Exhibit AA: Amendments to Information Required by 47 C.F.R. § 25.114(c)

Most of the details of the original KuBS application are contained in Exhibit A to the Form 312 filed by Teledesic on January 8, 1999. The Exhibit AA filed with this amendment supersedes the 1999 application insofar as there are any differences. Except as indicated herein, all prior statements contained in the original application and in the amendment filed December 3, 2001 remain applicable.

Section 25. 114(c)(5): Radio Frequency Plan[1]

Table A-1 gives the amended frequency bands, center frequencies, polarization, emission designators, allocated bandwidths, power levels, satellite receive system noise temperature, and G/T values for KuBS.

Table A-1. Frequency Plan

	Uplink	Downlink
Frequency Bands	12.75-13.25 GHz **(see Note 1)** 13.75-14.0 GHz **(see Note 2)** 14.0-14.5 GHz 17.3-17.8 GHz **(see Note 3)**	10.7-12.7 GHz **(see Note 4)**

[1] At the time the KuBS application was submitted, the portions of Ku-band spectrum that could be used by NGSO FSS systems had not been defined yet. In addition, there was no decision on which of these bands could be used for gateway links and for service links. These issues have now been resolved, and Teledesic is amending Exhibit A of the initial application accordingly. This text assumes that the statement in ¶ 79 of the Order in IB Docket No.01-96, FCC 02-123 ("licensees have the option to use other spectrum bands when they provide service to other countries") means that (1) the frequency band 17.3-17.8 GHz can still be used for KuBS uplinks in Regions 1 and 3; (2) the band 13.1500-13.2125 GHz can be used by KuBS outside the United States; and (3) the frequency bands that in the United Space are limited to gateway links can still be used for service link operation in other countries.

	Uplink	**Downlink**		
Center Frequencies (Service Links and Gateway Links)	12.75 + n x 0.05 GHz, n = 1 to 9 **(see Note 5)** 13.75 + n x 0.05 GHz, n = 1 to 14 17.30 + n x 0.05 GHz, n = 1 to 9	11.7 + nx0.5 GHz, n = 0, ±1 **(see Note 6)**	11.7 + nx0.25 GHz, n = 0, ±1, ±2, ±3 **(see Note 7)**	11.7 + nx0.125 GHz, n = 0, ±1, ±2, ±3, ±4, ±5, ±6, ±7 **(see Note 8)**
Polarization	RHC & LHC	RHC & LHC		
Emission Designator	100MG7D	1G00G7D	500MG7D	250MG7D
Allocated Bandwidth	100 MHz	1 GHz	500 MHz	250 MHz
Maximum Power at Satellite Antenna Terminal (dBW/Hz) **(see Note 9)**		n = 0: -82.6 n < 0: -80.7	n = 0: -82.6 n < 0: -80.7	n = 0: -82.6 n < 0: -80.7
Maximum e.i.r.p. (dBW/Hz) **(see Note 9)**		n = 0: -34.8 n < 0: -32.9	n = 0: -34.8 n < 0: -32.9	n = 0: -34.8 n < 0: -32.9
Peak PFD at the Earth (dB(W/m^2)/4 kHz)		n = 0: -150.0 n < 0: -148.1	n = 0: -150.0 n < 0: -148.1	n = 0: -150.0 n < 0: -148.1
Receiving System Noise Temperature (K)	587			
G/T (dB/K)	20.4 (13 GHz) 21.2 (14 GHz) 23.0 (17 GHz)			

Note 1: Operation in the United States is limited to gateway links and only in the bands 12.75-13.15 GHz and 13.2125-13.25 GHz.

Note 2: Operation in the United States is limited to gateway links.

Note 3: Operation is limited to Regions 1 and 3 (no NGSO FSS allowed in Region 2).

Note 4: In the United States, operation in the band 10.7-11.7 GHz is limited to gateway links.

Note 5: In the United States, center frequencies corresponding to n=8, 9 are not used.

Note 6: In the United States, center frequencies corresponding to n=0, -1 are only used for gateway links.

Note 7: In the United States, center frequencies corresponding to n=0, -1, -2, -3 are only used for gateway links.

Note 8: In the United States, center frequencies corresponding to n=0, -1, -2, -3, -4, -5, -6, -7 are only used for gateway links.

Note 9: Maximum power and e.i.r.p. densities are calculated from the link budgets using a symbol rate that is 75% of the carrier allocated bandwidth.

Emissions from satellites and from earth stations will be attenuated with respect to the mean output power of the transmitter as indicated in Table A-2.

Table A-2. Emission Mask

Difference Between Center Frequency of 4 kHz Band and Center Frequency of Emission (Percentage of Authorized Bandwidth)	Attenuation of Unwanted Emissions Within a 4 kHz Band with Respect to Total Mean Carrier Power P (dB)
50% to 100%	25
100% to 250%	35
> 250%	(43 + 10 log P)

Section 25. 114(c)(7): Space Station Antenna Gain Patterns

Predicted satellite transmit and receive antenna gain patterns for the phased-array antennas are shown in Figure 1 and Figure 2, respectively, of the original Exhibit A. Figure A-1 below provides the antenna gain pattern for the beacon antenna. The backup TT&C antenna operating in the 6/4 GHz band is omni-directional.

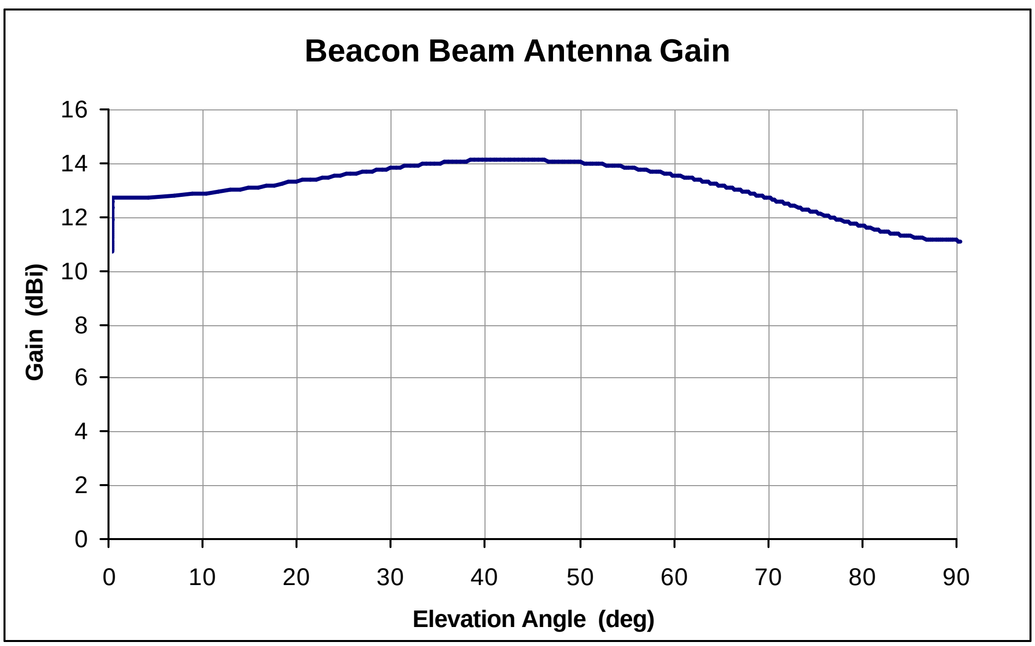

Figure A-1. Satellite Beacon Transmit Antenna Pattern.

Section 25.114(c)(8): Services to Be Provided

- **Service Area**

Several statements included in Exhibit A of the original KuBS application seem to indicate that KuBS will not serve earth stations located between the latitudes 18° North and 18° South. In reality, each KuBS satellite will be turned off when its *sub-satellite point* is between latitudes 18° North and 18° South. However, earth stations located within this range of latitudes can still be served by a satellite with sub-satellite point above 18° North or below 18° South, provided the rules associated with the "polar pointing" algorithm are met. A revised statement of that algorithm is contained below in the amendments related to section 25.114(c)(16).

The coverage of the KuBS constellation, taking into account the "polar-pointing" algorithm, is shown in Figure A-2 for a minimum operational elevation angle of 25°.

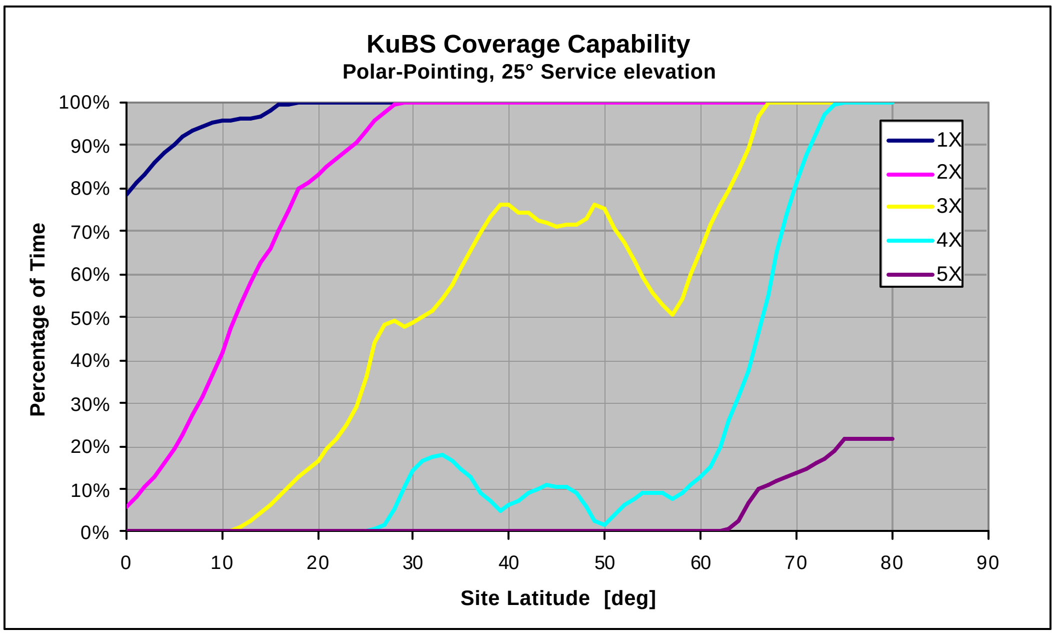

Figure A-2. Satellite Coverage With 25° Minimum Elevation Angle.

It can be concluded from Figure A-2 that KuBS meets the coverage requirements in § 25.146(h)(1) and (2), since it is "capable of providing service on a continuous basis throughout the fifty states, Puerto Rico, and the U.S. Virgin Islands" and "of serving locations as far north as 70 degrees latitude and as far south as 55 degrees" for at least 78.4% of the time (percentage of time associated with an earth station at the equator).

Since the Order in IB Docket No.01-96 (FCC 02-123) has adopted "avoidance of in-line events" as a sharing mechanism, the capability of implementing satellite diversity will be useful during coordination with other NGSO FSS systems. KuBS has the ability to implement satellite diversity when required. In particular, it can be concluded from Figure 1 that, except for equatorial areas, the KuBS constellation will be able to provide double coverage during high percentages of time (100% of the time for latitudes north of 28° North and for latitudes south of 28° South).

- **Link Budgets**

More detailed updated link budgets are being provided. As a result, Table 5 of the original Exhibit A is superseded by the following Table A-3.

Table A-3. Typical User Terminal Parameters

		Subscriber	Gateway	Gateway (4.5 m)
Maximum Uplink Data Rate	(Mbit/s)	100	1,000	1,000
Maximum Downlink Data Rate	(Mbit/s)	1,000	1,000	1,000
Maximum EIRP	(dBW)	44.4	54.3	48.5
G/T (in clear sky)	(dB/K)	9.9 to 10.6	19.7 to 20.4	29.6

The link budgets contained in Tables 6 and 7 of the KuBS application are superseded by the following more detailed link budgets.

Table A-4A. Link Budgets for Service Uplinks

Uplink							
		(12.75-13.25) (Note 1)		*(14-14.5)*		*(17.3-17.8) (Note 2)*	
Frequency	GHz	13.00	13.00	14.25	14.25	17.55	17.55
Allocated Bandwidth	MHz	100.0	100.0	100.0	100.0	100.0	100.0
Elevation	deg	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	**Rain**	**Clear Sky**	**Rain**	**Clear Sky**	**Rain**
Transmit Power	dBW	5.0	8.5	4.3	8.4	2.6	8.6
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	34.2	34.2	35.0	35.0	36.8	36.8
EIRP	dBW	38.2	41.7	38.3	42.4	38.4	44.4
Transmit Pointing Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
FSL	dB	197.0	197.0	197.8	197.8	199.6	199.6
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.2	0.2	0.2	0.3	0.3
Rain Margin	dB	0.0	3.5	0.0	4.1	0.0	6.0
Total Propag. Loss	dB	197.7	201.2	198.5	202.7	200.5	206.5
Receive Gain	dBi	48.7	48.7	49.5	49.5	51.3	51.3
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
Total System Temp.	K	588.8	588.8	588.8	588.8	588.8	588.8
G/T	dBi/K	20.4	20.4	21.2	21.2	23.0	23.0
Received Signal (C)	dBW	-111.4	-111.4	-111.4	-111.4	-111.4	-111.4
N0	dBW/Hz	-200.9	-200.9	-200.9	-200.9	-200.9	-200.9
C/N0	dB-Hz	89.5	89.5	89.5	89.5	89.5	89.5
Data Rate	Mbps	100.0	100.0	100.0	100.0	100.0	100.0
Eb/No	dB	9.5	9.5	9.5	9.5	9.5	9.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	2.0	2.0	2.0	2.0	2.0	2.0
Unallocated Margin	dB	1.0	1.0	1.0	1.0	1.0	1.0

Note 1: Operation in the United States is limited to gateway links and only in the bands 12.75-13.15 GHz and 13.2125-13.25 GHz.

Note 2: Operation is limited to Regions 1 and 3 (no NGSO FSS allowed in Region 2).

Table A-4B. Link Budgets for Service Downlinks in 10.7-11.7 GHz (outside the United States only)

Downlink (10.7 – 11.7 GHz)							
		(10.7-11.7)		*(10.7-11.7)*		*(10.7-11.7)*	
Frequency	GHz	11.20	11.20	11.200	11.2	11.20	11.2
Allocated Bandwidth	MHz	1000.0	1000.0	500.0	500.0	250.0	250.0
Elevation	deg	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	Rain	Clear Sky	Rain	Clear Sky	Rain
Transmit Power	dBW	9.0	9.0	6.0	6.0	3.0	3.0
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	47.8	47.8	47.8	47.8	47.8	47.8
EIRP	dBW	55.8	55.8	52.8	52.8	49.8	49.8
Transmit Pointing Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
FSL	dB	195.7	195.7	195.7	195.7	195.7	195.7
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Rain Margin	dB	0.0	1.6	0.0	1.6	0.0	1.6
Total Propag. Loss	dB	196.4	198.0	196.4	198.0	196.4	198.0
Receive Gain	dBi	32.9	32.9	32.9	32.9	32.9	32.9
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
Total System Temp.	K	173.8	263.1	173.8	263.1	173.8	263.1
G/T	dBi/K	9.9	8.1	9.9	8.1	9.9	8.1
Received Signal (C)	dBW	-108.3	-109.9	-111.3	-112.9	-114.3	-115.9
N0	dBW/Hz	-206.2	-204.4	-206.2	-204.4	-206.2	-204.4
C/N0	dB-Hz	97.9	94.5	94.9	91.5	91.9	88.5
Data Rate (3dB spread)	Mbps	500.0	500.0	250.0	250.0	125.0	125.0
Eb/No	dB	10.9	7.5	10.9	7.5	10.9	7.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	0.0	0.0	0.0	0.0	0.0	0.0
Unallocated Margin	dB	4.4	1.0	4.4	1.0	4.4	1.0

Table A-4C. Link Budgets for Service Downlinks in 11.7-12.7 GHz

Downlink (11.7 – 12.7 GHz)							
		(11.7-12.7)		*(11.7-12.7)*		*(11.7-12.7)*	
Frequency	GHz	12.20	12.20	12.200	12.2	12.20	12.2
Allocated Bandwidth	MHz	1000.0	1000.0	500.0	500.0	250.0	250.0
Elevation	Deg	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	**Rain**	**Clear Sky**	**Rain**	**Clear Sky**	**Rain**
Transmit Power	dBW	7.1	7.1	4.0	4.0	1.0	1.0
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	47.8	47.8	47.8	47.8	47.8	47.8
EIRP	dBW	53.9	53.9	50.8	50.8	47.8	47.8
Transmit Pointing Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
FSL	dB	196.4	196.4	196.4	196.4	196.4	196.4
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.2	0.1	0.2	0.1	0.2
Rain Margin	dB	0.0	2.2	0.0	2.2	0.0	2.2
Total Propag. Loss	dB	197.2	199.4	197.2	199.4	197.2	199.4
Receive Gain	dBi	33.6	33.6	33.6	33.6	33.6	33.6
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
Total System Temp.	K	173.8	289.7	173.8	289.7	173.8	289.7
G/T	dBi/K	10.6	8.4	10.6	8.4	10.6	8.4
Received Signal (C)	dBW	-110.3	-112.5	-113.3	-115.5	-116.3	-118.5
N0	dBW/Hz	-206.2	-204.0	-206.2	-204.0	-206.2	-204.0
C/N0	dB-Hz	95.9	91.5	92.9	88.5	89.9	85.5
Data Rate (6dB spread)	Mbps	250.0	250.0	125.0	125.0	62.5	62.5
Eb/No	dB	11.9	7.5	11.9	7.5	11.9	7.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	0.0	0.0	0.0	0.0	0.0	0.0
Unallocated Margin	dB	5.4	1.0	5.4	1.0	5.4	1.0

Table A-5A. Link Budgets for Gateway Uplinks

		(12.75-13.25)		*(13.75-14)(Note 1)*		*(14-14.5)*		*(17.3-17.8)*	
Frequency	GHz	13.00	13.00	13.875	13.875	14.25	14.25	17.55	17.55
Allocated Bandwidth	MHz	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Elevation	deg	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	Rain	Clear Sky	Rain	Clear Sky	Rain	Clear Sky	Rain
Transmit Power	dBW	-4.8	4.3	-15.1	-4.8	-5.5	5.3	-7.2	8.5
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	44.2	44.2	54.3	54.3	45.0	45.0	46.8	46.8
EIRP	dBW	38.4	47.5	38.2	48.5	38.5	49.3	38.6	54.3
Transmit Pointing Loss	dB	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
FSL	dB	197.0	197.0	197.6	197.6	197.8	197.8	199.6	199.6
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Rain Margin	dB	0.0	9.1	0.0	10.3	0.0	10.8	0.0	15.7
Total Propag. Loss	dB	197.9	207.0	198.5	208.8	198.7	209.6	200.7	216.4
Receive Gain	dBi	48.7	48.7	49.5	49.5	49.5	49.5	51.3	51.3
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total System Temp.	K	588.8	588.8	588.8	588.8	588.8	588.8	588.8	588.8
G/T	dBi/K	20.4	20.4	21.2	21.2	21.2	21.2	23.0	23.0
Received Signal (C)	dBW	-111.4	-111.4	-111.4	-111.4	-111.4	-111.4	-111.4	-111.4
N0	dBW/Hz	-200.9	-200.9	-200.9	-200.9	-200.9	-200.9	-200.9	-200.9
C/N0	dB-Hz	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5
Data Rate	Mbps	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Eb/No	dB	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Unallocated Margin	dB	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Note 1: Minimum 4.5 m-diameter antenna required in this band. Link budget conforms to RR 5.502 and 5.503.

Table A-5B. Link Budgets for Gateway Downlinks in 10.7-11.7 GHz

Downlink (10.7 – 11.7 GHz)							
		(10.7-11.7)		*(10.7-11.7)*		*(10.7-11.7)*	
Frequency	GHz	11.20	11.20	11.20	11.20	11.20	11.20
Allocated Bandwidth	MHz	1000.0	1000.0	500.0	500.0	250.0	250.0
Elevation	deg	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	Rain	Clear Sky	Rain	Clear Sky	Rain
Transmit Power	dBW	9.2	9.2	6.1	6.1	3.1	3.1
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	47.8	47.8	47.8	47.8	47.8	47.8
EIRP	dBW	56.0	56.0	52.9	52.9	49.9	49.9
Transmit Pointing Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
FSL	dB	195.7	195.7	195.7	195.7	195.7	195.7
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Rain Margin	dB	0.0	6.7	0.0	6.7	0.0	6.7
Total Propag. Loss	dB	196.4	203.1	196.4	203.1	196.4	203.1
Receive Gain	dBi	42.9	42.9	42.9	42.9	42.9	42.9
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.7	0.7	0.7	0.7	0.7	0.7
Total System Temp.	K	173.8	401.6	173.8	401.6	173.8	401.6
G/T	dBi/K	19.7	16.1	19.7	16.1	19.7	16.1
Received Signal (C)	dBW	-98.4	-105.1	-101.4	-108.1	-104.4	-111.1
N0	dBW/Hz	-206.2	-202.6	-206.2	-202.6	-206.2	-202.6
C/N0	dB-Hz	107.8	97.5	104.8	94.5	101.8	91.5
Data Rate	Mbps	1000.0	1000.0	500.0	500.0	250.0	250.0
Eb/No	dB	17.8	7.5	17.8	7.5	17.8	7.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	0.0	0.0	0.0	0.0	0.0	0.0
Unallocated Margin	dB	11.3	1.0	11.3	1.0	11.3	1.0

Table A-5C. Link Budgets for Gateway Downlinks in 11.7-12.7 GHz

Downlink (11.7 – 12.7 GHz)							
		(11.7-12.7)		*(11.7-12.7)*		*(11.7-12.7)*	
Frequency	GHz	12.20	12.20	12.20	12.20	12.20	12.20
Allocated Bandwidth	MHz	1000.0	1000.0	500.0	500.0	250.0	250.0
Elevation	deg	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	**Rain**	**Clear Sky**	**Rain**	**Clear Sky**	**Rain**
Transmit Power	dBW	7.7	7.7	4.7	4.7	1.7	1.7
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	47.8	47.8	47.8	47.8	47.8	47.8
EIRP	dBW	54.5	54.5	51.5	51.5	48.5	48.5
Transmit Pointing Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
FSL	dB	196.4	196.4	196.4	196.4	196.4	196.4
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.2	0.1	0.2	0.1	0.2
Rain Margin	dB	0.0	8.0	0.0	8.0	0.0	8.0
Total Propag. Loss	dB	197.2	205.2	197.2	205.2	197.2	205.2
Receive Gain	dBi	43.6	43.6	43.6	43.6	43.6	43.6
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.7	0.7	0.7	0.7	0.7	0.7
Total System Temp.	K	173.8	418.2	173.8	418.2	173.8	418.2
G/T	dBi/K	20.4	16.6	20.4	16.6	20.4	16.6
Received Signal (C)	dBW	-99.8	-107.9	-102.9	-110.9	-105.9	-113.9
N0	dBW/Hz	-206.2	-202.4	-206.2	-202.4	-206.2	-202.4
C/N0	dB-Hz	106.4	94.5	103.3	91.5	100.3	88.5
Data Rate (3dB spread)	Mbps	500.0	500.0	250.0	250.0	125.0	125.0
Eb/No	dB	19.4	7.5	19.4	7.5	19.4	7.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	0.0	0.0	0.0	0.0	0.0	0.0
Unallocated Margin	dB	12.9	1.0	12.9	1.0	12.9	1.0

Table A-5D. Link Budgets for Downlinks to 4.5 m Gateways

Downlink (4.5m Antenna)							
		(10.7-12.7)		*(10.7-12.7)*		*(10.7-12.7)*	
Frequency	GHz	11.70	11.70	11.70	11.70	11.70	11.70
Allocated Bandwidth	MHz	1000.0	1000.0	500.0	500.0	250.0	250.0
Elevation	deg	25.0	25.0	25.0	25.0	25.0	25.0
Slant Range	km	12970.15	12970.15	12970.15	12970.15	12970.15	12970.15
		Clear Sky	**Rain**	**Clear Sky**	**Rain**	**Clear Sky**	**Rain**
Transmit Power	dBW	0.4	0.4	-2.6	-2.6	-5.6	-5.6
Feed Loss	dB	1.0	1.0	1.0	1.0	1.0	1.0
Transmit Gain	dBi	47.8	47.8	47.8	47.8	47.8	47.8
EIRP	dBW	47.2	47.2	44.2	44.2	41.2	41.2
Transmit Pointing Loss	dB	0.5	0.5	0.5	0.5	0.5	0.5
FSL	dB	196.1	196.1	196.1	196.1	196.1	196.1
Polarization Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Atmospheric Loss	dB	0.1	0.1	0.1	0.1	0.1	0.1
Rain Margin	dB	0.0	7.4	0.0	7.4	0.0	7.4
Total Propag. Loss	dB	196.8	204.2	196.8	204.2	196.8	204.2
Receive Gain	dBi	52.8	52.8	52.8	52.8	52.8	52.8
Polarization Mismatch	dB	0.1	0.1	0.1	0.1	0.1	0.1
Receive EOB/Point Loss	dB	0.7	0.7	0.7	0.7	0.7	0.7
Total System Temp.	K	173.8	410.6	173.8	410.6	173.8	410.6
G/T	dBi/K	29.6	25.9	29.6	25.9	29.6	25.9
Received Signal (C)	dBW	-97.6	-105.0	-100.6	-108.0	-103.6	-111.0
N0	dBW/Hz	-206.2	-202.5	-206.2	-202.5	-206.2	-202.5
C/N0	dB-Hz	108.6	97.5	105.6	94.5	102.6	91.5
Data Rate	Mbps	1000.0	1000.0	500.0	500.0	250.0	250.0
Eb/No	dB	18.6	7.5	18.6	7.5	18.6	7.5
Required Eb/N0 (10^-10)	dB	2.5	2.5	2.5	2.5	2.5	2.5
Implementation Loss	dB	2.0	2.0	2.0	2.0	2.0	2.0
Intra-System Interference	dB	2.0	2.0	2.0	2.0	2.0	2.0
Power Control Margin	dB	0.0	0.0	0.0	0.0	0.0	0.0
Unallocated Margin	dB	12.1	1.0	12.1	1.0	12.1	1.0

Section 25. 114(c)(10): Power Flux Density Levels

Peak power flux density at the Earth's surface will meet the limits in § 25.208(b) as can be verified from the link budgets provided in Tables A-4B, A-4C, A-5B, A-5C, and A-5D. Table A-6 presents a summary of peak PFD values at the Earth's surface.

Table A-6. Peak PFD Values

	Nadir		Edge of Coverage @ 25°	
	10.7-11.7 GHz	11.7-12.7 GHz	10.7-11.7 GHz	11.7-12.7 GHz
Peak e.i.r.p. Density dBW/4 kHz	3.2	1.3	3.2	1.3
Spreading Loss dB(m^{-2})	-151.3		-153.3	
Peak PFD dB(W/m^2)/4 kHz	-148.1	-150.0	-150.1	-152.0

Note: The peak e.i.r.p. density values in this table are calculated from the link budgets using a symbol rate that is 75% of the carrier allocated bandwidth.

Section 25. 114(c)(11): Tracking, Telemetry, and Control

Table 10 of the original Exhibit A is superseded by the following Table A-7.

Table A-7. Beacon RF Plan

	Downlink
Frequency Band	10.7 – 12.7 GHz
Polarization	Linear
Emission Designator	10M0G1D
Bandwidth	10 MHz
Transmit Power	5 W
Feeder Loss	0.5 dB
Maximum EIRP	20 dBW

Note: Any beacon transmissions from a satellite with sub-satellite point between 18° South latitude and 18° North latitude will be spread over a 100 MHz bandwidth. Since satellites in such locations will not be providing communication services because of the "polar pointing" architecture, more bandwidth is thus available for the beacon signals.

Section 25. 114(c)(15):   Schedule

Table 15 of the original Exhibit A has been superseded by the Commission's adoption of new milestones for Ku-band NGSO FSS licensees. An amended milestone schedule is provided in Table A-8.

Table A-8. Milestone Schedule

Non-contingent satellite manufacturer contract for the system	Within one year of authorization
Complete Critical Design Review	Within two years of authorization
Begin physical construction of satellites	Within two and a half years of authorization
Complete construction and launch first two satellites	Within three and a half years of authorization
Entire system launched and operational	Within six years of authorization

Section 25.114(c)(16): Public Interest Considerations

- **Interference Analysis**

In order to clarify the application of the "polar-pointing" algorithm, the first paragraph of the "Interference Analysis" in the original Exhibit A (pp. A-16 to A-17) is superseded by the following text:

KuBS will use an innovative "polar-pointing" architecture to facilitate band sharing with GSO systems. The KuBS satellites will not communicate with ground terminals when the satellite's sub-satellite point is between 18° South latitude and 18° North latitude. Also, communication between KuBS terminals and satellites are subject to the following conditions:

(i) terminals located between the equator and 18° North latitude communicate only with satellites with sub-satellite point north of 18° North;

(ii) terminals located between 18° South latitude and the equator communicate only with satellites with sub-satellite point south of 18° South;

(iii) terminals located between 18° and 57.1° North latitude communicate only with satellites with sub-satellite point at a latitude that is north of the terminal's latitude;

(iv) terminals located between 18° and 57.1° South latitude communicate only with satellites with sub-satellite point at a latitude that is south of the terminal's latitude;

(v) terminals located at latitudes north of 57.1° North communicate only with satellites with sub-satellite point at a latitude that is also north of 57.1° North;

(vi) terminals located at latitudes south of 57.1° South communicate only with satellites with sub-satellite point at a latitude that is also south of 57.1° South.

These conditions guarantee that both main-beam and sidelobe interference from a KuBS satellite never appear in the main-beam of a GSO earth terminal, and that main-beam interference from a KuBS earth terminal never appears in the beam of a GSO satellite.

Section 25. 114(c)(22): Information Required by Section 25.146

- **Section 25.146(a): Technical Showing That Validation $EPFD_{down}$ and $EPFD_{up}$ Limits Are Met**

A simulation in accordance with the specifications stipulated in Recommendation ITU-R BO.1503 was used to generate the cumulative probability distribution function of epfd for the several combinations of GSO earth station latitudes, link elevations, antenna diameters, and gain pattern models. The results show that KuBS meets validation epfd limits contained in § 25.208(g), (k), and (l).

- **Single-Entry $EPFD_{down}$ Limits**

  - (i), (ii) pfd Masks and Conditions Under Which They Were Generated

Power flux density masks were generated in accordance with the specifications stipulated in Recommendation ITU-R BO.1503. There are two general kinds of pfd masks to be considered: those corresponding to one of the beams of the phased-array antenna and those associated with the beacon beam.

For the phased-array beams, the maximum power densities supplied to the satellite antenna are -80.7 dBW/Hz, in the band 10.7-11.7 GHz, and -82.6 dBW/Hz, in the band 11.7-12.7 GHz (see Table A-1). These are the power densities used for generating the pfd masks associated with the phased-array downlink. They correspond to the service downlinks with link budgets shown, respectively, in Tables A-4B and A-4C. As indicated in these link budgets, the satellite antenna gain is 47.8 dBi and the corresponding antenna pattern appears in Figure 1 of the initial KuBS application.

For KuBS there are at most eight co-frequency beams that have to be at least 2° apart as measured at the satellite. In the pfd calculations, each of the eight beams is assumed to transmit at the maximum power density. One of the beams points towards the point on the Earth where the pfd is being computed, or as close as possible to this point in order to be consistent with a minimum 25° elevation angle and the "polar pointing" algorithm described above in the amendments related to section 25.114(c)(16). The other seven beams will be as close as possible to the first beam subject to the minimum beam reuse distance of 2°.

For the beacon beam, the maximum power density supplied to the satellite antenna is -62.2 dBW/Hz, in the band 10.7-12.7 GHz (see Table A-7), and the satellite antenna gain is 13.5 dBi with the pattern shown in Figure A-1 above. As indicated in connection with Table A-7, the power density for transmissions from satellites with sub-satellite points between 18° South latitude and 18° North latitude will be reduced by 10 dB and will therefore be -72.2 dBW/Hz.

A summary of the conditions under which pfd masks are generated, as described in the preceding paragraphs, is given in Table A-9.

Table A-9. Conditions for Generation of pfd Masks

Phased Array Antennas	
Downlink Pointing	25° Minimum Elevation Angle; "Polar-Pointing" Algorithm
Power Density per Beam	-80.7 dB(W/Hz), 10.7 – 11.7 GHz -82.6 dB(W/Hz), 11.7 – 12.7 GHz
Beam Peak Gain	47.8 dBi
Number of Co-Frequency Beams	8
Beam Reuse Distance	2°
Beacon Beam	
Downlink Pointing	10-dB power density reduction with satellite sub-points between ±18° latitude
Beam Power Density	-62.2 dB(W/Hz) , 10.7 – 12.7 GHz
Peak Gain	13.5 dBi
Number of Co-Frequency Beams	1

Because the KuBS constellation does not have repeating ground tracks, pfd masks depend on the latitude, and not on the longitude, of the sub-satellite point. Moreover, since KuBS downlink beams are individually steered to fixed points on the Earth during a certain period of time and do not remain fixed with respect to the satellite, there is no need to distinguish between pfd masks associated with ascending and descending satellites. An example pfd mask for a KuBS satellite at 25°N latitude is shown in Figure A-3. The image represents a satellite-based (10320-km altitude) view of the Earth, with the grids indicating azimuth relative to North (radial) and elevation contours (rings).

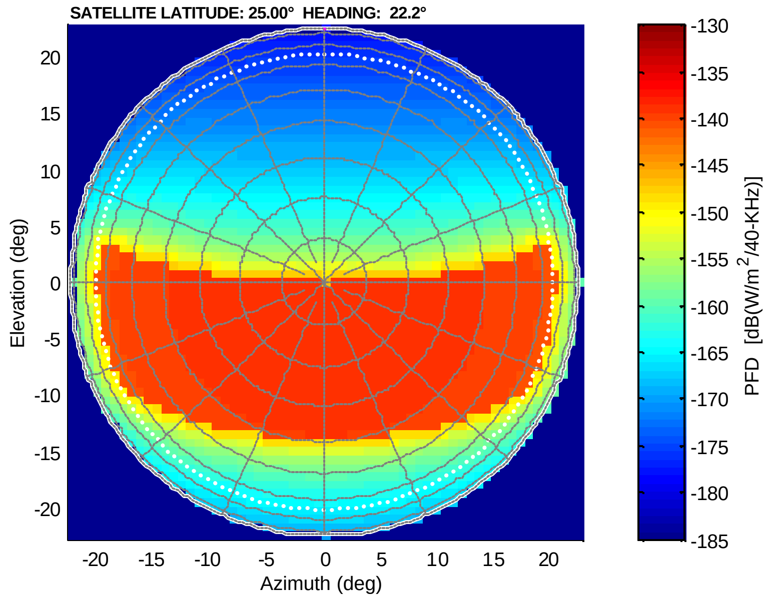

Figure A-3. Example KuBS pfd Mask for 25°N (11.7-12.7 GHz); maximum = -137.96 dB(W/m^2/40-KHz)

The KuBS beacon beam produces a pfd at the surface of the Earth that is a function of elevation angle only. The pfd mask associated with satellites with sub-satellite points at latitudes north of 18° North or south of 18° South is shown in Figure A-4, as a function of the elevation angle. When a KuBS satellite has its sub-satellite point between 18° South latitude and 18° North latitude, the power density is reduced by 10-dB to mitigate interference into any GSO earth station.

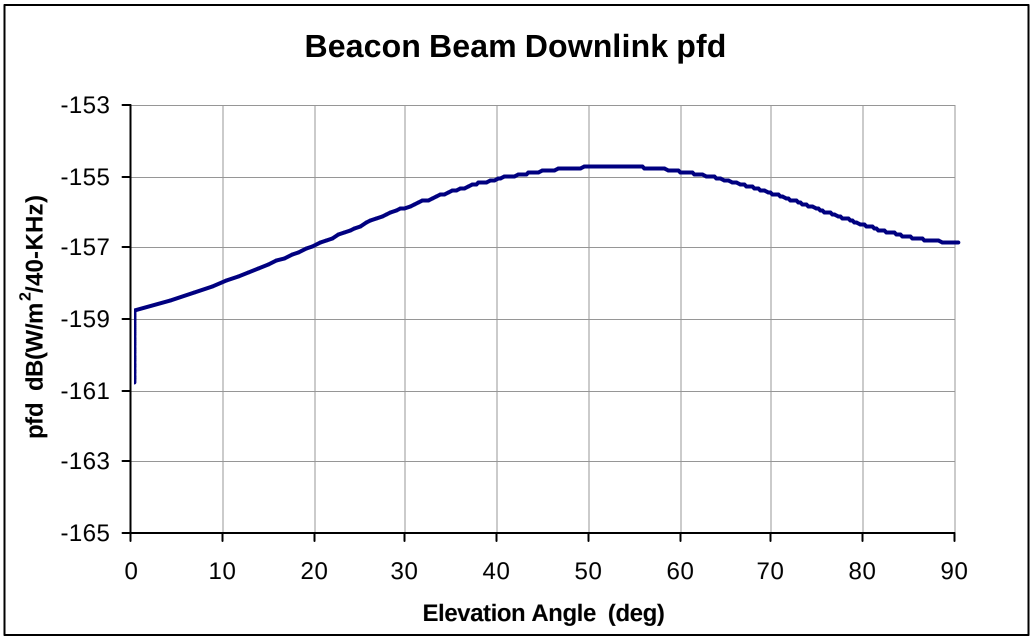

Figure A-4. KuBS Beacon Beam Downlink pfd Mask (Sub-satellite point at latitude north of 18° North or south of 18° South)

A set of pfd masks is being provided in electronic format. The set for the phased array antennas is comprised of 2-dimensional pfd arrays for 42 satellite sub-point latitudes: any latitude between 0° and 18° North (a single pfd mask); latitudes from 18° North through 57.1° North at 1° latitude steps; and any latitude above 57.1° North (a single pfd mask). The set for the beacon antenna has two pfd masks, one for satellite sub-point latitudes between 0° and 18° and the other for latitudes above 18° North. Taking advantage of symmetry, the same masks can be used for sub-satellite points in the Southern Hemisphere. Each array is defined for a 61-point elevation by 61-point azimuth grid circumscribing the Earth's disc as seen from 10320-km altitude. The definition of azimuth and elevation can be found in Recommendation ITU-R BO.1503 section 5.4.3.

- (iii), (iv) Computer Program for $EPFD_{down}$ Generation and Input Parameters

A computer program for $epfd_{down}$ generation is being provided. It generates $epfd_{down}$ statistics in accordance with the analytic method described in Recommendation ITU-R BO.1503. Input parameters include the GSO earth station location, antenna diameter, signal frequency and flag identifying BSS service; GSO space station longitude; desired KuBS pfd mask set filename; and number of KuBS co-frequency links allowed per site.

- (v) $EPFD_{down}$ Cumulative Probability Distribution Function

For KuBS the number of the phased array antenna beams from any of the available satellites pointing towards a given point on the ground is 1, *i.e.*, in the notation of Recommendation ITU-R BO.1503, N_{co}[latitude]=1. On the other hand, all KuBS satellites in view to a GSO earth station are assumed to transmit the same beacon channel, *i.e.*, when calculating $epfd_{down}$ values associated with the beacon beam, N_{co}[latitude]=maximum number of visible satellites.

The cumulative distribution function of $epfd_{down}$ was generated for the phased array antennas transmitting in the band 10.7-11.7 GHz, for the same antennas in the band 11.7-12.7 GHz, and for the beacon beam in the band 10.7-12.7 GHz. For each of these three situations, $epfd_{down}$ distribution functions have been generated for different: (a) latitudes of the sub-satellite point; (b) sizes and corresponding gain diagrams of all GSO receive antennas included in Tables 1G and 1L in § 25.208, as appropriate; and (c) elevation angles of the GSO antenna up to the maximum elevation angle towards the GSO compatible with the earth station latitude.

Phased Array Antennas in the Band 10.7-11.7 GHz

The relevant probability distribution functions of $epfd_{down}$ taking into consideration (a), (b), and (c) above have been determined and compared to the validation limits in § 25.208 Tables 1G and 2G.

Figure A-5 presents the maximum difference between the simulated KuBS $epfd_{down}$ probability distribution curves and $epfd_{down}$ validation limits applicable in the 10.7 – 11.7 GHz band. These differences are presented as a function of latitude for the four GSO FSS antenna sizes that have to be considered. As explained in (c) above, for each latitude and GSO antenna size, several elevation angles have been considered (up to the maximum possible elevation angle). The difference shown in Figure A-5 is therefore the maximum over all percentages of time and all possible elevation angles of the GSO earth station antenna.

In the band 10.7-11.7 GHz, the $epfd_{down}$ probability distribution for KuBS is the closest from the applicable validation limit for a 1.2-m diameter GSO FSS antenna (modeled using Recommendation ITU-R S.1428), at 62°N and operating at 10.7 GHz with a 5° elevation angle. The corresponding $epfd_{down}$ results are shown in Figure A-6 for all possible elevation angles of the GSO earth station antenna.

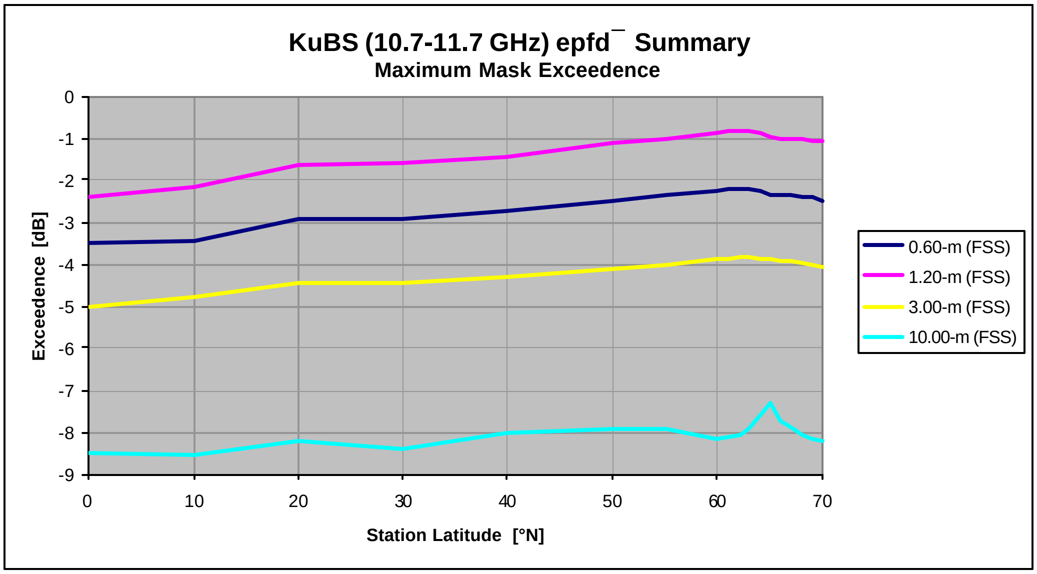

Figure A-5. Maximum Difference Between $epfd_{down}$ Probability Distribution Curves and $epfd_{down}$ Validation Limits (10.7 – 11.7 GHz) – Phased Array Antennas

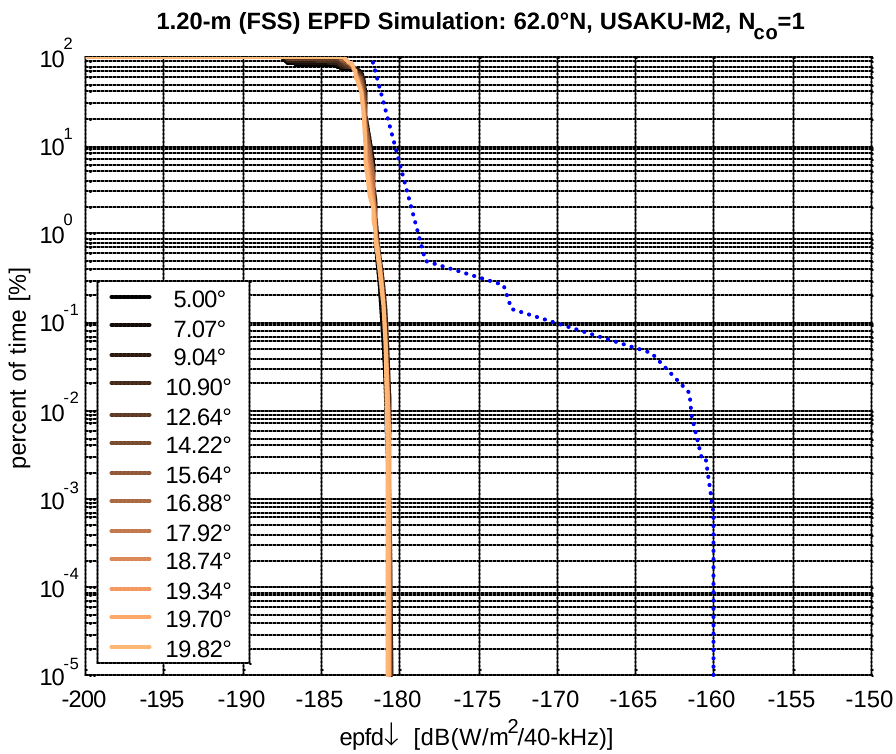

Figure A-6. KuBS 10.7 GHz $epfd_{down}$ Probability Distribution Functions for 1.2-m GSO FSS Earth Station at Several Elevation Angles and Corresponding Validation Limits (62°N)

Phased Array Antennas in the Band 11.7-12.7 GHz

The relevant probability distribution functions of $epfd_{down}$ taking into consideration (a), (b) and (c) above have been determined and compared to the validation limits in § 25.208 Tables 1G, 2G, 1L and 2L.

Figure A-7 presents the maximum difference between the simulated KuBS $epfd_{down}$ probability distribution curves and $epfd_{down}$ validation limits applicable in the 11.7 – 12.7 GHz band. These differences are presented as a function of latitude for the four GSO FSS and the eight GSO BSS antenna sizes that have to be considered and represent the maximum over all percentages of time and all possible elevation angles of the GSO earth station antenna.

In the 11.7-12.7 GHz, the $epfd_{down}$ probability distribution for KuBS is the closest from the applicable validation limit for a 45-cm diameter GSO BSS antenna (modeled using Recommendation ITU-R BO.1433, Annex 1), at 55°N and operating at 11.7 GHz with a 27° elevation angle. The corresponding $epfd_{down}$ results are shown in Figure A-8 for all possible elevation angles of the GSO BSS earth station antenna.

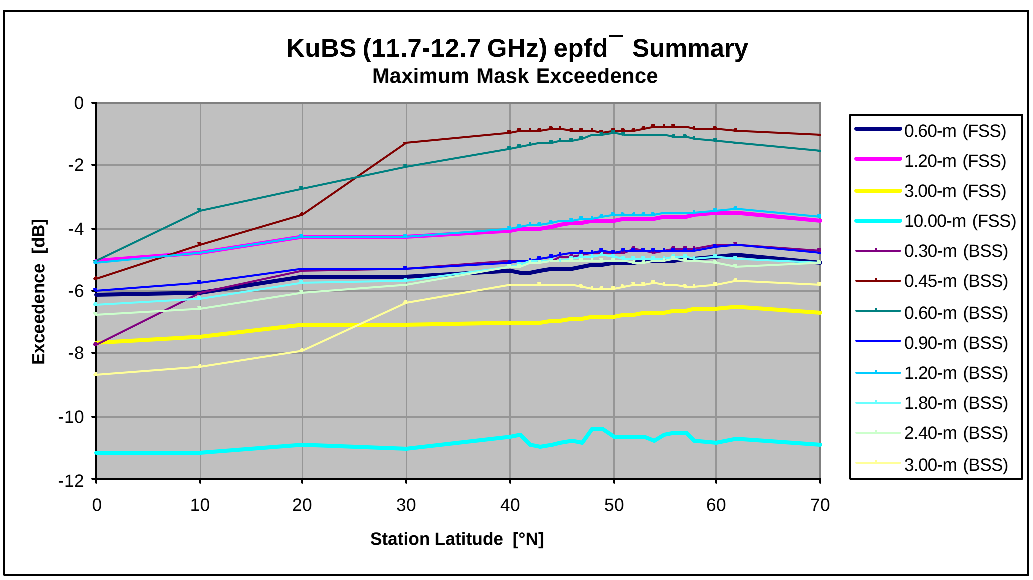

Figure A-7. Maximum Difference Between $epfd_{down}$ Probability Distribution Curves and $epfd_{down}$ Validation Limits (11.7 – 12.7 GHz) – Phased Array Antennas

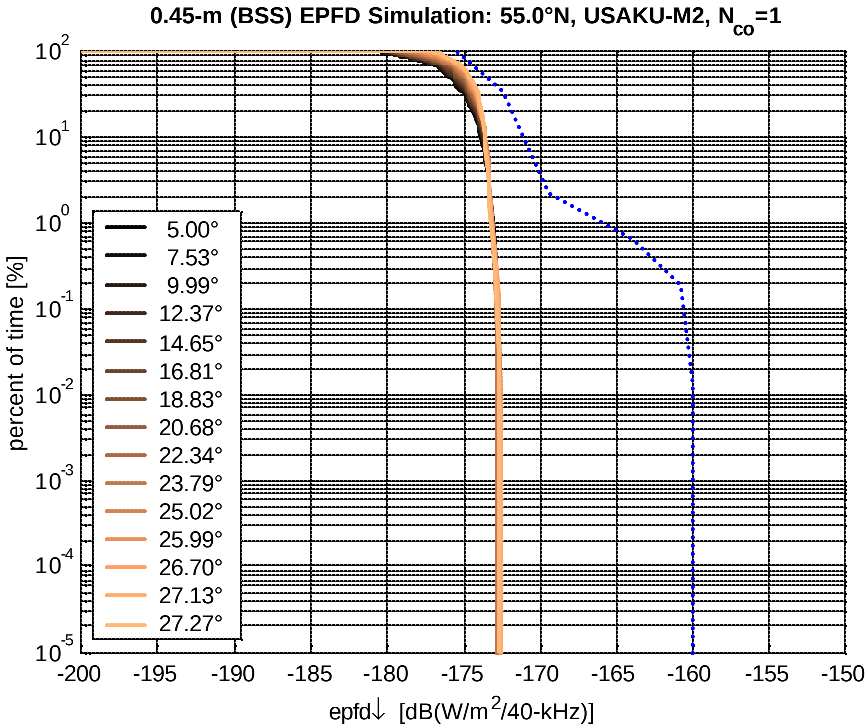

Figure A-8. KuBS 11.7 GHz epfd$_{down}$ Probability Distribution Functions for 45-cm GSO BSS Earth Station at Several Elevation Angles and Corresponding Validation Limits (55°N)

Beacon Beam in the Band 10.7-12.7 GHz

The relevant probability distribution functions of epfd$_{down}$ taking into consideration (a), (b) and (c) above have been determined and compared to the validation limits in § 25.208 Tables 1G, 2G, 1L and 2L.

Figure A-9 presents the maximum difference between the simulated KuBS epfd$_{down}$? probability distribution curves and epfd$_{down}$ validation limits applicable in the 10.7 – 12.7 GHz band. These differences are presented as a function of latitude for the four GSO FSS and the eight GSO BSS antenna sizes that have to be considered, and each curve represents the maximum over all percentages of time and all possible elevation angles of each GSO earth station antenna.

In the band 10.7-12.7 GHz, the epfd$_{down}$ probability distribution for KuBS is the closest from the applicable validation limit for a 1.2-m diameter GSO FSS antenna (modeled using

Recommendation ITU-R S.1428), operating at 10.7 GHz, at 0°N with a 46° elevation angle or at 40°N with a 37° elevation angle. The $epfd_{down}$ results corresponding to the earth station at 0°N are shown in Figure A-10 for all possible elevation angles of the GSO FSS earth station antenna.

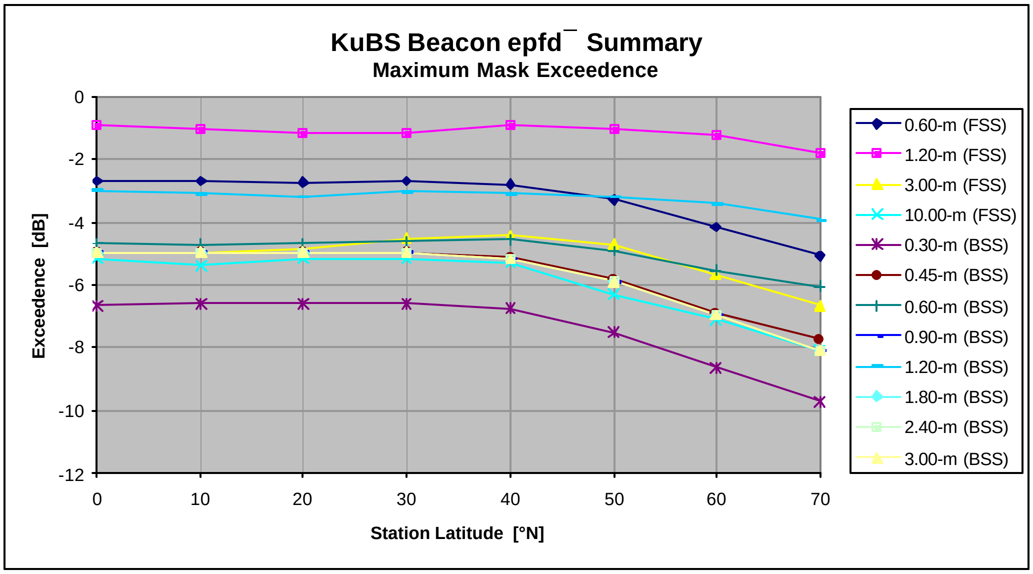

Figure A-9. Maximum Difference Between $epfd_{down}$ Probability Distribution Curves and $epfd_{down}$ Validation Limits (10.7 – 12.7 GHz) – Beacon Beam

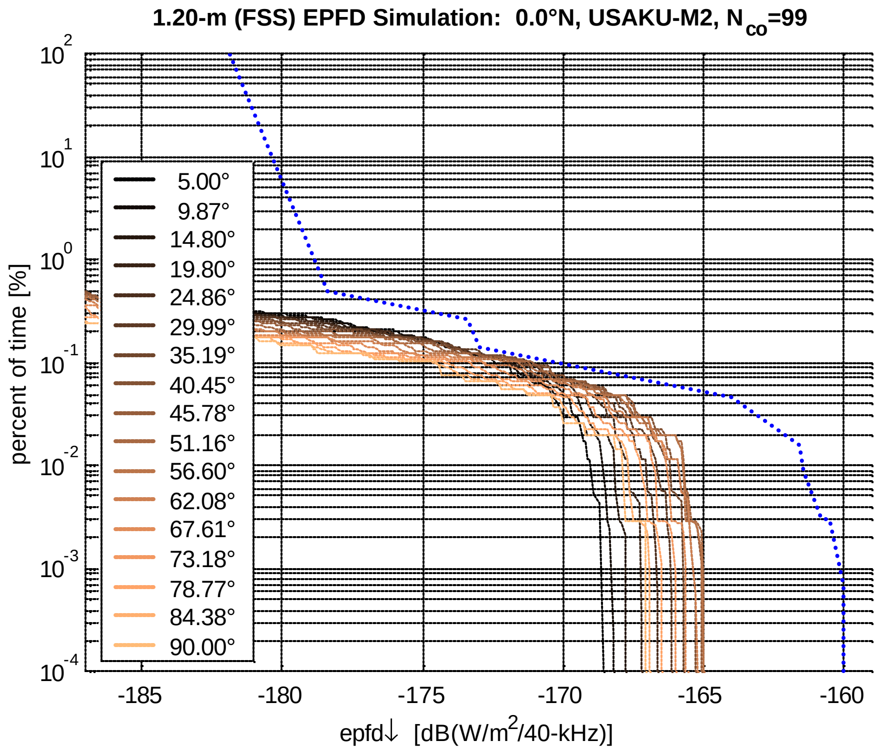

Figure A-10. KuBS 11.7 GHz epfd$_{down}$ Probability Distribution Functions for 1.2-m GSO FSS Earth Station at Several Elevation Angles and Corresponding Validation Limits (0°N)
{note: Nco=99 indicates the maximum number of visible satellites}

❖ (2) Single-Entry EPFD$_{up}$ Limits

- ❑ (i), (ii) e.i.r.p. Density Masks and Conditions Under Which They Were Generated

Masks for earth station e.i.r.p. densities were generated in accordance with the specifications stipulated in Recommendation ITU-R BO.1503, *i.e.* maximum e.i.r.p. density as a function of off-axis angle. Seven different e.i.r.p. density masks were generated corresponding to: a subscriber terminal in each of the bands 12.75-13.25 GHz, 14.0-14.5 GHz, 17.3-17.8 GHz; a gateway in each of the bands 12.75-13.25 GHz; 14.0-14.5 GHz; 17.3-17.8 GHz; and a 4.5 m gateway transmitting in the band 13.75-14.0 GHz. The underlying conditions for the generation of the e.i.r.p. density masks are given in Table A-10 while the radiation patterns for the transmit antennas are shown in Figure A-11.

The corresponding e.i.r.p. density masks are presented in Figure A-12 and are also being provided in electronic form.

Table A-10. Conditions for Generation of e.i.r.p. Density Masks

Earth Station	Frequency Band (GHz)	Power Density (dBW/Hz)	G_{max} (dBi)
Subscriber	12.75 – 13.25	-71.2	34.2
	14.00 – 14.50	-71.3	35.0
	17.30 – 17.80	-71.1	36.8
Gateway	12.75 – 13.25	-75.4	44.2
	14.00 – 14.50	-74.4	45.0
	17.30 – 17.80	-71.2	46.8
4.5-m	13.75 – 14.00	-84.5	54.3

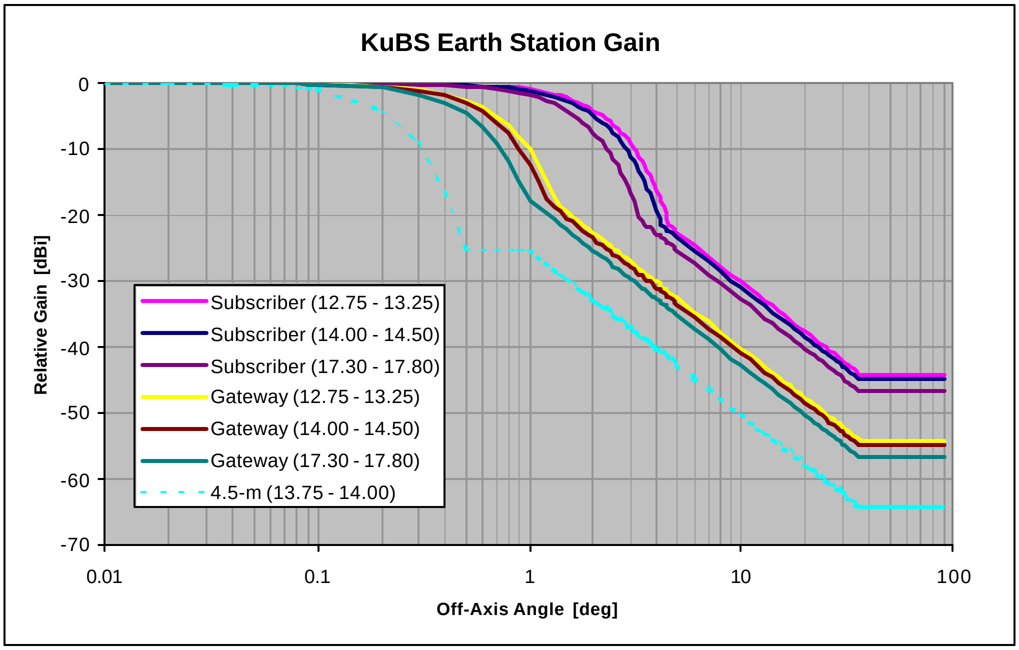

Figure A-11. Earth Station Antenna Gains as a Function of Off-Axis Angle

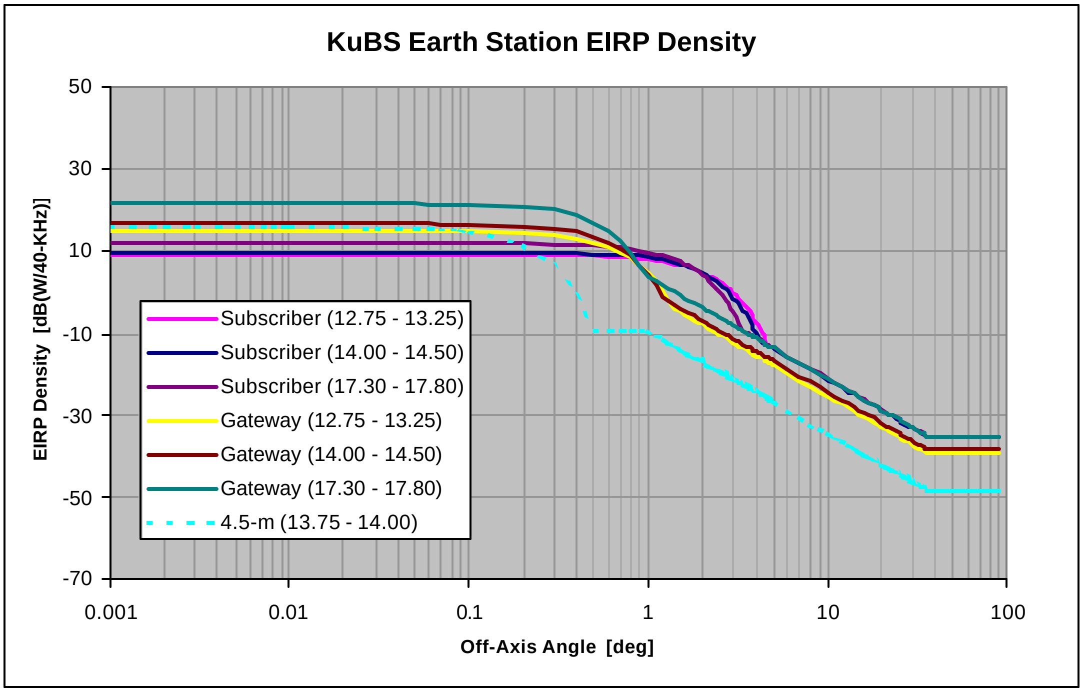

Figure A-12. e.i.r.p. Density Masks (dBW/40-kHz) as a Function of Off-Axis Angle

- (iii), (iv) Computer Program for $EPFD_{up}$ Generation and Input Parameters

A simulation according to the specifications stipulated in Recommendation ITU-R BO.1503 was used to compute the $epfd_{up}$ probability distribution function. Because the KuBS constellation does not have repeating ground tracks, the $epfd_{up}$ probability distribution functions do not depend on the longitude of the interfered-with GSO satellite, provided the same grid of earth stations, and with the same position relative to the GSO satellite, is considered. Therefore, $epfd_{up}$ calculations for KuBS can be limited to a single GSO orbital location.

The interference geometry specified in Recommendation ITU-R BO.1503 to obtain worst-case results for the calculation of $epfd_{up}$ in Ku-band considers a GSO satellite at 50°E with boresight directed at (42.5°N; 50°E). The GSO satellite receive antenna is modeled with Recommendation ITU-R S.672 ($\phi_{3\text{-dB}}$ = 4°, L_N=-20 dB). For KuBS, the average distance between beam centers, ES_DISTANCE in the notation of Recommendation ITU-R BO.1503, is

460 km. This distance was determined based on a 2° beam separation distance at the average elevation angle.

Figure A-13 presents the modeled KuBS earth station distribution based on rectangular grid locations spaced 460-km East-West and 460-km North-South. The number of earth stations is determined by filling a GSO service area defined by its -15 dB relative gain contour. GSO gain contours shown in Figure A-13 are for -3, -6 and -12-dB.

The same KuBS emission is assumed to be transmitted from each of the earth stations in the grid. When computing the $epfd_{up}$ probability distribution functions, it has been assumed that each earth station uses the KuBS satellite that corresponds to the highest elevation angle and satisfies the polar-pointing constraint.

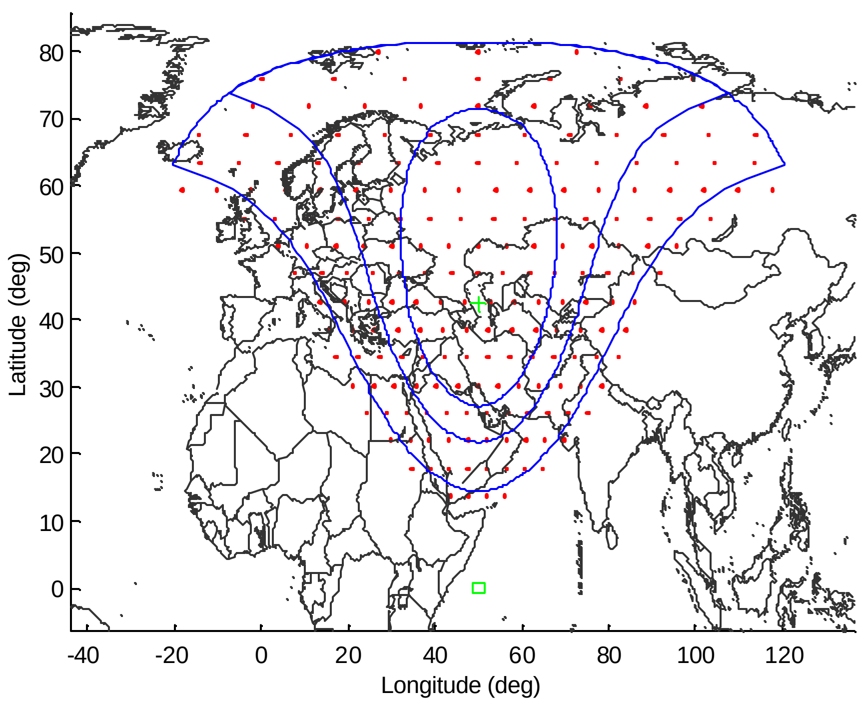

Figure A-13. Earth Station Distribution for KuBS (ES_DISTANCE = 460 km)

A computer program for $epfd_{up}$ generation is being provided. It has been developed to generate $epfd_{up}$ statistics in accordance with the analytic method described in Recommendation ITU-R S.1503. Input parameters include the GSO earth station location (antenna boresight); GSO space station longitude; and desired KuBS earth station eirp mask set filename.

- (v) $EPFD_{up}$ Cumulative Probability Distribution Function

The resulting $epfd_{up}$ probability distribution functions are shown in Figure A-14. Even though no attempt was made to limit the number of uplinks that a particular satellite could handle (*i.e.*, at most eight co-frequency beams), there is over 19 dB available in satisfying the $epfd_{up}$ validation limit of -160 dB[(W/m^2)/40 kHz] for 100% of the time, as prescribed in § 25.208(k). If the number of uplinks were limited to eight per covering satellite, many of the modeled grid locations would be turned off and the $epfd_{up}$ levels would be reduced.

As explained in (iii), (iv) above, because the KuBS constellation does not have repeating ground tracks, the $epfd_{up}$ probability distribution functions do not depend on the longitude of the interfered-with GSO satellite, and therefore there is no need to provide results for every two-degree (or every three-degree) spacing, as requested in § 25.146(a)(2)(v).

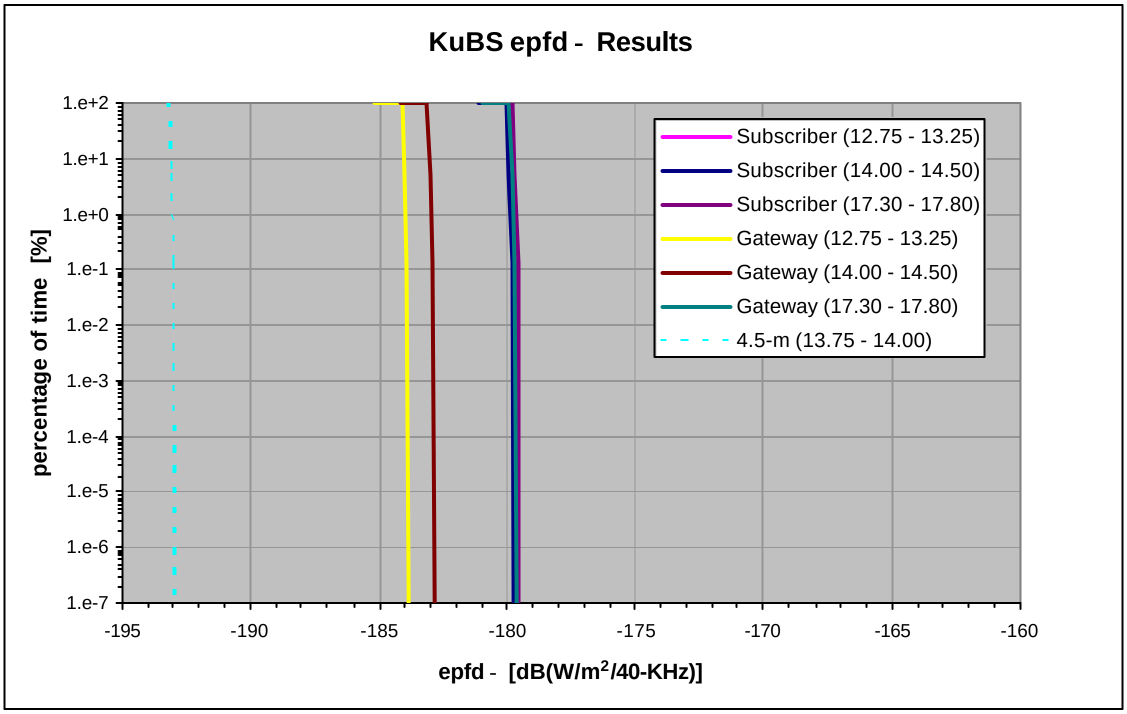

Figure A-14. KuBS $epfd_{up}$ Probability Distribution Functions

- **Section 25.146(b), (c), (d), (e), (f), (i), (k), (l), (m):**

  KuBS will comply as required.

- **Section 25.146(h):**

  - **(1), (2) U.S. and Worldwide Coverage**

As demonstrated above (see discussion under "Service Area" above), KuBS is "capable of providing service on a continuous basis throughout the fifty states, Puerto Rico, and the U.S. Virgin Islands" and "of serving locations as far north as 70 degrees latitude and as far south as 55 degrees" for at least 78.4% of the time (percentage of time associated with an earth station at the equator).

❖ (3) Additional System Characteristics

Each KuBS earth station will communicate with the KuBS satellite highest in elevation at any given instance, subject to the "polar-pointing" constraints discussed above. At the instant when another satellite satisfying the "polar pointing" constraints becomes higher in elevation than the current serving satellite, the earth station will switch to the higher satellite. Each earth station will only be served by a single satellite. There is an additional constraint of eight uplink and eight downlink beams per satellite. So, although an earth station is "served" by a satellite, this does not mean that a satellite beam is dedicated 100% of the time to that earth station. The uplink and downlink beams are shared among the earth stations "served" by a satellite through a time division multiple access scheme.

For switching protocol to avoid transmission towards the GSO, see description of the polar pointing algorithm in the amendment relating to section 25.114(c)(16) above.

For satellite antenna patterns see Section 25.114(c)(7) of the original submission, as amended above.

Earth station antenna patterns were given in Figure A-11 above when addressing § 25.146(a)(2)(i), (ii).

The KuBS orbital parameters were provided in Exhibit A of the KuBS application. Two parameters requested in Section A.3 of Annex 1 of Resolution 46– semi-major axis and eccentricity – were not directly specified in the original application. The semi-major axis (a_j) and eccentricity (e_j) for each plane is 16698 km and 0.0, respectively.

❖ (4) Debris Mitigation

To limit orbital debris associated with the KuBS System, Teledesic will use a spacecraft and upper stages designed to minimize the amount of debris released during normal operations.

As the KuBS program matures, Teledesic will be able to demonstrate that no credible failure modes exist which can lead to an accidental explosion during normal operations or before completion of post operations disposal. At the end of the operational life of each KuBS satellite, Teledesic will maneuver its spacecraft to a storage orbit with a perigee that is above the operational orbit. Once the vehicle has reached its final disposal orbit, all on-board sources of stored energy will be depleted or safed.

- **Section 25.146(j)**: Implementation Milestone Schedule
  See Table A-8 above.

Exhibit BB: Suppression of Waiver Requests

The waivers requested in Exhibit B of the original application are no longer required because the financial qualifications rule has been waived and the appropriate allocations to the fixed-satellite service have already been introduced to the United States Table of Frequency Allocations, as a result of the First Report and Order in ET Docket No.98-206. As a result, Exhibit B of the original application can be suppressed.

Exhibit CC: Owners, Officers, and Directors of Teledesic LLC[2]

Equity Owners of Teledesic LLC

Teledesic LLC currently has two equity owners: Teledesic Corporation, a Delaware corporation, and Teledesic Holdings Limited, a corporation organized under the laws of Bermuda. Teledesic Corporation functions as the manager of Teledesic LLC and has complete and full authority to manage the business and affairs of Teledesic LLC. The ownership interests of these two companies are as follows.

Equity Owner	Citizenship	Percentage of Units[3]
Teledesic Corporation	U.S. (Delaware)	78.1%
Teledesic Holdings Limited	Bermuda	21.9%

Beneficial Equity Owners Holding in Excess of 10% Equity in Teledesic Enterprise (Including Teledesic Corporation & Teledesic Holdings Ltd.)

Equity Owner	Citizenship	Percentage of Units
AT&T Wireless Services, Inc. P.O. Box 97061 Redmond, WA 98073	U.S.	10.3438% (13.2432% of Teledesic Corporation)

2 This information is submitted in response to Form 312, items 34 and 40.

3 These percentages do not reflect additional "reserved" units held by Teledesic Corporation. Teledesic Corporation receives credit for these "reserved" units on a one-for-one basis for each share of stock issued by Teledesic Corporation from time to time upon the exercise of outstanding or authorized stock options or warrants for stock of Teledesic Corporation.

Equity Owner	Citizenship	Percentage of Units
Eagle River Investments, LLC[4] 2300 Carillon Point Kirkland, Washington 98033	U.S.	17.5486% (22.4074% of Teledesic Corporation)
➢ Mente LLC[5] **c/o Michael Larson** **2635 Carillon Point** **Kirkland, Washington 98033**	U.S.	25.2824% (32.3691% of Teledesic Corporation)
Kingdom 5-KR-77, Ltd. c/o Ugland House P. O. Box 309 Cayman Islands, West Indies	Cayman Islands	13.8255% (63.1494% of Teledesic Holdings Limited)

Officers of Teledesic LLC[6]

Name	➢ Office	Address
Craig O. McCaw	Chairman and Co-Chief Executive Officer	2300 Carillon Point Kirkland, WA 98033
William A. Owens	Co-Chief Executive Officer and Vice Chairman	1445 – 120th Avenue N.E. Bellevue, WA 98005
Dennis James	President	1445 – 120th Avenue N.E. Bellevue, WA 98005
Farzad Ghazvinian	Senior Vice President and Chief Technology Officer	1445 – 120th Avenue N.E. Bellevue, WA 98005
R. Gerard Salemme	Senior Vice President	1133 21st Street, NW 8th Floor Washington, D.C. 20036

4 Eagle River Investments LLC is controlled and substantially owned by Mr. Craig O. McCaw.

5 Mente LLC is controlled and substantially owned by Mr. William H. Gates III.

6 These officers hold the same offices for both Teledesic LLC and Teledesic Corporation.

Name	➢ Office	Address
Jose Albuquerque	Vice President-International and Government Affairs	1445 – 120th Avenue N.E. Bellevue, WA 98005
Lyle Bien	Vice President, Government Programs	1445 – 120th Avenue N.E. Bellevue, WA 98005
Michael Doyle	Vice President-Finance, Chief Financial Officer and Treasurer	1445 – 120th Avenue N.E. Bellevue, WA 98005
Sami Hinedi	Vice President of User Equipment	1445 – 120th Avenue N.E. Bellevue, WA 98005
Michael McGowen	Vice President and General Counsel	1445 – 120th Avenue N.E. Bellevue, WA 98005
David Patterson	Vice President and Chief Scientist	1445 – 120th Avenue N.E. Bellevue, WA 98005
Len Quadracci	Vice President-Systems Engineering	1445 – 120th Avenue N.E. Bellevue, WA 98005

Directors of Teledesic LLC

As a limited liability company, Teledesic LLC has no directors. Instead, Teledesic LLC has a manager, which is Teledesic Corporation.