TECHNICAL APPENDIX

Modification Application (Call Sign E140087)
Astronics AeroSat Corporation

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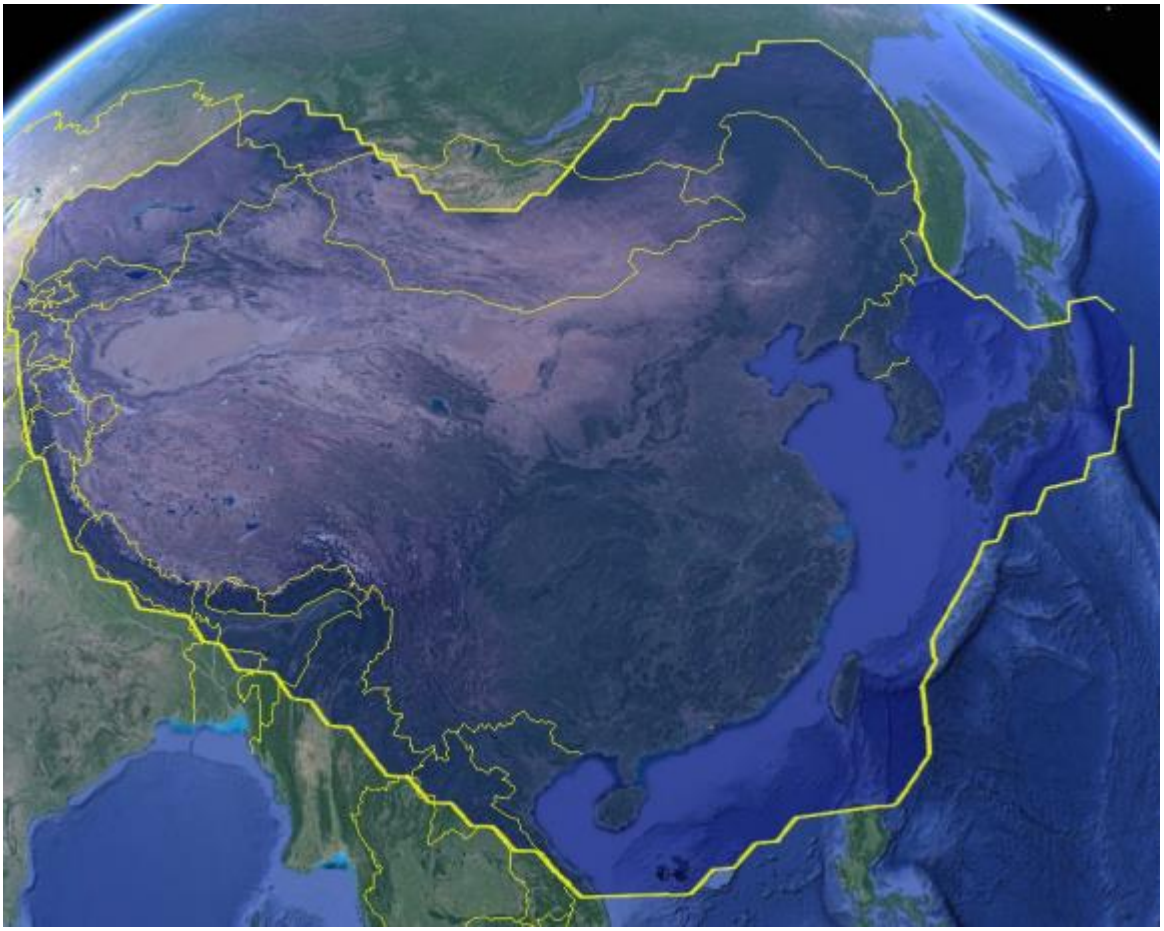
I. Proposed Satellite Points of Communication

1. AsiaSat-7

i. Coverage Map



ii. AsiaSat-7 Link Budgets

Forward Link Budget

FliteStream Terminal

Antenna Type	HR129	
Rx Lat. (North +)	22.9	degree
Rx Lng. (East +)	112	degree
G/T	11.38	dB/K

Satellite

Name	A7	
Sat. Lng. (East +)	105.5	degree

Hub Earth Station

Name	Beijing	
Tx Lat. (North +)	22.45	degree
Tx Lng. (East +)	114.18	degree
Max EIRP	79.996	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.600	
Overhead	0.940	
Channel Factor	1.2	
Spectral Efficiency	1.128	bps/Hz
Data Rate	50760.000	kb/s
Information Rate (Data + Overhead)	54000	kb/s
Symbol Rate	45000	ksps
Signal or Noise Bandwidth	45	MHz
Channel Spacing Occupied Bandwidth	54	MHz
C/N Threshold	2.7	dB

Uplink

Uplink Freq.	14.33	GHz
Output Backoff	4.2	dB
EIRP Spectral Density	35.284	dBW/4kHz
Tx Range	36429.282	km
FS Loss	206.796	dB
Pointing Loss	0	
Weather	5.6	
Radome	0	
Satellite G/T	7	dB/K
Uplink C/No	98.999	dB-Hz
Uplink C/(No+Io)	98.501	dB-Hz

Satellite

SFD	-89	dBW/m2
Small Signal Gain	2	
Output Backoff	1	dB

Downlink

Downlink Freq.	12.582	GHz
Beampeak EIRP	53.6	dBW
Sat. EIRP	53	dBW
DL PSD Limit	15	dBW/4kHz
DL PSD @ Beam Peak	12.063	dBW/4kHz
Carrier EIRP @ Beam Peak	52.575	dBW
Carrier EIRP	51.975	dBW
Rx Range	36414.548	km
FS Loss	205.662	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	85.692	dB-Hz
Downlink C/(No+Io)	80.777	dB-Hz

End-to-End

Composite C/No+Io	80.704	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	3.172	dB-Hz
Link Margin	0.472	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR129	
Tx Lat. (North +)	22.9	degree
Tx Lng. (East +)	112	degree
Max EIRP	41.42	dBW

Satellite

Name	A7	
Sat. Lng. (East +)	105.5	degree

Hub Earth Station

Name	Beijing	
Rx Lat. (North +)	22.45	degree
Rx Lng. (East +)	114.18	degree
G/T	37.304	dB/K

Signal

Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spreading Factor	1	
Code Rate	0.500	
Overhead Rate	0.833	
Channel Factor	1.2	
Spectral Efficiency	0.417	bps/Hz
Data Rate	2776.389	kb/s
Information Rate (Data + Overhead)	3333	kb/s
Symbol Rate	6666	ks/s
Chip Rate (Noise Bandwidth)	6666	kHz
Occupied Bandwidth	7999.2	kHz
C/N Threshold	-0.7	dB

Uplink

Uplink Freq.	14.192	GHz
Back-off	0	dB
EIRP Spectral Density	9.199	dBW/4kHz
Tx Range	36414.548	km
FS Loss	206.708	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	7	dB/K
Uplink C/No	69.608	dB-Hz
Uplink C/No+Io	68.306	dB-Hz

Satellite

SFD @ terminal	-92.1	dBW/m2
Small Signal Gain	3	dB
Output Backoff	22.8	dB

Downlink

Downlink Freq.	12.444	GHz
Beampeak EIRP	53.6	dBW
Sat. EIRP	53	dBW
DL PSD Limit	15	dBW/4kHz
Downlink PSD @ Beam Peak	-5.019	dBW/4kHz
Carrier Beam Peak EIRP	27.199	dBW
Carrier EIRP	26.599	dBW
Rx Range	36429.282	km
FS Loss	205.570	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	6.5	dB
Radome, Lr	0	dB
DownLink C/No	80.432	dB-Hz
Downlink C/No+io	78.532	dB-Hz

End-to-End

Composite C/No+Io	67.912	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	-0.326	dB
Link Margin	0.374	dB

Forward Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Rx Lat. (North +)	22.9	degree
Rx Lng. (East +)	112	degree
G/T	12.49	dB/K

Satellite

Name	A7	
Sat. Lng. (East +)	105.5	degree

Hub Earth Station

Name	Beijing	
Tx Lat. (North +)	22.45	degree
Tx Lng. (East +)	114.18	degree
Max EIRP	79.996	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	8PSK	
Total bits per symbol	3	
Spreading Factor	1	
Code Rate	0.667	
Overhead	0.940	
Channel Factor	1.2	
Spectral Efficiency	1.880	bps/Hz
Data Rate	84600.000	kb/s
Information Rate (Data + Overhead)	90000	kb/s
Symbol Rate	45000	ksps
Signal or Noise Bandwidth	45	MHz
Channel Spacing Occupied Bandwidth	54	MHz
C/N Threshold	7.4	dB

Uplink

Uplink Freq.	14.33	GHz
Output Backoff	4.2	dB
EIRP Spectral Density	35.284	dBW/4kHz
Tx Range	36429.282	km
FS Loss	206.796	dB
Pointing Loss	0	
Weather	5.6	
Radome	0	
Satellite G/T	7	dB/K
Uplink C/No	98.999	dB-Hz
Uplink C/(No+Io)	98.501	dB-Hz

Satellite

SFD	-89	dBW/m2
Small Signal Gain	2	
Output Backoff	1	dB

Downlink

Downlink Freq.	12.582	GHz
Beampeak EIRP	53.6	dBW
Sat. EIRP	53	dBW
DL PSD Limit	15	dBW/4kHz
DL PSD @ Beam Peak	12.063	dBW/4kHz
Carrier EIRP @ Beam Peak	52.575	dBW
Carrier EIRP	51.975	dBW
Rx Range	36414.548	km
FS Loss	205.662	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	86.799	dB-Hz
Downlink C/(No+Io)	86.103	dB-Hz

End-to-End

Composite C/No+Io	85.860	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	8.328	dB-Hz
Link Margin	0.928	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Tx Lat. (North +)	22.9	degree
Tx Lng. (East +)	112	degree
Max EIRP	45.01	dBW

Satellite

Name	A7	
Sat. Lng. (East +)	105.5	degree

Hub Earth Station

Name	Beijing	
Rx Lat. (North +)	22.45	degree
Rx Lng. (East +)	114.18	degree
G/T	37.304	dB/K

Signal

Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spreading Factor	1	
Code Rate	0.500	
Overhead Rate	0.833	
Channel Factor	1.2	
Spectral Efficiency	0.833	bps/Hz
Data Rate	5552.778	kb/s
Information Rate (Data + Overhead)	6666	kb/s
Symbol Rate	6666	ks/s
Chip Rate (Noise Bandwidth)	6666	kHz
Occupied Bandwidth	7999.2	kHz
C/N Threshold	3.6	dB

Uplink

Uplink Freq.	14.192	GHz
Back-off	0	dB
EIRP Spectral Density	12.788	dBW/4kHz
Tx Range	36414.548	km
FS Loss	206.708	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	7	dB/K
Uplink C/No	73.197	dB-Hz
Uplink C/No+Io	72.711	dB-Hz

Satellite

SFD @ terminal	-92.1	dBW/m2
Small Signal Gain	3	dB
Output Backoff	22.8	dB

Downlink

Downlink Freq.	12.444	GHz
Beampeak EIRP	53.6	dBW
Sat. EIRP	53	dBW
DL PSD Limit	15	dBW/4kHz
Downlink PSD @ Beam Peak	-1.430	dBW/4kHz
Carrier Beam Peak EIRP	30.788	dBW
Carrier EIRP	30.188	dBW
Rx Range	36429.282	km
FS Loss	205.570	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	6.5	dB
Radome, Lr	0	dB
DownLink C/No	84.022	dB-Hz
Downlink C/No+io	80.491	dB-Hz

End-to-End

Composite C/No+Io	72.042	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	3.803	dB
Link Margin	0.203	dB

2. Galaxy 16

i. Coverage Map

ii. Galaxy 16 Link Budget

Forward Link Budget

FliteStream Terminal		
Antenna Type	HR129	
Rx Lat. (North +)	27.9	degree
Rx Lng. (East +)	-81	degree
G/T	11.06	dB/K

Satellite		
Name	G-16	
Sat. Lng. (East +)	-99	degree

Hub Earth Station		
Name	Brewster	
Tx Lat. (North +)	48.1	degree
Tx Lng. (East +)	-119.8	degree
Max EIRP	80.100	dBW

Signal		
FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.600	
Overhead	0.940	
Channel Factor	1.2	
Spectral Efficiency	1.128	bps/Hz
Data Rate	33840.000	kb/s
Information Rate (Data + Overhead)	36000	kb/s
Symbol Rate	30000	ksps
Signal or Noise Bandwidth	30	MHz
Channel Spacing Occupied Bandwidth	36	MHz
C/N Threshold	2.7	dB

Uplink		
Uplink Freq.	14.42	GHz
Output Backoff	3.2	dB
EIRP Spectral Density	38.150	dBW/4kHz
Tx Range	38505.870	km
FS Loss	207.332	dB
Pointing Loss	0	
Weather	1.5	
Radome	0	
Satellite G/T	2.9	dB/K
Uplink C/No	99.568	dB-Hz
Uplink C/(No+Io)	99.084	dB-Hz

Satellite		
SFD	-84.9	dBW/m2
Small Signal Gain	1.5	
Output Backoff	1	dB

Downlink		
Downlink Freq.	12.12	GHz
Beampeak EIRP	52.3	dBW
Sat. EIRP	51.3	dBW
DL PSD Limit	13	dBW/4kHz
DL PSD @ Beam Peak	12.647	dBW/4kHz
Carrier EIRP @ Beam Peak	51.398	dBW
Carrier EIRP	50.398	dBW
Rx Range	36962.733	km
FS Loss	205.467	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	83.985	dB-Hz
Downlink C/(No+Io)	79.033	dB-Hz

End-to-End		
Composite C/No+Io	78.991	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	3.219	dB-Hz
Link Margin	0.519	dB

Return Link Budget

FliteStream Terminal		
Antenna Type	HR129	
Tx Lat. (North +)	27.9	degree
Tx Lng. (East +)	-81	degree
Max EIRP	41.45	dBW

Satellite		
Name	G-16	
Sat. Lng. (East +)	-99	degree

Hub Earth Station		
Name	Brewster	
Rx Lat. (North +)	48.1	degree
Rx Lng. (East +)	-119.8	degree
G/T	37.226	dB/K

Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spreading Factor	2	
Code Rate	0.500	
Overhead Rate	0.778	
Channel Factor	1.2	
Spectral Efficiency	0.195	bps/Hz
Data Rate	1361.5	kb/s
Information Rate (Data + Overhead)	1750	kb/s
Symbol Rate	3500	ks/s
Chip Rate (Noise Bandwidth)	7000	kHz
Occupied Bandwidth	8400	kHz
C/N Threshold	-2.3	dB

Uplink		
Uplink Freq.	14.24	GHz
Back-off	0	dB
EIRP Spectral Density	9.016	dBW/4kHz
Tx Range	36962.733	km
FS Loss	206.867	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	4.9	dB/K
Uplink C/No	67.378	dB-Hz
Uplink C/No+Io	66.589	dB-Hz

Satellite		
SFD @ terminal	-95.8	dBW/m2
Small Signal Gain	2.5	dB
Output Backoff	19.7	dB

Downlink		
Downlink Freq.	11.94	GHz
Beampeak EIRP	52.3	dBW
Sat. EIRP	50.3	dBW
DL PSD Limit	13	dBW/4kHz
Downlink PSD @ Beam Peak	-3.432	dBW/4kHz
Carrier Beam Peak EIRP	28.999	dBW
Carrier EIRP	26.999	dBW
Rx Range	38505.870	km
FS Loss	205.692	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	1.7	dB
Radome, Lr	0	dB
DownLink C/No	85.431	dB-Hz
Downlink C/No+io	83.629	dB-Hz

End-to-End		
Composite C/No+Io	66.504	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	-1.947	dB
Link Margin	0.353	dB

Forward Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Rx Lat. (North +)	27.9	degree
Rx Lng. (East +)	-81	degree
G/T	12.16	dB/K

Satellite

Name	G-16	
Sat. Lng. (East +)	-99	degree

Hub Earth Station

Name	Brewster	
Tx Lat. (North +)	48.1	degree
Tx Lng. (East +)	-119.8	degree
Max EIRP	80.100	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	8PSK	
Total bits per symbol	3	
Spreading Factor	1	
Code Rate	0.667	
Overhead	0.940	
Channel Factor	1.2	
Spectral Efficiency	1.880	bps/Hz
Data Rate	56400.000	kb/s
Information Rate (Data + Overhead)	60000	kb/s
Symbol Rate	30000	ksps
Signal or Noise Bandwidth	30	MHz
Channel Spacing Occupied Bandwidth	36	MHz
C/N Threshold	7.4	dB

Uplink

Uplink Freq.	14.42	GHz
Output Backoff	3.2	dB
EIRP Spectral Density	38.150	dBW/4kHz
Tx Range	38505.870	km
FS Loss	207.332	dB
Pointing Loss	0	
Weather	1.5	
Radome	0	
Satellite G/T	2.9	dB/K
Uplink C/No	99.568	dB-Hz
Uplink C/(No+Io)	99.084	dB-Hz

Satellite

SFD	-84.9	dBW/m2
Small Signal Gain	1.5	
Output Backoff	1	dB

Downlink

Downlink Freq.	12.12	GHz
Beampeak EIRP	52.3	dBW
Sat. EIRP	51.3	dBW
DL PSD Limit	13	dBW/4kHz
DL PSD @ Beam Peak	12.647	dBW/4kHz
Carrier EIRP @ Beam Peak	51.398	dBW
Carrier EIRP	50.398	dBW
Rx Range	36962.733	km
FS Loss	205.467	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	85.092	dB-Hz
Downlink C/(No+Io)	84.024	dB-Hz

End-to-End

Composite C/No+Io	83.891	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	8.119	dB-Hz
Link Margin	0.719	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Tx Lat. (North +)	27.9	degree
Tx Lng. (East +)	-81	degree
Max EIRP	45.04	dBW

Satellite

Name	G-16	
Sat. Lng. (East +)	-99	degree

Hub Earth Station

Name	Brewster	
Rx Lat. (North +)	48.1	degree
Rx Lng. (East +)	-119.8	degree
G/T	37.226	dB/K

Signal

Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spreading Factor	1	
Code Rate	0.500	
Overhead Rate	0.778	
Channel Factor	1.2	
Spectral Efficiency	0.389	bps/Hz
Data Rate	2594.63	kb/s
Information Rate (Data + Overhead)	3335	kb/s
Symbol Rate	6670	ks/s
Chip Rate (Noise Bandwidth)	6670	kHz
Occupied Bandwidth	8004	kHz
C/N Threshold	1.2	dB

Uplink

Uplink Freq.	14.24	GHz
Back-off	0	dB
EIRP Spectral Density	12.815	dBW/4kHz
Tx Range	36962.733	km
FS Loss	206.867	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	4.9	dB/K
Uplink C/No	70.967	dB-Hz
Uplink C/No+Io	70.503	dB-Hz

Satellite

SFD @ terminal	-95.8	dBW/m2
Small Signal Gain	2.5	dB
Output Backoff	19.7	dB

Downlink

Downlink Freq.	11.94	GHz
Beampeak EIRP	52.3	dBW
Sat. EIRP	50.3	dBW
DL PSD Limit	13	dBW/4kHz
Downlink PSD @ Beam Peak	0.367	dBW/4kHz
Carrier Beam Peak EIRP	32.588	dBW
Carrier EIRP	30.588	dBW
Rx Range	38505.870	km
FS Loss	205.692	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	1.7	dB
Radome, Lr	0	dB
DownLink C/No	89.020	dB-Hz
Downlink C/No+io	85.531	dB-Hz

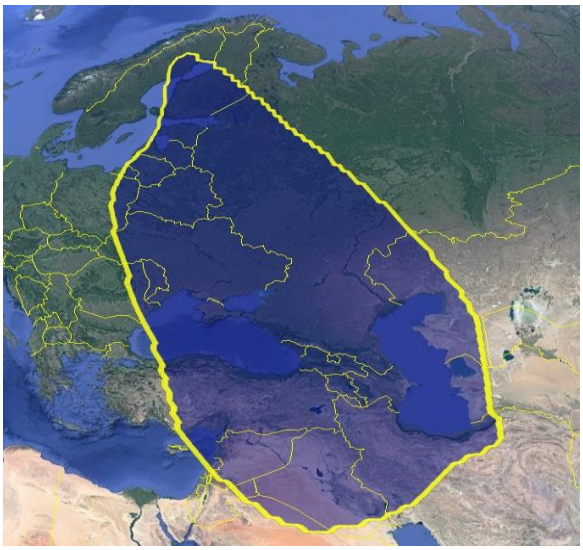
End-to-End

Composite C/No+Io	70.369	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	2.127	dB
Link Margin	0.927	dB

3. IS-33E

i. Coverage Maps

K31 Beam



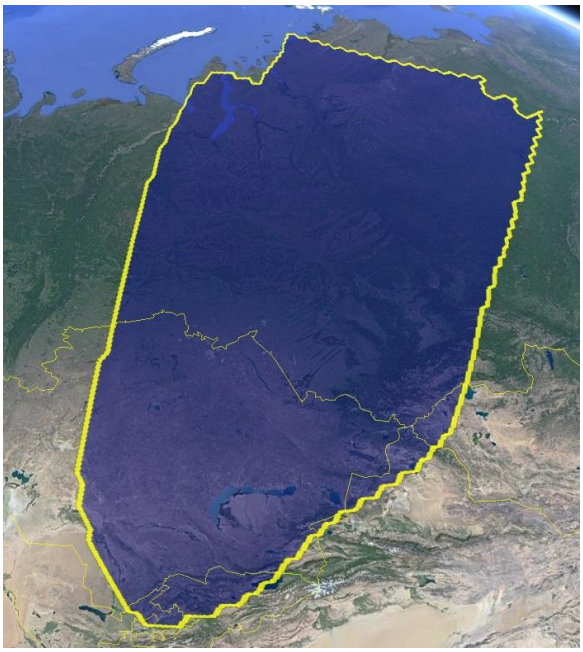
K34 Beam

K41 Beam

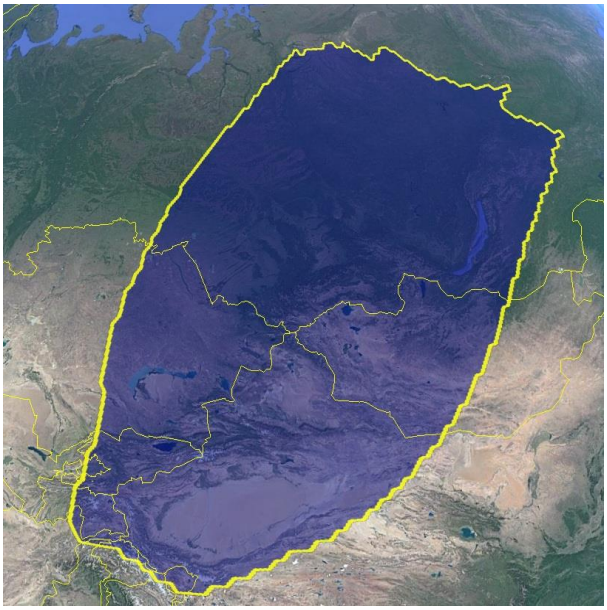
K48 Beam

i. Coverage Maps (Cont.)

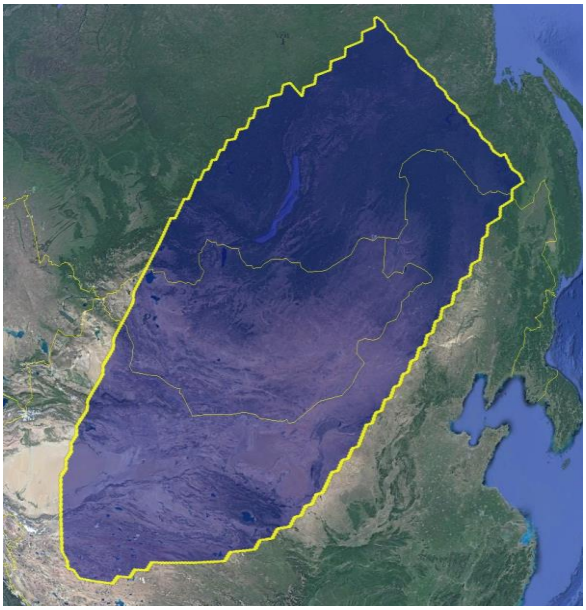
K49 Beam



K52 Beam



K53 Beam



K63 Beam

ii. IS-33E Link Budgets

Forward Link Budget

FliteStream Terminal

Antenna Type	HR129	
Rx Lat. (North +)	26	degree
Rx Lng. (East +)	52	degree
G/T	10.22	dB/K

Satellite

Name	IS33e K31	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Cologne	
Tx Lat. (North +)	50.9424	degree
Tx Lng. (East +)	7.0292	degree
Max EIRP	79.997	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.667	
Overhead	0.920	
Channel Factor	1.2	
Spectral Efficiency	1.227	bps/Hz
Data Rate	55200.000	kb/s
Information Rate (Data + Overhead)	60000	kb/s
Symbol Rate	45000	ksps
Signal or Noise Bandwidth	45	MHz
Channel Spacing Occupied Bandwidth	54	MHz
C/N Threshold	3.5	dB

Uplink

Uplink Freq.	17.55	GHz
Output Backoff	7.7	dB
EIRP Spectral Density	31.785	dBW/4kHz
Tx Range	40179.485	km
FS Loss	209.407	dB
Pointing Loss	0	
Weather	6.1	
Radome	0	
Satellite G/T	16	dB/K
Uplink C/No	101.388	dB-Hz
Uplink C/(No+Io)	100.820	dB-Hz

Satellite

SFD	-89	dBW/m2
Small Signal Gain	2	
Output Backoff	6.6	dB

Downlink

Downlink Freq.	11.008	GHz
Beampeak EIRP	60.4	dBW
Sat. EIRP	59.4	dBW
DL PSD Limit	14	dBW/4kHz
DL PSD @ Beam Peak	14.013	dBW/4kHz
Carrier EIRP @ Beam Peak	54.524	dBW
Carrier EIRP	53.524	dBW
Rx Range	36600.389	km
FS Loss	204.546	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	87.197	dB-Hz
Downlink C/(No+Io)	81.208	dB-Hz

End-to-End

Composite C/No+Io	81.161	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	3.628	dB-Hz
Link Margin	0.128	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR129	
Tx Lat. (North +)	26	degree
Tx Lng. (East +)	52	degree
Max EIRP	41.33	dBW

Satellite

Name	IS33e K31	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Cologne	
Rx Lat. (North +)	50.9424	degree
Rx Lng. (East +)	7.0292	degree
G/T	37.504	dB/K

Signal

Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spreading Factor	1	
Code Rate	0.600	
Overhead Rate	0.867	
Channel Factor	1.2	
Spectral Efficiency	1.040	bps/Hz
Data Rate	6935.3064	kb/s
Information Rate (Data + Overhead)	7999.2	kb/s
Symbol Rate	6666	ks/s
Chip Rate (Noise Bandwidth)	6666	kHz
Occupied Bandwidth	7999.2	kHz
C/N Threshold	2.7	dB

Uplink

Uplink Freq.	14.058	GHz
Back-off	0	dB
EIRP Spectral Density	9.116	dBW/4kHz
Tx Range	36600.389	km
FS Loss	206.670	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	12.7	dB/K
Uplink C/No	75.263	dB-Hz
Uplink C/No+Io	71.674	dB-Hz

Satellite

SFD @ terminal	-90.2	dBW/m2
Small Signal Gain	2	dB
Output Backoff	25.8	dB

Downlink

Downlink Freq.	11.45	GHz
Beampeak EIRP	60	dBW
Sat. EIRP	60	dBW
DL PSD Limit	14	dBW/4kHz
Downlink PSD @ Beam Peak	-1.646	dBW/4kHz
Carrier Beam Peak EIRP	30.572	dBW
Carrier EIRP	30.572	dBW
Rx Range	40179.485	km
FS Loss	205.698	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	4.1	dB
Radome, Lr	0	dB
DownLink C/No	86.878	dB-Hz
Downlink C/No+io	81.260	dB-Hz

End-to-End

Composite C/No+Io	71.221	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	2.983	dB
Link Margin	0.283	dB

Forward Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Rx Lat. (North +)	26	degree
Rx Lng. (East +)	52	degree
G/T	11.33	dB/K

Satellite

Name	IS33e K31	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Cologne	
Tx Lat. (North +)	50.9424	degree
Tx Lng. (East +)	7.0292	degree
Max EIRP	79.997	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	8PSK	
Total bits per symbol	3	
Spreading Factor	1	
Code Rate	0.750	
Overhead	0.920	
Channel Factor	1.2	
Spectral Efficiency	2.070	bps/Hz
Data Rate	93150.000	kb/s
Information Rate (Data + Overhead)	101250	kb/s
Symbol Rate	45000	ksps
Signal or Noise Bandwidth	45	MHz
Channel Spacing Occupied Bandwidth	54	MHz
C/N Threshold	8.5	dB

Uplink

Uplink Freq.	17.55	GHz
Output Backoff	8.4	dB
EIRP Spectral Density	31.085	dBW/4kHz
Tx Range	40179.485	km
FS Loss	209.407	dB
Pointing Loss	0	
Weather	6.1	
Radome	0	
Satellite G/T	16	dB/K
Uplink C/No	100.688	dB-Hz
Uplink C/(No+Io)	100.200	dB-Hz

Satellite

SFD	-89	dBW/m2
Small Signal Gain	2	
Output Backoff	6.6	dB

Downlink

Downlink Freq.	11.008	GHz
Beampeak EIRP	60.4	dBW
Sat. EIRP	59.4	dBW
DL PSD Limit	14	dBW/4kHz
DL PSD @ Beam Peak	13.313	dBW/4kHz
Carrier EIRP @ Beam Peak	53.824	dBW
Carrier EIRP	52.824	dBW
Rx Range	36600.389	km
FS Loss	204.546	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	87.604	dB-Hz
Downlink C/(No+Io)	86.613	dB-Hz

End-to-End

Composite C/No+Io	86.427	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	8.895	dB-Hz
Link Margin	0.395	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Tx Lat. (North +)	26	degree
Tx Lng. (East +)	52	degree
Max EIRP	44.92	dBW

Satellite

Name	IS33e K31	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Cologne	
Rx Lat. (North +)	50.9424	degree
Rx Lng. (East +)	7.0292	degree
G/T	37.504	dB/K

Signal

Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spreading Factor	1	
Code Rate	0.860	
Overhead Rate	0.867	
Channel Factor	1.2	
Spectral Efficiency	1.491	bps/Hz
Data Rate	9940.60584	kb/s
Information Rate (Data + Overhead)	11465.52	kb/s
Symbol Rate	6666	ks/s
Chip Rate (Noise Bandwidth)	6666	kHz
Occupied Bandwidth	7999.2	kHz
C/N Threshold	7.5	dB

Uplink

Uplink Freq.	14.058	GHz
Back-off	0	dB
EIRP Spectral Density	12.706	dBW/4kHz
Tx Range	36600.389	km
FS Loss	206.670	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	12.7	dB/K
Uplink C/No	78.853	dB-Hz
Uplink C/No+Io	78.432	dB-Hz

Satellite

SFD @ terminal	-90.2	dBW/m2
Small Signal Gain	2	dB
Output Backoff	25.8	dB

Downlink

Downlink Freq.	11.45	GHz
Beampeak EIRP	60	dBW
Sat. EIRP	60	dBW
DL PSD Limit	14	dBW/4kHz
Downlink PSD @ Beam Peak	1.944	dBW/4kHz
Carrier Beam Peak EIRP	34.162	dBW
Carrier EIRP	34.162	dBW
Rx Range	40179.485	km
FS Loss	205.698	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	4.1	dB
Radome, Lr	0	dB
DownLink C/No	90.467	dB-Hz
Downlink C/No+io	81.988	dB-Hz

End-to-End

Composite C/No+Io	76.845	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	8.607	dB
Link Margin	1.107	dB

Forward Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Rx Lat. (North +)	43.8	degree
Rx Lng. (East +)	99	degree
G/T	11.43	dB/K

Satellite

Name	IS33e K63	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Moscow	
Tx Lat. (North +)	55.898	degree
Tx Lng. (East +)	37.997	degree
Max EIRP	79.997	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.833	
Overhead	0.935	
Channel Factor	1.2	
Spectral Efficiency	1.558	bps/Hz
Data Rate	63105.750	kb/s
Information Rate (Data + Overhead)	67500	kb/s
Symbol Rate	40500	ksps
Signal or Noise Bandwidth	40.5	MHz
Channel Spacing Occupied Bandwidth	48.6	MHz
C/N Threshold	5.6	dB

Uplink

Uplink Freq.	17.55	GHz
Output Backoff	14.3	dB
EIRP Spectral Density	25.643	dBW/4kHz
Tx Range	39228.735	km
FS Loss	209.199	dB
Pointing Loss	0	
Weather	3.9	
Radome	0	
Satellite G/T	16	dB/K
Uplink C/No	97.196	dB-Hz
Uplink C/(No+Io)	96.702	dB-Hz

Satellite

SFD	-89	dBW/m2
Small Signal Gain	2	
Output Backoff	10	dB

Downlink

Downlink Freq.	11.143	GHz
Beampeak EIRP	60.9	dBW
Sat. EIRP	59.9	dBW
DL PSD Limit	14	dBW/4kHz
DL PSD @ Beam Peak	10.778	dBW/4kHz
Carrier EIRP @ Beam Peak	50.832	dBW
Carrier EIRP	49.832	dBW
Rx Range	38944.761	km
FS Loss	205.191	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	84.073	dB-Hz
Downlink C/(No+Io)	83.427	dB-Hz

End-to-End

Composite C/No+Io	83.227	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	6.153	dB-Hz
Link Margin	0.553	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR6400	
Tx Lat. (North +)	43.8	degree
Tx Lng. (East +)	99	degree
Max EIRP	45.01	dBW

Satellite

Name	IS33e K63	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Moscow	
Rx Lat. (North +)	55.898	degree
Rx Lng. (East +)	37.997	degree
G/T	37.504	dB/K

Signal

Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spreading Factor	1	
Code Rate	0.857	
Overhead Rate	0.870	
Channel Factor	1.2	
Spectral Efficiency	1.491	bps/Hz
Data Rate	9941.862857	kb/s
Information Rate (Data + Overhead)	11427.42857	kb/s
Symbol Rate	6666	ks/s
Chip Rate (Noise Bandwidth)	6666	kHz
Occupied Bandwidth	7999.2	kHz
C/N Threshold	7.5	dB

Uplink

Uplink Freq.	14.193	GHz
Back-off	0	dB
EIRP Spectral Density	12.789	dBW/4kHz
Tx Range	38944.761	km
FS Loss	207.292	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	14	dB/K
Uplink C/No	79.614	dB-Hz
Uplink C/No+Io	78.965	dB-Hz

Satellite

SFD @ terminal	-94.1	dBW/m2
Small Signal Gain	2	dB
Output Backoff	22.3	dB

Downlink

Downlink Freq.	11.45	GHz
Beampeak EIRP	60	dBW
Sat. EIRP	60	dBW
DL PSD Limit	14	dBW/4kHz
Downlink PSD @ Beam Peak	5.387	dBW/4kHz
Carrier Beam Peak EIRP	37.606	dBW
Carrier EIRP	37.606	dBW
Rx Range	39228.735	km
FS Loss	205.490	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0	dB
DownLink C/No	95.619	dB-Hz
Downlink C/No+io	85.601	dB-Hz

End-to-End

Composite C/No+Io	78.112	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	9.874	dB
Link Margin	2.374	dB

Forward Link Budget

FliteStream Terminal

Antenna Type	HR129	
Rx Lat. (North +)	43.8	degree
Rx Lng. (East +)	99	degree
G/T	9.83	dB/K

Satellite

Name	IS33e K63	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Moscow	
Tx Lat. (North +)	55.898	degree
Tx Lng. (East +)	37.997	degree
Max EIRP	79.997	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.500	
Overhead	0.935	
Channel Factor	1.2	
Spectral Efficiency	0.935	bps/Hz
Data Rate	37863.450	kb/s
Information Rate (Data + Overhead)	40500	kb/s
Symbol Rate	40500	ksps
Signal or Noise Bandwidth	40.5	MHz
Channel Spacing Occupied Bandwidth	48.6	MHz
C/N Threshold	0.9	dB

Uplink

Uplink Freq.	17.55	GHz
Output Backoff	14.3	dB
EIRP Spectral Density	25.643	dBW/4kHz
Tx Range	39228.735	km
FS Loss	209.199	dB
Pointing Loss	0	
Weather	3.9	
Radome	0	
Satellite G/T	16	dB/K
Uplink C/No	97.196	dB-Hz
Uplink C/(No+Io)	96.702	dB-Hz

Satellite

SFD	-89	dBW/m2
Small Signal Gain	2	
Output Backoff	10	dB

Downlink

Downlink Freq.	11.143	GHz
Beampeak EIRP	60.9	dBW
Sat. EIRP	59.9	dBW
DL PSD Limit	14	dBW/4kHz
DL PSD @ Beam Peak	10.778	dBW/4kHz
Carrier EIRP @ Beam Peak	50.832	dBW
Carrier EIRP	49.832	dBW
Rx Range	38944.761	km
FS Loss	205.191	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
DownLink C/No	82.472	dB-Hz
Downlink C/(No+Io)	79.225	dB-Hz

End-to-End

Composite C/No+Io	79.148	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	2.073	dB-Hz
Link Margin	1.173	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR129	
Tx Lat. (North +)	43.8	degree
Tx Lng. (East +)	99	degree
Max EIRP	41.42	dBW

Satellite

Name	IS33e K63	
Sat. Lng. (East +)	60	degree

Hub Earth Station

Name	Moscow	
Rx Lat. (North +)	55.898	degree
Rx Lng. (East +)	37.997	degree
G/T	37.504	dB/K

Signal

Waveform	iDirect	
Modulation	QPSK	
Bits per symbol	2	
Spreading Factor	1	
Code Rate	0.667	
Overhead Rate	0.870	
Channel Factor	1.2	
Spectral Efficiency	1.160	bps/Hz
Data Rate	7732.56	kb/s
Information Rate (Data + Overhead)	8888	kb/s
Symbol Rate	6666	ks/s
Chip Rate (Noise Bandwidth)	6666	kHz
Occupied Bandwidth	7999.2	kHz
C/N Threshold	5.1	dB

Uplink

Uplink Freq.	14.193	GHz
Back-off	0	dB
EIRP Spectral Density	9.199	dBW/4kHz
Tx Range	38944.761	km
FS Loss	207.292	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	14	dB/K
Uplink C/No	76.024	dB-Hz
Uplink C/No+Io	75.760	dB-Hz

Satellite

SFD @ terminal	-94.1	dBW/m2
Small Signal Gain	2	dB
Output Backoff	22.3	dB

Downlink

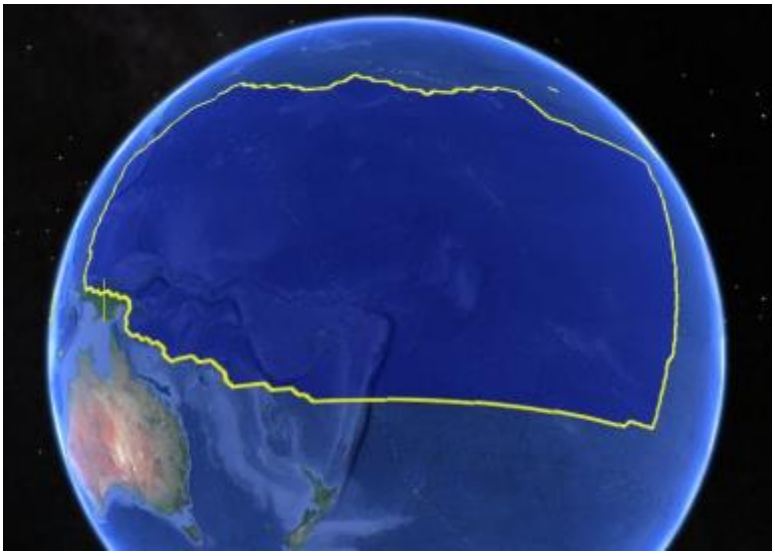
Downlink Freq.	11.45	GHz
Beampeak EIRP	60	dBW
Sat. EIRP	60	dBW
DL PSD Limit	14	dBW/4kHz
Downlink PSD @ Beam Peak	1.798	dBW/4kHz
Carrier Beam Peak EIRP	34.016	dBW
Carrier EIRP	34.016	dBW
Rx Range	39228.735	km
FS Loss	205.490	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	2.6	dB
Radome, Lr	0	dB
DownLink C/No	92.030	dB-Hz
Downlink C/No+io	85.078	dB-Hz

End-to-End

Composite C/No+Io	75.280	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	7.041	dB
Link Margin	1.941	dB

4. JCSAT-2B

i. Coverage Maps



ii. JCSAT-2B Link Budgets

Forward Link Budget

FliteStream Terminal		
Antenna Type	HR6400	
Rx Lat. (North +)	-2	degree
Rx Lng. (East +)	147.9	degree
G/T	11.70	dB/K

Satellite		
Name	J2B	
Sat. Lng. (East +)	154	degree

Hub Earth Station		
Name	Honolulu	
Tx Lat. (North +)	21.35	degree
Tx Lng. (East +)	-157.85	degree
Max EIRP	79.996	dBW

Signal		
FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.800	
Overhead	0.922	
Channel Factor	1.2	
Spectral Efficiency	1.475	bps/Hz
Data Rate	21537.920	kb/s
Information Rate (Data + Overhead)	23360	kb/s
Symbol Rate	14600	ksps
Signal or Noise Bandwidth	14.6	MHz
Channel Spacing Occupied Bandwidth	17.52	MHz
C/N Threshold	5.1	dB

Uplink		
Uplink Freq.	14.406	GHz
Output Backoff	6.9	dB
EIRP Spectral Density	37.473	dBW/4kHz
Tx Range	38526.191	km
FS Loss	207.328	dB
Pointing Loss	0	
Weather	4.6	
Radome	0	
Satellite G/T	-2	dB/K
Uplink C/No	87.767	dB-Hz
Uplink C/(No+Io)	87.264	dB-Hz

Satellite		
SFD	-86	dBW/m2
Small Signal Gain	3.2	
Output Backoff	5.1	dB

Downlink		
Downlink Freq.	11.489	GHz
Beampeak EIRP	51.5	dBW
Sat. EIRP	50	dBW
DL PSD Limit	11	dBW/4kHz
DL PSD @ Beam Peak	10.866	dBW/4kHz
Carrier EIRP @ Beam Peak	46.488	dBW
Carrier EIRP	44.988	dBW
Rx Range	35830.096	km
FS Loss	204.732	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0.5	dB
Radome, Lr	0	dB
DownLink C/No	79.953	dB-Hz
Downlink C/(No+Io)	78.784	dB-Hz

End-to-End		
Composite C/No+Io	78.208	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	5.56	dB-Hz
Composite Link Margin	0.46	dB

Return Link Budget

FliteStream Terminal		
Antenna Type	HR6400	
Tx Lat. (North +)	-2	degree
Tx Lng. (East +)	147.9	degree
Max EIRP	45.14	dBW

Satellite		
Name	J2B	
Sat. Lng. (East +)	154	degree

Hub Earth Station		
Name	Honolulu	
Rx Lat. (North +)	21.35	degree
Rx Lng. (East +)	-157.85	degree
G/T	37.200	dB/K

Signal		
Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spreading Factor	2	
Code Rate	0.500	
Overhead Rate	0.735	
Channel Factor	1.2	
Spectral Efficiency	0.184	bps/Hz
Data Rate	1378.125	kb/s
Information Rate (Data + Overhead)	1875	kb/s
Symbol Rate	3750	ks/s
Chip Rate (Noise Bandwidth)	7500	kHz
Occupied Bandwidth	9000.000	kHz
C/N Threshold	-2.3	dB

Uplink		
Uplink Freq.	14.406	GHz
Back-off	0	dB
EIRP Spectral Density	12.406	dBW/4kHz
Tx Range	35830.096	km
FS Loss	206.698	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	2	dB/K
Uplink C/No	68.338	dB-Hz
Uplink C/No+Io	67.831	dB-Hz

Satellite		
SFD @ terminal	-90	dBW/m2
Small Signal Gain	3.2	dB
Output Backoff	24.6	dB

Downlink		
Downlink Freq.	11.489	GHz
Beampeak EIRP	51.5	dBW
Sat. EIRP	43	dBW
DL PSD Limit	11	dBW/4kHz
Downlink PSD @ Beam Peak	-5.671	dBW/4kHz
Carrier Beam Peak EIRP	27.059	dBW
Carrier EIRP	18.559	dBW
Rx Range	38526.191	km
FS Loss	205.363	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	4.8	dB
Radome, Lr	0	dB
DownLink C/No	74.196	dB-Hz
Downlink C/No+io	73.029	dB-Hz

End-to-End		
Composite C/No+Io	66.684	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	-2.07	dB
Composite Link Margin	0.23	dB

Forward Link Budget

FliteStream Terminal

Antenna Type	HR129	
Rx Lat. (North +)	-2	degree
Rx Lng. (East +)	147.9	degree
G/T	12.63	dB/K

Satellite

Name	J2B	
Sat. Lng. (East +)	154	degree

Hub Earth Station

Name	Honolulu	
Tx Lat. (North +)	21.35	degree
Tx Lng. (East +)	-157.85	degree
Max EIRP	79.996	dBW

Signal

FEC Decoder	DVB-S2	
Modulation	QPSK	
Total bits per symbol	2	
Spreading Factor	1	
Code Rate	0.500	
Overhead	0.922	
Channel Factor	1.2	
Spectral Efficiency	0.922	bps/Hz
Data Rate	13461.200	kb/s
Information Rate (Data + Overhead)	14600	kb/s
Symbol Rate	14600	ksps
Signal or Noise Bandwidth	14.6	MHz
Channel Spacing Occupied Bandwidth	17.52	MHz
C/N Threshold	0.9	dB

Uplink

Uplink Freq.	14.406	GHz
Output Backoff	6.9	dB
EIRP Spectral Density	37.473	dBW/4kHz
Tx Range	38526.191	km
FS Loss	207.328	dB
Pointing Loss	0	
Weather	4.6	
Radome	0	
Satellite G/T	-2	dB/K
Uplink C/No	87.767	dB-Hz
Uplink C/(No+Io)	87.264	dB-Hz

Satellite

SFD	-86	dBW/m2
Small Signal Gain	3.2	
Output Backoff	5.1	dB

Downlink

Downlink Freq.	11.489	GHz
Beampeak EIRP	51.5	dBW
Sat. EIRP	50	dBW
DL PSD Limit	11	dBW/4kHz
DL PSD @ Beam Peak	10.866	dBW/4kHz
Carrier EIRP @ Beam Peak	46.488	dBW
Carrier EIRP	44.988	dBW
Rx Range	35830.096	km
FS Loss	204.732	dB
Pointing Loss, Lpnt	0.100	dB
Atmosphere / Weather Loss, La	0.5	dB
Radome, Lr	0	dB
DownLink C/No	80.884	dB-Hz
Downlink C/(No+Io)	75.241	dB-Hz

End-to-End

Composite C/No+Io	74.977	dB-Hz
Implementation Loss	1	dB
End to End C/N+I with Imp Loss	2.33	dB-Hz
Composite Link Margin	1.43	dB

Return Link Budget

FliteStream Terminal

Antenna Type	HR129	
Tx Lat. (North +)	-2	degree
Tx Lng. (East +)	147.9	degree
Max EIRP	41.55	dBW

Satellite

Name	J2B	
Sat. Lng. (East +)	154	degree

Hub Earth Station

Name	Honolulu	
Rx Lat. (North +)	21.35	degree
Rx Lng. (East +)	-157.85	degree
G/T	37.200	dB/K

Signal

Waveform	iDirect	
Modulation	BPSK	
Bits per symbol	1	
Spreading Factor	4	
Code Rate	0.500	
Overhead Rate	0.735	
Channel Factor	1.2	
Spectral Efficiency	0.092	bps/Hz
Data Rate	689.0625	kb/s
Information Rate (Data + Overhead)	937.5	kb/s
Symbol Rate	1875	ks/s
Chip Rate (Noise Bandwidth)	7500	kHz
Occupied Bandwidth	9000.000	kHz
C/N Threshold	-5.6	dB

Uplink

Uplink Freq.	14.406	GHz
Back-off	0	dB
EIRP Spectral Density	8.817	dBW/4kHz
Tx Range	35830.096	km
FS Loss	206.698	dB
Pointing Loss, Lpnt	0.2	dB
Atmosphere / Weather Loss, La	0	dB
Radome, Lr	0.5	dB
Satellite G/T	2	dB/K
Uplink C/No	64.748	dB-Hz
Uplink C/No+Io	64.519	dB-Hz

Satellite

SFD @ terminal	-90	dBW/m2
Small Signal Gain	3.2	dB
Output Backoff	24.6	dB

Downlink

Downlink Freq.	11.489	GHz
Beampeak EIRP	51.5	dBW
Sat. EIRP	43	dBW
DL PSD Limit	11	dBW/4kHz
Downlink PSD @ Beam Peak	-9.260	dBW/4kHz
Carrier Beam Peak EIRP	23.470	dBW
Carrier EIRP	14.970	dBW
Rx Range	38526.191	km
FS Loss	205.363	dB
Pointing Loss, Lpnt	0	dB
Atmosphere / Weather Loss, La	4.8	dB
Radome, Lr	0	dB
DownLink C/No	70.607	dB-Hz
Downlink C/No+io	70.057	dB-Hz

End-to-End

Composite C/No+Io	63.449	dB-Hz
Implementtion Loss	0	dB
Composite C/N+I w/imp loss	-5.30	dB
Composite Link Margin	0.30	dB

II. FliteStream™ 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 3C*	U.S.	95° W	11.7-12.2	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-19*	U.S.	166° E	12.25-12.75	U.S.-licensed	2, 3	No
IS-22*	U.S.	72.1° E	11.45-11.7; 12.25-12.75	U.S.-licensed	1, 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

* Satellite Points of Communication for HR6400 ESAA Terminal Only.

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

Satellite	Satellite Operator	Gateway Earth Station Location	Country	Gateway Operator	FCC Call Sign
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
Eutelsat 172A (SP)	Eutelsat	Adelaide	Australia	SpeedCast	N/A
Galaxy 3C*	Intelsat	Hagerstown, MD	U.S.	Intelsat	E080006
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-19*	Intelsat	Napa, CA	U.S.	Intelsat	E980460
IS-22*	Intelsat	Chungnam	S. Korea	Korea Telecom	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

[1] Effective November 2017, the IS-33 satellite will be supported by a new gateway earth station located at a Cologne, Germany teleport facility operated by Stellar.

Satellite	Satellite Operator	Gateway Earth Station Location	Country	Gateway Operator	FCC Call Sign
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
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

* Satellite Points of Communication for HR6400 ESAA Terminal Only.

III. SECTION 25.227 CERTIFICATIONS

Astronics AeroSat Corporation ("Astronics AeroSat"), 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, Astronics AeroSat 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), Astronics AeroSat 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, Astronics AeroSat 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. Astronics AeroSat 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: s/ Frank Blanda

Frank Blanda
Chief Technical Officer

March 15, 2017

IV. 47 C.F.R. § 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; File No. SES-LIC-20140902-00688 at Technical Appendix (HR6400) and File No. SES-MFS-20161003-00823 at Technical Appendix (HR129).
§ 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.	*Id.* Astronics AeroSat complies for HR6400 and HR129 ESAA operations in all two-degree spacing environments.
§ 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.	*See* File No. SES-LIC-20140902-00688 and subsequent modifications. *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* SES-LIC-20140902-00688, 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. Astronics AeroSat 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. Astronics AeroSat 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-LIC-20140902-00688 at Technical Appendix (HR6400) and File No. SES-MFS-20161003-00823 at Technical Appendix (HR129).
§ 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, 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.	Astronics AeroSat 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; File No. SES-LIC-20140902-00688 at Technical Appendix (HR6400) and File No. SES-MFS-20161003-00823 at Technical Appendix (HR129).

§ 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* File No. SES-LIC-20140902-00688 at Technical Appendix (HR6400) and File No. SES-MFS-20161003-0082 3 at Technical Appendix (HR129).
§ 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, 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-LIC-20140902-00688 , 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, III.
§ 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* File No. SES-LIC-20140902-00688 at Technical Appendix (HR6400) and File No. SES-MFS-20161003-00823 at Technical Appendix (HR129).

§ 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 File No. SES-LIC-20140902-00688, Astronics AeroSat Corporation Section 1.65 Letter Update on Coordination Status (filed on February 2, 2015).
§ 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 File No. SES-LIC-20140902-00688, Astronics AeroSat Corporation Section 1.65 Letter Update on Coordination Status (filed on February 2, 2015).

V. Technical Certification

I, Frank Blanda, hereby certify that I am the technically qualified person responsible for the preparation of the technical information contained in the Astronics AeroSat blanket license 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.

By: s/ Frank Blanda

Frank Blanda
Astronics AeroSat Corporation
Chief Technical Officer

March 15, 2017