Globalstar, L.P.
Exhibit A

SUPPLEMENTAL INFORMATION FOR GEOSTATIONARY SATELLITE AT 99° W.L.

In a modification application filed on July 17, 2002, Globalstar, L.P. ("GLP") requested assignment of spectrum in the 13.795-13.995 GHz (Earth-to-space) and 11.5-11.7 GHz (space-to-Earth) bands in conjunction with its 2 GHz Mobile Satellite Service system for a geostationary satellite at orbital location 99° W.L.

These frequency bands and this orbital location are requested for the following reasons:

(1) The bands are compatible with the design of GLP's gateway earth station and will provide excellent link availability at a reasonable cost;

(2) Although GLP had previously sought assignment of feederlink bands in the conventional Ku-band, the Commission denied this request because of the heavy use of the conventional Ku-bands. However, the bands proposed in the modification application are in a portion of the Ku-band which is not widely used (particularly in the United States) for Ku-band FSS systems. In addition, the bands are subject to a number of technical and operational restrictions with which the Globalstar feederlink gateway can comply, as demonstrated in the attached materials.

(3) The orbital location was chosen to enable the Globalstar 2 GHz system to operate over Region 2, including service to Alaska, Hawaii and Central and South America;

(4) The orbital location is not currently licensed for operation in the frequency bands requested;

(5) GLP's feederlink operation will not cause unacceptable intersatellite interference to satellites in the vicinity of 99° W.L.;

(6) A waiver of the limitation on use of 11.45-11.7 GHz to international systems is warranted because there will be only one gateway earth station located in the United States and, as is demonstrated in Exhibit A, the emissions from the downlink will meet the power-flux density limit for this band, and as is further demonstrated in Exhibit B, the operation of this earth station from the proposed location will not interfere with nor constrain future operations of the Fixed Service.

The attachments to Exhibit A are as follows:

Attachment 1 demonstrates compliance with Commission rules and orders regarding the use of the 13.75-14 GHz (including Sections 25.204(a), 25.204(b), and the Commission's Report and Order on 13.75-14 GHz) and 11.45-11.7 GHz bands (including Section 25.208(b)).

Appendix A to Attachment 1 – Globalstar Earth Station Antenna Reference Gain Pattern.

Appendix B to Attachment 1 – Output of ITM Program Calculating Globalstar Uplink PFD at the U.S. coastline.

Attachment 2 utilizes the ITU filings for the purposes of the adjacent satellite interference study. Some U.S. licensed systems operate in parts of these bands. Analysis using the data in the ITU filings presents a worst case interference result. Use of the specific characteristics of U.S. licensed systems would likely result in even less interference from the proposed Globalstar feederlink. In any event, Globalstar would be operating at least two degrees from any other U.S. or international system and would coordinate its feederlink operations with those systems. While the results show interference into the Globalstar feederlinks that in some cases exceed an assumed protection criteria of a C/I of 24 C/I, this is due to a large imbalance in power levels between the wanted and interfering signals that is unlikely to occur in actual operation. In addition, in actual operation, Globalstar feederlink transmissions can be managed to take into consideration the operating characteristics of nearby satellites transmitting in these bands.

ATTACHMENT 1

ATTACHMENT 1

Technical Analysis Demonstrating How Operation of the Globalstar Feeder links in the 13.75-14 GHz and 11.45-11.7 GHz Bands will Comply with the Part 25 of the FCC Rules as well as other policies governing FSS Operations in These Bands

Introduction

This attachment demonstrates how the operation of the proposed Globalstar feeder links will comply both with Part 25 of the Commission's rules as well as other requirements contained in the Commission's Report and Order revising Part 2 of the Commission's Table of Allocations to permit co-primary fixed-satellite service operations in the 13.75-14 GHz band and the 11.45-11.7 GHz band. Globalstar proposes to operate its feeder links in the 13.795-13.995 GHz and the 11.5-11.7 GHz. The lower part of the 13.75-14 GHz is avoided to protect NASA's TDRSS.

Below are various analyses of emission levels from the proposed Globalstar gateway earth station to be located near Clifton, TX. with respect to the restrictions contained in FCC Part 25 rules and the FCC's Report and Order on 13.75-14 GHz.

Globalstar Characteristics

The following table summarizes the characteristics of the Globalstar earth station used in this analysis. Emission characteristics were taken from the Globalstar Amendment dated November 3, 2000.

Globalstar Feederlink Characteristics

Earth Station Location	31° 47' N, 97° 35' W
Earth Station Height	200 m
Earth Station Antenna Diameter	5 m
Earth Station Reference Antenna Pattern	See Appendix A
Space Station Location	99 W
Space Station Antenna Gain	38 dBi

Uplink Emissions				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
13795	1M23G7W	63.9	-52.0	55.0
13995	2M46G7W	66.9	-52.0	
	4M92G7W	69.9	-52.0	

Downlink Emissions				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
11450	1M23G7W	45.9	-53.0	53.4
11700	2M46G7W	48.9	-53.0	
	4M92G7W	51.9	-53.0	

Analysis

The applicable paragraphs from FCC Part 25 rules are quoted below followed by calculations to show compliance with the specified levels.

25.204 (a)

"In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+40 dBW in any 4 KHz band for $\theta<0°$
+40+3 θ *dBW in any 4 KHz band for* $0°<\theta\leq5°$

where θ *is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it."*

The elevation angle of the earth station located at Clifton, TX toward a satellite at 99° WL is greater than 52 degrees. The antenna gain for angles greater than 40° is –10 dBi. With an uplink power density of –52 dBW/Hz (or –16 dBW/4kHz), the eirp radiated toward the horizon is –16 – 10 = -26 dBW/4kHz.

25.204 (b)

"In the band 13.75–14 GHz, an earth station in the fixed-satellite service shall have a minimum antenna diameter of 4.5 m and the e.i.r.p. of any emission should be at least 68 dBW and should not exceed 85 dBW. The e.i.r.p. density of emissions from any earth station in the FSS operating with a space station in geostationary-satellite orbit shall not exceed 71 dBW in any 6 MHz band from 13.77 to 13.78 GHz. The e.i.r.p. density of emissions from any earth station in the FSS operating with a space station in non-geostationary- satellite orbit shall not exceed 51 dBW in any 6 MHz band from 13.77 to 13.78 GHz. Automatic power control may be used to increase the e.i.r.p. density in the 6 MHz band in this frequency range to compensate for rain attenuation, to the extent that the power flux-density at the FSS space station does not exceed the value resulting from use by an earth station of an e.i.r.p. of 71 dBW or 51 dBW, as appropriate, in the 6 MHz band in clear-sky conditions."

The feederlink earth station uses an antenna with a diameter of 5 meters. The eirp of the widest bandwidth signal (4M92G7W) is 69.9 dBW. The narrower emissions occupy the entire transponder using the same power density (-52 dBW/Hz) and thus produce equivalent interference levels.

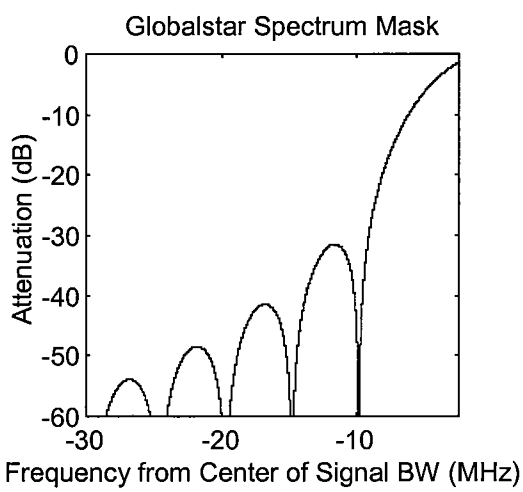
The earth station transmits within the 13.795 – 13.995 GHz band. The minimum frequency offset between the earth station emissions and the 13.77 – 13.78 GHz band is 15 MHz. The earth station transmit signal characteristics are modeled as mask based on a raised cosine filter (this representation was taken from recent work in ITU WP4A):

$$A = \frac{\left[\sin c\left(\frac{f}{B_N}\right)\right]^2}{\left[1-\left(\frac{f}{B_N}\right)^2\right]^2}$$

where:

A	=	attenuation
f	=	frequency from center of the necessary bandwidth
B_N	=	necessary bandwidth

Using this model the frequency spectrum for the 4.92 MHz signal is calculated and plotted below:



13.78 GHz is separated from the center frequency of the uplink signal by about 20 MHz. From the graph above, the attenuation is at least 30 dB, which reduces the eirp in the 13.77 – 13.78 GHz band to well below 71 dBW/6 MHz.

Additional Requirements relating to Operations in the 13.75-14 GHz Band

FCC's Report and Order on 13.75-14 GHz

"A power flux density ("PFD") value of -167 dB(W/m2/4 kHz) is required to protect radiolocation receivers; geographical separation of the FSS earth stations from the radar must be sufficient to yield this value.".

Since the majority of the U.S. government's radiolocation receivers are located along the coasts of the United States, the analysis evaluates the pfd at the coastal areas.

The pfd of the earth station toward the horizon given by:

$$PFD = PD_{ESTX} + G_{ESTX}(\theta) + L_P - 10\log(\frac{\lambda^2}{4\pi})$$

where:

PD_{ESTX}	=	earth station transmit power density, dBW in 4 kHz
$G_{ESTX}(\theta)$	=	earth station transmit antenna gain, dBi
θ	=	off-axis pointing angle, degrees
L_P	=	propagation path loss, dB
λ	=	wavelength, m

The earth station transmit power density is –52 dBW/Hz (or –16 dBW/4kHz). The elevation angle at Clifton, TX is around 52° which gives an antenna gain of –10 dB toward the horizon.

Clifton is located approximately 390 km from the coast of the Gulf of Mexico. The propagation path loss is calculated using the US DOC NTIA/ITS Irregular Terrain Model (Longley-Rice) assuming a smooth earth (no terrain blocking) and is less than -230 dB (the output of the ITM program is included as Appendix B). So the pfd is:

$$PFD = -52 + 10\log(4kHz) - 10 - 230 + 44.4 = -211.6$$

Compliance with Rules Applicable to the 11.45-11.7 GHz Band

25.208 (b)

"In the bands 10.95–11.2 and 11.45–11.7 GHz for GSO FSS space stations and 10.7–11.7 GHz for NGSO FSS space stations, the power flux-density at the Earth's surface produced by emissions from a space station for all conditions and for all methods of modulation shall not exceed the lower of the following values:

(1) -150 dB(W/m^2) in any 4 kHz band for angles of arrival between 0 and 5 de-grees above the horizontal plane; -150+(δ –5)/2 dB(W/m^2) in any 4 kHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and -140 dB(W/m^2) in any 4 kHz band for angles of arrival between 25 and 90 degrees above the horizontal plane; or

(2) -126 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane; -126+(δ –5)/2 dB(W/m^2) in any 1 MHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and -116 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

NOTE TO PARAGRAPH (b): These limits relate to the power flux density, which would be obtained under assumed free-space propagation conditions."

The pfd is calculated as follows:

$$PFD = PD_{SSTX} + G_{SSTX}(\theta) + 10 * \log10(\frac{1}{4\pi rr^2})$$

where:

PD_{SSTX}	=	space station transmit power density, dBW in either 4 kHz or 1 MHz
$G_{SSTX}(\theta)$	=	space station transmit antenna gain, dBi
θ	=	off-nadir pointing angle, degrees

The range, r, is given by:

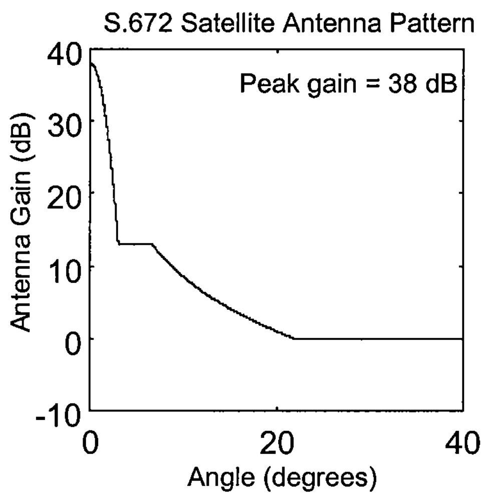
$$r = \sqrt{R_{GSO}^2 - R_{EARTH}^2 \cos^2(\delta)} - R_{EARTH} \sin(\delta)$$

where δ is the elevation angle.

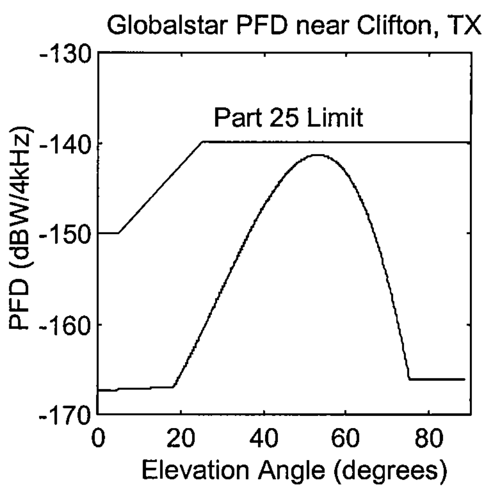
The relationship between δ and θ is given by:

$$\sin(90 + \delta) / R_{GSO} = \sin(\theta) / R_{EARTH}$$

The space station transmit antenna gain is modeled using ITU-R Recommendation S.672 (peak gain = 38, sidelobe level = -25, α = 2, b = 6.32):



The space station beam is assumed to be pointing at the feederlink earth station. The pfd and associated elevation angles are calculated at latitudes north and south of the earth station location to generate the following plot:



For a 1 MHz bandwidth, both the transmit power density and the Part 25 limit increase by 10*log(1 MHz/4 kHz) = 24 dB. Thus, the 1 MHz limit is met by exactly the same margin as shown above.

Limitation of Use of 11.45-11.7 GHz Band to International Systems

Part 25. 202 (a)(1) of the Commission's rules limit the use of the 11.45-11.7 GHz band to international systems.

The reason for this restriction is the fact that this band is also allocated, in the U.S., on a co-primary basis, to the Fixed Service.

As discussed in Globalstar's application, a waiver of this rule is respectfully requested. Under the Commission's rules and policies, rule waivers may be granted for good cause shown and if in the public interest.

The instant case provides substantial basis for a waiver. First, the system will be both international and domestic. Second, only one earth station will be employed in the United States operating in this frequency band. Third, this large, gateway station can be located and/or shielded so as to minimize any possible future restrictions on implementation of Fixed Service systems. Any necessary coordination with Fixed Service systems will be undertaken.

Appendix A

Globalstar Earth Station Antenna Reference Gain Pattern

The following expressions are used to model the earth station antenna considered in this analysis.

$$G(j) = G_{\max} - 2.5\times10^{-3}\left(\frac{D}{l}j\right) \qquad \text{for} \quad 0 < j < j_m$$

$$G(j) = G_1 \qquad \text{for} \quad j_m \le j < j_r$$

$$G(j) = 29 - 25\log j \qquad \text{for} \quad j_r \le j < 48°$$

$$G(j) = -10 \qquad \text{for} \quad 48° \le j \le 180°$$

where:

D = antenna diameter, meters
l = wavelength, meters
j = off-axis angle of the antenna, degrees
G_1 = gain of the first sidelobe = $2 + 15\log\frac{D}{l}$
j_m, j_r = angles at which these curves intersect, degrees

Appendix B

Output of Irregular Terrain Model (ITM) Program

```
Globalstar Uplink PFD at coastline

         Frequency       13750. MHz
   Antenna heights   200.0     50.0 m
 Effective heights   200.0     50.0 m (siting=0,0)
  Terrain, Delta H          0. m
Pol=1, eps=15., sgm=  .005 S/m
Clim=5, Ns= 301.N-units, K= 1.333

Broadcast service: required reliability- 50.0% time, 50.0% locations

Estimated quantiles of basic transmission loss (dB)
```

Dist km	Free space	with confidence 50.0	90.0	10.0
350.0	166.1	241.6	248.0	235.1
360.0	166.3	242.6	249.1	236.1
370.0	166.6	243.7	250.1	237.2
380.0	166.8	244.7	251.2	238.2
390.0	167.0	245.7	252.2	239.2
400.0	167.3	246.7	253.2	240.2
410.0	167.5	247.7	254.2	241.2
420.0	167.7	248.7	255.1	242.2
430.0	167.9	249.6	256.1	243.2
440.0	168.1	250.6	257.0	244.2

ATTACHMENT 2

ATTACHMENT 2

GLOBALSTAR ADJACENT SATELLITE INTERFERENCE STUDY

1. Overview

This study addresses the co-frequency compatibility between the Globalstar feederlink located at 99 degrees west longitude and co-frequency networks within 8 degrees of this location as identified in the ITU Space Network List. The pertinent ITU publications for these systems are:

USASAT-40M (107W)	AR11/C/3488	CPUB 09/04/00
USASAT-35I (101W)	AR11/C/3373	CPUB 04/13/00
LATAMSAT-2 (97W)	AR11/C/2460	CPUB 03/10/95
USASAT-23F (95W)	AR11/C/3558	CPUB 01/09/01

The B-SAT-H network, located at 92 W, is also identified in the Space Network List. However, this network does not have overlapping coverage with the Globalstar feederlink and so interference between this network and Globalstar is negligible.

The analysis shows that interference into the four systems is in general very low. In all cases the uplink interference meets the protection requirement. The interference into the USASAT-35I downlink exceeds the protection criteria for the smallest antenna size. This is mainly due to the relatively poor off-axis discrimination of the antenna gain for this small antenna.

The interference level into the Globalstar system in some cases exceeds the protection criteria on both the uplink and downlink. This is due to a large imbalance in power levels between the wanted and interfering signals that is unlikely to occur in actual operation.

2. System Characteristics

The parameters for the satellite systems needed for performing the interference studies are derived from the filings identified above and from link data representative of the expected Globalstar feederlink performance.

Summaries of the uplink and downlink emission characteristics for all systems are shown in Annex 1. Included are the minimum EIRP and minimum power density for each emission used in the calculations of interference into each system.

3. Protection Criteria

The interference protection criterion used in this analysis is a C/I of 24 dB. This value is consistent with the recommendations of the FCC Reduced Orbital Spacing Advisory Committee.

4. Analysis Methodology

The following equations describe the modeling of interference used in this analysis.

$$(C/I)_U = P_t + G_1 - \Delta L_U - p_t - g_1(\theta) + \Delta G_2 + Y_U$$

and

$$(C/I)_D = E + G_4 - \Delta L_D - e - G_4(\theta) + Y_D$$

where:

$(C/I)_{U,D}$:	up- and down-link wanted-to-interfering ratios (dB);
P_t, p_t:	transmit powers of wanted and interfering carriers delivered to the associated earth-station antenna (dBW);
G_1, G_4:	transmit and receive antenna gains of one or more wanted earth stations;
ΔL_U:	path loss differential in the uplink to the wanted satellite from the two earth stations, $\Delta L = L_{wanted} - L_{interfering}$ (dB);
ΔL_D:	path loss differential in the downlink to the wanted earth station from the two satellites, ΔL as above (dB);
$g_1(\theta)$:	antenna gain component at the unwanted earth station towards the wanted satellite (dB);
θ:	topocentric angle satellite spacing at the interfering earth station;
ΔG_2:	differential in receive antenna gains at the wanted satellite toward the two earth stations, $\Delta G2 = G_{2,wanted} - G_{2, interfering}$ (dB);
Y_U:	minimum polarization discrimination between interfering uplink carrier and wanted satellite receive antenna (dB);
Y_D:	minimum polarization discrimination between interfering downlink carrier and wanted earth station receive antenna (dB);
E, e:	e.i.r.p. of the wanted and interfering carriers in the direction of the wanted earth station (dBW);
$G_4(\theta)$:	antenna gain component at the wanted earth station towards the interfering satellite (dB).

Note: powers and antenna gains associated with the wanted network are in capitals, those associated with the interfering network use lower case letters. Suffixes associated with the various antenna gains follow the signal path, viz.: 1 = earth station transmit, 2 = satellite receive, 3 = satellite transmit, 4 = earth station receive.

5. Interference Calculations

The tables presented here provide the results of interference calculations for 4 cases:

Case 1 – USASAT-40M and Globalstar
Case 2 – USASAT-35I and Globalstar
Case 3 – LATAMSAT-2 and Globalstar
Case 4 – USASAT-23F and Globalstar

Details of the interference calculations are provided in Annex 2, which contains the worst-case link for each antenna size. Assumptions made in these calculations include:

- The wanted and interfering carriers have the same center frequencies (i.e., interference reduction due to carrier frequency offset is ignored).
- All signals are assumed to be multiple channel per carrier. This assumption means that the wanted signal bandwidth is always fully occupied by interfering signals.
- The wanted carrier radiates at the minimum power level while the interfering carrier radiates at the maximum power level.
- The signal transmit power is adjusted to ensure that the specified C/N objectives are met (if the given power level does not allow the link to close).
- The wanted earth station is located at the –2 dB contour of the wanted space station antenna. The interfering earth station is located at the peak of the space station beam.
- A pointing error of 0.05 degrees is applied to reduce the carrier power.
- The polarization discrimination between the interfering signal and the wanted receive antenna is zero.

These assumptions lead to quite conservative results since in practice satellites likely will have carrier frequencies which are offset from each other, will transmit at similar power levels, and will have some polarization discrimination.

5.1 Case 1 - USASAT-40M and Globalstar

Table 1 shows the range of C/I values for all combinations of co-frequency emissions between USASAT-40M and Globalstar.

Table 1
Summary of Interference between USASAT-40M and Globalstar

Case 1	ES Gain	C/I Range		Margin Range	
Uplink into USASAT-40M	48.8	41.1	47.4	17.1	23.4
	54.4	40.9	47.4	16.9	23.4
	58.7	48.5	81.5	24.5	57.5
Downlink into USASAT-40M	39.4	36.8	37.0	12.8	13.0
	47.5	37.4	38.7	13.4	14.7
	53.5	40.8	44.6	16.8	20.6
Uplink into Globalstar	55.0	11.6	17.2	-12.4	-6.8
Downlink into Globalstar	53.4	26.0	26.2	2.0	2.2

As can be seen from this table, the interference levels from Globalstar into the USASAT-40M system result in a C/I in excess of the 24 dB criteria in both the uplink and downlink directions. The interference levels into the Globalstar system in some cases does not meet the assumed protection criteria. It should be emphasized that the wanted carrier is assumed to be at the minimum power density level while the interfering carrier is assumed to be at the maximum power density level. This results in the wanted carrier operating substantially below the power level assumed for the interfering carrier. This large imbalance in power leads to interference levels that will probably not be seen in actual operation since the systems are likely to actually operate at similar power levels.

5.2 Case 2 - USASAT-35I and Globalstar

Table 2 shows the range of C/I values for all combinations of co-frequency emissions between USASAT-35I and Globalstar.

Table 2
Summary of Interference between USASAT-35I and Globalstar

Case 2	ES Gain	C/I Range		Margin Range	
Uplink into USASAT-35I	54.2	41.6	58.5	17.6	34.5
	56.8	44.0	60.9	20.0	36.9
	60.2	46.9	63.7	22.9	39.7
	61.9	48.1	65.0	24.1	41.0
Downlink into USASAT-35I	37.8	17.8	30.4	-6.2	6.4
	39.8	27.3	37.1	3.3	13.1
	44.9	33.7	43.5	9.7	19.5
	48.4	37.2	47.0	13.2	23.0
	52.8	41.5	55.3	17.5	31.3
	55.3	43.8	53.6	19.8	29.6
	58.8	46.9	56.7	22.9	32.7
	60.6	48.3	58.1	24.3	34.1
Uplink into Globalstar	55.0	8.0	20.5	-16.0	-3.5
Downlink into Globalstar	53.4	8.3	22.1	-15.7	-1.9

The results for this case are similar to case 1. The uplink interference from Globalstar into USASAT-35I meets or exceeds the assumed C/I protection criteria for all antenna sizes and signal designators. However, on the downlink the interference into USASAT-35I does not meet the protection criteria for the smallest antenna. This is mainly due to the relatively poor off-axis discrimination of the antenna gain for this small antenna. As in case 1, the interference level into the Globalstar system in some cases does not meet the assumed protection criteria of a C/I of 24 dB on both the uplink and downlink. And again, this is due to a large imbalance in power levels between the wanted and interfering signals that is unlikely to occur in actual operation.

5.3 Case 3 – LATAMSAT-2 and Globalstar

Table 3 shows the range of C/I values for all combinations of co-frequency emissions between LATAMSAT-2 and Globalstar.

Table 3
Summary of Interference between LATAMSAT-2 and Globalstar

Case 3	ES Gain	C/I Range		Margin Range	
Uplink into LATAMSAT-2	54.0	54.0	66.9	30.0	42.9
	56.5	55.0	66.6	31.0	42.6
Downlink into LATAMSAT-2	42.5	32.0	32.1	8.0	8.1
	49.0	38.4	38.6	14.4	14.6
Uplink into Globalstar	55.0	-1.2	13.0	-25.2	-11.0
Downlink into Globalstar	53.4	20.8	21.0	-3.2	-3.0

The interference levels into the LATAMSAT-2 system meet or exceed the assumed protection criteria. As in the previous cases, the interference levels into the Globalstar uplink do not meet the criteria of 24 dB.

5.4 Case 4 – USASAT-23F and Globalstar

Table 4 shows the range of C/I values for all combinations of co-frequency emissions between USASAT-23F and Globalstar.

Table 4
Summary of Interference between USASAT-23F and Globalstar

Case 4	ES Gain	C/I Range		Margin Range	
Uplink into USASAT-23F	54.4	53.2	64.6	29.2	40.6
	58.3	52.8	64.2	28.8	40.2
	62.2	51.9	63.3	27.9	39.3
	63.7	51.2	82.7	27.2	58.7
Downlink into USASAT-23F	35.5	26.8	28.6	2.8	4.6
	39.0	27.3	42.1	3.3	18.1
	40.7	29.0	43.8	5.0	19.8
	44.7	32.1	38.1	8.1	14.1
	45.0	33.3	48.0	9.3	24.0
	47.2	40.5	40.5	16.5	16.5
	51.3	39.5	54.2	15.5	30.2
	53.0	41.1	55.9	17.1	31.9
	56.8	44.6	59.4	20.6	35.4
	60.7	47.9	62.6	23.9	38.6
	61.9	47.9	57.6	23.9	33.6
	62.2	48.9	63.7	24.9	39.7
Uplink into Globalstar	55.0	0.0	31.5	-24.0	7.5
Downlink into Globalstar	53.4	16.7	32.4	-7.3	8.4

As can be seen from this table, the interference levels into the USASAT-23F system meet or exceed the protection criteria of 24 dB in both the uplink and downlink directions. The interference level into the Globalstar system in some cases fails to meet the assumed protection criteria.

5.5 Summary of Results

The worst case margin for each case considered here is summarized in Table 5.

Table 5 – Summary of Results

Link Direction	Case 1: USASAT-40M		Case 2: USASAT-35I	
	Minimum Margin (dB)	Percentage of Cases with Negative Margin	Minimum Margin (dB)	Percentage of Cases with Negative Margin
Uplink into other system	16.9	0%	17.6	0%
Downlink into other system	12.8	0%	-6.2	6%
Uplink into Globalstar	-12.4	100%	-16.0	100%
Downlink into Globalstar	2.0	0%	-15.7	100%
Link Direction	Case 3: LATAMSAT-2		Case 4: USASAT-23F	
	Minimum Margin (dB)	Percentage of Cases with Negative Margin	Minimum Margin (dB)	Percentage of Cases with Negative Margin
Uplink into other system	30.0	0%	27.2	0%
Downlink into other system	8.0	0.0	2.8	0%
Uplink into Globalstar	-25.2	100%	-24.0	41%
Downlink into Globalstar	-3.2	100%	-7.3	20%

6. Conclusions

The analysis shows that interference from Globalstar into the four systems is in general very low. In all cases the uplink interference meets the protection requirement. The interference into the USASAT-35I downlink does not meet the protection criteria for the smallest antenna size. This is mainly due to the relatively poor off-axis discrimination of the antenna gain for this small antenna.

The interference level into the Globalstar system in some cases does not meet the protection criteria on both the uplink and downlink. This is due to a large imbalance in power levels between the wanted and interfering signals that is unlikely to occur in actual operation.

Annex 1 - Emission Characteristics

Globalstar Emission Characteristics

Globalstar Uplinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
13800	1M23G7W	47.9	-68.0	55.0
14000	2M46G7W	50.9	-68.0	
	4M92G7W	53.9	-68.0	

Globalstar Downlinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
11450	1M23G7W	25.9	-75.0	53.4
11700	2M46G7W	28.9	-75.0	
	4M92G7W	31.9	-75.0	

USASAT-40M Emission Characteristics

USASAT-40M Uplinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
13750.5	100KN0N	75.2	-33.5	48.8
13751.75	1M50G9D	87.0	-33.5	54.4
13875	240MG1D	102.7	-29.9	58.7

USASAT-40M Downlinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
11450.5	100KN0N	37.1	-49.9	39.4
11451.75	1M50G9D	48.8	-49.9	47.5
11575	214MG1D	70.4	-49.9	53.5
	240MG1D	70.9	-49.9	

USASAT-35I Emission Characteristics

USASAT-35I Uplinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
13875	15M0M7D	83.1	-50.6	54.2
13955	24M0G7W	83.6	-52.5	56.8
	29M0G7W	83.6	-52.1	60.2
	36M0F3F	83.6	-41.3	61.9
	36M0F8W	83.6	-53.8	
	48M0G1D	83.6	-51.1	
	72M0G1D	83.6	-52.6	

USASAT-35I Downlinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
11575	100KG1D	26.6	-53.3	37.8
11655	15M0M7D	52.0	-48.5	39.8
	1M60G1D	38.6	-53.5	44.9
	24M0G7W	52.0	-50.3	48.4
	29M0G7W	52.0	-51.3	52.8
	36M0F3F	52.0	-45.6	55.3
	36M0F8W	52.0	-52.1	58.8
	48M0G1D	52.0	-53.6	60.6
	50K0F3F	23.6	-52.0	
	72M0G1D	52.0	-55.2	

LATAMSAT-2 Emission Characteristics

LATAMSAT-2 Uplinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
13775	32M2G7W	85.0	-46.6	54.0
13795	32M2G7W	83.7	-45.3	56.5
13815	36M0F8W	84.7	-35.3	
13835	36M0F8W	84.7	-37.8	
13855	45K0G1X	68.0	-32.5	
13875	45K0G1X	68.0	-35.1	
13895				
13915				
13935				
13955				
13975				

LATAMSAT-2 Downlinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
11480	32M2G7W	52.1	-73.0	42.5
11500	36M0F8W	44.0	-73.0	49.0
11520	45K0G1X	23.6	-73.0	
11540				
11560				
11580				
11600				
11620				
11640				
11680				

USASAT-23F Emission Characteristics

USASAT-23F Uplinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
13751.50	12M0G7W	77.6	-46.8	54.4
13770.38	1M45G7W	68.6	-46.0	58.3
13799.54	24M0F9W	80.6	-36.8	62.2
13828.70	24M0G7W	80.6	-46.8	63.7
13857.86	600KF9D	86.5	-26.0	
13887.02	6M00G7W	74.6	-46.8	
13916.18				
13945.34				
13974.50				
13998.50				

USASAT-23F Downlinks				
Frequency (MHz)	Signal Designator	EIRP (dBW)	Power Density (dBW/Hz)	Earth Station Antenna Gain (dBi)
11451.25	120KF9D	26.1	-57.7	35.5
11460.00	12M0G7W	47.2	-55.8	39.0
11480.88	1M45G7W	35.1	-58.0	40.7
11510.04	200KG7W	33.5	-51.2	44.7
11539.20	24M0F9W	51.8	-44.2	45.0
11568.36	400KG7W	33.4	-53.8	47.2
11597.52	6M00G7W	41.2	-58.8	51.3
11626.68	89K6G7W	27.4	-53.8	53.0
11655.84	933KG7W	38.7	-52.7	56.8
11685.00				60.7
				61.9
				62.2

Annex 2 – Interference Calculations

This annex contains sample calculations of the interference between the systems studied here. Only the worst case interference condition is shown for each antenna size of the wanted system. Thus the following tables summarize only a small fraction of the calculations performed for this analysis.

Worst Case Uplink Interference from Globalstar into USASAT-40M

Interfering network (Globalstar)	Case 1			
Space station longitude	+E,-W	-99.0	-99.0	-99.0
Beam		RFL	RFL	RFL
Emission designator		1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	13800	13800	13800
Bandwidth	MHz	1.23	1.23	1.23
ESTX max power density	dBW/Hz	-68.0	-68.0	-68.0
ESTX peak gain	dB	55.0	55.0	55.0
ESTX max EIRP	dBW	47.9	47.9	47.9
Receive system noise temperature	K	512	512	512
C/N	dB	21.6	21.6	21.6
theta (off-axis angle toward wss)	degree	9.1	9.1	9.1
ESTX gain(theta)	dB	5.0	5.0	5.0
Space loss (toward wss)	dB	-206.6	-206.6	-206.6
Wanted SSRX peak gain	dB	37.0	37.0	37.0
Wanted SSRX contour (toward ies)	dB	0	0	0
Interference power density	dBW/Hz	-232.6	-232.6	-232.6
Wanted network (USASAT-40M)				
Space station longitude	+E,-W	-107.0	-107.0	-107.0
Beam		H2R	H2R	H2R
Emission designator		240MG1D	240MG1D	1M50G9D
Frequency	MHz	13875	13875	13751.75
Bandwidth	MHz	240	240	1.5
ESTX min power density	dBW/Hz	-68.4	-74.0	-70.3
ESTX peak gain	dB	48.8	54.4	58.7
ESTX min EIRP	dBW	64.2	64.2	50.1
theta (off-axis angle toward wss)	degree	0.1	0.1	0.1
ESTX gain(theta)	dB	48.7	54.1	58.0
Space loss (toward wss)	dB	-206.8	-206.8	-206.7
SSRX peak gain	dB	37.0	37.0	37.0
SSRX contour (toward wes)	dB	-2	-2	-2
Receive system noise temperature	K	365	365	900
C/N	dB	11.5	11.3	15.0
Wanted carrier power density	dBW/Hz	-191.5	-191.6	-184.1
Interference				
C/I	dB	41.1	40.9	48.5
C/I required	dB	24.0	24.0	24.0
C/I margin	dB	17.1	16.9	24.5

Worst Case Downlink Interference from Globalstar into USASAT-40M

Interfering network (Globalstar)	Case 1			
Space station longitude	+E,-W	-99.0	-99.0	-99.0
Beam		TFL	TFL	TFL
Emission designator		1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	11450.0	11450.0	11450.0
Bandwidth	MHz	1.23	1.23	1.23
SSTX max power density	dBW/Hz	-75.0	-75.0	-75.0
SSTX peak gain	dB	40.0	40.0	40.0
SSTX max EIRP	dBW	25.9	25.9	25.9
PFD	dBW/m^2-4kHz	-161.3	-161.3	-161.3
Receive system noise temperature	K	120	120	120
C/N	dB	21.0	21.0	21.0
SSTX contour (toward wes)	dB	0.0	0.0	0.0
Space loss (toward wes)	dB	-205.1	-205.1	-205.1
Wanted ESRX peak gain	dB	39.4	47.5	53.5
theta (off-axis angle toward wss)	degree	8.9	8.9	8.9
Wanted ESRX gain(theta)	dB	5.2	5.2	5.2
Interference power density	dBW/Hz	-234.9	-234.9	-234.9
Wanted network (USASAT-40M)				
Space station longitude	+E,-W	-107.0	-107.0	-107.0
Beam		H2AR	H4AR	H2AR
Emission designator		214MG1D	240MG1D	1M50G9D
Frequency	MHz	11575.0	11575.0	11451.8
Bandwidth	MHz	214	240	1.5
SSTX min power density	dBW/Hz	-67.2	-67.5	-77.2
SSTX peak gain	dB	37.0	29.8	37.0
SSTX min EIRP	dBW	45.3	46.1	4.9
PFD	dBW/m^2-4kHz	-164.5	-164.2	-183.3
SSTX contour (toward wes)	dB	-2.0	-2.0	-2.0
Space loss (toward wes)	dB	-205.2	-205.2	-205.1
ESRX peak gain	dB	39.4	47.5	53.5
theta (off-axis angle toward wss)	degree	0.0	0.0	0.0
ESRX gain(theta)	dB	39.4	47.4	53.3
Receive system noise temperature	K	90	75	90
C/N	dB	11.0	12.4	15.0
Wanted carrier power density	dBW/Hz	-198.1	-197.5	-194.1
Interference				
C/I	dB	36.8	37.4	40.8
C/I required	dB	24.0	24.0	24.0
C/I margin	dB	12.8	13.4	16.8

Worst Case Uplink Interference from USASAT-40M into Globalstar

Interfering network (USASAT-40M)	Case 1	
Space station longitude	+E,-W	-107.0
Beam		H2R
Emission designator		240MG1D
Frequency	MHz	13875
Bandwidth	MHz	240
ESTX max power density	dBW/Hz	-29.9
ESTX peak gain	dB	48.8
ESTX max EIRP	dBW	102.7
Receive system noise temperature	K	365
C/N	dB	50.0
theta (off-axis angle toward wss)	degree	8.9
ESTX gain(theta)	dB	5.2
Space loss (toward wss)	dB	-206.8
Wanted SSRX peak gain	dB	40.0
Wanted SSRX contour (toward ies)	dB	0
Interference power density	dBW/Hz	-191.5
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		RFL
Emission designator		1M23G7W
Frequency	MHz	13800
Bandwidth	MHz	1.23
ESTX min power density	dBW/Hz	-68.0
ESTX peak gain	dB	55.0
ESTX min EIRP	dBW	47.9
theta (off-axis angle toward wss)	degree	0.1
ESTX gain(theta)	dB	54.7
Space loss (toward wss)	dB	-206.6
SSRX peak gain	dB	40.0
SSRX contour (toward wes)	dB	0
Receive system noise temperature	K	512
C/N	dB	21.6
Wanted carrier power density	dBW/Hz	-179.9
Interference		
C/I	dB	11.6
C/I required	dB	24.0
C/I margin	dB	-12.4

Worst Case Downlink Interference from USASAT-40M into Globalstar

Interfering network (USASAT-40M)	Case 1	
Space station longitude	+E,-W	-107.0
Beam		H2AR
Emission designator		214MG1D
Frequency	MHz	11575.0
Bandwidth	MHz	214
SSTX max power density	dBW/Hz	-49.9
SSTX peak gain	dB	37.0
SSTX max EIRP	dBW	70.4
PFD	dBW/m^2-4kHz	-139.4
Receive system noise temperature	K	90
C/N	dB	28.3
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
Wanted ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	9.1
Wanted ESRX gain(theta)	dB	5.0
Interference power density	dBW/Hz	-212.9
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		TFL
Emission designator		1M23G7W
Frequency	MHz	11700.0
Bandwidth	MHz	1.23
SSTX min power density	dBW/Hz	-75.0
SSTX peak gain	dB	40.0
SSTX min EIRP	dBW	25.9
PFD	dBW/m^2-4kHz	-161.3
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	0.0
ESRX gain(theta)	dB	53.2
Receive system noise temperature	K	120
C/N	dB	20.8
Wanted carrier power density	dBW/Hz	-187.0
Interference		
C/I	dB	26.0
C/I required	dB	24.0
C/I margin	dB	2.0

Worst Case Uplink Interference from Globalstar into USASAT-35I

Interfering network (Globalstar)	Case 2				
Space station longitude	+E,-W	-99.0	-99.0	-99.0	-99.0
Beam		RFL	RFL	RFL	RFL
Emission designator		1M23G7W	1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	13800	13800	13800	13800
Bandwidth	MHz	1.23	1.23	1.23	1.23
ESTX max power density	dBW/Hz	-68.0	-68.0	-68.0	-68.0
ESTX peak gain	dB	55.0	55.0	55.0	55.0
ESTX max EIRP	dBW	47.9	47.9	47.9	47.9
Receive system noise temperature	K	512	512	512	512
C/N	dB	21.9	21.9	21.9	21.9
theta (off-axis angle toward wss)	degree	2.3	2.3	2.3	2.3
ESTX gain(theta)	dB	20.0	20.0	20.0	20.0
Space loss (toward wss)	dB	-206.6	-206.6	-206.6	-206.6
Wanted SSRX peak gain	dB	31.6	31.6	31.6	31.6
Wanted SSRX contour (toward ies)	dB	0	0	0	0
Interference power density	dBW/Hz	-223.0	-223.0	-223.0	-223.0
Wanted network (USASAT-35I)					
Space station longitude	+E,-W	-101.0	-101.0	-101.0	-101.0
Beam		REN	REN	REN	REN
Emission designator		29M0G7W	29M0G7W	29M0G7W	29M0G7W
Frequency	MHz	13875	13875	13875	13875
Bandwidth	MHz	29	29	29	29
ESTX min power density	dBW/Hz	-58.1	-58.1	-58.1	-58.1
ESTX peak gain	dB	54.2	56.8	60.2	61.9
ESTX min EIRP	dBW	69.9	72.5	75.9	77.6
theta (off-axis angle toward wss)	degree	0.1	0.1	0.1	0.1
ESTX gain(theta)	dB	53.9	56.3	59.2	60.4
Space loss (toward wss)	dB	-206.8	-206.8	-206.8	-206.8
SSRX peak gain	dB	31.6	31.6	31.6	31.6
SSRX contour (toward wes)	dB	-2	-2	-2	-2
Receive system noise temperature	K	900	900	900	900
C/N	dB	17.7	20.1	23.0	24.2
Wanted carrier power density	dBW/Hz	-181.3	-178.9	-176.1	-174.9
Interference					
C/I	dB	41.6	44.0	46.9	48.1
C/I required	dB	24.0	24.0	24.0	24.0
C/I margin	dB	17.6	20.0	22.9	24.1

Worst Case Downlink Interference from Globalstar into USASAT-35I

Interfering network (Globalstar)	Case 2								
Space station longitude	+E,-W	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0
Beam		TFL	TFL	TFL	TFL	TFL	TFL	TFL	TFL
Emission designator		1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	11450.0	11450.0	11450.0	11450.0	11450.0	11450.0	11450.0	11450.0
Bandwidth	MHz	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23
SSTX max power density	dBW/Hz	-75.0	-75.0	-75.0	-75.0	-75.0	-75.0	-75.0	-75.0
SSTX peak gain	dB	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
SSTX max EIRP	dBW	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9
PFD	dBW/m^2-4kHz	-161.3	-161.3	-161.3	-161.3	-161.3	-161.3	-161.3	-161.3
Receive system noise temperature	K	120	120	120	120	120	120	120	120
C/N	dB	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3
SSTX contour (toward wes)	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space loss (toward wes)	dB	-205.1	-205.1	-205.1	-205.1	-205.1	-205.1	-205.1	-205.1
Wanted ESRX peak gain	dB	37.8	39.8	44.9	48.4	52.8	55.3	58.8	60.6
theta (off-axis angle toward wss)	degree	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Wanted ESRX gain(theta)	dB	26.4	21.8	20.4	20.4	20.4	20.4	20.4	20.4
Interference power density	dBW/Hz	-213.6	-218.3	-219.7	-219.7	-219.7	-219.7	-219.7	-219.7
Wanted network (USASAT-35I)									
Space station longitude	+E,-W	-101.0	-101.0	-101.0	-101.0	-101.0	-101.0	-101.0	-101.0
Beam		TES	TEN	TEN	TEN	TEN	TEN	TEN	TEN
Emission designator		100KG1D	72M0G1D	72M0G1D	72M0G1D	72M0G1D	72M0G1D	72M0G1D	72M0G1D
Frequency	MHz	11575.0	11575.0	11575.0	11575.0	11575.0	11575.0	11575.0	11575.0
Bandwidth	MHz	0.1	72	72	72	72	72	72	72
SSTX min power density	dBW/Hz	-58.0	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2
SSTX peak gain	dB	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6
SSTX min EIRP	dBW	20.9	52.0	52.0	52.0	52.0	52.0	52.0	52.0
PFD	dBW/m^2-4kHz	-154.1	-150.1	-150.1	-150.1	-150.1	-150.1	-150.1	-150.1
SSTX contour (toward wes)	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Space loss (toward wes)	dB	-205.2	-205.2	-205.2	-205.2	-205.2	-205.2	-205.2	-205.2
ESRX peak gain	dB	37.8	39.8	44.9	48.4	52.8	55.3	58.8	60.6
theta (off-axis angle toward wss)	degree	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ESRX gain(theta)	dB	37.8	39.8	44.9	48.3	52.6	55.0	58.1	59.5
Receive system noise temperature	K	120	120	120	120	120	120	120	120
C/N	dB	12.0	16.8	21.9	25.3	29.6	32.0	35.1	36.5

Wanted carrier power density	dBW/Hz	-195.8	-191.0	-185.9	-182.5	-178.2	-175.8	-172.7	-171.3
Interference									
C/I	dB	17.8	27.3	33.7	37.2	41.5	43.8	46.9	48.3
C/I required	dB	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
C/I margin	dB	-6.2	3.3	9.7	13.2	17.5	19.8	22.9	24.3

Worst Case Uplink Interference from USASAT-35I into Globalstar

Interfering network (USASAT-35I)	Case 2	
Space station longitude	+E,-W	-101.0
Beam		REN
Emission designator		36M0F3F
Frequency	MHz	13955
Bandwidth	MHz	36
ESTX max power density	dBW/Hz	-41.3
ESTX peak gain	dB	54.2
ESTX max EIRP	dBW	75.9
Receive system noise temperature	K	900
C/N	dB	34.5
theta (off-axis angle toward wss)	degree	2.2
ESTX gain(theta)	dB	20.4
Space loss (toward wss)	dB	-206.8
Wanted SSRX peak gain	dB	40.0
Wanted SSRX contour (toward ies)	dB	0
Interference power density	dBW/Hz	-187.7
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		RFL
Emission designator		1M23G7W
Frequency	MHz	14000
Bandwidth	MHz	1.23
ESTX min power density	dBW/Hz	-68.0
ESTX peak gain	dB	55.0
ESTX min EIRP	dBW	47.9
theta (off-axis angle toward wss)	degree	0.0
ESTX gain(theta)	dB	55.0
Space loss (toward wss)	dB	-206.7
SSRX peak gain	dB	40.0
SSRX contour (toward wes)	dB	0
Receive system noise temperature	K	512
C/N	dB	21.8
Wanted carrier power density	dBW/Hz	-179.7
Interference		
C/I	dB	8.0
C/I required	dB	24.0
C/I margin	dB	-16.0

Worst Case Downlink Interference from USASAT-35I into Globalstar

Interfering network (USASAT-35I)	Case 2	
Space station longitude	+E,-W	-101.0
Beam		TES
Emission designator		36M0F3F
Frequency	MHz	11575.0
Bandwidth	MHz	36
SSTX max power density	dBW/Hz	-41.6
SSTX peak gain	dB	31.6
SSTX max EIRP	dBW	52.0
PFD (at beam peak)	dBW/m^2-4kHz	-136.5
Receive system noise temperature	K	120
C/N	dB	43.2
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
Wanted ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	2.3
Wanted ESRX gain(theta)	dB	20.0
Interference power density	dBW/Hz	-195.0
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		TFL
Emission designator		1M23G7W
Frequency	MHz	11700.0
Bandwidth	MHz	1.23
SSTX min power density	dBW/Hz	-75.0
SSTX peak gain	dB	40.0
SSTX min EIRP	dBW	25.9
PFD	dBW/m^2-4kHz	-161.3
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	0.0
ESRX gain(theta)	dB	53.4
Receive system noise temperature	K	120
C/N	dB	21.1
Wanted carrier power density	dBW/Hz	-186.7
Interference measures		
C/I	dB	8.3
C/I required	dB	24.0
C/I margin	dB	-15.7

Worst Case Uplink Interference from Globalstar into LATAMSAT-2

Interfering network (Globalstar)	Case 3		
Space station longitude	+E,-W	-99.0	-99.0
Beam		RFL	RFL
Emission designator		1M23G7W	1M23G7W
Frequency	MHz	13800	13800
Bandwidth	MHz	1.23	1.23
ESTX max power density	dBW/Hz	-68.0	-68.0
ESTX peak gain	dB	55.0	55.0
ESTX max EIRP	dBW	47.9	47.9
Receive system noise temperature	K	512	512
C/N	dB	21.6	21.6
theta (off-axis angle toward wss)	degree	2.2	2.2
ESTX gain(theta)	dB	20.3	20.3
Space loss (toward wss)	dB	-206.6	-206.6
Wanted SSRX peak gain	dB	37.0	37.0
Wanted SSRX contour (toward ies)	dB	0	0
Interference power density	dBW/Hz	-217.3	-217.3
Wanted network (LATAMSAT-2)			
Space station longitude	+E,-W	-97.0	-97.0
Beam		HSR	HSR
Emission designator		32M2G7W	32M2G7W
Frequency	MHz	13895	13895
Bandwidth	MHz	32.2	32.2
ESTX min power density	dBW/Hz	-45.3	-46.6
ESTX peak gain	dB	54.0	56.5
ESTX min EIRP	dBW	83.7	85.0
theta (off-axis angle toward wss)	degree	0.1	0.1
ESTX gain(theta)	dB	53.8	56.1
Space loss (toward wss)	dB	-206.8	-206.8
SSRX peak gain	dB	37.0	37.0
SSRX contour (toward wes)	dB	-2	-2
Receive system noise temperature	K	1400	1400
C/N	dB	33.8	34.8
Wanted carrier power density	dBW/Hz	-163.3	-162.3
Interference			
C/I	dB	54.0	55.0
C/I required	dB	24.0	24.0
C/I margin	dB	30.0	31.0

Worst Case Downlink Interference from Globalstar into LATAMSAT-2

Interfering network (Globalstar)	Case 3		
Space station longitude	+E,-W	-99.0	-99.0
Beam		TFL	TFL
Emission designator		1M23G7W	1M23G7W
Frequency	MHz	11450.0	11450.0
Bandwidth	MHz	1.23	1.23
SSTX max power density	dBW/Hz	-75.0	-75.0
SSTX peak gain	dB	40.0	40.0
SSTX max EIRP	dBW	25.9	25.9
PFD	dBW/m^2-4kHz	-161.3	-161.3
Receive system noise temperature	K	120	120
C/N	dB	21.0	21.0
SSTX contour (toward wes)	dB	0.0	0.0
Space loss (toward wes)	dB	-205.1	-205.1
Wanted ESRX peak gain	dB	42.5	49.0
theta (off-axis angle toward wss)	degree	2.2	2.2
Wanted ESRX gain(theta)	dB	20.4	20.4
Interference power density	dBW/Hz	-219.7	-219.7
Wanted network (LATAMSAT-2)			
Space station longitude	+E,-W	-97.0	-97.0
Beam		S1R	S1R
Emission designator		32M2G7W	32M2G7W
Frequency	MHz	11560.0	11560.0
Bandwidth	MHz	32.2	32.2
SSTX min power density	dBW/Hz	-73.0	-73.0
SSTX peak gain	dB	50.0	50.0
SSTX min EIRP	dBW	52.1	52.1
PFD	dBW/m^2-4kHz	-149.5	-149.5
SSTX contour (toward wes)	dB	-2.0	-2.0
Space loss (toward wes)	dB	-205.2	-205.2
ESRX peak gain	dB	42.5	49.0
theta (off-axis angle toward wss)	degree	0.1	0.1
ESRX gain(theta)	dB	42.5	48.9
Receive system noise temperature	K	300	250
C/N	dB	16.1	23.4
Wanted carrier power density	dBW/Hz	-187.7	-181.3
Interference			
C/I	dB	32.0	38.4
C/I required	dB	24.0	24.0
C/I margin	dB	8.0	14.4

Worst Case Uplink Interference from LATAMSAT-2 into Globalstar

Interfering network (LATAMSAT-2)	Case 3	
Space station longitude	+E,-W	-97.0
Beam		HSR
Emission designator		45K0G1X
Frequency	MHz	13915
Bandwidth	MHz	0.045
ESTX max power density	dBW/Hz	-32.5
ESTX peak gain	dB	54.0
ESTX max EIRP	dBW	68.0
Receive system noise temperature	K	1400
C/N	dB	46.6
theta (off-axis angle toward wss)	degree	2.2
ESTX gain(theta)	dB	20.4
Space loss (toward wss)	dB	-206.8
Wanted SSRX peak gain	dB	40.0
Wanted SSRX contour (toward ies)	dB	0
Interference power density	dBW/Hz	-178.8
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		RFL
Emission designator		1M23G7W
Frequency	MHz	14000
Bandwidth	MHz	1.23
ESTX min power density	dBW/Hz	-68.0
ESTX peak gain	dB	55.0
ESTX min EIRP	dBW	47.9
theta (off-axis angle toward wss)	degree	0.1
ESTX gain(theta)	dB	54.7
Space loss (toward wss)	dB	-206.7
SSRX peak gain	dB	40.0
SSRX contour (toward wes)	dB	0
Receive system noise temperature	K	512
C/N	dB	21.5
Wanted carrier power density	dBW/Hz	-180.0
Interference		
C/I	dB	-1.2
C/I required	dB	24.0
C/I margin	dB	-25.2

Worst Case Downlink Interference from LATAMSAT-2 into Globalstar

Interfering network (LATAMSAT-2)	Case 3	
Space station longitude	+E,-W	-97.0
Beam		S1R
Emission designator		32M2G7W
Frequency	MHz	11580.0
Bandwidth	MHz	32.2
SSTX max power density	dBW/Hz	-73.0
SSTX peak gain	dB	50.0
SSTX max EIRP	dBW	52.1
PFD (at beam peak)	dBW/m^2-4kHz	-149.5
Receive system noise temperature	K	250
C/N	dB	23.3
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
Wanted ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	2.2
Wanted ESRX gain(theta)	dB	20.3
Interference power density	dBW/Hz	-207.8
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		TFL
Emission designator		1M23G7W
Frequency	MHz	11700.0
Bandwidth	MHz	1.23
SSTX min power density	dBW/Hz	-75.0
SSTX peak gain	dB	40.0
SSTX min EIRP	dBW	25.9
PFD	dBW/m^2-4kHz	-161.3
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	0.0
ESRX gain(theta)	dB	53.2
Receive system noise temperature	K	120
C/N	dB	20.8
Wanted carrier power density	dBW/Hz	-187.0
Interference measures		
C/I	dB	20.8
C/I required	dB	24.0
C/I margin	dB	-3.2

Worst Case Uplink Interference from Globalstar into USASAT-23F

Interfering network (Globalstar)	Case 4				
Space station longitude	+E,-W	-99.0	-99.0	-99.0	-99.0
Beam		RFL	RFL	RFL	RFL
Emission designator		1M23G7W	1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	13800	13800	13800	13800
Bandwidth	MHz	1.23	1.23	1.23	1.23
ESTX max power density	dBW/Hz	-68.0	-68.0	-68.0	-68.0
ESTX peak gain	dB	55.0	55.0	55.0	55.0
ESTX max EIRP	dBW	47.9	47.9	47.9	47.9
Receive system noise temperature	K	512	512	512	512
C/N	dB	21.6	21.6	21.6	21.6
theta (off-axis angle toward wss)	degree	4.5	4.5	4.5	4.5
ESTX gain(theta)	dB	12.6	12.6	12.6	12.6
Space loss (toward wss)	dB	-206.6	-206.6	-206.6	-206.6
Wanted SSRX peak gain	dB	30.2	30.2	30.2	30.2
Wanted SSRX contour (toward ies)	dB	0	0	0	0
Interference power density	dBW/Hz	-231.8	-231.8	-231.8	-231.8
Wanted network (USASAT-23F)					
Space station longitude	+E,-W	-95.0	-95.0	-95.0	-95.0
Beam		RK2V	RK2V	RK2V	RK2V
Emission designator		12M0G7W	12M0G7W	12M0G7W	12M0G7W
Frequency	MHz	13887.02	13887.02	13887.02	13887.02
Bandwidth	MHz	12	12	12	12
ESTX min power density	dBW/Hz	-54.1	-58.0	-61.9	-63.4
ESTX peak gain	dB	54.4	58.3	62.2	63.7
ESTX min EIRP	dBW	70.3	70.3	70.3	70.3
theta (off-axis angle toward wss)	degree	0.1	0.1	0.1	0.1
ESTX gain(theta)	dB	54.1	57.6	60.6	61.4
Space loss (toward wss)	dB	-206.8	-206.8	-206.8	-206.8
SSRX peak gain	dB	30.2	30.2	30.2	30.2
SSRX contour (toward wes)	dB	-2	-2	-2	-2
Receive system noise temperature	K	575	575	575	575
C/N	dB	22.5	22.1	21.1	20.4
Wanted carrier power density	dBW/Hz	-178.5	-178.9	-179.9	-180.6
Interference					
C/I	dB	53.2	52.8	51.9	51.2
C/I required	dB	24.0	24.0	24.0	24.0
C/I margin	dB	29.2	28.8	27.9	27.2

Worst Case Downlink Interference from Globalstar into USASAT-23F

Interfering network (Globalstar)	Case 4								
Space station longitude	+E,-W	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0
Beam		TFL	TFL	TFL	TFL	TFL	TFL	TFL	TFL
Emission designator		1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	11450.0	11450.0	11450.0	11450.0	11450.0	11450.0	11450.0	11450.0
Bandwidth	MHz	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23
SSTX max power density	dBW/Hz	-75.0	-75.0	-75.0	-75.0	-75.0	-75.0	-75.0	-75.0
SSTX peak gain	dB	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
SSTX max EIRP	dBW	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9
PFD	dBW/m^2-4kHz	-161.3	-161.3	-161.3	-161.3	-161.3	-161.3	-161.3	-161.3
Receive system noise temperature	K	120	120	120	120	120	120	120	120
C/N	dB	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
SSTX contour (toward wes)	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space loss (toward wes)	dB	-205.1	-205.1	-205.1	-205.1	-205.1	-205.1	-205.1	-205.1
Wanted ESRX peak gain	dB	35.5	39.0	40.7	44.7	45.0	47.2	51.3	53.0
theta (off-axis angle toward wss)	degree	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Wanted ESRX gain(theta)	dB	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Interference power density	dBW/Hz	-227.3	-227.3	-227.3	-227.3	-227.3	-227.3	-227.3	-227.3
Wanted network (USASAT-23F)									
Space station longitude	+E,-W	-95.0	-95.0	-95.0	-95.0	-95.0	-95.0	-95.0	-95.0
Beam		T1LH	T1LH	T1LH	T1LH	T1LH	T1LH	T1LH	T1LH
Emission designator		12M0G7W	6M00G7W	6M00G7W	400KG7W	6M00G7W	400KG7W	6M00G7W	6M00G7W
Frequency	MHz	11568.4	11568.4	11568.4	11460.0	11568.4	11460.0	11568.4	11568.4
Bandwidth	MHz	12	6	6	0.4	6	0.4	6	6
SSTX min power density	dBW/Hz	-61.8	-64.8	-64.8	-65.8	-64.8	-59.8	-64.8	-64.8
SSTX peak gain	dB	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
SSTX min EIRP	dBW	41.2	35.2	35.2	21.4	35.2	27.4	35.2	35.2
PFD	dBW/m^2-4kHz	-155.3	-158.3	-158.3	-159.3	-158.3	-153.3	-158.3	-158.3
SSTX contour (toward wes)	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Space loss (toward wes)	dB	-205.2	-205.2	-205.2	-205.1	-205.2	-205.1	-205.2	-205.2
ESRX peak gain	dB	35.5	39.0	40.7	44.7	45.0	47.2	51.3	53.0
theta (off-axis angle toward wss)	degree	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ESRX gain(theta)	dB	35.5	39.0	40.7	44.7	45.0	47.1	51.2	52.8
Receive system noise temperature	K	124	124	124	198	159	198	159	159
C/N	dB	7.2	7.7	9.4	10.4	12.6	18.9	18.8	20.4

Wanted carrier power density	dBW/Hz	-200.5	-200.0	-198.3	-195.2	-194.0	-186.8	-187.8	-186.2
Interference									
C/I	dB	26.8	27.3	29.0	32.1	33.3	40.5	39.5	41.1
C/I required	dB	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
C/I margin	dB	2.8	3.3	5.0	8.1	9.3	16.5	15.5	17.1

Worst Case Downlink Interference from Globalstar into USASAT-23F (continued)

Interfering network (Globalstar)	Case 4				
Space station longitude	+E,-W	-99.0	-99.0	-99.0	-99.0
Beam		TFL	TFL	TFL	TFL
Emission designator		1M23G7W	1M23G7W	1M23G7W	1M23G7W
Frequency	MHz	11450.0	11450.0	11450.0	11450.0
Bandwidth	MHz	1.23	1.23	1.23	1.23
SSTX max power density	dBW/Hz	-75.0	-75.0	-75.0	-75.0
SSTX peak gain	dB	40.0	40.0	40.0	40.0
SSTX max EIRP	dBW	25.9	25.9	25.9	25.9
PFD	dBW/m^2-4kHz	-161.3	-161.3	-161.3	-161.3
Receive system noise temperature	K	120	120	120	120
C/N	dB	21.0	21.0	21.0	21.0
SSTX contour (toward wes)	dB	0.0	0.0	0.0	0.0
Space loss (toward wes)	dB	-205.1	-205.1	-205.1	-205.1
Wanted ESRX peak gain	dB	56.8	60.7	61.9	62.2
theta (off-axis angle toward wss)	degree	4.4	4.4	4.4	4.4
Wanted ESRX gain(theta)	dB	12.8	12.8	12.8	12.8
Interference power density	dBW/Hz	-227.3	-227.3	-227.3	-227.3
Wanted network (USASAT-23F)					
Space station longitude	+E,-W	-95.0	-95.0	-95.0	-95.0
Beam		T1LH	T1LH	T1LH	T1LH
Emission designator		6M00G7W	6M00G7W	89K6G7W	6M00G7W
Frequency	MHz	11568.4	11568.4	11460.0	11568.4
Bandwidth	MHz	6	6	0.0896	6
SSTX min power density	dBW/Hz	-64.8	-64.8	-65.7	-64.8
SSTX peak gain	dB	33.0	33.0	33.0	33.0
SSTX min EIRP	dBW	35.2	35.2	15.4	35.2
PFD	dBW/m^2-4kHz	-158.3	-158.3	-159.2	-158.3
SSTX contour (toward wes)	dB	-2.0	-2.0	-2.0	-2.0
Space loss (toward wes)	dB	-205.2	-205.2	-205.1	-205.2
ESRX peak gain	dB	56.8	60.7	61.9	62.2
theta (off-axis angle toward wss)	degree	0.1	0.1	0.1	0.1
ESRX gain(theta)	dB	56.3	59.6	60.4	60.6
Receive system noise temperature	K	159	159	198	159
C/N	dB	23.9	27.1	26.2	28.2
Wanted carrier power density	dBW/Hz	-182.7	-179.4	-179.4	-178.4
Interference					
C/I	dB	44.6	47.9	47.9	48.9
C/I required	dB	24.0	24.0	24.0	24.0
C/I margin	dB	20.6	23.9	23.9	24.9

Worst Case Uplink Interference from USASAT-23F into Globalstar

Interfering network (USASAT-23F)	Case 4	
Space station longitude	+E,-W	-95.0
Beam		RK1V
Emission designator		600KF9D
Frequency	MHz	13751.5
Bandwidth	MHz	0.6
ESTX max power density	dBW/Hz	-26.0
ESTX peak gain	dB	63.7
ESTX max EIRP	dBW	86.5
Receive system noise temperature	K	575
C/N	dB	57.1
theta (off-axis angle toward wss)	degree	4.4
ESTX gain(theta)	dB	12.8
Space loss (toward wss)	dB	-206.7
Wanted SSRX peak gain	dB	40.0
Wanted SSRX contour (toward ies)	dB	0
Interference power density	dBW/Hz	-179.9
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		RFL
Emission designator		1M23G7W
Frequency	MHz	13800
Bandwidth	MHz	1.23
ESTX min power density	dBW/Hz	-68.0
ESTX peak gain	dB	55.0
ESTX min EIRP	dBW	47.9
theta (off-axis angle toward wss)	degree	0.1
ESTX gain(theta)	dB	54.7
Space loss (toward wss)	dB	-206.6
SSRX peak gain	dB	40.0
SSRX contour (toward wes)	dB	0
Receive system noise temperature	K	512
C/N	dB	21.6
Wanted carrier power density	dBW/Hz	-179.9
Interference		
C/I	dB	0.0
C/I required	dB	24.0
C/I margin	dB	-24.0

Worst Case Downlink Interference from USASAT-23F into Globalstar

Interfering network (USASAT-23F)	Case 4	
Space station longitude	+E,-W	-95.0
Beam		T1LH
Emission designator		24M0F9W
Frequency	MHz	11597.5
Bandwidth	MHz	24
SSTX max power density	dBW/Hz	-44.2
SSTX peak gain	dB	33.0
SSTX max EIRP	dBW	51.8
PFD (at beam peak)	dBW/m^2-4kHz	-137.7
Receive system noise temperature	K	124
C/N	dB	28.2
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
Wanted ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	4.5
Wanted ESRX gain(theta)	dB	12.6
Interference power density	dBW/Hz	-203.7
Wanted network (Globalstar)		
Space station longitude	+E,-W	-99.0
Beam		TFL
Emission designator		1M23G7W
Frequency	MHz	11700.0
Bandwidth	MHz	1.23
SSTX min power density	dBW/Hz	-75.0
SSTX peak gain	dB	40.0
SSTX min EIRP	dBW	25.9
PFD	dBW/m^2-4kHz	-161.3
SSTX contour (toward wes)	dB	0.0
Space loss (toward wes)	dB	-205.1
ESRX peak gain	dB	53.4
theta (off-axis angle toward wss)	degree	0.0
ESRX gain(theta)	dB	53.2
Receive system noise temperature	K	120
C/N	dB	20.8
Wanted carrier power density	dBW/Hz	-187.0
Interference measures		
C/I	dB	16.7
C/I required	dB	24.0
C/I margin	dB	-7.3

Technical Certification

I hereby certify that I am the technically qualified person who has prepared the foregoing material, that I am familiar with Part 25 of the FCC's Rules and Regulations, and the ITU Radio Regulations, and that the foregoing material is true and accurate to the best of my knowledge and belief.

R E LeClair

Roger E. LeClair

Date: 9/9/02