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April 26, 2005

Via HAND DELIVERY

Marlene H. Dortch
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, DC 20554

Re: **The Boeing Company Application to Modify Blanket AMSS Earth Station Authorization, Call Sign E000723; File No. SES-MOD-20040301-00304**

Dear Ms. Dortch:

The Boeing Company ("Boeing") hereby files the attached additional information for association with the above-captioned proceeding. Specifically, at the request of the Commission staff in this unopposed application proceeding, Boeing is providing: (i) additional technical information regarding the link parameters of its aircraft earth station ("AES") operations with the Yamal-200, Asiasat 3S and SESAT satellites; and (ii) orbital debris mitigation statements for the Yamal and SESAT satellites.

With respect to the latter material, Boeing believes that the orbital debris information submitted for the Yamal-200 and SESAT satellites complies with the Commission's current policies regarding orbital debris mitigation. Out of an abundance of caution, however, Boeing respectfully requests a waiver of any requirements that the Commission concludes is not met by these in-orbit and operating satellites.

Boeing would also note that it had intended to submit these materials in connection with a comprehensive amendment of the above-captioned modification application that would address the staff's information request and add new satellite points of communication. However, ongoing coordination discussions have delayed finalization of such an amendment. Accordingly, Boeing is submitting the attached supplemental information at this time rather than further deferring this filing. Boeing will shortly file a separate modification application to add additional satellite points of communication.

Any questions regarding this matter may be directed to the undersigned.

Respectfully submitted,

Philip L. Malet /CM

Philip L. Malet
Carlos M. Nalda
Counsel for The Boeing Company

International Waters Supplementary Data

Annex A. YAMAL 200 data

Annex B. Asiasat 3S East Asia beam

Annex C. Asiasat 3S South Asia Beam

Annex D. SESAT

Annex A. YAMAL 200 data

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
1		Satellite Name	Yamal 200	
2		ITU-R name	Express-7	
3	1,2,3,4	Applicant (CBB) information	See Form FCC-312	
4	5	Transponder Designation, Transponder Center Frequency, Transponder Bandwidth, Transponder Polarization	K4 11.5 GHz 72 MHz Vertical	K1 14.040 GHz 72 MHz Horizontal
		CBB Center frequency CBB Bandwidth	11.5 GHz 31.01 MHz	14.055 GHz 13.5 MHz
5	5	Emission designator Allocated bandwidth	31M1G7D	13M5G7D
6	5	Final amplifier maximum output power and e.i.r.p.	49 dBW e.i.r.p.	--
7	5	Power of CBB emission	45.5 dBW e.i.r.p.	--
8	5	Identification of Antenna beam used	Ku CIS Beam (SKR)	Ku CIS Beam (SKR)
9	5	TT&C information	Not controlled by CBB.	
10	5	Satellite receiver noise temperature	--	794 K (1.5 dB/K)
11	5	Satellite Saturation Flux density	--	-96 dBW/m^2 (@ G/T = 0 dB/K)
12	5	Gain step through the satellite	Not required	
13	6(i)	Orbit location	90° East	
14	6(ii)	NGSO data	Not applicable	
15	7	Satellite antenna radiation patterns, showing gain contours, for beams used	see Figure A-1	see Figure A-2
16	8	Link budgets for service links	see Table A-1	see Table A-2
17	9	GSO station keeping	+/- 0.1 ° E-W +/- 0.2 ° N-S	
18	10	Conformance with §25.208 and ITU PFD limits on the downlink	--	See Annex B of International Waters Application
19	11-13	Not applicable	--	
20	14	Non-common-carrier statement	See FCC Form 312	

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
21	15	Not applicable	--	
22	16	Public interest statement	See Narrative	
23	17-21	Not applicable	--	
24	§25.114 (d)	Not applicable	--	

Table A-1. Forward Link Budget

Satellite	**Yamal_200**
Latitude (deg)	37.6
Longitude (deg)	55.75
Satellite Longitude (deg)	90
Transponder Center Frequency (GHz)	11.518
Spread Bandwidth (MHz)	**31.01**
Transponder EIRP (dBW)	**45.5**
Spherical Spreading Loss (dB)	205.337
Atmospheric Loss (dB)	0.197664
Rain Availability	0.999
Pol-mismatch Loss (dB)	0.064503
Pointing Loss (dB)	0.093529
Aircraft Altitude (Km)	0
Rain Loss (dB)	1.86802
Aircraft Antenna Gain w/radome (dBi)	29.447
Receive Power at Receiver (dBW)	-132.614
Crosspol Isolation (dB)	15
Aircraft Received Noise Temp (dBK)	20.6024
Noise pwr (dBW/Hz)	-207.997
Adjacent Satellite Interference (dBW)	-140.606
Crosspol Interference (dBW)	-147.614
Total Interference (dBW)	-139.817
No+Io (dBW/Hz)	-207.395
C/(No+Io) Downlink(dB/Hz)	74.7805
Eb/No Uplink (dB)	23.2916
Eb/No End-to-End (dB)	7.6701
Datarate (Mb/s)	5
Eb/No Requirement (dB)	3.8
Eb/No Margin	3.8701

Table A-2. Return Link Budget

Satellite	**Yamal 200**
Latitude (deg)	37.6
Longitude (deg)	55.75
Satellite Longitude (deg)	90
Transponder Center Frequency (GHz)	14.282
Spread Bandwidth (MHz)	**13.5**
Transmit EIRP (dBW)	42.8059
Spherical Spreading Loss (dB)	207.206
Atmospheric Loss (dB)	0.299459
Aircraft Altitude (Km)	0
Rain Availability	0.999
Rain Loss (dB)	3.17483
Pol-mismatch Loss (dB)	0.064503
Pointing Loss (dB)	0.082734
Satellite Antenna Gain (dBi)	30.5
Receiver Input Power (dBW)	-137.374
No (dBW/Hz)	-199.599
CDMA Self-Interference reduce (dB)	0
Total Interference (dB/Hz)	-201.512
No+Io Uplink (dBW/Hz)	-197.441
C/(No+Io) Uplink (dBHz)	60.0666
C/No Groundlink single gndlink (dBHz	81.052
C/No End-to-End single link (dBHz)	60.0321
Datarate (Kb/s)	**450**
Eb/No Requirement (dB)	3.5
Power Margin (dB)	3.82191

Note: The data rate of the return link is variable. The AES e.i.r.p. varies proportionally to the data rate.

Figure A-1. Yamal 200 @ 90° East, Downlink e.i.r.p.

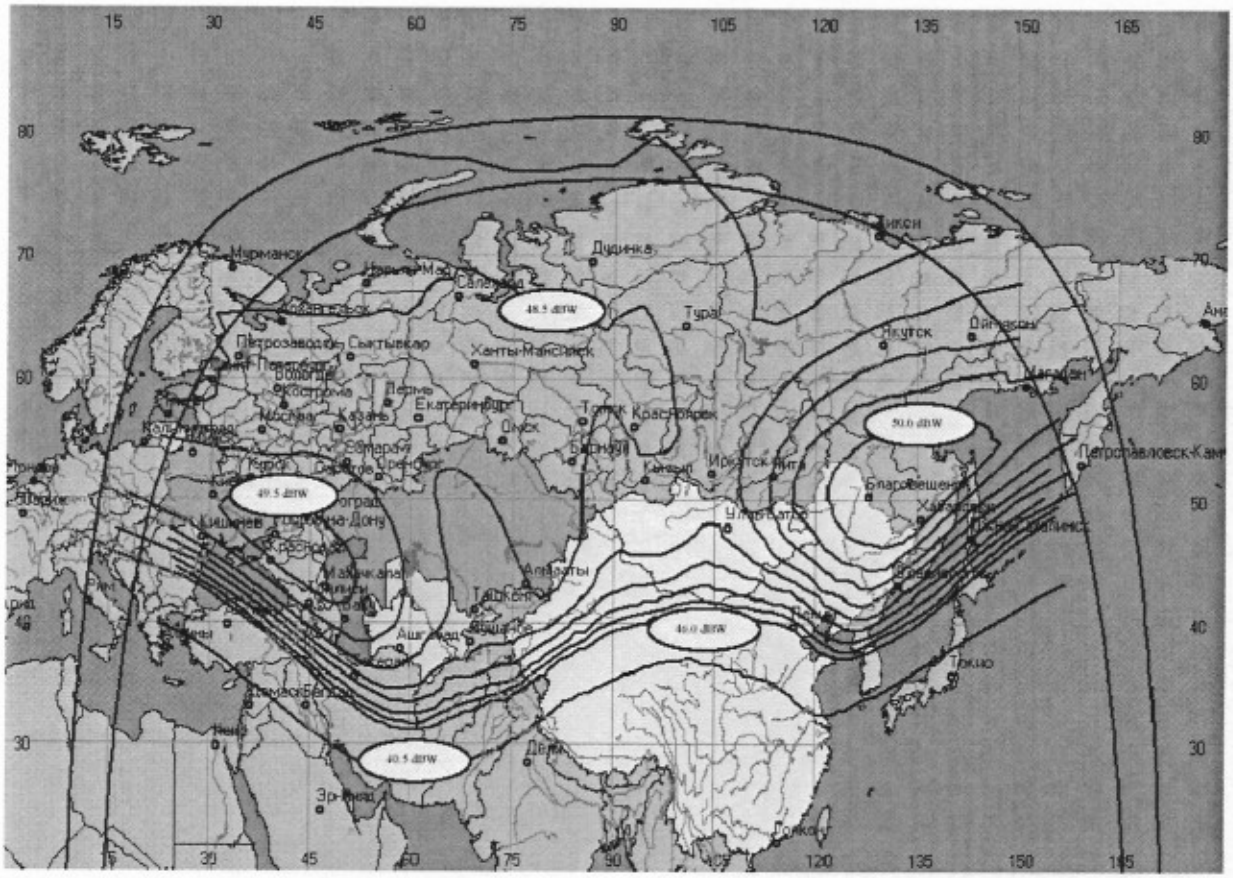
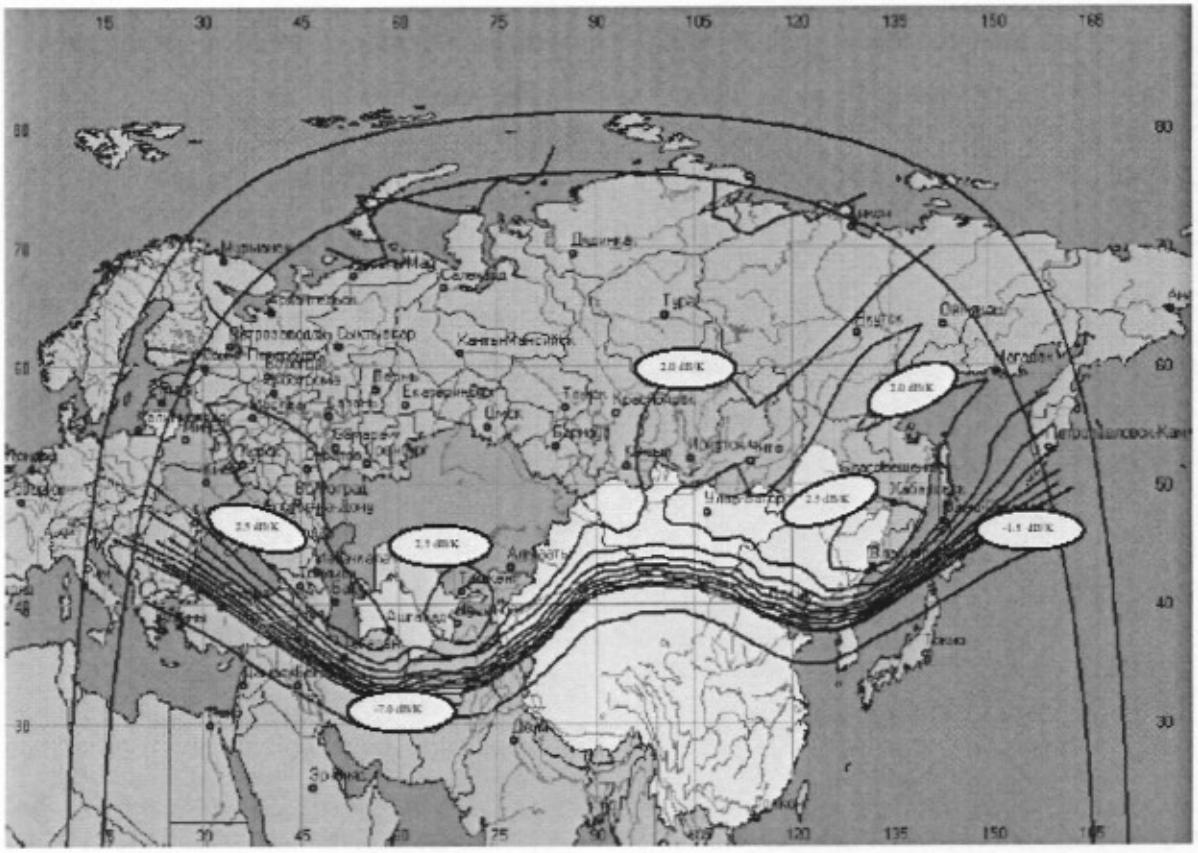


Figure A-2. Yamal 200 @ 90° East, Uplink G/T



Annex B. Asiasat 3S East Asia beam

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
1		Satellite Name	AsiaSat 3S East Asia Beam	
2		ITU-R name	AsiaSat-Ck, CK1, CKX	
3	1,2,3,4	Applicant (CBB) information	See Form FCC-312	
4	5	Transponder Designation, Transponder Center Frequency, Transponder Bandwidth, Transponder Polarization	K4V 12.48 GHz 54 MHz Vertical	K2V 14.108 GHz 72 MHz Horizontal
		CBB Center frequency CBB Bandwidth	12.48 GHz 30.24 MHz	14.123 GHz 13.5 MHz
5	5	Emission designator Allocated bandwidth	30M3G7D	13M5G7D
6	5	Final amplifier maximum output power and e.i.r.p.	53 dBW e.i.r.p.	--
7	5	Power of CBB emission	46 dBW e.i.r.p.	--
8	5	Identification of Antenna beam used	East Asia	East Asia
9	5	TT&C information	Not controlled by CBB.	
10	5	Satellite receiver noise temperature	--	794.33 K (6 dB/K)
11	5	Satellite Saturation Flux density	--	-93 dBW/m^2 (@ G/T = 0 dB/K)
12	5	Gain step through the satellite	Not required	
13	6(i)	Orbit location	90° East	
14	6(ii)	NGSO data	Not applicable	
15	7	Satellite antenna radiation patterns, showing gain contours, for beams used	see Figure B-1	see Figure B-1
16	8	Link budgets for service links	see Table B-1	see Table B-2
17	9	GSO station keeping	+/- 0.1 ° E-W +/- 3.0 ° N-S	
18	10	Conformance with §25.208 and ITU PFD limits on the downlink	--	See Annex B of International Waters Application
19	11-13	Not applicable	--	
20	14	Non-common-carrier statement	See FCC Form 312	

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
21	15	Not applicable	--	
22	16	Public interest statement	See Narrative	
23	17-21	Not applicable	--	
24	§25.114 (d)	Not applicable	--	

Table B-1. Forward Link Budget

Sat name=	AsiaSat3S_EastAsia - Vpol
Sat lon (deg)	105.5
# Satellite-Aircraft Geometry:	
ALnk lat (deg)	35
ALnk lon (deg)	145
ALnk alt (Km)	9
# Satellite-Aircraft:	
ALnk Freq (GHz)	12.48
ALnk Sat Polarization	VPOL
ALnk EIRP from sat (dBW)	46
# Satellite-Aircraft Channel:	
ALnk Loss path (dB)	206.069
ALnk Loss atmospheric (dB)	0.0232336
ALnk Rain availability	0.999
ALnk Loss rain (dB)	0
ALnk Loss other (dB)	0
ALnk Loss total channel (dB)	206.093
# Satellite-Aircraft Link:	
ALnk Loss radome (dB)	0.21
ALnk Gain ant w/radome (dBi)	29.8919
ALnk Loss - pol mismatch (dB)	0.0645031
ALnk Loss - ptg errors (dB)	0.0935294
ALnk Pwr rcvd signal (dBW)	-130.359
ALnk Temp radome (dB)	20.3019
ALnk Temp ant w/radome (dBi)	20.823
ALnk Temp_noise rcvr sys (K)	120.865
ALnk Temp_noise rcvr sys (dBK)	20.823
ALnk Partial spread bandwidth (MHz)	30.24
ALnk Noise pwr (dBW/Hz)	-207.776
ALnk I_adjacent (dBW)	-140.527
ALnk Isat EIRP (dBW)	46
ALnk Isat Loss atmos (dB)	0.6
ALnk Xpol isolation (dB)	15
ALnk I_xpol signal sat (dBW)	-145.359
ALnk I_total (dBW)	-139.293
ALnk I_reduction (dB)	0
ALnk I_total reduced (dBW)	-139.293
ALnk Io (dBW/Hz)	-213.749
ALnk No+Io (dBW/Hz)	-206.797
ALnk C/(No+Io) (dB/Hz)	76.4388
Modem specified datarate (Mb/s)	6.5
Modem Eb/No (dB)	8.17394
Modem Eb/No rqmt at spec rate (dB)	2.7
Modem Eb/No extra margin (dB)	1.1
Modem margin at specified datarate	4.37394

Note: ALlnk indicates a link to or from the aircraft.
GLnk indicates a link to or from the ground station
E2E indicates "end-to-end", that is the entire link

Table B-2. Return Link Budget

Sat name	AsiaSat3S_EastAsia
Sat lon (deg)	105.5
# Aircraft:	
Air lat (deg)	35
Air lon (deg)	145
Air alt (Km)	9
# Satellite-Aircraft Geometry:	
ALnk range (Km)	38446.9
ALnk azimuth (deg)	123.237
ALnk elevation (deg)	33.4866
ALnk ant phi (deg)	0
ALnk ant theta (deg)	0
ALnk ant elevation (deg)	90
# Satellite-Aircraft Channel:	
ALnk Freq (GHz)	14.108
ALnk Sat Polarization	HPOL
ALnk Partial spread bandwidth (MHz)	13.5
ALnk Loss path (dB)	207.134
ALnk Loss atmospheric (dB)	0.0250273
ALnk Rain availability	0.999
ALnk Loss rain (dB)	0
ALnk Loss other (dB)	0
ALnk Loss total channel (dB)	207.159
ALnk aircraft rate (Kb/s)	64
ALnk spread bandwidth (MHz)	13.5
# Aircraft Uplink Performance:	
ALnk aircraft EIRP (dBW)	37.3798
ALnk Loss - pol mismatch (dB)	0.0645031
ALnk Loss - ptg errors (dB)	0.0827336
ALnk Loss - channel (dB)	207.159
ALnk Gain ant (dBi)	25
ALnk Pwr rcvr in (dBW)	-144.78
ALnk I adjsat (dB/Hz)	-200
ALnk I adjsat reduce (dB)	0
ALnk I CDMA (dB/Hz)	-214.831
ALnk I CDMA reduce (dB)	0
ALnk Io (dB/Hz)	-199.86
ALnk Noise Temp ant (K)	794.33
ALnk No (dBW/Hz)	-199.599
ALnk No+Io sat (dBW/Hz)	-196.717
ALnk C/(No+Io) uplink (dBHz)	51.9375
GLnk C/(No+Io) (dBHz)	62.3772
# End-to-End Link Performance:	
ALnk C/(No+Io) single uplink (dBHz)	51.9375
GLnk C/(No+Io) single gndlink (dBHz	62.3772
E2E C/(No+Io) single link (dBHz)	51.5618

E2E Eb/No required (dB)	3.5
E2E Datarate (Kb/s)	64
E2E Number of links	2.33407
E2E Bitrate aggregate (Kb/s)	149.381
E2E Aircraft PSD Fraction (%)	42.8436
E2E Power margin at spec rate (dB)	9.25473

Note: ALlnk indicates a link to or from the aircraft.
GLnk indicates a link to or from the ground station
E2E indicates end-to-end, that is the entire link
The data rate of the return link is variable. The AES e.i.r.p. varies proportionally to the data rate.

Figure B-1. Asiasat 3S East Asia Beam, Downlink e.i.r.p.

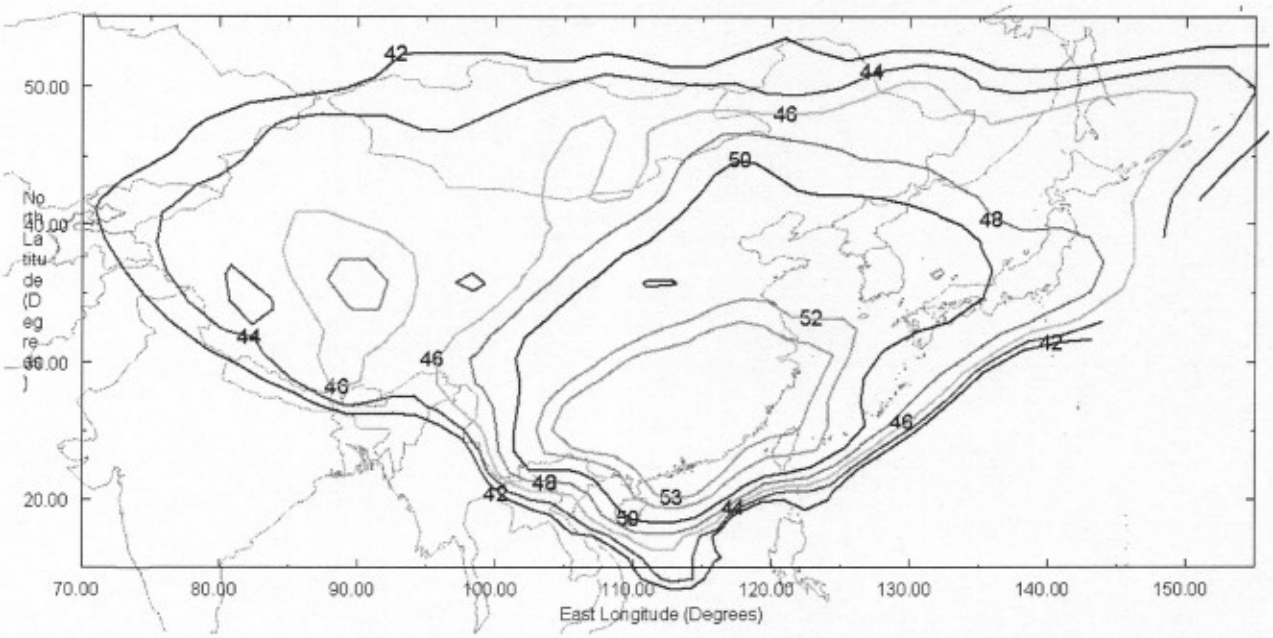
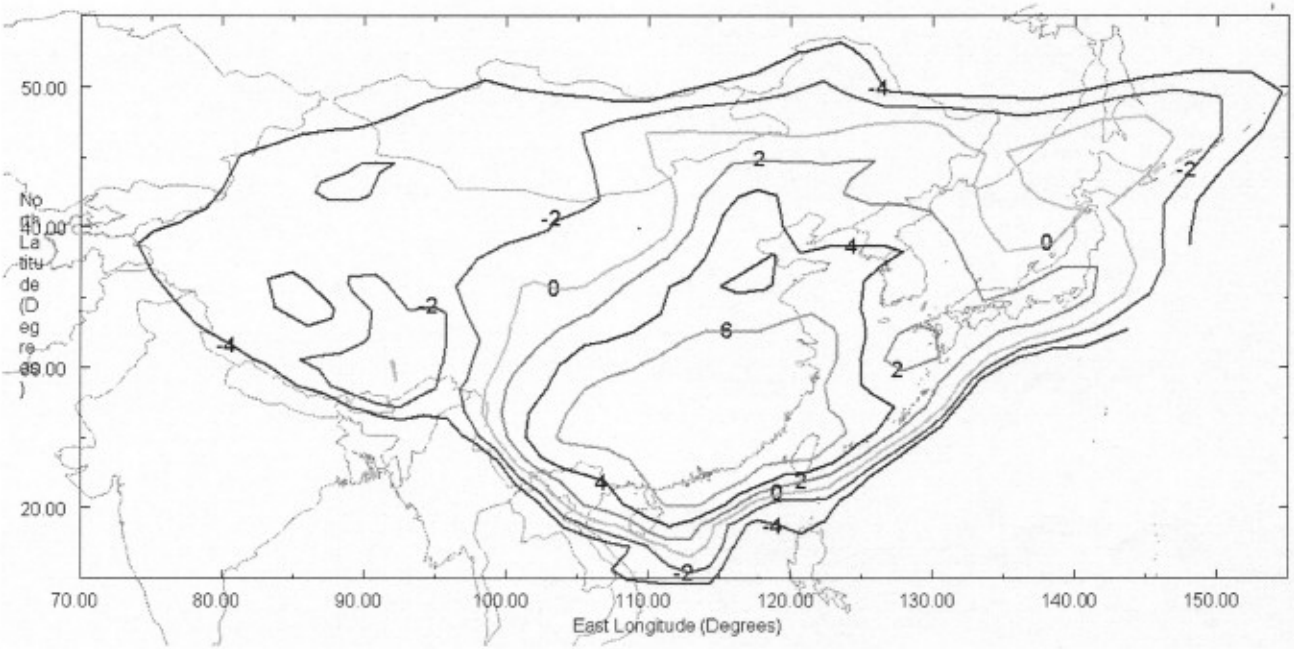


Figure B-2. Asiasat 3S East Asia Beam, Uplink G/T



Annex C. Asiasat 3S South Asia Beam

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
1		Satellite Name	AsiaSat 3S South Asia Beam	
2		ITU-R name	AsiaSat-Ck, CK1, CKX	
3	1,2,3,4	Applicant (CBB) information	See Form FCC-312	
4	5	Transponder Designation, Transponder Center Frequency, Transponder Bandwidth, Transponder Polarization	K1V 12.3 GHz 54 MHz Vertical	K3V 14.168 GHz 54 MHz Horizontal
		CBB Center frequency CBB Bandwidth	12.3 GHz 30.24 MHz	14.153 GHz 13.5 MHz
5	5	Emission designator Allocated bandwidth	30M3G7D	13M5G7D
6	5	Final amplifier maximum output power and e.i.r.p.	53 dBW e.i.r.p.	--
7	5	Power of CBB emission	xx dBW e.i.r.p.	--
8	5	Identification of Antenna beam used	South Asia	South Asia
9	5	TT&C information	Not controlled by CBB.	
10	5	Satellite receiver noise temperature	--	xx K (6 dB/K)
11	5	Satellite Saturation Flux density	--	-93 dBW/m^2 (@ G/T = 0 dB/K)
12	5	Gain step through the satellite	Not required	
13	6(i)	Orbit location	105.5° East	
14	6(ii)	NGSO data	Not applicable	
15	7	Satellite antenna radiation patterns, showing gain contours, for beams used	see Figure C-1	see Figure C-2
16	8	Link budgets for service links	see Table C-1	see Table C-2
17	9	GSO station keeping	+/- 0.1 ° E-W +/- 3.0 ° N-S	
18	10	Conformance with §25.208 and ITU PFD limits on the downlink	--	See Annex B of International Waters Application
19	11-13	Not applicable	--	

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
20	14	Non-common-carrier statement	See FCC Form 312	
21	15	Not applicable	--	
22	16	Public interest statement	See Narrative	
23	17-21	Not applicable	--	
24	§25.114 (d)	Not applicable	--	

Table C-1. Asiasat 3S South (West) Asia Forward Link Budget

Sat name=	AsiaSat3S_SWAsia - Vpol
Sat lat (deg)	0
# Satellite-Aircraft Geometry:	
ALnk lat (deg)	35
ALnk lon (deg)	35
ALnk alt (Km)	9
# Satellite-Aircraft:	
ALnk Freq (GHz)	12.3
ALnk Sat Polarization	VPOL
ALnk EIRP from sat (dBW)	46
# Satellite-Aircraft Channel:	
ALnk Loss path (dB)	206.477
ALnk Loss atmospheric (dB)	0.0959083
ALnk Rain availability	0.999
ALnk Loss rain (dB)	0
ALnk Loss other (dB)	0
ALnk Loss total channel (dB)	206.572
# Satellite-Aircraft Link:	
ALnk Loss radome (dB)	0.38
ALnk Gain ant w/radome (dBi)	29.7219
ALnk Loss - pol mismatch (dB)	0.0645031
ALnk Loss - ptg errors (dB)	0.0935294
ALnk Pwr rcvd signal (dBW)	-131.008
ALnk Temp radome (dB)	20.3019
ALnk Temp ant w/radome (dBi)	20.8283
ALnk Temp_noise rcvr sys (K)	121.012
ALnk Temp_noise rcvr sys (dBK)	20.8283
ALnk Partial spread bandwidth (MHz)	30.24
ALnk Noise pwr (dBW/Hz)	-207.771
ALnk I_adjacent (dBW)	-137.784
ALnk Isat EIRP (dBW)	46
ALnk Isat Loss atmos (dB)	0.6
ALnk Xpol isolation (dB)	15
ALnk I_xpol signal sat (dBW)	-146.008
ALnk I_total (dBW)	-137.175
ALnk I_reduction (dB)	0
ALnk I_total reduced (dBW)	-137.175
ALnk Io (dBW/Hz)	-211.631
ALnk No+Io (dBW/Hz)	-206.275
ALnk C/(No+Io) (dB/Hz)	75.2667
Modem specified datarate (Mb/s)	6.5
Modem Eb/No (dB)	7.03355
Modem Eb/No rqmt at spec rate (dB)	2.7
Modem Eb/No extra margin (dB)	1.1
Modem margin at specified datarate	3.23355

Note: ALlnk indicates a link to or from the aircraft.
GLnk indicates a link to or from the ground station
E2E indicates end-to-end, that is the entire link

Table C-2. Asiasat 3S South (West) Asia Return Link Budget

Sat name=	AsiaSat3S_SWAsia - Hpol
Sat lon (deg)	105.5
# Aircraft:	
Air lat (deg)	35
Air lon (deg)	35
Air alt (Km)	9
Air roll (deg)	0
Air pitch (deg)	3
Air heading (deg)	0
# Satellite-Aircraft Geometry:	
ALnk range (Km)	40881.9
ALnk azimuth (deg)	-101.093
ALnk elevation (deg)	7.81319
ALnk ant phi (deg)	0
ALnk ant theta (deg)	0
ALnk ant elevation (deg)	90
# Satellite-Aircraft Channel:	
ALnk Freq (GHz)	14.168
ALnk Sat Polarization	HPOL
ALnk Partial spread bandwidth (MHz)	13.5
ALnk Loss path (dB)	207.705
ALnk Loss atmospheric (dB)	0.104403
ALnk Rain availability	0.999
ALnk Loss rain (dB)	0
ALnk Loss other (dB)	0
ALnk Loss total channel (dB)	207.809
ALnk aircraft rate (Kb/s)	64
ALnk spread bandwidth (MHz)	13.5
# Aircraft Uplink Performance:	
ALnk aircraft EIRP (dBW)	36.6659
ALnk Loss - pol mismatch (dB)	0.0645031
ALnk Loss - ptg errors (dB)	0.0827336
ALnk Loss - channel (dB)	207.809
ALnk Gain ant (dBi)	27
ALnk Pwr rcvr in (dBW)	-144.143
ALnk I adjsat (dB/Hz)	-200
ALnk I adjsat reduce (dB)	0
ALnk I CDMA (dB/Hz)	-203.996
ALnk I CDMA reduce (dB)	0
ALnk Io (dB/Hz)	-198.544
ALnk Noise Temp ant (K)	794.33
ALnk No (dBW/Hz)	-199.599
ALnk No+Io sat (dBW/Hz)	-196.029
ALnk C/(No+Io) uplink (dBHz)	51.886
GLnk C/(No+Io) (dBHz)	62.9929
# End-to-End Link Performance:	

ALnk C/(No+Io) single uplink (dBHz)	51.886
GLnk C/(No+Io) single gndlink (dBHz	62.9929
E2E C/(No+Io) single link (dBHz)	51.5618
E2E Eb/No required (dB)	3.5
E2E Datarate (Kb/s)	64
E2E Number of links	14.9641
E2E Bitrate aggregate (Kb/s)	957.704
E2E Aircraft PSD Fraction (%)	6.68265
E2E Power margin at spec rate (dB)	9.92705
# EIRP Per Aircraft calculation:	
GLnk EIRP max (dBW)	49
GLnk FD_ant (dBW/m2)	-126.601
GLnk SFD at EOC (dB)	-85
GLnk SFD smsig adjust (dB)	4.5
GLnk G_comp_for_satEOC_dB	-2
GLnk EIRP_sat (dBW)	9.8988
GLnk Loss channel - Gant (dB)	152.038
GLnk Carrier (dBW)	-142.14
GLnk No (dBWpHz)	-205.192
GLnk C/(No+Io) (dBHz)	63.0529
# End-to-End Link Performance:	
ALnk C/(No+Io) single uplink (dBHz)	51.8814
GLnk C/(No+Io) single gndlink (dBHz	63.0529
E2E C/(No+Io) single link (dBHz)	51.5618
E2E Eb/No required (dB)	3.5
E2E Datarate (Kb/s)	64
E2E Number of links	16.0655
E2E Bitrate aggregate (Kb/s)	1028.19
E2E Aircraft PSD Fraction (%)	6.22451
E2E Power margin at spec rate (dB)	9.86704

Note: ALlnk indicates a link to or from the aircraft.
GLnk indicates a link to or from the ground station
E2E indicates end-to-end, that is the entire link
The data rate of the return link is variable. The AES e.i.r.p. varies proportionally to the data rate.

Figure C-1. Asiasat 3S South Asia beam, Downlink e.i.r.p.

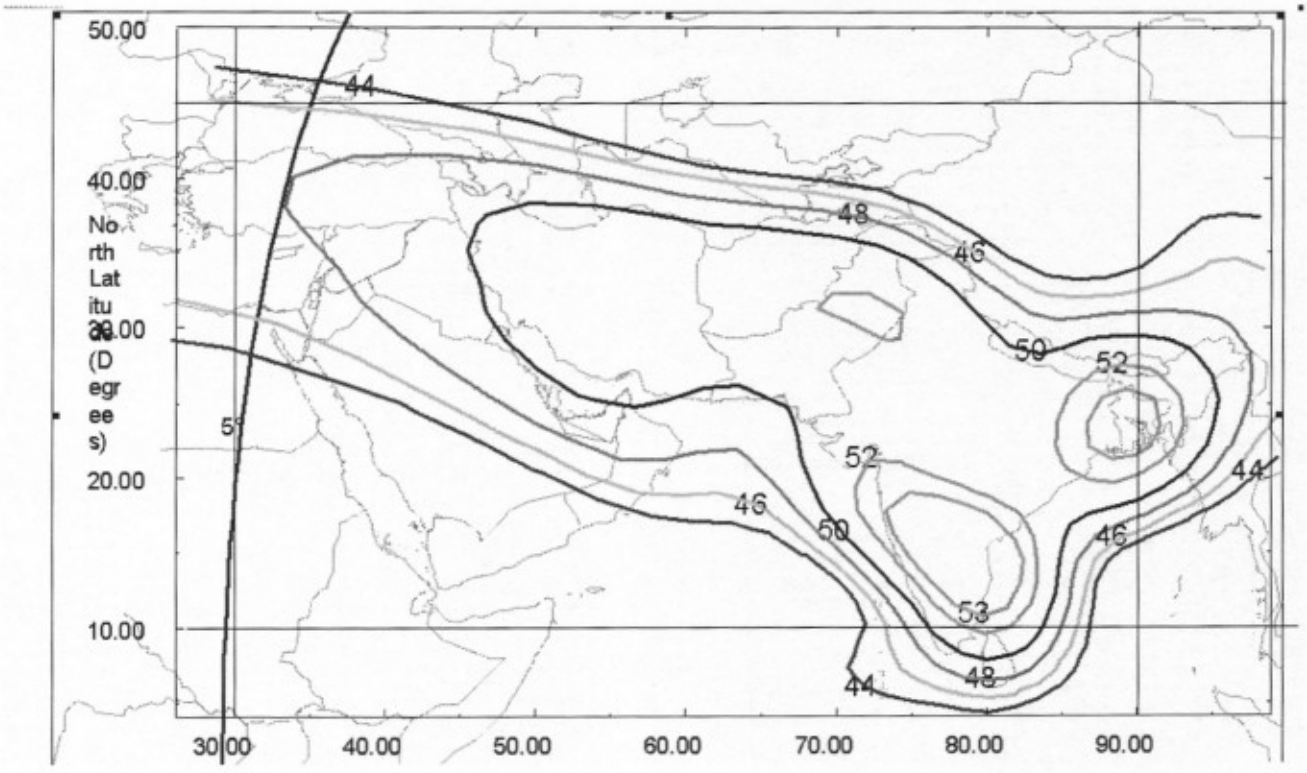
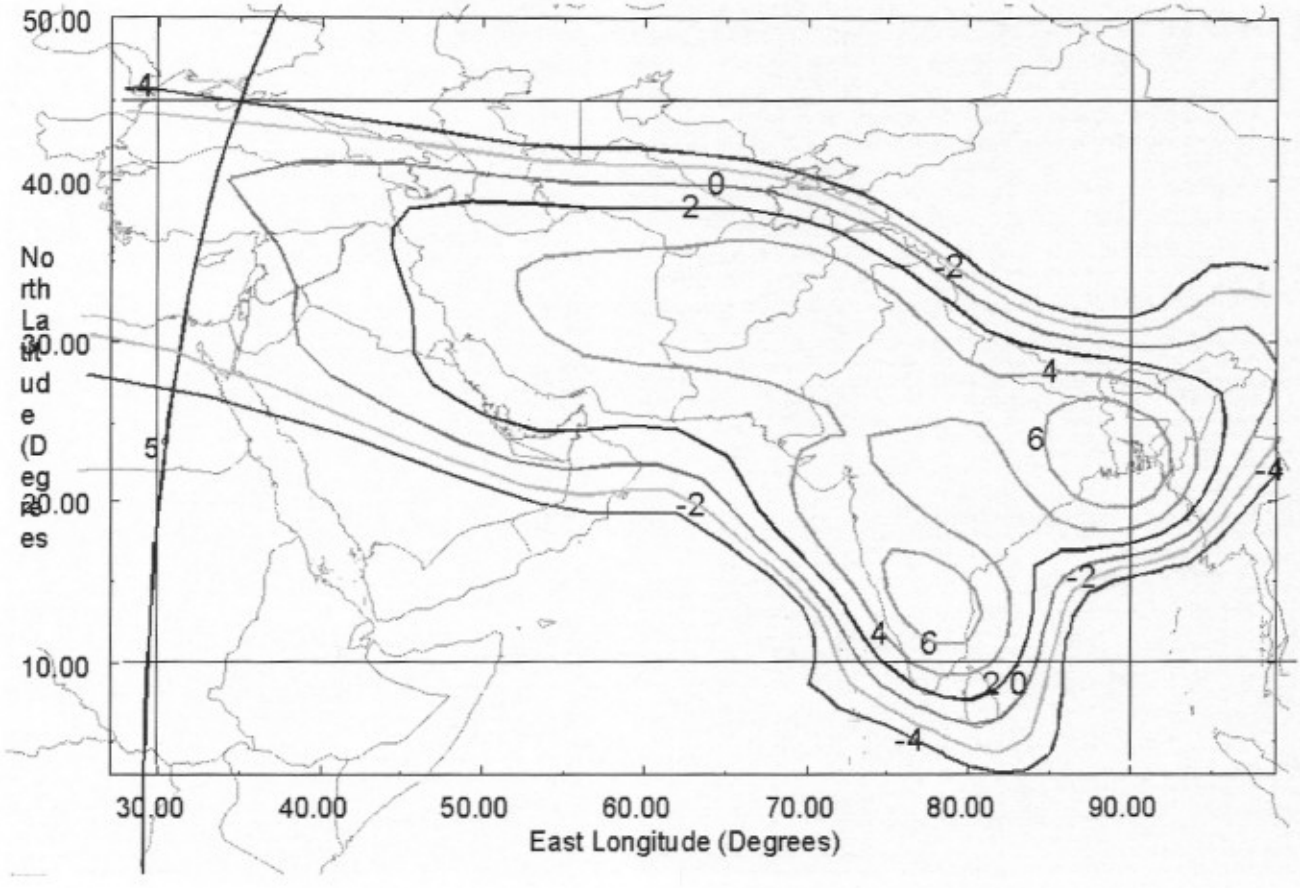


Figure A-2. Asiasat 3S South Asia beam, Uplink G/T



Annex D. SESAT

#	§25.114 (c) Subsection	Data Item Description	Data	
			Forward Link	Return Link
1		Satellite Name	SESAT	
2		ITU-R name	EUTELSAT 2-36E	
3	1,2,3,4	Applicant (CBB) information	See Form FCC-312	
4	5	Transponder Designation, Transponder Center Frequency, Transponder Bandwidth, Transponder Polarization	D4 11.575 GHz 72 MHz Vertical	F3 14.125 GHz 54 MHz Horizontal
		CBB Center frequency CBB Bandwidth	11.575 GHz 23.26 MHz	14.10558 GHz 13.5 MHz
5	5	Emission designator Allocated bandwidth	23M3G7D	13M5G7D
6	5	Final amplifier maximum output power and e.i.r.p.	49 dBW e.i.r.p.	--
7	5	Power of CBB emission	45 dBW e.i.r.p.	--
8	5	Identification of Antenna beam used	Fixed Widebeam	Fixed Widebeam
9	5	TT&C information	Not controlled by CBB.	
10	5	Satellite receiver noise temperature	--	794 K (6 dB/K)
11	5	Satellite Saturation Flux density	--	-83 dBW/m^2 (@ G/T = 0 dB/K)
12	5	Gain step through the satellite	Not required	
13	6(i)	Orbit location	36° East	
14	6(ii)	NGSO data	Not applicable	
15	7	Satellite antenna radiation patterns, showing gain contours, for beams used	see Figure D-1	see Figure D-2
16	8	Link budgets for service links	see Table D-1	see Table D-2
17	9	GSO station keeping	+/- 0.05 ° E-W +/- 0.05 ° N-S	
18	10	Conformance with §25.208 and ITU PFD limits on the downlink	--	See Annex B of International Waters Application
19	11-13	Not applicable	--	

			Data
20	14	Non-common-carrier statement	See Narrative
21	15	Not applicable	--
22	16	Public interest statement	See FCC Form 312
23	17-21	Not applicable	--
24	§25.114 (d)	Not applicable	--

Table D-1. Forward Link Budget

Sat name=	SESAT_EU_RFP - Vpol
Sat lon (deg)	36
# Satellite-Aircraft Geometry:	
ALnk lat (deg)	35
ALnk lon (deg)	-15
ALnk alt (Km)	9
# Satellite-Aircraft:	
ALnk Freq (GHz)	11.575
ALnk Sat Polarization	VPOL
ALnk EIRP from sat (dBW)	45
# Satellite-Aircraft Channel:	
ALnk Loss path (dB)	205.596
ALnk Loss atmospheric (dB)	0.03033
ALnk Rain availability	0.999
ALnk Loss rain (dB)	0
ALnk Loss other (dB)	0
ALnk Loss total channel (dB)	205.626
# Satellite-Aircraft Link:	
ALnk Loss radome (dB)	0.43
ALnk Gain ant w/radome (dBi)	29.4194
ALnk Loss - pol mismatch (dB)	0.0645031
ALnk Loss - ptg errors (dB)	0.0935294
ALnk Pwr rcvd signal (dBW)	-131.365
ALnk Temp radome (dB)	20.1494
ALnk Temp ant w/radome (dBi)	20.6267
ALnk Temp_noise rcvr sys (K)	115.524
ALnk Temp_noise rcvr sys (dBK)	20.6267
ALnk Partial spread bandwidth (MHz)	23.26
ALnk Noise pwr (dBW/Hz)	-207.972
ALnk I_adjacent (dBW)	-139.728
ALnk Isat EIRP (dBW)	45
ALnk Isat Loss atmos (dB)	0.6
ALnk Xpol isolation (dB)	15
ALnk I_xpol signal sat (dBW)	-146.365
ALnk I_total (dBW)	-138.875
ALnk I_reduction (dB)	0
ALnk I_total reduced (dBW)	-138.875
ALnk Io (dBW/Hz)	-213.331
ALnk No+Io (dBW/Hz)	-206.863
ALnk C/(No+Io) (dB/Hz)	75.4976
Modem specified datarate (Mb/s)	7.5
Modem Eb/No (dB)	6.65181
Modem Eb/No rqmt at spec rate (dB)	2.9
Modem Eb/No extra margin (dB)	1.1
Modem margin at specified datarate	2.65181

Note: ALlnk indicates a link to or from the aircraft.
GLnk indicates a link to or from the ground station
E2E indicates end-to-end, that is the entire link

Table D-2. Return Link Budget

Sat name=	SESAT_EU_RFP - Vpol
Sat lon (deg)	36
# Aircraft:	
Air lat (deg)	35
Air lon (deg)	-15
Air alt (Km)	9
# Satellite-Aircraft Geometry:	
ALnk range (Km)	39254.9
ALnk azimuth (deg)	-113.717
ALnk elevation (deg)	24.2526
ALnk ant phi (deg)	0
ALnk ant theta (deg)	0
ALnk ant elevation (deg)	90
# Satellite-Aircraft Channel:	
ALnk Freq (GHz)	14.125
ALnk Sat Polarization	VPOL
ALnk Partial spread bandwidth (MHz)	6.75
ALnk Polangle - air (deg)	-47.9812
ALnk Polangle - ant (deg)	-47.9812
ALnk Loss path (dB)	207.325
ALnk Loss atmospheric (dB)	0.0337673
ALnk Rain availability	0.999
ALnk Loss rain (dB)	0
ALnk Loss other (dB)	0
ALnk Loss total channel (dB)	207.359
ALnk aircraft rate (Kb/s)	64
ALnk spread bandwidth (MHz)	13.5
# Aircraft Uplink Performance:	
ALnk aircraft EIRP (dBW)	36.9219
ALnk Loss - pol mismatch (dB)	0.0645031
ALnk Loss - ptg errors (dB)	0.0827336
ALnk Loss - channel (dB)	207.359
ALnk Gain ant (dBi)	29
ALnk Pwr rcvr in (dBW)	-141.437
ALnk I adjsat (dB/Hz)	-195
ALnk I adjsat reduce (dB)	0
ALnk I CDMA (dB/Hz)	-201.411
ALnk I CDMA reduce (dB)	0
ALnk Io (dB/Hz)	-194.106
ALnk Noise Temp ant (K)	794.33
ALnk No (dBW/Hz)	-199.599
ALnk No+Io sat (dBW/Hz)	-193.026
ALnk C/(No+Io) uplink (dBHz)	51.589
GLnk C/(No+Io) (dBHz)	73.6

# End-to-End Link Performance:	
ALnk C/(No+Io) single uplink (dBHz)	51.589
GLnk C/(No+Io) single gndlink (dBHz	73.6
E2E C/(No+Io) single link (dBHz)	51.5618
E2E Eb/No required (dB)	3.5
E2E Datarate (Kb/s)	64
E2E Number of links	7.79113
E2E Bitrate aggregate (Kb/s)	498.632
E2E Aircraft PSD Fraction (%)	12.8351
E2E Power margin at spec rate (dB)	9.71784

Note: ALlnk indicates a link to or from the aircraft.
GLnk indicates a link to or from the ground station
E2E indicates end-to-end, that is the entire link
The data rate of the return link is variable. The AES e.i.r.p. varies proportionally to the data rate.

Figure D-1. SESAT @ 36° East, Downlink

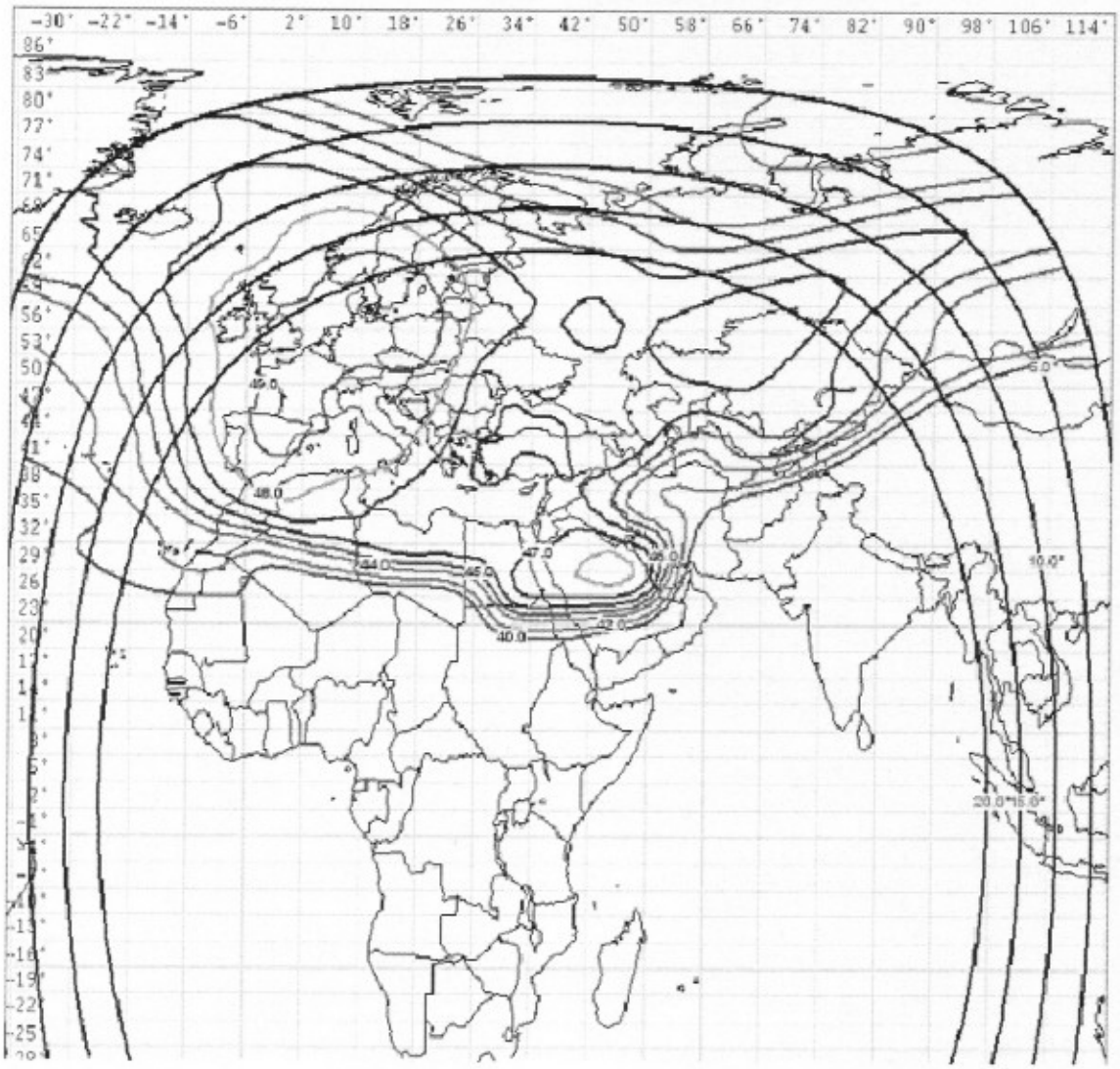
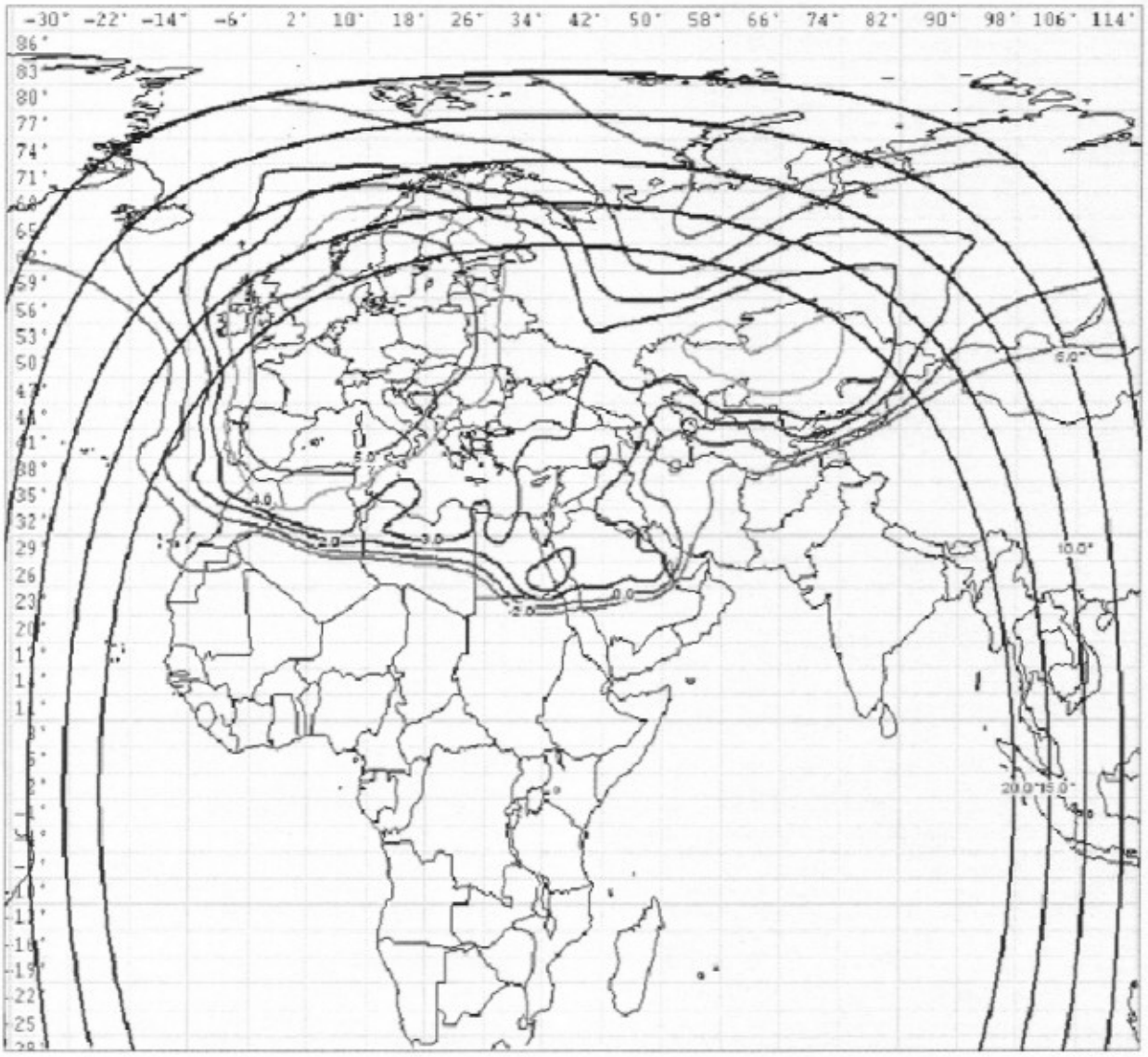


Figure D-2. SESAT @ 36° East, Uplink



GAZKOM OPEN JOINT STOCK COMPANY

APPROVED BY
First Deputy General
Director
(signature) Verkhoturov V. I.
on 24.03.2005

Yamal_KA extraterrestrial complex with Yamal-200 KA

Methods of reduction of GSO pollution

10AOGK.0000-0 PM-3

Director of the Department
of Space Projects
(signature) O. S. Grafodatskiy
21.03.05

Director of the Design Department
(signature) V. I. Kravchenko
21.03.05

Inv. #	Signature and date	Vzam. Inv. #	Inv. # doubl.	Signature and date

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Design		Sharapov	(signature)	12.03.05	
Prov.		Kravchenko	(signature)	18.03.05	
N. contr.					
Approved		Kravchenko	(signature)	18.03.05	

Extraterrestrial complex Yamal-KA with KA Yamal-200
Methods of reduction of GSO pollution

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INTRODUCTION

This document was drawn up in order to secure fulfillment of the branch standard of the Federal Space Agency of the Russian Federation (OST 134-1023-2000); it is a common method of reduction of GSO pollution. This plan is used by Gazkom Open Joint Stock Company as one of the basic documents on reduction of space pollution in relation to KA Yamal-200.

1. REFERENCE DOCUMENTATION

The following documentation is not a formal part of this document; it is meant only for a more precise understanding of the contents:

1. Branch standard of the Federal Space Agency of the Russian Federation OST 134-1023-2000 "General Requirements on Reduction of the Man-caused NESE pollution".
2. Spacecraft Yamal-200 KA-1. Explanatory note. Part 12. Ballistics materials. 300GK.0000A201-0 PZ11 part 12.
3. Instruction on preparation of the initial data for flight control. Part 1. 300GK.0000A201-0 IE62 part 1.
4. Committee on the Peaceful Uses of Outer Space. Scientific and Technical Subcommittee Fortieth session. Vienna, 17-28 February 2003 Item 10 of the provisional agenda. Space debris.
5. IADS Space Debris Mitigation Guidelines. IADS-02-01. 15 Okt. 2002.

2. GENERAL INFORMATION ON KA YAMAL-200.

KA Yamal-200 was produced in compliance with the Russian standards and specifications, and has a connected useful load produced by Gazkom Open Joint Stock Company. The spacecraft is equipped with orientation engines and plasma correction engines running on xenon. KA Yamal-200 was launched in the year 2003, and the period of active existence will expire not earlier than in 2013.

3. EXPLOITATION OF KA YAMAL-200

All materials used in KA Yamal-200 pursuant to GOST R50109-92 have minimal coefficients of outgassing and loss of mass.

Exploitation of KA Yamal-200 at GSO, transfer of the SC to a different operating point at GSO (if necessary), deorbiting of SC [spacecraft] from GSO after regular exploitation should be carried out under permanent control of the ballistic group of the TH of the LBCC in order to secure flight safety and exclude collision with other SCs at the orbit.

On-board equipment of KA Yamal-200 includes equipment operating under pressure: NHAB, xenon SSB. There is no possibility of destruction of this equipment, and this is assured by a significant safety margin and confirmed by numerous ground tests and flight qualification, over 20 missions.

In the course of exploitation of the SC on the GSO and deorbiting of the SC any separations of structural components and devices from KA Yamal-200 are excluded.

KA Yamal-200 are functioning on the geostationary orbit in the orbital positions longitude 90 East and 49 East, pursuant to the application filed to the ITU and in compliance with all ITU legal regulations; therefore, possibility of collision with other SCs through the fault of Gazkom Open Joint Stock Company is excluded.

KA Yamal-200 is being operated in continuous mode. Correction of the orbit is carried out by a standard method in compliance with the plan for orbit correction.

Construction of on-board systems and principles of operation of KA Yamal-200 are arranged in such a way that no single failure or a single erroneous instruction lead to an unsanctioned ignition of the engines.

4. DEORBITING OF SC YAMAL-200

Gazkom Open Joint Stock Company has planned the following operations on deorbiting of the SC upon expiry of the period of active existence:

1. Calculation of the working medium reserve necessary for deorbiting of the SC from GSO upon completion of exploitation.

2. Telemetric control over working medium reserve of CEI (xenon) throughout the whole period of exploitation (requirement established by paragraph 4. 17.4.3 of TZ for KA Yamal-200).

3. Deorbiting of the SC from GSO upon completion of exploitation with respective working medium reserves of CEI (requirement established by paragraph 4. 17.4.3 of TZ for KA Yamal-200). Perigee of the orbit of SC taken to the deorbiting area should be not less than 200 km over the radius of geostationary orbit (OST 134-1023-2000). Considering this data, raise of altitude during deorbiting from GSO equal to 200 km is approved for KA Yamal-200 (300GK.0000A201-0 P311 part 12).

4. As part of measures aimed at passivation of the SC upon its withdrawal it is provided that all power sources will switched off, and thus transformation of the energy of the on-board power sources into destructive one is excluded. Such measures comprise:

- Transfer of the correction and orientation engines to the state of inoperability (shutdown of power sources). We would like to note that insignificant remnants of the engine installation's working medium (neutral xenon gas) are explosion-safe.

- Final discharge of the accumulator batteries upon instruction from the LBCC after deorbiting from GSO;

- Shutdown of the on-board equipment.

5. During deorbiting of the SC from GSO work of OOW radio line will be planned basing on exclusion of radio frequency interferences for other SCs.

5. NOTIFICATIONS.

Gazkom Open Joint Stock Company undertakes to provide copies of the documents related to this matter as required by (PKA, IADS) with all respective notifications, as provided by the law or regulations for spacecrafts of Gazkom Open Joint Stock Company, including, but not limited to matters of putting into operation, orbital position, moving to another point, alteration of the orbit incline, moving to another orbit.

Appendix A

SSB – xenon storage and supply block;
GSO – geostationary orbit;
SC – spacecraft;
ITU – International Telecommunications Union;
NHAB – nickel hydrogen accumulator battery;
LBCC – land based control center;
CEI – combined engine installation;
NESE – near-Earth space environment;
OOW – order operation wire;
TH – tracking headquarters.

ОТКРЫТОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО «ГАЗКОМ»

УТВЕРЖДАЮ
Первый заместитель
генерального директора
_____Верхотуров В.И.
«24» 05 2005 года

Космический комплекс «Ямал-КА» с КА «Ямал-200»

Методика сокращения загрязнения ГСО

10АОГК.0000-0 ПМ-3

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21.05.05

Начальник
проектно-конструкторского отдела
_____В.И. Кравченко
21.09.05

2005

Инв.№ подл.	Подпись и дата	Взам. инв.№	Инв.№ дубл.	Подпись и дата

СОДЕРЖАНИЕ

Перв. примен.
Справ. №
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Подпись и дата
Инв. № подл.

Изм.	Лист	№ докум.	Подп.	Дата
Разраб.		Шарапов		12.03.05
Пров.		Кравченко		18.3.05
Н.контр.				
Утв.		Кравченко		18.3.05

10АОГК.0000-0 ПМ-3

Космический комплекс «Ямал-КА» с КА «Ямал-200»
Методика сокращения загрязнения ГСО

Лит.	Лист	Листов
	2	6

ВВЕДЕНИЕ

Настоящий документ создан в обеспечение выполнения отраслевого стандарта федерального космического агентства РФ (ОСТ 134-1023-2000) и представляет собой общую методику сокращения загрязнения ГСО. Данный план используется ОАО «Газком» как один из основополагающих документов по сокращению загрязнения космического пространства в отношении КА «Ямал-200».

1 ССЫЛОЧНАЯ ДОКУМЕНТАЦИЯ

Следующая документация является не формальной частью этого документа и предназначена для более четкого понимания содержания:

1. Отраслевой стандарт федерального космического агентства РФ ОСТ 134-1023-2000 «Общие требования по ограничению техногенного засорения ОКП».
2. Космический аппарат «Ямал-200» КА-1 Пояснительная записка Часть 12. Материалы по баллистике. 300ГК.0000А201-0 ПЗ11 ч.12.
3. Инструкция по подготовке исходных данных для управления в полете Часть1. 300ГК.0000А201-0 ИЭ62 ч.1.
4. Committee on the Peaceful Uses of Outer Space. Scientific and Technical Subcommitee Fortieth session. Vienna, 17-28 February 2003 Item 10 of the provisional agenda. Space debris.
5. IADS Space Debris Mitigation Guidelines. IADS –02-01. 15 Okt. 2002.

2 ОБЩИЕ СВЕДЕНИЯ О КА «ЯМАЛ-200»

КА «Ямал-200» изготовлен в соответствии с российскими стандартами и спецификациями, и имеет связную полезную нагрузку изготовленную ОАО «Газком».

Космический аппарат имеет двигатели ориентации и плазменные двигатели коррекции работающие на ксеноне.

КА «Ямал-200» запущен в 2003г., срок активного существования заканчивается не ранее 2013г.

3 ЭКСПЛУАТАЦИЯ КА «ЯМАЛ-200»

Все материалы используемые на КА «Ямал-200» в соответствии с ГОСТ Р50109-92 имеют минимальные коэффициенты массопотери и гажения.

Эксплуатация КА «Ямал-200» на ГСО, перевод КА в новую рабочую точку на ГСО (при необходимости), увод КА с ГСО после окончания штатной эксплуатации проводится под постоянным контролем и управлением баллистической группы ЦУП НКУ КА «Ямал», что обеспечивает безопасность полета и исключает возможность столкновений с другими КА на орбите.

В состав бортовой аппаратуры КА «Ямал-200» входит оборудование, находящееся под давлением: НВАБ, БХП ксенона. Возможность разрушения указанного оборудования отсутствует, что обеспечивается значительными запасами прочности и подтверждено многочисленными наземными испытаниями и лётной квалификацией, более 20 миссий.

В процессе эксплуатации КА на ГСО и в процессе увода с ГСО исключены любые отделения элементов конструкции и агрегатов от КА «Ямал-200».

КА «Ямал-200» функционируют на геостационарной орбите в орбитальных позициях 90° в.д. и 49° в.д., в соответствии с поданной заявкой в МСЭ и в соответствии со всеми правовыми нормами МСЭ, таким образом возможность столкновения с другими КА по вине ОАО «Газком» исключена.

КА «Ямал-200» управляется в непрерывном режиме. Коррекция орбиты проводится стандартным образом в соответствии с планом коррекции орбиты.

Построение бортовых систем и принципы управления КА «Ямал-200» организованы таким образом, чтобы никакой одиночный отказ или ошибочно выданная единичная команда не приводили к несанкционированному включению двигателей.

4 УВОД С ОРБИТЫ КА «ЯМАЛ-200»

ОАО «Газком» запланированы следующие операции по уводу КА с орбиты после завершения САС:

1. Расчёт необходимого запаса рабочего тела для увода КА с ГСО после завершения эксплуатации.
2. Телеметрический контроль запасов рабочего тела ОДУ (ксенон) в течение всего срока эксплуатации (требование п.4.17.4.3 ТЗ на КА «Ямал-200»).
3. Увод КА с ГСО после окончания эксплуатации с соответствующими запасами рабочего тела ОДУ (требование п.4.17.4.3 ТЗ на КА «Ямал-200»). Перигей орбиты КА выведенного в область увода должен превышать радиус геостационарной орбиты не менее чем на 200 км (ОСТ 134-1023-2000). С учетом этого для КА «Ямал-200» принимается подъём высоты при уводе с ГСО равный 200км (300ГК.0000А201-0 ПЗ11 ч.12).

4. Как часть мероприятий по пассивации КА после вывода из эксплуатации предусматривается, что все источники энергии будут выключены, таким образом исключается возможность трансформации энергии бортовых источников питания в разрушающую. Указанные мероприятия включают:
   - перевод в неработоспособное состояние двигателей коррекции и ориентации (выключение источников питания). Необходимо отметить, что незначительные остатки рабочего тела двигательной установки (нейтральный газ ксенон) являются взрывобезопасными;
   - окончательный разряд аккумуляторных батарей по команде с НКУ после увода с ГСО;
   - отключение бортовой аппаратуры.
5. Во время увода КА с ГСО работа радиолинии СКУ будет планироваться исходя из исключения возможности появления помех в частотах других КА.

5 УВЕДОМЛЕНИЯ

ОАО «Газком» берет на себя обязательства предоставлять копии документов относящихся к данному вопросу как требует (РКА, IADS) со всеми соответствующими уведомлениями, как требуется по закону или нормам для аппаратов ОАО «Газком», включая, но не ограничивая вопросы ввода в эксплуатацию, орбитальную позицию, перевод в другую точку, изменение наклонения орбиты, переход на другую орбиту.

СПИСОК СОКРАЩЕНИЙ

БХП		блок хранения и подачи ксенона;
ГСО	-	геостационарная орбита;
КА	-	космический аппарат;
МСЭ		международный союз электросвязи;
НВАБ		никель-водородная аккумуляторная батарея;
НКУ	-	наземный комплекс управления;
ОДУ	-	объединенная двигательная установка;
ОКП	-	околоземное космическое пространство;
СКУ	-	служебный канал управления;
ЦУП	-	центр управления полетом;

eutelsat
communications via satellite

Ref.: Ctl_Sat/2005/ 11/LRP **Date:** 5 January 2005

FAX TRANSMISSION

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Number of pages (including this cover): **1**

Supporting Information for FCC Authorisation

Dear Mr. Nalda,

Please find attached the SESAT 1 Space Debris Mitigation Plan which we have produced to reflect our Company Policy with regard to the SESAT 1 satellite specifically, and which we believe fulfils the requirements of the FCC for Orbital Debris Mitigation.

We would like to confirm to you (on a confidential basis but you may of course disclose this information for your needs with respect to the FCC) that SESAT 1 is controlled from the EUTELSAT Satellite Control Centre that is located at EUTELSAT headquarters, Paris, France.

Our SCC is under the control of the company uniquely and is manned by Eutelsat staff. The ground facilities used for the in-orbit control are as for those used for the rest of the fleet, and were procured and are owned by EUTELSAT.

We would also like to confirm that all satellites operated by Eutelsat are in geostationary orbit and that we have always followed the normal rules and conventions around control of satellites in orbit. EUTELSAT has to date performed End-Of-Life operations on two other satellites (both in the last 2 years).

The following main operations having been successfully performed on all satellites de-orbited by the company:

- Orbit raised in compliance with the IADC recommendations (as confirmed by the European Space Agency).
- Depletion of the propulsion tanks and also of the remaining auxiliary systems (pipes, thrusters, etc) as far as could be achieved.
- Switch-off of all equipment transmitting at radio frequencies.
- Complete discharge of the batteries.

Please do not hesitate to request any further information or clarification you may require.

L.R. Pattinson

SESAT1 Space Debris Mitigation Plan
(prepared for the Federal Communications Commission)

ISSUE/REVISION: 1.2

ISSUE DATE: 04 January 2005

Prepared by:	*Title*	*Organisation*	*Signature*	*Date*
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Approved by:	*Title*	*Organisation*	*Signature*	*Date*
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M. B. Saunders	Director of Technical Department	EUTELSAT		

CHANGE RECORD

Date	*Issue/rev*	*Pages affected*	*Description*

TABLE OF CONTENTS

1. Introduction

This is the general space debris mitigation plan that EUTELSAT shall apply to the **SESAT1** space station.

2. Related Documents

2.1. Applicable Documents

The following documents are applicable to the extent specified herein.

1. EUTELSAT General Debris Mitigation Plan. EUT/QMS/EUT/PLN/83021
2. FCC. Orbital Debris Mitigation Standard Practices. FCC 04-130. June 21, 2004.

2.2. Reference Documents

The following documents, though not formally part of this document, amplify or clarify its content:

1. European Code of Conduct for Space Debris Mitigation. Issue 1.0. 28 June 2004.
2. IADC Space Debris Mitigation Guidelines. IADC-02-01. 15 Oct 2002.
3. Space Product Assurance. Safety. ECSS-Q-40A. 19 April 1996
4. Orbital Debris Mitigation Standard Practices. FCC 04-130. 21 June 2004
5. NASA Safety Standard. Guidelines and Assessment Procedures for limiting Orbital Debris. NSS 1740.14. Aug 1995
6. ITU Environment Protection of the Geostationary Orbit. S.1003. 1993.
7. UNCOPUOS. Technical Report on Space Debris. 1999.
8. U.N. Article VI and VII of The Outer Space Treaty.

3. SESAT1 design

- SESAT 1 was manufactured according to European standards and specifications, and carries a communications payload manufactured by Alcatel, France.
- The satellite has chemical propulsion for attitude control and electrical propulsion for orbit control.
- SESAT 1 was launched during 2000, and the end of useful life is not expected to be before early 2011.

4. SESAT1 Operations

EUTELSAT operates in order to control and limit the amount of debris released in a planned manner during normal operations, and assesses and limits the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal.

EUTELSAT operates in order to control and limit the probability of accidental explosions during and after completion of mission operations.

- EUTELSAT operates in order to control and limit the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. EUTELSAT assessed for SESAT1 whether there were any known satellites located at the requested orbital location or might overlap.
- SESAT 1 supports geostationary operations at 36° EAST, filed with the ITU.
- SESAT1 is controlled within its designated orbit control window by standard routine periodic orbit correction manoeuvres. In case of anticipated violation of the window, correction manoeuvres would be implemented to avoid such violation.
- Satellite design is such that high levels of thruster activity and orbit perturbation are not expected to result when foreseeable on-board events occur.

5. SESAT1 End of life disposal

EUTELSAT has planned the post-mission disposal activities as follows:

1. It is to be noted that since SESAT1 was launched during year 2000, it is grandfathered from the application of the IADC formula that determines end of life disposal altitude, as explicitly mentioned on the second notice of the FCC.
2. Fuel shall be retained to perform raising the satellite to an orbit having a perigee of at least 150 km above synchronous altitude with a probability of success of 99%.
3. The necessary number of manoeuvres will raise the satellite orbit such that the above minimum perigee is obtained.
4. As part of the end of life activities SESAT 1 energy sources will be rendered inactive, such that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the satellite. For SESAT 1, this involves the following:

   - disabling of the electrical propulsion system (power supply switch-off and isolation).

   - depleting the chemical propulsion system, and where possible leaving open fuel lines and valves.

   - leaving all batteries in a state of permanent discharge by isolation of the battery charge circuits and leaving certain loads connected to the batteries.
5. EUTELSAT will determine the corresponding fuel gauging.
6. EUTELSAT will calculate the corresponding amount of fuel that must be reserved in order to achieve the corresponding minimum perigee at the level of probability indicated above.
7. The satellite tracking, TM and TC usage are planned so as to avoid electrical interference to other satellites and coordinated with any potential affected satellite networks.

8. During the orbit raising manoeuvres the tracking, TM and TC frequencies will be limited to those where the satellite is authorized to operate.

6. Notifications

EUTELSAT undertakes to provide the relevant bodies as required (UNCOPUOS, FCC, ITU, French ANFR, etc) with all appropriate notifications as required by law or regulations for EUTELSAT satellites including but not limited to those concerning initial entry of service, location, relocations, inclined orbit operations and re-orbiting operations.