5	dB
Uplink		
Frequency	17.550	GHz
Back off	8.4	dB
EIRP Spectral Density	31.1	dBW/4kHz
Slant Range	40181	km
Space Loss, Ls	209.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.1	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	16.0	dB/K
Thermal Noise, C/No	100.7	dBHz
C/(No+Io)	100.2	dBHz
Satellite		
Flux Density	-97.6	dBW/m2
SFD @ Hub	-89.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	6.6	dB
Downlink		
Frequency	11.008	GHz
Transponder Sat. EIRP @ Beam Peak	60.4	dBW
Transponder Sat. EIRP @ Terminal	59.4	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	13.3	dBW/4kHz
Carrier EIRP @ Beam Peak	53.9	dBW
Carrier EIRP @ Terminal	52.9	dBW
Slant Range	36610	km
Space Loss, Ls	204.6	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	87.8	dBHz
C/(No+Io)	87.1	dBHz
End to End		
End to End C/(No+Io)	86.9	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	9.4	dB
Link Margin	0.9	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	SPA	
Lat	26.0	deg
Lon	52.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K
Satellite		
Name	IS-33e	
Longitude	60.0	deg
Hub Earth Station		
Site	Cologne	
Lat	50.9424	deg
Lon	7.0292	deg
EIRP max	80.0	dBW
G/T	37.5	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	2.94E+06	Hz
C/N Threshold	7.5	dB
Uplink		
Frequency	14.058	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	36610	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	12.7	dB/K
Thermal Noise, C/No	79.0	dBHz
C/(No+Io)	78.5	dBHz
Satellite		
Flux Density	-117.9	dBW/m2
SFD @ Terminal	-90.2	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	25.8	dB
Downlink		
Frequency	11.450	GHz
Transponder Sat. EIRP @ Beam Peak	60.0	dBW
Transponder Sat. EIRP @ Hub	60.0	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	2.0	dBW/4kHz
Carrier EIRP @ Beam Peak	34.2	dBW
Carrier EIRP @ Hub	34.2	dBW
Slant Range	40181	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.1	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	90.6	dBHz
C/(No+Io)	81.9493	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

Forward Link Budget

eXConnect Terminal		
Antenna Type	DPA	
Lat	26.0	deg
Lon	52.0	deg
EIRP max	47.3	dBW
G/T	11.4	dB/K

Satellite		
Name	IS-33e	
Longitude	60.0	deg

Hub Earth Station		
Site	Cologne	
Lat	50.9424	deg
Lon	7.0292	deg
EIRP max	80.0	dBW
G/T	37.5	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	9.32E+07	bps
Information Rate (Data + Overhead)	1.01E+08	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	8.5	dB

Uplink		
Frequency	17.550	GHz
Back off	8.4	dB
EIRP Spectral Density	31.1	dBW/4kHz
Slant Range	40181	km
Space Loss, Ls	209.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.1	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	16.0	dB/K
Thermal Noise, C/No	100.7	dBHz
C/(No+Io)	100.2	dBHz

Satellite		
Flux Density	-97.6	dBW/m2
SFD @ Hub	-89.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	6.6	dB

Downlink		
Frequency	11.008	GHz
Transponder Sat. EIRP @ Beam Peak	60.4	dBW
Transponder Sat. EIRP @ Terminal	59.4	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	13.3	dBW/4kHz
Carrier EIRP @ Beam Peak	53.9	dBW
Carrier EIRP @ Terminal	52.9	dBW
Slant Range	36610	km
Space Loss, Ls	204.6	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	87.7	dBHz
C/(No+Io)	87.0	dBHz

End to End		
End to End C/(No+Io)	86.8	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	9.2	dB
Link Margin	0.7	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	DPA	
Lat	26.0	deg
Lon	52.0	deg
EIRP max	47.3	dBW
G/T	11.4	dB/K

Satellite		
Name	IS-33e	
Longitude	60.0	deg

Hub Earth Station		
Site	Cologne	
Lat	50.9424	deg
Lon	7.0292	deg
EIRP max	80.0	dBW
G/T	37.5	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	5.05E+06	Hz
C/N Threshold	7.5	dB

Uplink		
Frequency	14.058	GHz
Back off	0.0	dB
EIRP Spectral Density	15.1	dBW/4kHz
Slant Range	36610	km
Space Loss, Ls	206.7	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	12.7	dB/K
Thermal Noise, C/No	81.3	dBHz
C/(No+Io)	80.8	dBHz

Satellite		
Flux Density	-115.6	dBW/m2
SFD @ Terminal	-90.2	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	23.4	dB

Downlink		
Frequency	11.450	GHz
Transponder Sat. EIRP @ Beam Peak	60.0	dBW
Transponder Sat. EIRP @ Hub	60.0	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	4.3	dBW/4kHz
Carrier EIRP @ Beam Peak	36.6	dBW
Carrier EIRP @ Hub	36.6	dBW
Slant Range	40181	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.1	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	92.9	dBHz
C/(No+Io)	84.3058	dBHz

End to End		
End to End C/(No+Io)	79.2	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	11.0	dB
Link Margin	3.5	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	DPA	
Lat	43.9	deg
Lon	99.0	deg
EIRP max	46.0	dBW
G/T	10.0	dB/K

Satellite

Name	IS-33e	
Longitude	60.0	deg

Hub Earth Station

Site	Moscow	
Lat	55.9	deg
Lon	37.9972	deg
EIRP max	80.0	dBW
G/T	34.5	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	3.34E+07	bps
Information Rate (Data + Overhead)	3.58E+07	bps
Symbol Rate	2.15E+07	Hz
Chip Rate (Noise Bandwidth)	2.15E+07	Hz
Occupied Bandwidth	2.57E+07	Hz
Power Equivelent Bandwidth	2.57E+07	Hz
C/N Threshold	5.6	dB

Uplink

Frequency	14.250	GHz
Back off	2.8	dB
EIRP Spectral Density	39.9	dBW/4kHz
Slant Range	39232	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	-2.9	dB/K
Thermal Noise, C/No	92.8	dBHz
C/(No+Io)	92.3	dBHz

Satellite

Flux Density	-88.4	dBW/m2
SFD @ Hub	-80.1	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	6.3	dB

Downlink

Frequency	11.143	GHz
Transponder Sat. EIRP @ Beam Peak	55.3	dBW
Transponder Sat. EIRP @ Terminal	54.3	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	11.7	dBW/4kHz
Carrier EIRP @ Beam Peak	49.0	dBW
Carrier EIRP @ Terminal	48.0	dBW
Slant Range	38958	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	80.9	dBHz
C/(No+Io)	80.6	dBHz

End to End

End to End C/(No+Io)	80.3	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	DPA	
Lat	43.9	deg
Lon	99.0	deg
EIRP max	46.0	dBW
G/T	10.0	dB/K

Satellite

Name	IS-33e	
Longitude	60.0	deg

Hub Earth Station

Site	Moscow	
Lat	55.9	deg
Lon	37.9972	deg
EIRP max	80.0	dBW
G/T	34.5	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	8.00E+06	Hz
C/N Threshold	7.5	dB

Uplink

Frequency	14.193	GHz
Back off	0.4	dB
EIRP Spectral Density	13.3	dBW/4kHz
Slant Range	38958	km
Space Loss, Ls	207.3	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	14.0	dB/K
Thermal Noise, C/No	80.2	dBHz
C/(No+Io)	79.7	dBHz

Satellite

Flux Density	-117.9	dBW/m2
SFD @ Terminal	-95.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	20.9	dB

Downlink

Frequency	11.450	GHz
Transponder Sat. EIRP @ Beam Peak	53.5	dBW
Transponder Sat. EIRP @ Hub	53.5	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	0.3	dBW/4kHz
Carrier EIRP @ Beam Peak	32.6	dBW
Carrier EIRP @ Hub	32.6	dBW
Slant Range	39232	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	87.6	dBHz
C/(No+Io)	86.4438	dBHz

End to End

End to End C/(No+Io)	78.9	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	10.6	dB
Link Margin	3.1	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	SPA	
Lat	43.9	deg
Lon	99.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K

Satellite

Name	IS-33e	
Longitude	60.0	deg

Hub Earth Station

Site	Moscow	
Lat	55.9	deg
Lon	37.9972	deg
EIRP max	80.0	dBW
G/T	34.5	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	3.62E+07	bps
Information Rate (Data + Overhead)	3.81E+07	bps
Symbol Rate	2.15E+07	Hz
Chip Rate (Noise Bandwidth)	2.15E+07	Hz
Occupied Bandwidth	2.57E+07	Hz
Power Equivelent Bandwidth	2.57E+07	Hz
C/N Threshold	6.6	dB

Uplink

Frequency	14.250	GHz
Back off	2.8	dB
EIRP Spectral Density	39.9	dBW/4kHz
Slant Range	39232	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	-2.9	dB/K
Thermal Noise, C/No	92.8	dBHz
C/(No+Io)	92.3	dBHz

Satellite

Flux Density	-88.4	dBW/m2
SFD @ Hub	-80.1	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	6.3	dB

Downlink

Frequency	11.143	GHz
Transponder Sat. EIRP @ Beam Peak	55.3	dBW
Transponder Sat. EIRP @ Terminal	54.3	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	11.7	dBW/4kHz
Carrier EIRP @ Beam Peak	49.0	dBW
Carrier EIRP @ Terminal	48.0	dBW
Slant Range	38958	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	82.3	dBHz
C/(No+Io)	81.9	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	7.2	dB
Link Margin	0.6	dB

Return Link Budget

eXConnect Terminal

Antenna Type	SPA	
Lat	43.9	deg
Lon	99.0	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K

Satellite

Name	IS-33e	
Longitude	60.0	deg

Hub Earth Station

Site	Moscow	
Lat	55.9	deg
Lon	37.9972	deg
EIRP max	80.0	dBW
G/T	34.5	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	7.02E+06	Hz
C/N Threshold	7.5	dB

Uplink

Frequency	14.193	GHz
Back off	0.0	dB
EIRP Spectral Density	12.8	dBW/4kHz
Slant Range	38958	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	14.0	dB/K
Thermal Noise, C/No	79.6	dBHz
C/(No+Io)	79.1	dBHz

Satellite

Flux Density	-118.5	dBW/m2
SFD @ Terminal	-95.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	21.5	dB

Downlink

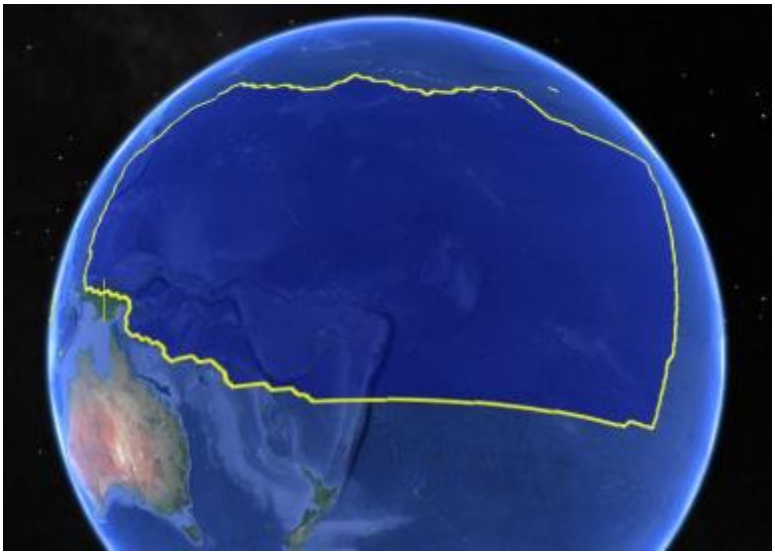
Frequency	11.450	GHz
Transponder Sat. EIRP @ Beam Peak	53.5	dBW
Transponder Sat. EIRP @ Hub	53.5	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	-0.2	dBW/4kHz
Carrier EIRP @ Beam Peak	32.0	dBW
Carrier EIRP @ Hub	32.0	dBW
Slant Range	39232	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	87.0	dBHz
C/(No+Io)	85.8770	dBHz

End to End

End to End C/(No+Io)	78.3	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	10.1	dB
Link Margin	2.6	dB

4. JCSAT-2B

i. Coverage Maps



ii. Satellite Operator Certification Letter

N/A. Panasonic has not provided an operator certification letter for JCSAT-2B because at all times Panasonic will operate the PPA and SPA terminals consistent with the off-axis ESD levels in Section 25.227(a)(1). *See* Narrative, Section II.A.2.

iii. JCSAT-2B Link Budgets

Forward Link Budget

eXConnect Terminal		
Antenna Type	DPA	
Lat	-2.0	deg
Lon	147.9	deg
EIRP max	47.9	dBW
G/T	11.9	dB/K
Satellite		
Name	J2B	
Longitude	154.0	deg
Hub Earth Station		
Site	Honolulu	
Lat	21.35	deg
Lon	-157.85	deg
EIRP max	80.0	dBW
G/T	37.2	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	2.27E+07	bps
Information Rate (Data + Overhead)	2.43E+07	bps
Symbol Rate	1.46E+07	Hz
Chip Rate (Noise Bandwidth)	1.46E+07	Hz
Occupied Bandwidth	1.75E+07	Hz
Power Equivelent Bandwidth	3.55E+07	Hz
C/N Threshold	5.6	dB
Uplink		
Frequency	14.406	GHz
Back off	6.9	dB
EIRP Spectral Density	37.5	dBW/4kHz
Slant Range	38530	km
Space Loss, Ls	207.3	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	-2.0	dB/K
Thermal Noise, C/No	87.7	dBHz
C/(No+Io)	87.2	dBHz
Satellite		
Flux Density	-94.3	dBW/m2
SFD @ Hub	-86.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.2	dB
OBO	5.1	dB
Downlink		
Frequency	11.489	GHz
Transponder Sat. EIRP @ Beam Peak	51.5	dBW
Transponder Sat. EIRP @ Terminal	50.0	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	10.8	dBW/4kHz
Carrier EIRP @ Beam Peak	46.4	dBW
Carrier EIRP @ Terminal	44.9	dBW
Slant Range	35841	km
Space Loss, Ls	204.7	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	80.1	dBHz
C/(No+Io)	79.3	dBHz
End to End		
End to End C/(No+Io)	78.6	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	DPA	
Lat	-2.0	deg
Lon	147.9	deg
EIRP max	47.9	dBW
G/T	11.9	dB/K
Satellite		
Name	J2B	
Longitude	154.0	deg
Hub Earth Station		
Site	Honolulu	
Lat	21.35	deg
Lon	-157.85	deg
EIRP max	80.0	dBW
G/T	37.2	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	1.81E+06	bps
Information Rate (Data + Overhead)	2.50E+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	5.88E+05	Hz
C/N Threshold	-1.2	dB
Uplink		
Frequency	14.406	GHz
Back off	1.2	dB
EIRP Spectral Density	13.9	dBW/4kHz
Slant Range	35841	km
Space Loss, Ls	206.7	dB
Pointing Loss, Lpnt	0.1	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	2.0	dB/K
Thermal Noise, C/No	69.9	dBHz
C/(No+Io)	69.4	dBHz
Satellite		
Flux Density	-116.1	dBW/m2
SFD @ Terminal	-90.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.2	dB
OBO	22.9	dB
Downlink		
Frequency	11.489	GHz
Transponder Sat. EIRP @ Beam Peak	51.5	dBW
Transponder Sat. EIRP @ Hub	43.0	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	-4.1	dBW/4kHz
Carrier EIRP @ Beam Peak	28.6	dBW
Carrier EIRP @ Hub	20.1	dBW
Slant Range	38530	km
Space Loss, Ls	205.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.8	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	75.7	dBHz
C/(No+Io)	74.6661	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	-0.5	dB
Link Margin	0.7	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	SPA	
Lat	-2.0	deg
Lon	147.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K

Satellite

Name	J2B	
Longitude	154.0	deg

Hub Earth Station

Site	Honolulu	
Lat	21.35	deg
Lon	-157.85	deg
EIRP max	80.0	dBW
G/T	37.2	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	2.15E+07	bps
Information Rate (Data + Overhead)	2.33E+07	bps
Symbol Rate	1.46E+07	Hz
Chip Rate (Noise Bandwidth)	1.46E+07	Hz
Occupied Bandwidth	1.75E+07	Hz
Power Equivelent Bandwidth	3.55E+07	Hz
C/N Threshold	5.1	dB

Uplink

Frequency	14.406	GHz
Back off	6.9	dB
EIRP Spectral Density	37.5	dBW/4kHz
Slant Range	38530	km
Space Loss, Ls	207.3	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	-2.0	dB/K
Thermal Noise, C/No	87.7	dBHz
C/(No+Io)	87.2	dBHz

Satellite

Flux Density	-94.3	dBW/m2
SFD @ Hub	-86.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.2	dB
OBO	5.1	dB

Downlink

Frequency	11.489	GHz
Transponder Sat. EIRP @ Beam Peak	51.5	dBW
Transponder Sat. EIRP @ Terminal	50.0	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	10.8	dBW/4kHz
Carrier EIRP @ Beam Peak	46.4	dBW
Carrier EIRP @ Terminal	44.9	dBW
Slant Range	35841	km
Space Loss, Ls	204.7	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	79.7	dBHz
C/(No+Io)	78.6	dBHz

End to End

End to End C/(No+Io)	78.0	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	-2.0	deg
Lon	147.9	deg
EIRP max	45.0	dBW
G/T	11.5	dB/K

Satellite

Name	J2B	
Longitude	154.0	deg

Hub Earth Station

Site	Honolulu	
Lat	21.35	deg
Lon	-157.85	deg
EIRP max	80.0	dBW
G/T	37.2	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	3.98E+05	Hz
C/N Threshold	-2.3	dB

Uplink

Frequency	14.406	GHz
Back off	0.0	dB
EIRP Spectral Density	12.3	dBW/4kHz
Slant Range	35841	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	2.0	dB/K
Thermal Noise, C/No	68.2	dBHz
C/(No+Io)	67.7	dBHz

Satellite

Flux Density	-117.8	dBW/m2
SFD @ Terminal	-90.0	dBW/m2
Small Signal Gain (IBO/OBO)	3.2	dB
OBO	24.6	dB

Downlink

Frequency	11.489	GHz
Transponder Sat. EIRP @ Beam Peak	51.5	dBW
Transponder Sat. EIRP @ Hub	43.0	dBW
DL PSD Limit	11.0	dBW/4kHz
DL PSD @ Beam Peak	-5.8	dBW/4kHz
Carrier EIRP @ Beam Peak	26.9	dBW
Carrier EIRP @ Hub	18.4	dBW
Slant Range	38530	km
Space Loss, Ls	205.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.8	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	74.1	dBHz
C/(No+Io)	72.9756	dBHz

End to End

End to End C/(No+Io)	66.6	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-2.2	dB
Link Margin	0.1	dB

II. TECOM 1000 Link Budgets

Forward Link Budget

eXConnect Terminal		
Antenna Type	TECOM	
Lat	5.8	deg
Lon	-75.2	deg
EIRP max	42.4	dBW
G/T	11.8	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	0.67	
Overhead Rate	0.94	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.26	bps/Hz
Data Rate	3.77E+07	bps
Information Rate (Data + Overhead)	4.00E+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	3.5	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	36956	km
Space Loss, Ls	205.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	83.5	dBHz
C/(No+Io)	80.0	dBHz
End to End		
End to End C/(No+Io)	79.7	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	3.9	dB
Link Margin	0.4	dB

Return Link Budget

eXConnect Terminal		
Antenna Type	TECOM	
Lat	5.8	deg
Lon	-75.2	deg
EIRP max	42.4	dBW
G/T	11.8	dB/K
Satellite		
Name	Anik-G1	
Longitude	-107.3	deg
Hub Earth Station		
Site	Lima	
Lat	-12.092	deg
Lon	-77.027	deg
EIRP max	80.0	dBW
G/T	36.1	dB/K
Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spread Factor	4	
Coding Rate	0.67	
Overhead Rate	0.72	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.12	bps/Hz
Data Rate	8.05E+05	bps
Information Rate (Data + Overhead)	1.11E+06	bps
Symbol Rate	1.67E+06	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	3.62E+05	Hz
C/N Threshold	-4.2	dB
Uplink		
Frequency	14.140	GHz
Back off	0.0	dB
EIRP Spectral Density	10.2	dBW/4kHz
Slant Range	36956	km
Space Loss, Ls	206.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	3.0	dB/K
Thermal Noise, C/No	66.7	dBHz
C/(No+Io)	66.2	dBHz
Satellite		
Flux Density	-120.5	dBW/m2
SFD @ Terminal	-94.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.5	dB
OBO	24.0	dB
Downlink		
Frequency	11.840	GHz
Transponder Sat. EIRP @ Beam Peak	51.0	dBW
Transponder Sat. EIRP @ Hub	47.0	dBW
DL PSD Limit	13.2	dBW/4kHz
DL PSD @ Beam Peak	-5.3	dBW/4kHz
Carrier EIRP @ Beam Peak	27.0	dBW
Carrier EIRP @ Hub	23.0	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	79.2	dBHz
C/(No+Io)	76.9263	dBHz
End to End		
End to End C/(No+Io)	65.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-2.4	dB
Link Margin	1.8	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	26.9	deg
Lon	-81.1	deg
EIRP max	42.4	dBW
G/T	11.8	dB/K

Satellite

Name	G-16	
Longitude	-99.0	deg

Hub Earth Station

Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.1	dBW
G/T	33.4	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	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	14.420	GHz
Back off	3.2	dB
EIRP Spectral Density	38.1	dBW/4kHz
Slant Range	38509	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	2.9	dB/K
Thermal Noise, C/No	99.5	dBHz
C/(No+Io)	99.0	dBHz

Satellite

Flux Density	-87.4	dBW/m2
SFD @ Hub	-84.9	dBW/m2
Small Signal Gain (IBO/OBO)	1.5	dB
OBO	1.0	dB

Downlink

Frequency	12.120	GHz
Transponder Sat. EIRP @ Beam Peak	52.3	dBW
Transponder Sat. EIRP @ Terminal	51.3	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	12.5	dBW/4kHz
Carrier EIRP @ Beam Peak	51.3	dBW
Carrier EIRP @ Terminal	50.3	dBW
Slant Range	36912	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	84.7	dBHz
C/(No+Io)	81.1	dBHz

End to End

End to End C/(No+Io)	81.0	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	TECOM	
Lat	26.9	deg
Lon	-81.1	deg
EIRP max	42.4	dBW
G/T	11.8	dB/K

Satellite

Name	G-16	
Longitude	-99.0	deg

Hub Earth Station

Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.1	dBW
G/T	33.4	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	4.89E+05	Hz
C/N Threshold	-1.2	dB

Uplink

Frequency	14.240	GHz
Back off	0.0	dB
EIRP Spectral Density	10.2	dBW/4kHz
Slant Range	36912	km
Space Loss, Ls	206.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	4.9	dB/K
Thermal Noise, C/No	68.5	dBHz
C/(No+Io)	68.0	dBHz

Satellite

Flux Density	-120.5	dBW/m2
SFD @ Terminal	-95.8	dBW/m2
Small Signal Gain (IBO/OBO)	2.5	dB
OBO	22.2	dB

Downlink

Frequency	11.940	GHz
Transponder Sat. EIRP @ Beam Peak	52.3	dBW
Transponder Sat. EIRP @ Hub	50.3	dBW
DL PSD Limit	13.0	dBW/4kHz
DL PSD @ Beam Peak	-2.1	dBW/4kHz
Carrier EIRP @ Beam Peak	30.1	dBW
Carrier EIRP @ Hub	28.1	dBW
Slant Range	38509	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	82.8	dBHz
C/(No+Io)	79.5643	dBHz

End to End

End to End C/(No+Io)	67.7	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-0.5	dB
Link Margin	0.7	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	33.8	deg
Lon	-118.2	deg
EIRP max	42.4	dBW
G/T	11.8	dB/K

Satellite

Name	GE-23	
Longitude	172.0	deg

Hub Earth Station

Site	Brewster	
Lat	48.1	deg
Lon	-119.8	deg
EIRP max	80.0	dBW
G/T	37.3	dB/K

Signal

Waveform	DVB-S2	
Modulation	QPSK	
Bits per symbol	2	
Spread Factor	1	
Coding Rate	0.80	
Overhead Rate	0.92	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.47	bps/Hz
Data Rate	2.21E+07	bps
Information Rate (Data + Overhead)	2.40E+07	bps
Symbol Rate	1.50E+07	Hz
Chip Rate (Noise Bandwidth)	1.50E+07	Hz
Occupied Bandwidth	1.80E+07	Hz
Power Equivelent Bandwidth	2.70E+07	Hz
C/N Threshold	5.1	dB

Uplink

Frequency	14.303	GHz
Back off	0.8	dB
EIRP Spectral Density	43.4	dBW/4kHz
Slant Range	41051	km
Space Loss, Ls	207.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.7	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	1.0	dB/K
Thermal Noise, C/No	94.2	dBHz
C/(No+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	46.0	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	45.0	dBW
Slant Range	40796	km
Space Loss, Ls	205.9	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	79.0	dBHz
C/(No+Io)	78.4	dBHz

End to End

End to End C/(No+Io)	78.2	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	TECOM	
Lat	33.8	deg
Lon	-118.2	deg
EIRP max	42.4	dBW
G/T	11.8	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	8	
Coding Rate	0.67	
Overhead Rate	0.72	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	0.06	bps/Hz
Data Rate	4.03E+05	bps
Information Rate (Data + Overhead)	5.56E+05	bps
Symbol Rate	8.34E+05	Hz
Chip Rate (Noise Bandwidth)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	1.58E+05	Hz
C/N Threshold	-7.2	dB

Uplink

Frequency	14.039	GHz
Back off	0.0	dB
EIRP Spectral Density	10.2	dBW/4kHz
Slant Range	40796	km
Space Loss, Ls	207.6	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	0.8	dB/K
Thermal Noise, C/No	63.6	dBHz
C/(No+Io)	63.1	dBHz

Satellite

Flux Density	-121.3	dBW/m2
SFD @ Terminal	-88.8	dBW/m2
Small Signal Gain (IBO/OBO)	1.9	dB
OBO	30.7	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	-15.2	dBW/4kHz
Carrier EIRP @ Beam Peak	17.0	dBW
Carrier EIRP @ Hub	14.3	dBW
Slant Range	41051	km
Space Loss, Ls	205.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	6.1	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	68.6	dBHz
C/(No+Io)	67.6968	dBHz

End to End

End to End C/(No+Io)	61.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	-6.4	dB
Link Margin	0.8	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	43.8	deg
Lon	-91.0	deg
EIRP max	42.4	dBW
G/T	11.8	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	0.75	
Overhead Rate	0.92	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	2.07	bps/Hz
Data Rate	7.77E+07	bps
Information Rate (Data + Overhead)	8.44E+07	bps
Symbol Rate	3.75E+07	Hz
Chip Rate (Noise Bandwidth)	3.75E+07	Hz
Occupied Bandwidth	4.50E+07	Hz
Power Equivelent Bandwidth	4.08E+07	Hz
C/N Threshold	8.5	dB

Uplink

Frequency	6.663	GHz
Back off	11.7	dB
EIRP Spectral Density	36.6	dBW/4kHz
Slant Range	38106	km
Space Loss, Ls	200.5	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.6	dB
Radome, Lr	0.0	dB
Transponder G/T @ Hub	4.0	dB/K
Thermal Noise, C/No	107.8	dBHz
C/(No+Io)	107.3	dBHz

Satellite

Flux Density	-86.9	dBW/m2
SFD @ Hub	-77.0	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	7.9	dB

Downlink

Frequency	11.888	GHz
Transponder Sat. EIRP @ Beam Peak	61.6	dBW
Transponder Sat. EIRP @ Terminal	60.6	dBW
DL PSD Limit	14.0	dBW/4kHz
DL PSD @ Beam Peak	14.0	dBW/4kHz
Carrier EIRP @ Beam Peak	53.7	dBW
Carrier EIRP @ Terminal	52.7	dBW
Slant Range	39062	km
Space Loss, Ls	205.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	86.8	dBHz
C/(No+Io)	85.7	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	9.0	dB
Link Margin	0.5	dB

Return Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	43.8	deg
Lon	-91.0	deg
EIRP max	42.4	dBW
G/T	11.8	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	2.17E+06	Hz
C/N Threshold	7.5	dB

Uplink

Frequency	14.363	GHz
Back off	0.0	dB
EIRP Spectral Density	10.2	dBW/4kHz
Slant Range	39062	km
Space Loss, Ls	207.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	15.3	dB/K
Thermal Noise, C/No	78.3	dBHz
C/(No+Io)	77.8	dBHz

Satellite

Flux Density	-121.0	dBW/m2
SFD @ Terminal	-92.3	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	26.7	dB

Downlink

Frequency	12.224	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	-6.2	dBW/4kHz
Carrier EIRP @ Beam Peak	26.0	dBW
Carrier EIRP @ Hub	26.0	dBW
Slant Range	38106	km
Space Loss, Ls	205.8	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.1	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	85.3	dBHz
C/(No+Io)	83.4665	dBHz

End to End

End to End C/(No+Io)	76.8	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	8.6	dB
Link Margin	1.1	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	9.9	deg
Lon	-79.1	deg
EIRP max	42.4	dBW
G/T	11.8	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	0.60	
Overhead Rate	0.94	
Channel Spacing	1.20	
Spectral Efficiency (Rate/Noise BW)	1.13	bps/Hz
Data Rate	3.38E+07	bps
Information Rate (Data + Overhead)	3.60E+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	2.7	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	37711	km
Space Loss, Ls	205.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	84.0	dBHz
C/(No+Io)	79.1	dBHz

End to End

End to End C/(No+Io)	79.1	dBHz
Implementation Loss	1.0	dB
End to End C/N w/ Imp Loss	3.3	dB
Link Margin	0.6	dB

Return Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	9.9	deg
Lon	-79.1	deg
EIRP max	42.4	dBW
G/T	11.8	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	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)	6.67E+06	Hz
Occupied Bandwidth	8.00E+06	Hz
Power Equivelent Bandwidth	2.66E+05	Hz
C/N Threshold	-1.2	dB

Uplink

Frequency	14.090	GHz
Back off	0.0	dB
EIRP Spectral Density	10.1	dBW/4kHz
Slant Range	37711	km
Space Loss, Ls	207.0	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
Transponder G/T @ Terminal	6.0	dB/K
Thermal Noise, C/No	69.5	dBHz
C/(No+Io)	69.0	dBHz

Satellite

Flux Density	-120.7	dBW/m2
SFD @ Terminal	-92.6	dBW/m2
Small Signal Gain (IBO/OBO)	2.0	dB
OBO	26.1	dB

Downlink

Frequency	12.590	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	-6.3	dBW/4kHz
Carrier EIRP @ Beam Peak	25.9	dBW
Carrier EIRP @ Hub	25.9	dBW
Slant Range	39711	km
Space Loss, Ls	206.4	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	4.1	dB
Radome, Lr	0.0	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	78.4	dBHz
C/(No+Io)	75.9342	dBHz

End to End

End to End C/(No+Io)	68.2	dBHz
Implementation Loss	0.0	dB
End to End C/N w/ Imp Loss	0.0	dB
Link Margin	1.2	dB

Forward Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	47.8	deg
Lon	-129.2	deg
EIRP max	42.4	dBW
G/T	11.8	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	39702	km
Space Loss, Ls	205.7	dB
Pointing Loss, Lpnt	0.0	dB
Atmosphere / Weather Loss, La	0.0	dB
Radome, Lr	0.5	dB
PCMA Loss	0.0	dB
Thermal Noise, C/No	86.2	dBHz
C/(No+Io)	86.0	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	10.6	dB
Link Margin	1.0	dB

Return Link Budget

eXConnect Terminal

Antenna Type	TECOM	
Lat	47.8	deg
Lon	-129.2	deg
EIRP max	42.4	dBW
G/T	11.8	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	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	2.74E+05	Hz
C/N Threshold	-1.2	dB

Uplink

Frequency	14.210	GHz
Back off	0.0	dB
EIRP Spectral Density	10.2	dBW/4kHz
Slant Range	39702	km
Space Loss, Ls	207.5	dB
Pointing Loss, Lpnt	0.0	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	69.5	dBHz
C/(No+Io)	69.0	dBHz

Satellite

Flux Density	-121.1	dBW/m2
SFD @ Terminal	-90.9	dBW/m2
Small Signal Gain (IBO/OBO)	3.0	dB
OBO	27.2	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	-5.8	dBW/4kHz
Carrier EIRP @ Beam Peak	26.4	dBW
Carrier EIRP @ Hub	24.8	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	81.4	dBHz
C/(No+Io)	77.6249	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

III. Radiation Hazard Analysis
TECOM 1000

This exhibit presents the radiation hazard analysis for Panasonic Avionics Corporation ("Panasonic") using the FCC procedure outlined in FCC Bulletin #65. The limit for exposure to RF energy, for frequencies greater than 1.5 GHz, is 5 mW/cm^2 for up to a 6 minute duration (occupational/controlled exposure) and 1 mW/cm^2 for up to a 30 minute duration (general population/uncontrolled exposure).[1]

Analysis for exposure to radiation is presented for the near field, far field and the transition region. Safe limits are computed for the controlled and uncontrolled exposure for both the antenna main beam and sidelobes.

The near field region for the main beam is defined in terms of the radius R_{nf} according to the relation

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

where D is the antenna panel width and λ is the transmit wavelength. The near field maximum power density, S_{nf}, is determined from

$$S_{nf} = 0.1\eta\ P_{PA}/A \text{ (in } mW/cm^2)$$

where P_{PA} is the transmit power (after cable losses are accounted for) and A is the surface area of the antenna panel. With an antenna height h, the surface area A=Dh

The far field region for the main beam is defined in terms of the radius R_{ff} given by

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

The far field power density S_{ff} at the minimum far field radius is given in terms of the EIRP denoted by P_{EIRP} according to

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

When the radius is expressed in meters, the power densities are w/m^2. The results are converted to mW/cm^2 by multiplying the power densities in w/m^2 by 0.1.

Near Field Exposure from Main Antenna Beam

[1] "Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields," Federal Communications Commission, Office of Engineering and Technology, Bulletin 65, Fourth Edition, August, 1999, p.15.
http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf

The TECOM antenna has dimensions D=0.625 m (24.6") and h=0.157 m (6.2") and a surface area A=0.098m^2. At the highest transmit frequency of 14.5 GHz, the wavelength is 0.0207 m. The near field radius is then

R_{nf} = 4.72 m

Since the maximum transmit power is P_{PA}=20 watts and the antenna efficiency =0.93, the maximum power density in the near field with 4.58 dB cable losses is

S_{nf} = 6.61 mW/cm^2

Far Field Exposure from Main Antenna Beam

Based on the wavelength and panel width given above, the far field radius is then

R_{ff} = 11.3 m

The maximum EIRP is 41.8 dBW resulting in a far field power density of

S_{ff} = 0.94 mW/cm^2

Transition Region Exposure from Main Antenna Beam

Assuming that the field density decrease linearly from S_{nf} = 6.61 mW/cm^2 to S_{ff} = 0.94 mW/cm^2, then the 5 mW/cm^2 power density for controlled exposure occurs at a distance of 6.6 meters.

For the case of the 1 mW/cm^2 power density for uncontrolled exposure the safe distance is 11.26 meters.

Based on antenna sidelobes with 12 dB reduction from the main beam, no individual in a controlled exposure should be within 6.35 meters (~21 feet) of the antenna while it is transmitting and for no longer than 6 minutes. The 30 minute exposure range for an uncontrolled exposure due to sidelobes is 10.4 meters (~34 feet).

<u>*Summary*</u>

This document presents the radiation hazard analysis for Panasonic's system incorporating the TECOM antenna and the maximum EIRP of 41.8 dBW. Individuals in a controlled exposure should be at least 6.6 meters (22 feet) away from the antenna and for no more than 6 minutes and in an uncontrolled exposure should be at least 11.26 meters (37 feet) away for 30 minutes, if they are in the main beam of the antenna.

IV. Updated Emission Designators

1. MELCO

Frequency Band (MHz)	Existing Emission Designators	Updated Emission Designators
10950 – 12500	1M20KG7D 36M0KG7D 54M0KG7D	Removed
11700 – 12200	1M20KG7D 36M0KG7D 54M0KG7D 9M00G7D 160KG7D 2M56G7D	1M20G7D 54M0G7D
10700 – 12750	1M20G7D 36M0G7D	Removed
10950-11200	New	1M20G7D 27M0G7D 54M0G7D
11450-12200	New	1M20G7D 27M0G7D 54M0G7D
10950 – 12750	54M0G7D	Removed
14000 – 14500	9M00KG7D 500KG7D	Removed
14000 – 14400	9M00G7D 500KG7D 2M56G7D 160KG7D	9M00G7D 500KG7D

2. PPA

Frequency Band (MHz)	Existing Emission Designators	Updated Emission Designators
10950 – 11200	27M0KG7D 1M20KG7D	27M0G7D 1M20G7D
10950 – 11700	54M0KG7D 1M20KG7D	54M0G7D 1M20G7D
10950 – 12200	54M0KG7D 1M20KG7D	54M0G7D 1M20G7D
10950 – 12500	54M0KG7D 36M0KG7D 1M20KG7D	54M0G7D 36M0G7D 1M20G7D
11450 – 12750	27M0KG7D 1M20KG7D	27M0G7D 1M20G7D
11700 – 12200	54M0KG7D 1M20KG7D 36M0KG7D	54M0G7D 1M20G7D 36M0G7D
12250 – 12750	54M0KG7D 1M20KG7D	54M0G7D 1M20G7D
12500 – 12750	54M0KG7D 1M20KG7D	54M0G7D 1M20G7D
14000 – 14500	9M00KG7D	9M00G7D

3. SPA

Frequency Band (MHz)	Existing Emission Designators	Updated Emission Designators
10700 – 12750	1M20KG7D 36M0KG7D	1M20G7D 36M0G7D
10950 – 11200	1M20KG7D 54M0KG7D	1M20G7D 54M0G7D
10950 – 11700	1M20KG7D 54M0KG7D	1M20G7D 54M0G7D
10950 – 12500	1M20KG7D 54M0KG7D	1M20G7D 54M0G7D
11450 – 11700	1M20KG7D 54M0KG7D	1M20G7D 54M0G7D
11450 – 11950	1M20KG7D 54M0KG7D	1M20G7D 54M0G7D
11450 – 12200	1M20KG7D 27M0KG7D 54M0KG7D	1M20G7D 27M0G7D 54M0G7D
11450 – 12750	1M20KG7D 36M0KG7D 54M0KG7D	1M20G7D 36M0G7D 54M0G7D
11700 – 12200	1M20KG7D 36M0KG7D 54M0KG7D	1M20G7D 36M0G7D 54M0G7D
12200 – 12750	1M20KG7D 36M0KG7D	1M20G7D 36M0G7D
12250 – 12750	1M20KG7D 54M0KG7D	1M20G7D 54M0G7D
12500 – 12750	1M20KG7D 36M0KG7D 54M0KG7D	1M20G7D 36M0G7D 54M0G7D
14000 – 14500	9M00KG7D	9M00G7D

V. Updated Frequency Coordination Table for MELCO, PPA and SPA ESAA Terminals

Antenna	Satellite Orbit Type	Frequency Limits (GHz)	Range of Satellite Arc (Degrees)	Earth Station Azimuth Angle (East Limit)	Antenna Elevation Limit (East Limit)	Earth Station Azimuth Angle (West Limit)	Antenna Elevation Angle (West Limit)	Max. EIRP Towards the Horizon (dBW/4kHz)
MELCO T14R	GSO	11.45-12.2	63W-63W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.4	63W-63W	0.0	5.0	360	5.0	-5.80
T11N	GSO	10.95-11.2	37.5W-37.5W	0.0	5.0	360	5.0	0.0
	GSO	11.45-12.2	37.5W-37.5W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.4	37.5W-37.5W	0.0	5.0	360	5.0	-8.62
PPA Anik G1	GSO	11.7-12.2	107.3W-107.3W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	107.3W-107.3W	0.0	5.0	360	5.0	-11.10
Apstar 6	GSO	10.7-12.75	134E-134E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	134E-134E	0.0	5.0	360	5.0	-1.63
Apstar 7	GSO	10.7-12.75	76.5E-76.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	76.5E-76.5E	0.0	5.0	360	5.0	-9.91
AsiaSat5	GSO	11.45-12.2	100.5E-100.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	100.5E-100.5E	0.0	5.0	360	5.0	-3.39
AsiaSat7	GSO	12.25-12.75	105.5E-105.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	105.5E-105.5E	0.0	5.0	360	5.0	1.37
Satmex 8	GSO	11.7-12.2	116.8W-116.8W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	116.8W-116.8W	0.0	5.0	360	5.0	-6.38
E10A	GSO	10.95-11.7	10E-10E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.75	10E-10E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	10E-10E	0.0	5.0	360	5.0	0.43
E172A	GSO	10.95-11.2	172E-172E	0.0	5.0	360	5.0	0.0
	GSO	11.45-11.7	172E-172E	0.0	5.0	360	5.0	0.0
	GSO	12.2-12.75	172E-172E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	172E-172E	0.0	5.0	360	5.0	0.47
E115WB	GSO	11.7-12.2	114.9W-114.9W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	114.9W-114.9W	0.0	5.0	360	5.0	-3.20

Galaxy 16	GSO	11.7-12.2	99W-99W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	99W-99W	0.0	5.0	360	5.0	-5.59
IS-15	GSO	12.5-12.75	85E-85E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	85E-85E	0.0	5.0	360	5.0	-5.80
IS-14	GSO	12.25-12.75	45W-45W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	45W-45W	0.0	5.0	360	5.0	-8.65
IS-29E	GSO	10.95-11.7	50W-50W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	50W-50W	0.0	5.0	360	5.0	0.17
IS33E	GSO	10.95-11.2	60E-60E	0.0	5.0	360	5.0	0.0
	GSO	11.45-12.2	60E-60E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.6	60E-60E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	60E-60E	0.0	5.0	360	5.0	-0.58
JCSAT5A	GSO	12.25-12.75	132E-132E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	132E-132E	0.0	5.0	360	5.0	-3.78
JCSAT-2B	GSO	11.45-11.7	154E-154E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	154E-154E	0.0	5.0	360	5.0	-8.33
NSS-6	GSO	11.45-11.7; 12.5-12.75	95E-95E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.75	95E-95E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	95E-95E	0.0	5.0	360	5.0	-3.40
T11N	GSO	11.45-12.2	37.5W-37.5W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	37.5W-37.5W	0.0	5.0	360	5.0	-7.88
T14R	GSO	11.45-12.2	63W-63W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	63W-63W	0.0	5.0	360	5.0	0.44
SB2	GSO	12.2-12.75	144E-144E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	144E-144E	0.0	5.0	360	5.0	-9.33
T12V	GSO	10.95-12.2	15W-15W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	15W-15W	0.0	5.0	360	5.0	-2.59
Y401	GSO	10.95-11.2	90E-90E	0.0	5.0	360	5.0	0.0
	GSO	11.45-12.75	90E-90E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	90E-90E	0.0	5.0	360	5.0	1.42
Y300K	GSO	10.95-11.7	183E-183E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	183E-183E	0.0	5.0	360	5.0	2.41
E70B	GSO	10.95-11.7	70.5E-70.5E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.75	70.5E-70.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	70.5E-70.5E	0.0	5.0	360	5.0	-2.86

SPA Anik G1	GSO	11.7-12.2	107.3W-107.3W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	107.3W-107.3W	0.0	5.0	360	5.0	-10.45
Apstar 6	GSO	10.7-12.75	134E-134E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	134E-134E	0.0	5.0	360	5.0	-3.59
Apstar 7	GSO	10.7-12.75	76.5E-76.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	76.5E-76.5E	0.0	5.0	360	5.0	-11.50
AsiaSat5	GSO	11.45-12.2	100.5E-100.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	100.5E-100.5E	0.0	5.0	360	5.0	-7.76
AsiaSat7	GSO	12.25-12.75	105.5E-105.5E	0.0	5.0	360	5.0	0.0
		14.0-14.5	105.5E-105.5E	0.0	5.0	360	5.0	-0.28
Satmex 8	GSO	11.7-12.2	116.8W-116.8W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	116.8W-116.8W	0.0	5.0	360	5.0	-9.16
E10A	GSO	11.7-12.2	10E-10E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	10E-10E	0.0	5.0	360	5.0	-1.65
E172A	GSO	10.95-11.2	172E-172E	0.0	5.0	360	5.0	0.0
	GSO	11.45-11.7	172E-172E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	172E-172E	0.0	5.0	360	5.0	-0.55
E115WB	GSO	11.7-12.2	114.9W-114.9W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	114.9W-114.9W	0.0	5.0	360	5.0	-4.01
Galaxy 16	GSO	11.7-12.2	99W-99W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	99W-99W	0.0	5.0	360	5.0	-5.85
IS-15	GSO	12.25-12.75	85E-85E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	85E-85E	0.0	5.0	360	5.0	-11.49
IS-14	GSO	11.45-11.95	45W-45W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	45W-45W	0.0	5.0	360	5.0	-11.38
IS-29E	GSO	10.95-12.2	50W-50W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	50W-50W	0.0	5.0	360	5.0	-1.43
IS33E	GSO	10.95-11.2	60E-60E	0.0	5.0	360	5.0	0.0
	GSO	11.45-12.2	60E-60E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.6	60E-60E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	60E-60E	0.0	5.0	360	5.0	-0.28
JCSAT5A	GSO	12.25-12.75	132E-132E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	132E-132E	0.0	5.0	360	5.0	-4.62
JCSAT-2B	GSO	11.45-11.7	154E-154E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	154E-154E	0.0	5.0	360	5.0	-12.48

NSS-6	GSO	11.45-12.75	95E-95E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.75	95E-95E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	95E-95E	0.0	5.0	360	5.0	-7.33
T11N	GSO	11.45-12.2	37.5W-37.5W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	37.5W-37.5W	0.0	5.0	360	5.0	-12.84
T14R	GSO	11.7-12.2	63W-63W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	63W-63W	0.0	5.0	360	5.0	-5.34
SB2	GSO	12.2-12.75	144E-144E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	144E-144E	0.0	5.0	360	5.0	-11.92
T12V	GSO	10.95-12.2	15W-15W	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	15W-15W	0.0	5.0	360	5.0	-1.99
Y401	GSO	10.95-11.2	90E-90E	0.0	5.0	360	5.0	0.0
	GSO	11.45-12.75	90E-90E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	90E-90E	0.0	5.0	360	5.0	-0.37
Y300K	GSO	10.95-11.7	183E-183E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	183E-183E	0.0	5.0	360	5.0	-0.28
E70B	GSO	10.95-11.7	70.5E-70.5E	0.0	5.0	360	5.0	0.0
	GSO	12.5-12.75	70.5E-70.5E	0.0	5.0	360	5.0	0.0
	GSO	14.0-14.5	70.5E-70.5E	0.0	5.0	360	5.0	-5.85

VI. eXConnect System Satellites and Gateways

Table 1. Satellite Points of Communication

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	APSTAR-2	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
AsiaSat 7	China	105.5° E	12.25-12.75	ASIASAT-CKX	3	No
Eutelsat 10A	France	10° E	11.7-12.2; 10.95-11.7; 12.5-12.75	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
Galaxy 16	U.S.	99° W	11.7-12.2	U.S.-licensed	2	Yes
IS-14	U.S.	45° W	11.45-11.95; 12.5-12.75	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	10.95-11.7	U.S.-licensed	1, 2	Yes
IS-33E	U.S.	60° E	10.95-11.2; 11.45-12.2; 12.5-12.6	U.S.-licensed	1, 3	No
JCSAT-2B	Japan	154° E	11.45-11.7	N-SAT-154E	3	No
JCSAT-5A	Japan	132° E	12.25-12.75	N-STAR-A	1	No
NSS-6	Netherlands	95° E	11.45-12.75	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	11.45-12.2	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

Table 2. 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
AsiaSat-7	AsiaSat	Beijing	China	China Telecom Satellite	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	E120043
Eutelsat 117WA	Eutelsat Americas	Brewster, WA	U.S.	USEI	E120043
Eutelsat 172A (NP/SEP/SWP)	Eutelsat	Brewster, WA	U.S.	USEI	E120043

Satellite	Satellite Operator	Gateway Earth Station Location	Country	Gateway Operator	FCC Call Sign
Eutelsat 172A (SP)	Eutelsat	Adelaide	Australia	SpeedCast	N/A
Galaxy 16	Intelsat	Brewster, WA	U.S.	U.S. Electrodynamics	E120043
IS-14	Intelsat	Cologne	Germany	Stellar	N/A
IS-15	Intelsat	Kofinou	Cyprus	Stellar	N/A
IS-29E	Intelsat	Hagerstown, MD	U.S.	Intelsat	E140121
IS-33E	Intelsat	Cologne	Germany	Stellar	N/A
IS-33E[1]	Intelsat	Moscow	Russia	Gazprom	N/A
JCSAT-2B	SKY Perfect JSAT	Kapolei, HI	U.S.	Hawaii Pacific Teleport LP	E010236
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	N/A
Telstar 11N (AO)	Skynet	Ellenwood, GA	U.S.	Intelsat	E990365
Telstar 12V (MW, MC, ME, MN)	Skynet	Mt. Jackson, VA	U.S.	Telesat	E030029

[1] Effective November 2017, the gateway earth station in Moscow, Russia will no longer support IS-33E satellite operations. Panasonic includes representative link budgets for IS-33E with both gateway earth station locations.

Satellite	Satellite Operator	Gateway Earth Station Location	Country	Gateway Operator	FCC Call Sign
Telstar 12V (NS)	Skynet	Chalfont	U.K.	Arqiva	N/A
Telstar 14R	Telesat	Mt. Jackson, VA	U.S.	Telesat	E030029
Yamal 300K	Gazprom	Brewster, WA	U.S.	USEI	E120043
Yamal 401	Gazprom	Moscow	Russia	RuSat	N/A

VII. Section 25.227 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

March 8, 2017

VIII. FCC § 25.227 Compliance Matrix

Rule	Text	Application Citation
§ 25.227	**§25.227 Blanket licensing provisions for ESAAs operating with GSO FSS space stations in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz, and 14.0-14.5 GHz bands.**	*See* Application Narrative, Section II and Technical Appendix; File No. SES-LIC-20100805-00992 (MELCO); File No. SES-MFS-20120913-00818 (PPA); File No. SES-MFS- 20160819-00730 (SPA).
§ 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) through (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.	
§ 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 section. ESAA licensees operating under this section 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 (iii) of this section.	Panasonic complies for SPA, PPA and TECOM operations with two-degree spaced/Permitted List satellites within the U.S. *See* Application Narrative, Section II and Technical Appendix, Sections I & II.
§ 25.227(a)(1)(i)(A)	(A) EIRP spectral density emitted in the plane tangent to the GSO arc, as defined in §25.103, must not exceed the following values: 15 - 25 log10(θ) dBW/4 kHz For $1.5° \leq \theta \leq 7°$ -6 dBW/4 kHz For $7° < \theta \leq 9.2°$ 18 - 25 log10(θ) dBW/4 kHz For $9.2° < \theta \leq 19.1°$ -14 dBW/4 kHz For $19.1° < \theta \leq 180°$ Where theta (θ) is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite. The EIRP density levels specified for $\theta > 7°$ may be exceeded by up to 3 dB in up to 10% of the range of theta (θ) angles from ±7-180°, and by up to 6 dB in the region of main reflector spillover energy.	*Id.*

§ 25.227(a)(1)(i)(B)	(B) The EIRP spectral density of co-polarized signals must not exceed the following values in the plane perpendicular to the GSO arc, as defined in §25.103: 18 - 25 log(θ) dBW/4 kHz For $3° \leq \theta \leq 19.1°$ -14 dBW/4 kHz For $19.1° < \theta \leq 180°$ Where θ is as defined in paragraph (a)(1)(i)(A) of this section. These EIRP density levels may be exceeded by up to 6 dB in the region of main reflector spillover energy and in up to 10% of the range of θ angles not included in that region, on each side of the line from the earth station to the target satellite.	*Id.*

§ 25.227(a)(1)(i)(C)	(C) The off-axis EIRP spectral-density of cross-polarized signals must not exceed the following values in the plane tangent to the GSO arc or in the plane perpendicular to the GSO arc 5 - 25 log10(θ) dBW/4 kHz For $1.8° \leq \theta \leq 7°$ Where θ is as defined in paragraph (a)(1)(i)(A) of this section.	*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 apply to ESAA systems that operate with off-axis EIRP spectral-densities in excess of the levels in paragraph (a)(1)(i) or (a)(3)(i) of this section under licenses granted based on certifications filed pursuant to paragraph (b)(2) of this section. (i) An ESAA or ESAA system licensed based on certifications filed pursuant to paragraph (b)(2) of this section must operate in accordance with the off-axis EIRP density specifications provided to the target satellite operator in order to obtain the certifications. (ii) Any ESAA transmitter operating under a license granted based on certifications filed pursuant to paragraph (b)(2) of this section must be self-monitoring and capable of shutting itself off and must cease or reduce emissions within 100 milliseconds after generating off-axis EIRP-density in excess of the specifications supplied to the target satellite operator. (iii) A system with variable power control of individual ESAA transmitters must monitor the aggregate off-axis EIRP density from simultaneously transmitting ESAA transmitters at the system's network control and monitoring center. If simultaneous operation of two or more ESAA transmitters causes aggregate off-axis EIRP density to exceed the off-axis EIRP density specifications supplied to the target satellite operator, the network control and monitoring center must command those transmitters to cease emissions or reduce the aggregate EIRP density to a level at or below those specifications, and the transmitters must comply within 100 milliseconds of receiving the command.	Panasonic complies, as applicable. *See* Application Technical Appendix, Section I; *see also* Section 25.227(b)(2).
§ 25.227(a)(3)	(3) The following requirements apply to an ESAA system that uses variable power-density control of individual ESAA earth stations transmitting simultaneously in the same frequencies to the same target satellite, unless the system operates pursuant to paragraph (a)(2) of this section. (i) Aggregate EIRP density from co-frequency earth stations in each target satellite receiving beam, not resulting from colliding data bursts transmitted pursuant to a contention protocol, will not exceed the limits specified in paragraph (a)(1)(i) of this section. (ii) Each ESAA transmitter must be self-monitoring and capable of shutting itself off and must cease or reduce emissions within 100 milliseconds after generating off-axis EIRP density in excess of the limit in paragraph (a)(3)(i) of this section. (iii) A system with variable power control of individual ESAA transmitters must monitor aggregate power density from simultaneously transmitting ESAA transmitters at the network control and monitoring center. If simultaneous operation of two or more transmitters causes aggregate off-axis EIRP density to exceed the off-axis EIRP density limit in paragraph (a)(3)(i) of this section, the network control and monitoring center must command those transmitters to cease emissions or reduce the aggregate EIRP density to a level at or below	N/A

	that limit, and those transmitters must comply within 100 milliseconds of receiving the command.	
§ 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* File No. SES-MFS-20160819-00730, Technical Appendix.
§ 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.	*Id.*
§ 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* File No. SES-MFS-20160819-00730, Technical Appendix; *See* Application Narrative, Section II.
§ 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 paragraph (a)(1)(i) of this section may request Permitted List 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, Section I.
§ 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 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.	Panasonic complies (no specific certification required).
§ 25.227(b)	(b) Applications for ESAA operation in the 14.0-14.5 GHz (Earth-to-space) band to GSO satellites in the FSS shall include, in addition to the particulars of operation identified on FCC 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 must	

	provide the information required by §25.115(g)(1). An applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(A) of this section must also provide the certifications identified in paragraph (b)(1)(iii) of this section. An applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(B) of this section must also provide the demonstrations identified in paragraph (b)(1)(iv) of this section. (i)-(ii) [Reserved] (iii) An ESAA applicant proposing to implement a transmitter under paragraph (a)(1)(ii)(A) of this section shall: (A) Demonstrate that the total tracking error budget of their antenna is within 0.2° 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 () from the mean value, *i.e.,* that there is a 0.997 probability the antenna maintains a pointing error within 0.2°; 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°. (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.	*See* Application Narrative, Section II and Technical Appendix, Section II; File No. SES-MFS-20120913-00818 (PPA); File No. SES-MFS- 20160819-00730 (SPA).

§ 25.227(b)(2)	(2) An ESAA applicant proposing to operate with off-axis EIRP density in excess of the levels in paragraph (a)(1)(i) or (a)(3)(i) of this section must provide the following in exhibits to its earth station application: (i) Off-axis EIRP density data pursuant to §25.115(g)(1); (ii) The certifications required by §25.220(d); and (iii) A detailed showing that each ESAA transmitter in the system will automatically cease or reduce emissions within 100 milliseconds after generating EIRP density exceeding specifications provided to the target satellite operator; and (iv) A detailed showing that the aggregate power density from simultaneously transmitting ESAA transmitters will be monitored at the system's network control and monitoring center; that if simultaneous operation of two or more ESAA transmitters causes the aggregate off-axis EIRP density to exceed the off-axis EIRP density specifications supplied to the target satellite operator, the network control and monitoring center will command those transmitters to cease emissions or reduce the aggregate EIRP density to a level at or below those specifications; and that those transmitters will comply within 100 milliseconds of receiving the command.	*See* Application Narrative, Section II and Technical Appendix, Section I; File No. SES-MFS-20120913-00818 (PPA); File No. SES-MFS-20160819-00730 (SPA)
§ 25.227(b)(3)	(3) An applicant proposing to implement an ESAA system subject to paragraph (a)(3) of this section must provide the following information in exhibits to its earth station application: (i) Off-axis EIRP density data pursuant to §25.115(g)(1); (ii) A detailed showing of the measures that will be employed to maintain aggregate EIRP density at or below the limit in paragraph (a)(3)(i) of this section; (iii) A detailed showing that each ESAA terminal will automatically cease or reduce emissions within 100 milliseconds after generating off-axis EIRP density exceeding the limit in paragraph (a)(3)(i) of this section; and (iv) A detailed showing that the aggregate power density from simultaneously transmitting ESAA transmitters will be monitored at the system's network control and monitoring center; that if simultaneous operation of two or more transmitters in the ESAA network causes aggregate off-axis EIRP density to exceed the off-axis density limit in paragraph (a)(3)(i) of this section, the network control and monitoring center will command those transmitters to cease emissions or reduce the aggregate EIRP density to a level at or below that limit; and that those transmitters will comply within 100 milliseconds of receiving the command.	N/A

§ 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* Application Technical Appendix, Section I.
§ 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* File No. SES-MFS-20160819-00730, Technical Appendix.
§ 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* Application Technical Appendix, Section 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 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.	*See* Application Technical Appendix, Section III.

§ 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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