

Technical Appendix

Annex A-1 Eutelsat 115WB Link Budgets

Forward Link Budget

eXConnect Terminal

Antenna Type	Aura LE
Lat	45.0 deg
Lon	-80.0 deg
EIRP max	46.1 dBW
G/T	11.1 dB/K

Satellite

Name	SatMex-7
Longitude	-114.9 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	0.75
Overhead Rate	0.92
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	2.07 bps/Hz
Data Rate	6.22E+07 bps
Information Rate (Data + Overhead)	6.75E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.03E+07 Hz
C/N Threshold	8.5 dB

Uplink

Frequency	14.327 GHz
Back off	3.8 dB
EIRP Spectral Density	37.5 dBW/4kHz
Slant Range	38222 km
Space Loss, Ls	207.2 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.4 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	98.3 dBHz
C/(No+Io)	97.8 dBHz

Satellite

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

Downlink

Frequency	12.027 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Terminal	53.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	13.0 dBW/4kHz
Carrier EIRP @ Beam Peak	51.8 dBW
Carrier EIRP @ Terminal	51.3 dBW
Slant Range	38819 km
Space Loss, Ls	205.8 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	85.0 dBHz
C/(No+Io)	84.7 dBHz

End to End

End to End C/(No+Io)	84.5 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	8.7 dB
Link Margin	0.2 dB

Return Link Budget

eXConnect Terminal

Antenna Type	AURA LE
Lat	45.0 deg
Lon	-80.0 deg
EIRP max	46.1 dBW
G/T	11.1 dB/K

Satellite

Name	SatMex-7
Longitude	-114.9 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	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 Equivalent Bandwidth	2.04E+06 Hz
C/N Threshold	3.6 dB

Uplink

Frequency	14.327 GHz
Back off	0.0 dB
EIRP Spectral Density	13.8 dBW/4kHz
Slant Range	38819 km
Space Loss, Ls	207.4 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	6.0 dB/K
Thermal Noise, C/No	73.2 dBHz
C/(No+Io)	72.7 dBHz

Satellite

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

Downlink

Frequency	12.027 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	5.9 dBW/4kHz
Carrier EIRP @ Beam Peak	38.2 dBW
Carrier EIRP @ Hub	33.6 dBW
Slant Range	38222 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.6 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	88.4 dBHz
C/(No+Io)	85.4429 dBHz

End to End

End to End C/(No+Io)	72.5 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	4.2 dB
Link Margin	0.6 dB

Forward Link Budget

eXConnect Terminal

Antenna Type	MELCO
Lat	45.0 deg
Lon	-80.0 deg
EIRP max	47.2 dBW
G/T	9.3 dB/K

Satellite

Name	SatMex-7
Longitude	-114.9 deg

Hub Earth Station

Site	Brewster
Lat	33.663 deg
Lon	-84.226 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	0.25
Overhead Rate	0.71
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.35 bps/Hz
Data Rate	1.06E+07 bps
Information Rate (Data + Overhead)	1.50E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	5.87E+06 Hz
C/N Threshold	-2.2 dB

Uplink

Frequency	14.327 GHz
Back off	0.0 dB
EIRP Spectral Density	41.3 dBW/4kHz
Slant Range	37865 km
Space Loss, Ls	207.1 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	4.4 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	-6.0 dB/K
Thermal Noise, C/No	91.2 dBHz
C/(No+Io)	90.7 dBHz

Satellite

Flux Density	-86.9 dBW/m2
SFD @ Hub	-76.0 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	8.9 dB

Downlink

Frequency	12.027 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Terminal	53.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	5.9 dBW/4kHz
Carrier EIRP @ Beam Peak	44.6 dBW
Carrier EIRP @ Terminal	44.1 dBW
Slant Range	38819 km
Space Loss, Ls	205.8 dB
Pointing Loss, Lpnt	0.3 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	75.9 dBHz
C/(No+Io)	74.0 dBHz

End to End

End to End C/(No+Io)	73.9 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	-1.9 dB
Link Margin	0.3 dB

Return Link Budget

eXConnect Terminal

Antenna Type	MELCO
Lat	45.0 deg
Lon	-80.0 deg
EIRP max	47.2 dBW
G/T	9.3 dB/K

Satellite

Name	SatMex-7
Longitude	-114.9 deg

Hub Earth Station

Site	Brewster
Lat	33.663 deg
Lon	-84.226 deg
EIRP max	80.1 dBW
G/T	33.4 dB/K

Signal

Waveform	iDirect
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.83
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.83 bps/Hz
Data Rate	5.55E+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 Equivalent Bandwidth	2.50E+06 Hz
C/N Threshold	3.6 dB

Uplink

Frequency	14.327 GHz
Back off	0.0 dB
EIRP Spectral Density	15.0 dBW/4kHz
Slant Range	38819 km
Space Loss, Ls	207.4 dB
Pointing Loss, Lpnt	0.4 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	6.0 dB/K
Thermal Noise, C/No	74.0 dBHz
C/(No+Io)	73.5 dBHz

Satellite

Flux Density	-116.0 dBW/m2
SFD @ Terminal	-100.0 dBW/m2
Small Signal Gain (IBO/OBO)	1.5 dB
OBO	14.5 dB

Downlink

Frequency	12.027 GHz
Transponder Sat. EIRP @ Beam Peak	53.5 dBW
Transponder Sat. EIRP @ Hub	41.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	6.8 dBW/4kHz
Carrier EIRP @ Beam Peak	39.0 dBW
Carrier EIRP @ Hub	26.5 dBW
Slant Range	37865 km
Space Loss, Ls	205.6 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	78.2 dBHz
C/(No+Io)	77.4246 dBHz

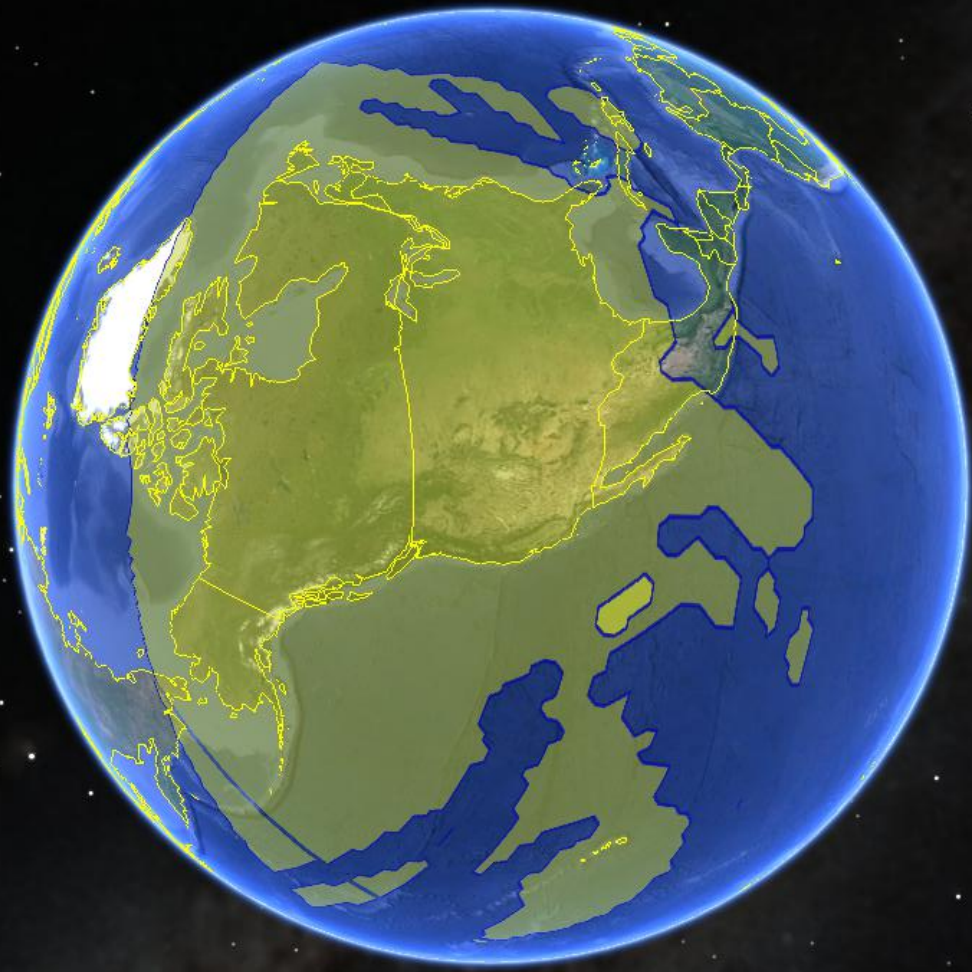
End to End

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

Technical Appendix

Annex A-2

Eutelsat 115WB Coverage Map



US Dept of State Geographer
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

44°58'14.45" N 114°52'31.26" W eye alt 16823.22 km

Technical Appendix

Annex B-1 IS-29E Link Budgets

Forward Link Budget

eXConnect Terminal

Antenna Type	MELCO
Lat	25.4 deg
Lon	-80.1 deg
EIRP max	47.2 dBW
G/T	9.3 dB/K

Satellite

Name	IS-29
Longitude	-50.0 deg

Hub Earth Station

Site	Mountainside
Lat	39.599 deg
Lon	-77.757 deg
EIRP max	80.0 dBW
G/T	40.4 dB/K

Signal

Waveform	DVB-S2
Modulation	QPSK
Bits per symbol	2
Spread Factor	1
Coding Rate	0.25
Overhead Rate	0.71
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.35 bps/Hz
Data Rate	1.59E+07 bps
Information Rate (Data + Overhead)	2.25E+07 bps
Symbol Rate	4.50E+07 Hz
Chip Rate (Noise Bandwidth)	4.50E+07 Hz
Occupied Bandwidth	5.40E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	-2.2 dB

Uplink

Frequency	14.000 GHz
Back off	6.3 dB
EIRP Spectral Density	33.2 dBW/4kHz
Slant Range	38106 km
Space Loss, Ls	207.0 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.1 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	16.0 dB/K
Thermal Noise, C/No	108.2 dBHz
C/(No+Io)	107.7 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	12.000 GHz
Transponder Sat. EIRP @ Beam Peak	48.1 dBW
Transponder Sat. EIRP @ Terminal	47.1 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	6.6 dBW/4kHz
Carrier EIRP @ Beam Peak	47.1 dBW
Carrier EIRP @ Terminal	46.1 dBW
Slant Range	37401 km
Space Loss, Ls	205.5 dB
Pointing Loss, Lpnt	0.3 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	78.2 dBHz
C/(No+Io)	76.6 dBHz

End to End

End to End C/(No+Io)	76.6 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	-0.9 dB
Link Margin	1.3 dB

Return Link Budget

eXConnect Terminal

Antenna Type	MELCO
Lat	25.4 deg
Lon	-80.1 deg
EIRP max	47.2 dBW
G/T	9.3 dB/K

Satellite

Name	IS-29
Longitude	-50.0 deg

Hub Earth Station

Site	Mountainside
Lat	39.599 deg
Lon	-77.757 deg
EIRP max	80.0 dBW
G/T	40.4 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	1.22E+06 bps
Information Rate (Data + Overhead)	1.67E+06 bps
Symbol Rate	3.33E+06 Hz
Chip Rate (Noise Bandwidth)	6.66E+06 Hz
Occupied Bandwidth	7.99E+06 Hz
Power Equivalent Bandwidth	2.72E+05 Hz
C/N Threshold	-2.3 dB

Uplink

Frequency	14.000 GHz
Back off	1.7 dB
EIRP Spectral Density	13.3 dBW/4kHz
Slant Range	37401 km
Space Loss, Ls	206.8 dB
Pointing Loss, Lpnt	0.4 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	0.2 dB/K
Thermal Noise, C/No	67.1 dBHz
C/(No+Io)	66.6 dBHz

Satellite

Flux Density	-117.3 dBW/m2
SFD @ Terminal	-88.2 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	27.1 dB

Downlink

Frequency	12.000 GHz
Transponder Sat. EIRP @ Beam Peak	60.0 dBW
Transponder Sat. EIRP @ Hub	60.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	0.6 dBW/4kHz
Carrier EIRP @ Beam Peak	32.9 dBW
Carrier EIRP @ Hub	32.9 dBW
Slant Range	38106 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.9 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	92.3 dBHz
C/(No+Io)	80.0479 dBHz

End to End

End to End C/(No+Io)	66.4 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-1.8 dB
Link Margin	0.5 dB

Forward Link Budget

eXConnect Terminal

Antenna Type	AURA LE
Lat	25.4 deg
Lon	-80.1 deg
EIRP max	46.9 dBW
G/T	11.9 dB/K

Satellite

Name	IS-29
Longitude	-50.0 deg

Hub Earth Station

Site	Mountainside
Lat	39.599 deg
Lon	-77.757 deg
EIRP max	80.0 dBW
G/T	40.4 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	5.08E+07 bps
Information Rate (Data + Overhead)	5.40E+07 bps
Symbol Rate	4.50E+07 Hz
Chip Rate (Noise Bandwidth)	4.50E+07 Hz
Occupied Bandwidth	5.40E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	2.7 dB

Uplink

Frequency	14.000 GHz
Back off	6.3 dB
EIRP Spectral Density	33.2 dBW/4kHz
Slant Range	38106 km
Space Loss, Ls	207.0 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.1 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	16.0 dB/K
Thermal Noise, C/No	108.2 dBHz
C/(No+Io)	107.7 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	12.000 GHz
Transponder Sat. EIRP @ Beam Peak	48.1 dBW
Transponder Sat. EIRP @ Terminal	47.1 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	6.6 dBW/4kHz
Carrier EIRP @ Beam Peak	47.1 dBW
Carrier EIRP @ Terminal	46.1 dBW
Slant Range	37401 km
Space Loss, Ls	205.5 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	81.0 dBHz
C/(No+Io)	80.6 dBHz

End to End

End to End C/(No+Io)	80.6 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	3.1 dB
Link Margin	0.4 dB

Return Link Budget

eXConnect Terminal

Antenna Type	AURA LE
Lat	25.4 deg
Lon	-80.1 deg
EIRP max	46.9 dBW
G/T	11.9 dB/K

Satellite

Name	IS-29
Longitude	-50.0 deg

Hub Earth Station

Site	Mountainside
Lat	39.599 deg
Lon	-77.757 deg
EIRP max	80.0 dBW
G/T	40.4 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)	6.66E+06 Hz
Occupied Bandwidth	7.99E+06 Hz
Power Equivalent Bandwidth	3.94E+05 Hz
C/N Threshold	-1.2 dB

Uplink

Frequency	14.000 GHz
Back off	0.0 dB
EIRP Spectral Density	14.6 dBW/4kHz
Slant Range	37401 km
Space Loss, Ls	206.8 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	0.2 dB/K
Thermal Noise, C/No	68.7 dBHz
C/(No+Io)	68.2 dBHz

Satellite

Flux Density	-115.7 dBW/m2
SFD @ Terminal	-88.2 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	25.5 dB

Downlink

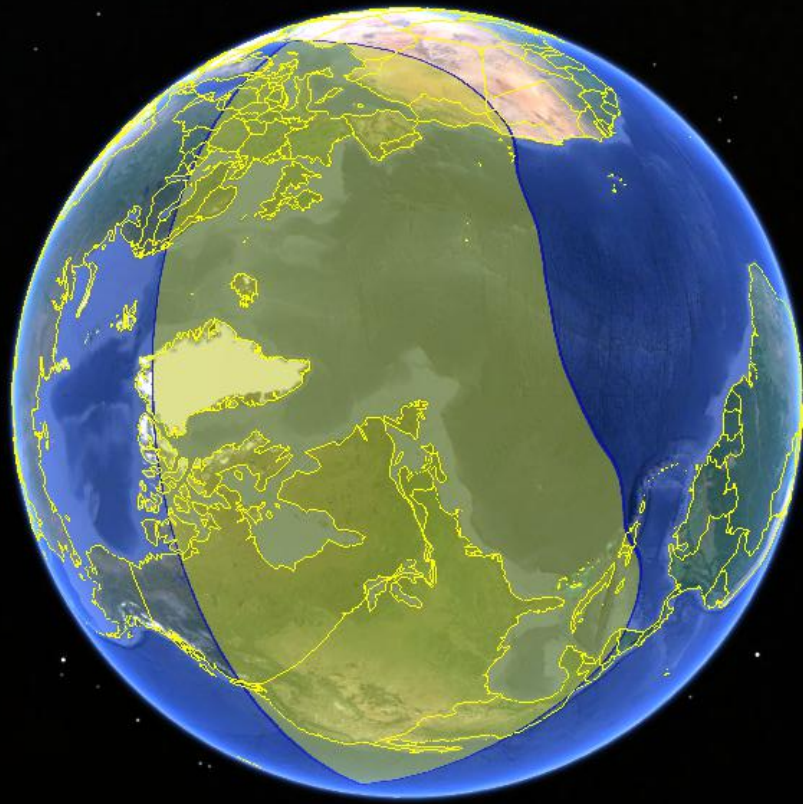
Frequency	12.000 GHz
Transponder Sat. EIRP @ Beam Peak	60.0 dBW
Transponder Sat. EIRP @ Hub	60.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	2.2 dBW/4kHz
Carrier EIRP @ Beam Peak	34.5 dBW
Carrier EIRP @ Hub	34.5 dBW
Slant Range	38106 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	3.9 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	93.9 dBHz
C/(No+Io)	81.6561 dBHz

End to End

End to End C/(No+Io)	68.0 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-0.2 dB
Link Margin	1.0 dB

Technical Appendix

Annex B-2
IS-29E Coverage Map



US Dept of State Geographer
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

60°27'59.79" N 52°58'33.83" W eye alt 21289.49 km

Technical Appendix

Annex C-1 AMC-16 Link Budgets

Forward Link Budget

eXConnect Terminal

Antenna Type	MELCO
Lat	35.0 deg
Lon	-90.1 deg
EIRP max	47.2 dBW
G/T	9.3 dB/K

Satellite

Name	AMC-16
Longitude	-85.0 deg

Hub Earth Station

Site	Brewster
Lat	48.1 deg
Lon	-119.8 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	0.75
Overhead Rate	0.92
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	1.39 bps/Hz
Data Rate	4.16E+07 bps
Information Rate (Data + Overhead)	4.50E+07 bps
Symbol Rate	3.00E+07 Hz
Chip Rate (Noise Bandwidth)	3.00E+07 Hz
Occupied Bandwidth	3.60E+07 Hz
Power Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	4.4 dB

Uplink

Frequency	14.120 GHz
Back off	7.6 dB
EIRP Spectral Density	33.7 dBW/4kHz
Slant Range	39035 km
Space Loss, Ls	207.3 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.7 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	94.1 dBHz
C/(No+Io)	93.6 dBHz

Satellite

Flux Density	-92.1 dBW/m ²
SFD @ Hub	-89.1 dBW/m ²
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.0 dB

Downlink

Frequency	11.820 GHz
Transponder Sat. EIRP @ Beam Peak	52.1 dBW
Transponder Sat. EIRP @ Terminal	51.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	12.3 dBW/4kHz
Carrier EIRP @ Beam Peak	51.1 dBW
Carrier EIRP @ Terminal	50.0 dBW
Slant Range	37147 km
Space Loss, Ls	205.3 dB
Pointing Loss, Lpnt	0.3 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	82.3 dBHz
C/(No+Io)	81.1 dBHz

End to End

End to End C/(No+Io)	80.9 dBHz
Implementation Loss	1.0 dB
End to End C/N w/ Imp Loss	5.1 dB
Link Margin	0.7 dB

Return Link Budget

eXConnect Terminal

Antenna Type	MELCO
Lat	35.0 deg
Lon	-90.1 deg
EIRP max	47.2 dBW
G/T	9.3 dB/K

Satellite

Name	AMC-16
Longitude	-85.0 deg

Hub Earth Station

Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	34.4 dB/K

Signal

Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	4
Coding Rate	0.50
Overhead Rate	0.74
Channel Spacing	1.20
Spectral Efficiency (Rate/Noise BW)	0.09 bps/Hz
Data Rate	6.13E+05 bps
Information Rate (Data + Overhead)	8.34E+05 bps
Symbol Rate	1.67E+06 Hz
Chip Rate (Noise Bandwidth)	6.67E+06 Hz
Occupied Bandwidth	8.00E+06 Hz
Power Equivalent Bandwidth	1.17E+05 Hz
C/N Threshold	-5.6 dB

Uplink

Frequency	14.080 GHz
Back off	7.0 dB
EIRP Spectral Density	8.0 dBW/4kHz
Slant Range	37147 km
Space Loss, Ls	206.8 dB
Pointing Loss, Lpnt	0.4 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	3.0 dB/K
Thermal Noise, C/No	64.6 dBHz
C/(No+Io)	64.1 dBHz

Satellite

Flux Density	-122.6 dBW/m ²
SFD @ Terminal	-90.7 dBW/m ²
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	28.9 dB

Downlink

Frequency	11.780 GHz
Transponder Sat. EIRP @ Beam Peak	52.1 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-9.0 dBW/4kHz
Carrier EIRP @ Beam Peak	23.2 dBW
Carrier EIRP @ Hub	20.1 dBW
Slant Range	39035 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.2 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	75.3 dBHz
C/(No+Io)	69.2654 dBHz

End to End

End to End C/(No+Io)	62.9 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	-5.3 dB
Link Margin	0.3 dB

Forward Link Budget

eXConnect Terminal

Antenna Type	AURA LE
Lat	35.0 deg
Lon	-90.1 deg
EIRP max	47.0 dBW
G/T	12.0 dB/K

Satellite

Name	AMC-16
Longitude	-85.0 deg

Hub Earth Station

Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	34.4 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 Equivalent Bandwidth	3.60E+07 Hz
C/N Threshold	7.4 dB

Uplink

Frequency	14.120 GHz
Back off	7.6 dB
EIRP Spectral Density	33.7 dBW/4kHz
Slant Range	39035 km
Space Loss, Ls	207.3 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	1.7 dB
Radome, Lr	0.0 dB
Transponder G/T @ Hub	2.0 dB/K
Thermal Noise, C/No	94.1 dBHz
C/(No+Io)	93.6 dBHz

Satellite

Flux Density	-92.1 dBW/m2
SFD @ Hub	-89.1 dBW/m2
Small Signal Gain (IBO/OBO)	2.0 dB
OBO	1.0 dB

Downlink

Frequency	11.820 GHz
Transponder Sat. EIRP @ Beam Peak	52.1 dBW
Transponder Sat. EIRP @ Terminal	51.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	12.3 dBW/4kHz
Carrier EIRP @ Beam Peak	51.1 dBW
Carrier EIRP @ Terminal	50.0 dBW
Slant Range	37147 km
Space Loss, Ls	205.3 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	85.2 dBHz
C/(No+Io)	84.0 dBHz

End to End

End to End C/(No+Io)	83.5 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	AURA LE
Lat	35.0 deg
Lon	-90.1 deg
EIRP max	47.0 dBW
G/T	12.0 dB/K

Satellite

Name	AMC-16
Longitude	-85.0 deg

Hub Earth Station

Site	Brewster
Lat	48.1 deg
Lon	-119.8 deg
EIRP max	80.0 dBW
G/T	34.4 dB/K

Signal

Waveform	iDirect
Modulation	BPSK
Bits per symbol	1
Spread Factor	1
Coding Rate	0.50
Overhead Rate	0.78
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 Equivalent Bandwidth	5.92E+05 Hz
C/N Threshold	1.2 dB

Uplink

Frequency	14.080 GHz
Back off	0.0 dB
EIRP Spectral Density	14.8 dBW/4kHz
Slant Range	37147 km
Space Loss, Ls	206.8 dB
Pointing Loss, Lpnt	0.1 dB
Atmosphere / Weather Loss, La	0.0 dB
Radome, Lr	0.0 dB
Transponder G/T @ Terminal	3.0 dB/K
Thermal Noise, C/No	71.6 dBHz
C/(No+Io)	71.1 dBHz

Satellite

Flux Density	-115.5 dBW/m2
SFD @ Terminal	-90.7 dBW/m2
Small Signal Gain (IBO/OBO)	3.0 dB
OBO	21.8 dB

Downlink

Frequency	11.780 GHz
Transponder Sat. EIRP @ Beam Peak	52.1 dBW
Transponder Sat. EIRP @ Hub	49.0 dBW
DL PSD Limit	13.0 dBW/4kHz
DL PSD @ Beam Peak	-2.0 dBW/4kHz
Carrier EIRP @ Beam Peak	30.3 dBW
Carrier EIRP @ Hub	27.2 dBW
Slant Range	39035 km
Space Loss, Ls	205.7 dB
Pointing Loss, Lpnt	0.0 dB
Atmosphere / Weather Loss, La	2.2 dB
Radome, Lr	0.0 dB
PCMA Loss	0.0 dB
Thermal Noise, C/No	82.3 dBHz
C/(No+Io)	76.2939 dBHz

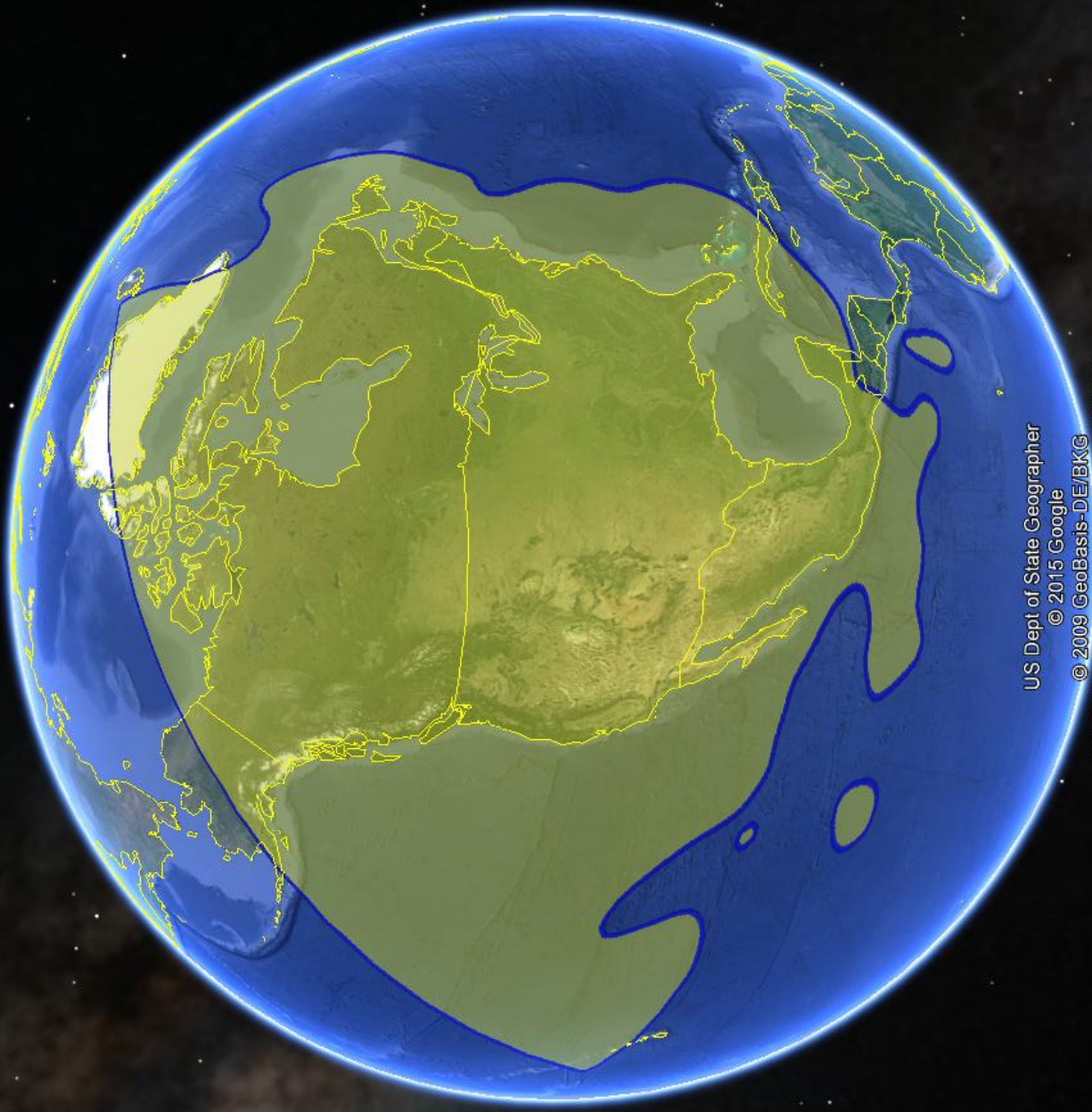
End to End

End to End C/(No+Io)	70.0 dBHz
Implementation Loss	0.0 dB
End to End C/N w/ Imp Loss	1.7 dB
Link Margin	0.5 dB

Technical Appendix

Annex C-2

AMC-16 Coverage Map



US Dept of State Geographer
© 2015 Google
© 2009 GeoBasis-DE/BKG
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

44°20'19.37" N 105°28'22.79" W eye alt 12186.35 km

Certification Letter Exhibit



June 12, 2015

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

Re: Engineering Certification of Eutelsat Americas

To Whom It May Concern:

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

Based on the information provided by Panasonic, EAS understands the technical characteristics of the PPA and MELCO terminals, and EAS (i) recognizes that operation of these terminals at the power density levels provided to EAS is consistent with existing coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from E115WB; (ii) acknowledges that the proposed operation of these terminals has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; and (iii) if the FCC authorizes the operations proposed by Panasonic, EAS will take into consideration the power density levels associated such operations in all future satellite network coordinations with adjacent satellite operators.

Sincerely,

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

Hector Fortis
Eutelsat Americas
International and Regulatory Affairs

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

4th June 2015

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

Re: Engineering Certification of Intelsat

To Whom It May Concern:

This letter certifies that Intelsat is aware that Panasonic Avionics Corporation ("Panasonic") is planning to seek a modification to its blanket authorization from the Federal Communications Commission ("FCC") to operate technically identical Ku-band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E100089. Among other changes, the Modification Application will seek authority for Panasonic's ESAA terminals to communicate with the IS-29e satellite (Call Sign S2913) to be located at 50°W. Intelsat understands that Panasonic will file the modification pursuant to the FCC rules governing ESAA operations, including Section 25.227.

Intelsat certifies that the proposed operation of the ESAA transmit/receive terminals at the power density levels proposed is consistent with existing operator-to-operator coordination agreements with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-29e. Intelsat also acknowledges that the proposed operation of the Panasonic ESAA terminal has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable. If the FCC authorizes the operations proposed by Panasonic, Intelsat will include the power density levels specified by Panasonic in all future satellite network coordinations with other adjacent satellite operators.

Sincerely,



Alan Yates
Senior Technical Advisor, Spectrum Strategy
Intelsat



August 18, 2015

Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

**Re: Panasonic Avionics Corporation, Amendment to Modification Application
File No. SES-MFS-20150609-00349, CallSign E100089 --
Engineering Certification of EchoStar Satellite Operating Corporation**

Dear Ms. Dortch:

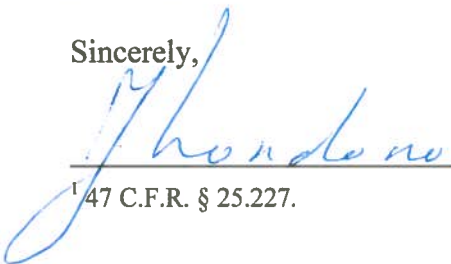
This letter certifies that EchoStar Satellite Operating Corporation (“ESOC”) is aware that Panasonic Avionics Corporation (“Panasonic”) is planning to seek authorization from the Federal Communications Commission (“FCC”) to operate Ku-band transmit/receive earth stations aboard aircraft (“ESAA”) terminals with the AMC-16 satellite located at 85° W.L. Specifically, we understand that Panasonic seeks to operate the previously authorized Panasonic Phased Array (“PPA”) and Mitsubishi Electric Corporation (“MELCO”) Ku-band antenna systems with AMC-16 for commercial purposes consistent with the FCC’s ESAA rules, including Section 25.227.¹

EchoStar confirms and hereby certifies the following with respect to the operation proposed in the above reference application:

- a) The proposed Ku-band ESAA operations of Panasonic has the potential to receive interference from satellite networks adjacent to the target satellite that may be unacceptable;
- b) The proposed operations of the ESAA transmit/receive terminals at the power density levels defined in the agreement between Panasonic and EchoStar are consistent with existing satellite coordination agreements with operators of satellites within +/-6 degrees of AMC-16.

If the FCC authorizes the operation proposed by Panasonic, EchoStar will include the power density levels specified by Panasonic, defined within the coordination agreement, in all future satellite network coordination with operators of satellites that are adjacent to AMC-16.

Sincerely,



¹47 C.F.R. § 25.227.



Jaime Londono
VP – Advanced Programs and Spectrum Development
EchoStar Satellite Operating Corporation