3.0 SPACECRAFT DESCRIPTION

3.1 TRACKING, TELEMETRY, AND COMMAND (TT&C) SUBSYSTEM

Uplink command and downlink telemetry beacon functions for C-band and Ku-band on the satellites will be performed at the band edges as shown in Table 3-1.

TABLE 3-1

COMMAND AND TELEMETRY PLAN

FOR GE-5

Function	Frequency	Polarization
SN 3 C Low Beacon	3700.5	H
SN 3 C low Beacon	4199.5	V
SN 3 Command	6423.5	H
GE- 5 Ku High Beacon	12198.0	V
GE- 5 Ku Low Beacon	11700.065	H
GE- 5 Ku Low Command	14001.0	V

GE Americom will use two of its geographically dispersed TT&C ground station sites at either South Mountain, CA, Vernon Valley, NJ., Woodbine, MD or Grand Junction, CO to control the in-orbit satellites.

For the SN 3 satellite, redundant communications receivers are provided on a 4-for-2 basis. The GE-5 command uplink will be modulated by a command subcarrier or ranging tones. The nominal carrier deviation will be ±400 kHz peak. Complete redundancy with suitable interconnects shall be provided. The command antenna shall feed the command receiver. A polarization switch shall be provided to change the uplink polarization on station path. Commands sent to the satellite shall be re-transmitted via telemetry for ground verification.

The telemetry subsystem shall consist of two completely redundant subsystems. The telemetry subsystem shall be capable of continuous operation in the horn through the omni antenna with all telemetry transmitters on. Intermodulation products shall be 40 dB below the telemetry transmitter over a 400 KHz band. This subcarrier and/or ranging tones phase modulate the telemetry transmitter.

3.2 ATTITUDE CONTROL AND STATIONKEEPING SUBSYSTEM

The GE-5 attitude control and stationkeeping (ACS) subsystem will provide satellite attitude control beginning with spacecraft separation from the launch vehicle and continuing through transfer to geosynchronous orbit. The ACS will also provide station acquisition and on-station attitude control. The ACS design will incorporate sun and earth sensors, momentum wheels, and thrusters to perform its required functions.

The spacecraft will be maintained within ±0.05°, in both the north/south and east/west directions, of the assigned orbital location. Ground-commandable reaction control thrusters located on the body of the spacecraft will perform the stationkeeping.

The spacecraft communications antenna will be maintained within a circular error of 0.15° in both east/west (pitch) and north/south (roll) directions of its nominal boresight position during both normal spacecraft operations and stationkeeping maneuver operations.

3.3 ELECTRICAL POWER SUBSYSTEM

The GE- 5 electrical power subsystem (EPS) will consist of solar arrays for converting solar energy into the electrical energy required for normal operations, nickel-hydrogen batteries for supplying 100% of the required electrical energy during eclipse periods, power supply electronics for charging the batteries and limiting the maximum bus voltage, and solar array drives for rotating the solar arrays. The power output of the EPS will be sufficient to provide the electrical power required to operate 100% of the spacecraft payload and all other subsystems for the full spacecraft design life.

There is sufficient power to meet the mission requirements over the life of the spacecraft.

3.4 PROPULSION

The GE-5 satellite propulsion subsystem will include all propellants/pressurants, components and assemblies associated with storing, conditioning, routing, controlling, and expelling propellant, required to change the spacecraft's attitude and its angular or linear velocity to meet the mission requirements, from the moment of separation from the launch vehicle through and including the final orbit raising maneuver.

3.5 RELIABILITY AND OPERATIONAL LIFE

The GE-5 spacecraft was designed to meet a mission life of 12 years. Because the satellite design is a well-proven design, it is expected that the actual satellite longevity will exceed the design life.

The calculated probability of survival of all the GE-5 satellite and payload subsystems will be greater than 0.74 for twelve years. The satellite subsystems shall be designed to include fail-safe features wherever possible. A failure within a unit or subsystem will not disable or degrade the performance of the remainder of the satellite.

3.6 LAUNCH VEHICLE

The satellite is compatible with the launch requirements of the Ariane 4, Ariane 5 launch vehicles. The satellites can be deployed during the standard launch window for all launch vehicles. The restartable bipropellant main satellite thruster combines high ISP with operational flexibility.

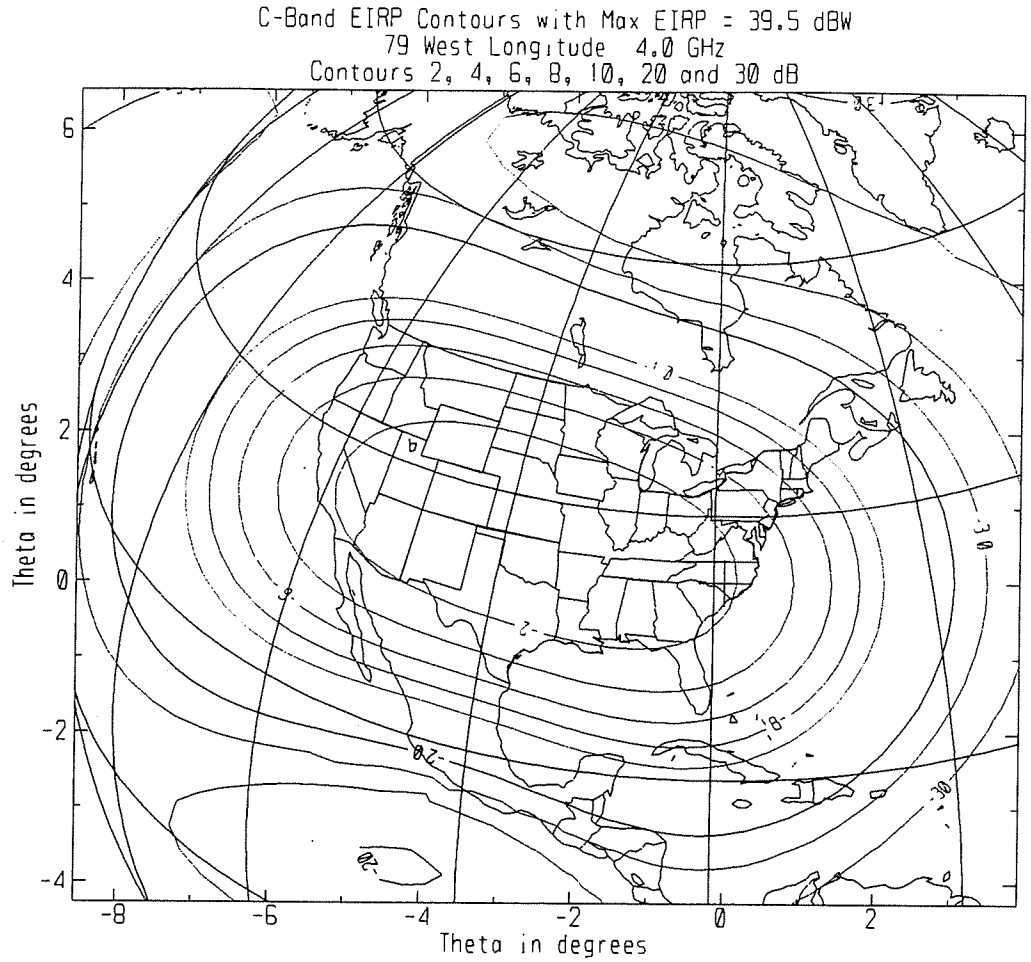
4.0 ORBITAL ARC CONSIDERATIONS

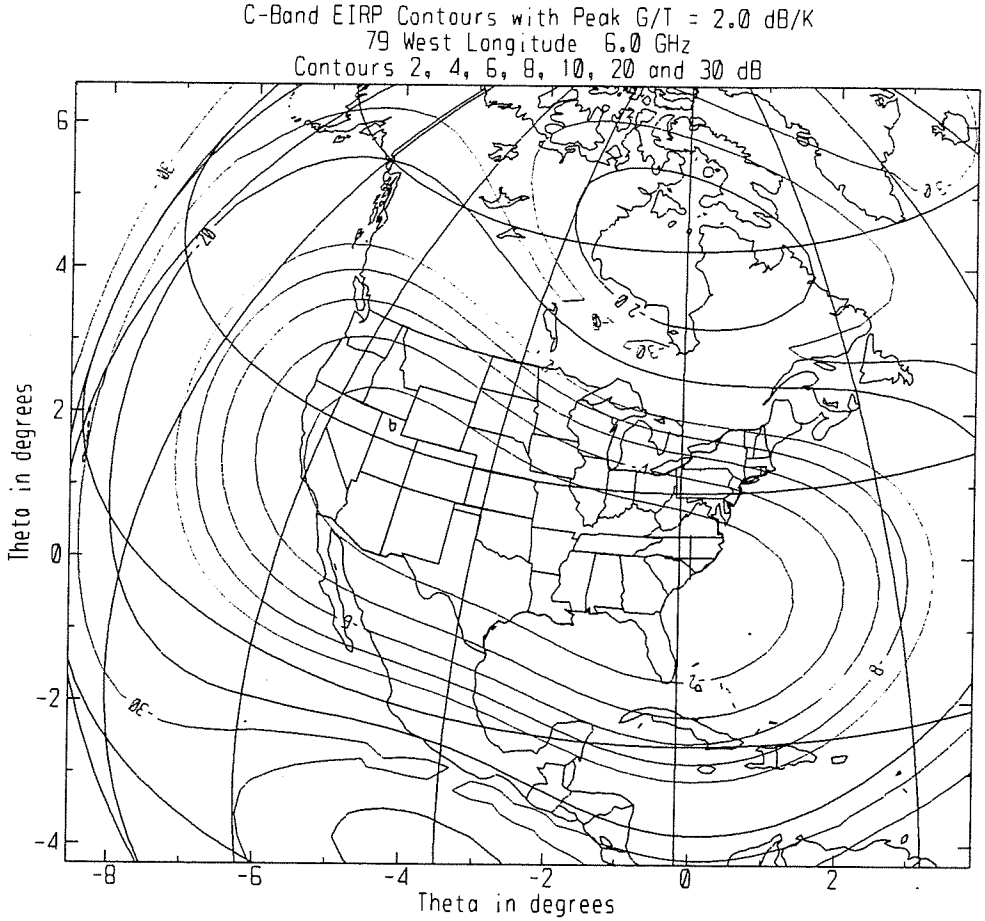
4.1 ORBITAL INTER-SATELLITE INTERFERENCE ANALYSIS

Satellite interference analysis for Ku- band has been performed and is provided in Attachment C.

Satellite interference analysis for C-band has been performed and is provided in Attachment D.

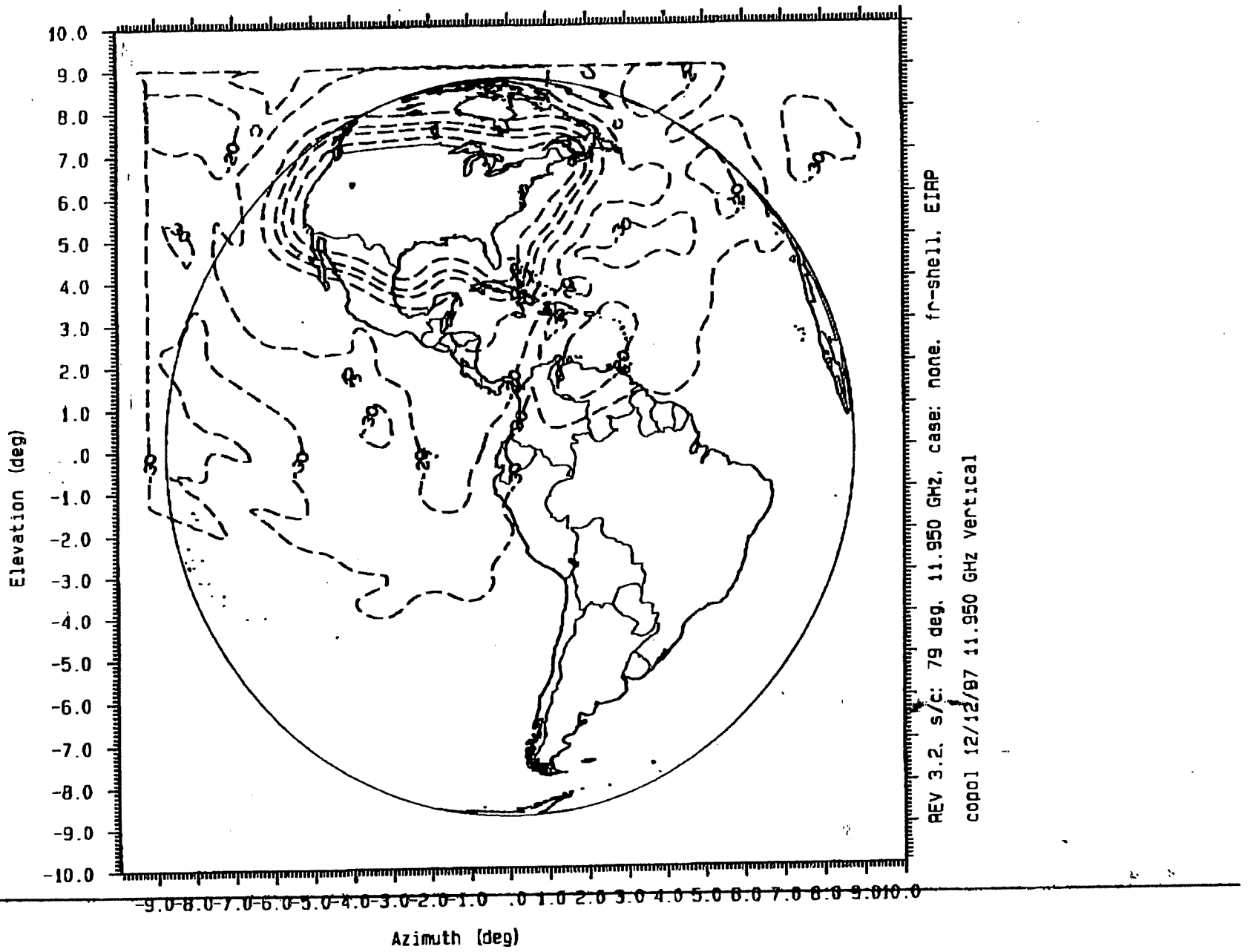
ATTACHMENT A
COVERAGE MAPS FOR
SN-3 C-BAND CONTOURS


C-Band EIRP Contours with Max EIRP = 39.5 dBW
79 West Longitude 4.0 GHz
Contours 2, 4, 6, 8, 10, 20 and 30 dB
Theta in degrees
Theta in degrees
6
4
2
0
-2
-4
-8
-6
-4
-2
0
2
30
20
18
10
8
6
4
2

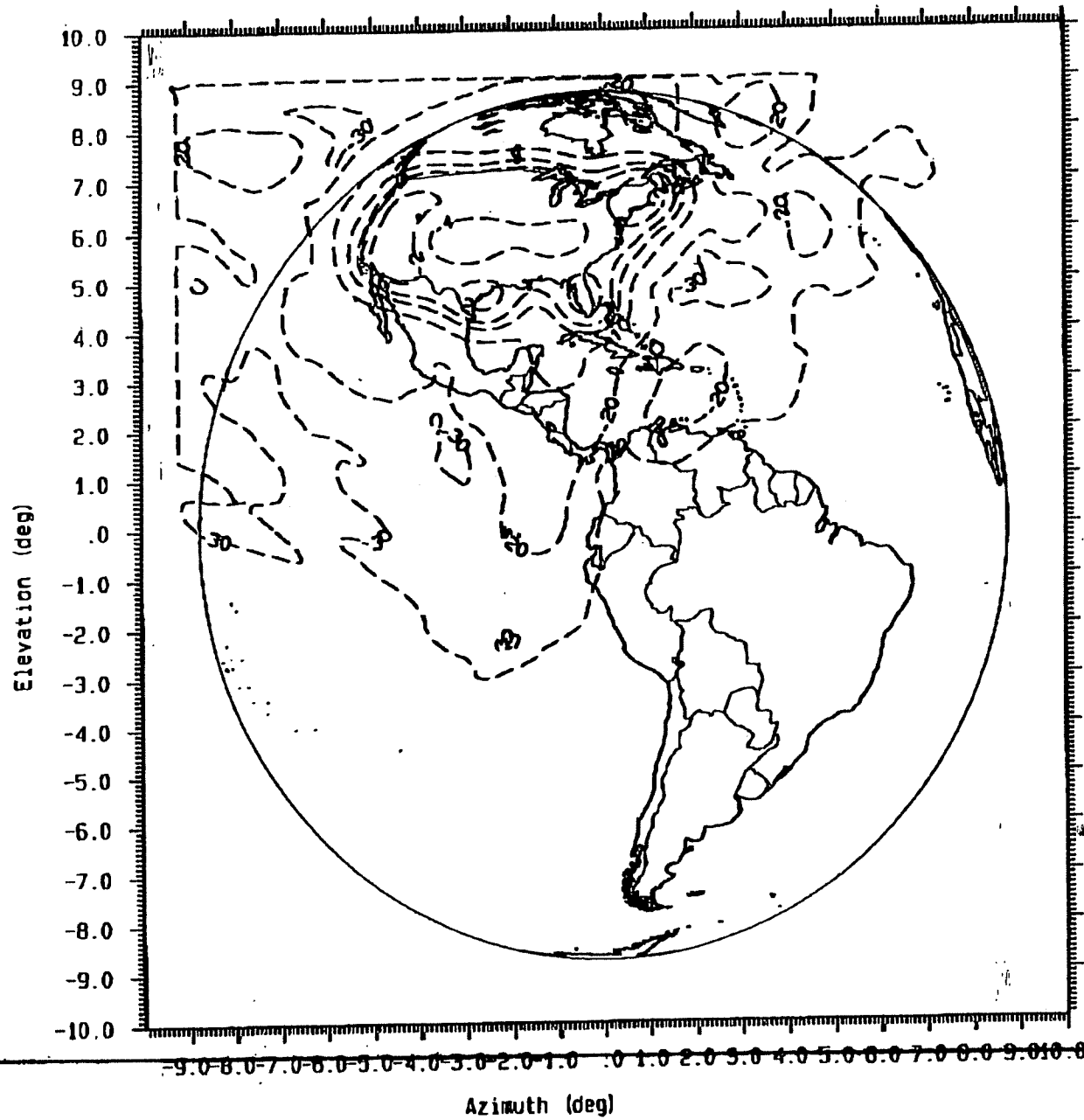

C-Band EIRP Contours with Peak G/T = 2.0 dB/K
79 West Longitude 6.0 GHz
Contours 2, 4, 6, 8, 10, 20 and 30 dB
Theta in degrees
Theta in degrees
6
4
2
0
-2
-4
-8
-6
-4
-2
0
2
20
30
30

ATTACHMENT B
COVERAGE MAPS FOR
GE-5 KU-BAND CONTOURS

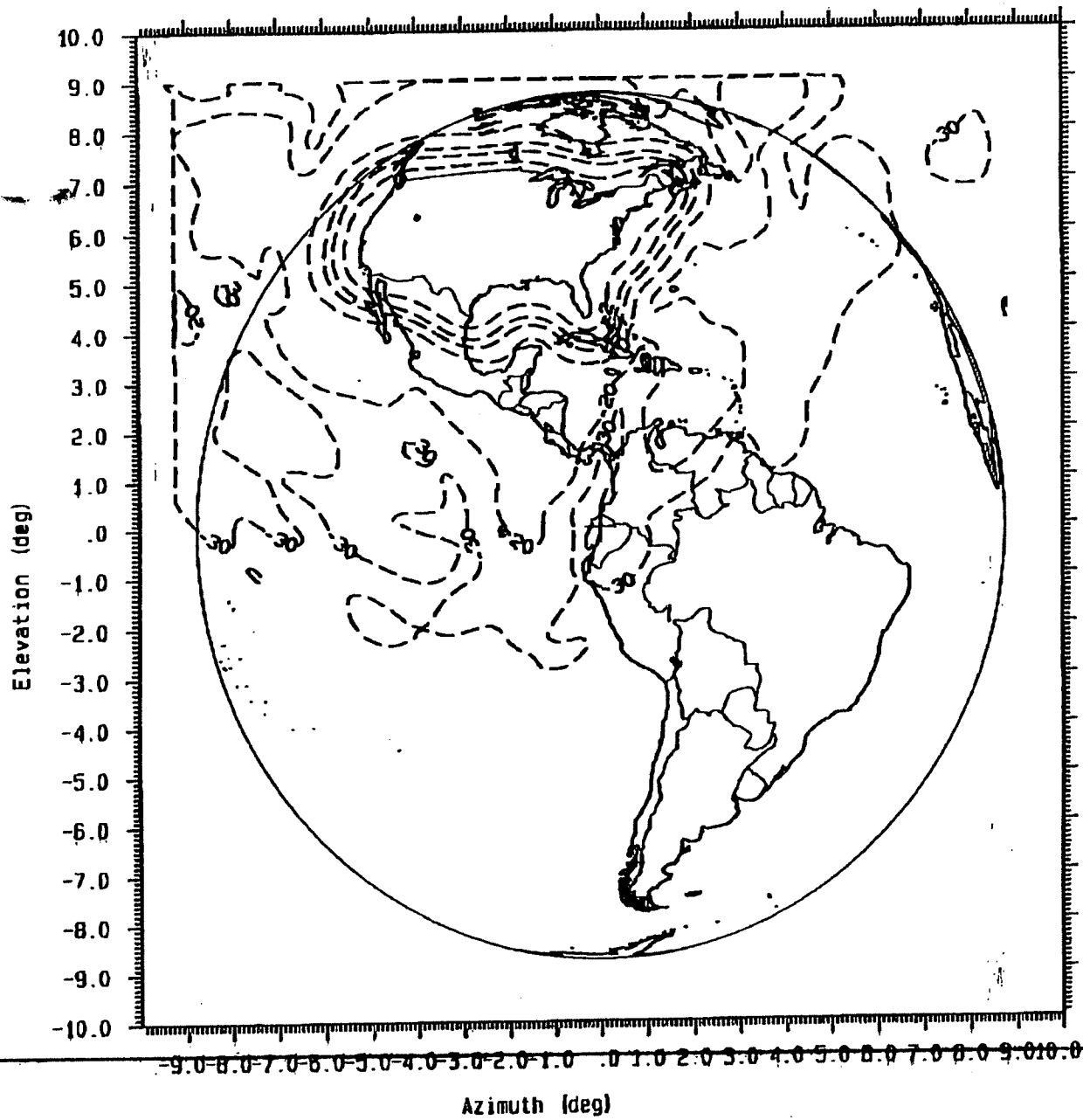
GE-5, Freq: 11.950 GHz, fr-shell, v-pol., EIRP
S/C: -79.0 deg, Case: none, Peak Value: 48.0dBW

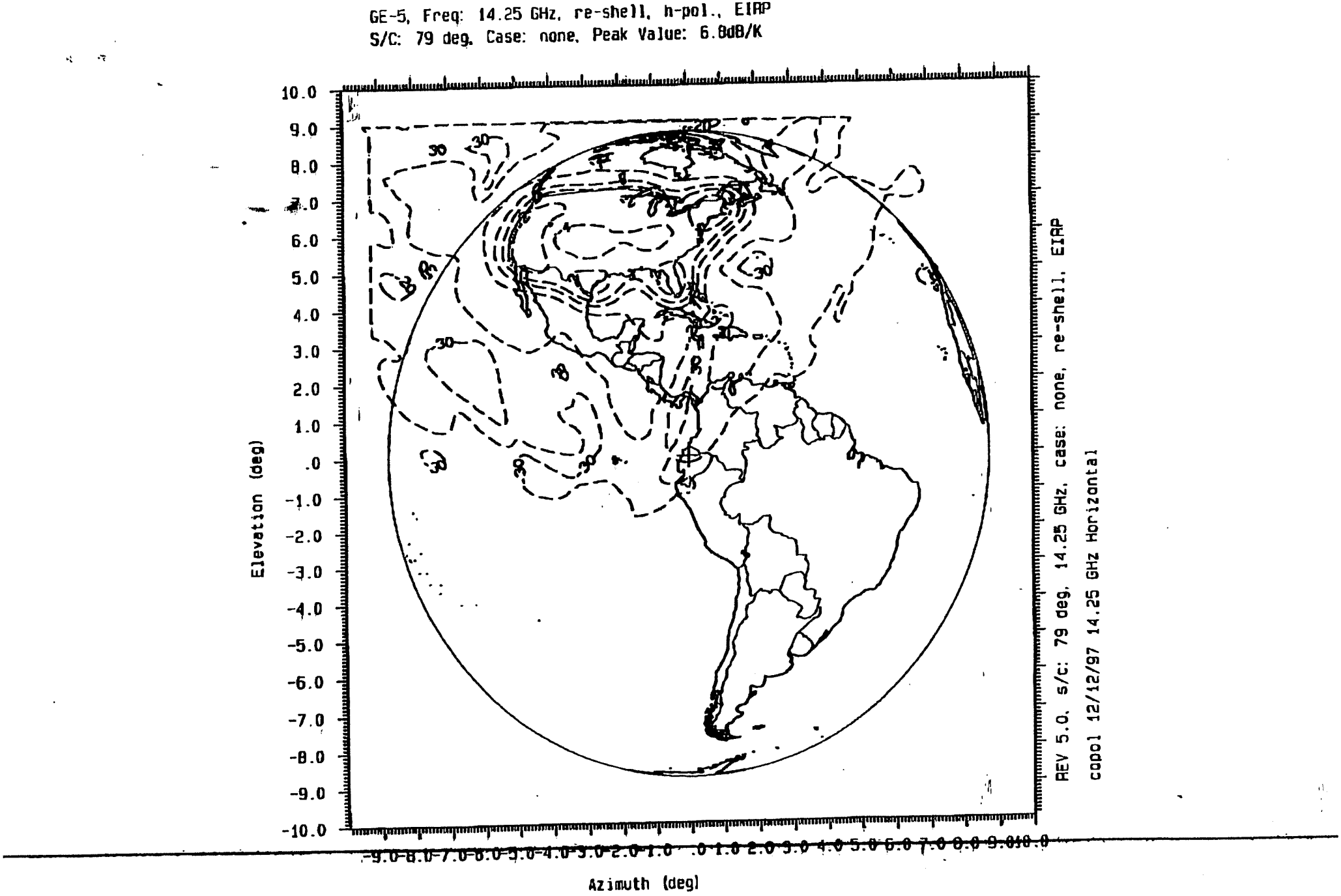


GE-5, Freq: 14.25 GHz, fr-shell, v-pol., G/T
S/C: -79.0 deg, Case: none, Peak Value: 7.0dB/K



GE-5, Freq: 11.950 GHz, re-shell, h-pol., EIRP
S/C: 79 deg, Case: none, Peak Value: 47.8dBW




GE-5, Freq: 14.25 GHz, re-shell, h-pol., EIRP
S/C: 79 deg, Case: none, Peak Value: 6.8dB/K
Elevation (deg)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-9.0 -8.0 -7.0 -6.0 -5.0 -4.0 -3.0 -2.0 -1.0 .0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
Azimuth (deg)
REV 5.0, s/c: 79 deg, 14.25 GHz, case: none, re-shell, EIRP
copol 12/12/97 14.25 GHz Horizontal

ATTACHMENT C
INTERFERENCE ANALYSIS
FOR GE-5
KU-BAND TRANSPONDERS

B.1 Introduction

The orbital location for GE-5 is the subject of a pending petition for reconsideration. The Commission originally assigned GE-5 to the 79° W.L. location. GE Americom has asked that the Commission reassign GE-5 to 83° W.L. and reassign EchoStar's FSS 1 spacecraft from 83° W.L. to 79° W.L. This reassignment is necessary to address the threat of harmful interference from the high powered FSS 1 spacecraft to GE Americom's GE-2 satellite at 85° W.L. In addition, the reassignment would result in a more compatible spacecraft (EchoStar FSS-1, rather than GE-5) occupying the 79° W.L. location adjacent to the high powered Loral satellite assigned to 77° W.L.

There will be no risk of harmful interference to adjacent satellites if GE-5 is reassigned to 83° W.L., as GE Americom has requested. The orbital locations adjacent to 83° W.L. are 81° W.L. and 85 ° W.L. The 81° W.L. location is currently occupied by GE Americom's Satcom K-2 spacecraft and is unassigned for future use. The 85° W.L. location is occupied by GE Americom's GE-2 spacecraft. GE Americom will coordinate traffic on its spacecraft to prevent harmful interference.

Similarly, if it is located at 79° W.L., GE-5 will not cause harmful interference into Loral 1 at 77° W.L. GE Americom has undertaken an analysis of traffic listed for Loral and Telstar spacecraft and has determined that the GE-5 satellites can co-exist under standard coordination criteria. GE Americom will coordinate its traffic with Loral.

B.1.1 Interference Into SCPC Carriers

As described below, the worst case of adjacent satellite interference is that in which a saturated analog video carrier is co-frequency and co-polarized with respect to the interfered-with single channel per carrier (SCPC)

traffic on the adjacent, interfered-with satellite. The region experiencing the greatest interference in the SCPC transponder is that region immediately adjacent to the center frequency of the video carrier. This fact is universally recognized by satellite operators, and it is general operational practice not to assign SCPC traffic to these high energy density regions of video transmissions. Indeed, in the revised Part 25 rules for C-Band, the FCC indicates that no protection will be afforded for narrow band carriers located within ±1 MHz of the center frequency of the video carrier. The amount of frequency offset from the center of the interfering video carrier required to achieve a desired protection ratio is determined by the robustness of the SCPC carrier.

B.1.2 Satellites Adjacent to GE-5

The satellite orbital slots immediately adjacent to the west of 79° are at 81° and 83° West Longitude. The 81° slot is currently occupied by GE K-2 and is unassigned for future use. The 83° slot was assigned to EchoStar[2].
The orbital slots immediately adjacent on the east of the 79° West Longitude orbital position are the slots located at 77° and 69° West Longitude. The 77°W has been assigned to Loral. GE Americom for the purpose of this analysis will use carriers provided by Loral and Telstar for the analysis.

In cases where incompatibilities exist GE Americom has some flexibility to move some traffic to transponders which are compatible with the traffic plans of other operators as part of any required coordination agreement.

B.2 Frequency Offsets of SCPC Carriers

The issue of frequency offsets of SCPC carriers to minimize adjacent satellite interference from analog video carriers was previously addressed by the Advisory Committee for the Implementation of Reduced Orbital Spacing Between United States Domestic Fixed-Satellites To The Federal Communications Commission (FCC 2° Spacing Advisory Committee). The Phase One Report of this Committee, published in September, 1985, recommended that SCPC carriers should not be assigned within ±1.0 MHz of the center frequencies of the interfering video carriers, and cautioned that SCPC carriers placed within ±3.0 MHz of the video carriers be designed with sufficient protection to withstand the high level of interference to be encountered in this region.

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[2] Currently subject to a reconsideration petition, as discussed above.

Several comments are in order concerning the above recommendation. Since the recommendation concerns video interference in C-Band, for which there is a standard satellite transponder frequency plan, reference to transponder center frequency is equivalent to reference to the center frequency of the interfering video carrier. Similarly, in Ku-Band where there is no standard frequency plan, the equivalent recommendation would be the avoidance by SCPC carriers of the regions surrounding the center frequencies of interfering video carriers.

SCPC carriers that are not robust and not designed with sufficient protection to withstand the high energy transmissions of video on adjacent satellites will require frequency offsets greater than the ±1.0 MHz or ±3 MHz recommended by the 2° Spacing Advisory Committee.

TABLE C-1

PROTECTION RATIOS

	COMMUNICATIONS TRAFFIC MODE	SINGLE-ENTRY CO-FREQUENCY PROTECTION RATIO
1.	Frequency Modulated Television (FM-TV)	C/I_{se} = 22.0 dB to 28.0 dB[1]
2.	Frequency Division Multiplexed Frequency Modulated (FDM-FM)Channels	Interference from an adjacent satellite shall contribute a maximum of 1000 picowatts of noise in the worst baseband channel.
3.	Digital Data Channels - Full Transponder Power Occupying Full Transponder Bandwidth	E_B/I_o = 25 dB
4.	Single Channel Per Carrier(SCPC) T1 (1.544 MBps)Digital Data	E_B/I_o = 20 dB
5.	Single Channel Per Carrier(SCPC) 56 kBps Digital Data	E_B/I_o = 20 dB
6.	Frequency Modulated Single Channel per Carrier (FM-SCPC)Message Voice Service	Interference from an adjacent satellite shall contribute a maximum of 1000 picowatts of noise in the worst baseband channel.
7.	Frequency Modulated Single Channel per Carrier (FM-SCPC) Program Audio	C/I_{se} = 24 dB
8.	Companded Single Sideband Channels	Interference from an adjacent satellite shall contribute a maximum of 1000 picowatts of noise in the worst baseband channel.
9.	Spread Spectrum Channels	E_B/I_o = 20 dB[2]

NOTES:

1. The single entry co-frequency protection ratio for desired television transmission shall be in the range of C/I_{se} = 22.0 dB to C/I_{se} = 28.0 dB. The single entry co-frequency protection ratio for point to multipoint (Cable, SMATV, and Direct to Home) transmission shall be C/I_{se} = 22.0 dB. The single entry co-frequency protection ratio for point-to-point transmission shall be a maximum of C/I_{se} = 28.0 dB. These protection ratios apply for television interference into television. It appears that non-television interference may allow lower protection ratios. Comments are invited as to what these protection ratios should be.

   Those system operators demanding a particular protection ratio must employ an antenna diameter such that the single entry carrier to adjacent satellite interference ratio for co-frequency TV into TV interference in a homogeneous satellite environment shall be that value.

2. This is a preliminary number that will be refined by further technical analysis in the second phase of work of the Advisory Committee.

B.3 Interference Into Adjacent Satellites

The analysis was performed using an FCC Video Mask. Data used in the analysis was either taken from information contained in Loral and Telstar filings.

GE Americom performed the analysis using the George Sharp ASIA program.

B.3.1 Interference BETWEEN GE-5 and Loral

2° Spacing Co Polarized

The following Sharp analysis is for GE-5 into Loral with 2° spacing. It was assumed that low level SCPC carriers were located at least 1 MHz from the center frequency of an analog video signal. Signals were considered to be co-polarized.

Table 1: Domestic Satellite R.F. Carrier Listing - 14/12 GHz

Carrier Number	Signal Type & (channels)	Bandwidth (MHz)	E.S. Antennas (m) up/down	EIRP (dBW) up/down
1: GE-K	TV/FM (1)	36.000	6.1/ 6.1	76.8/48.0
2: GE-K	TV/FM (1)	27.000	6.1/ 2.4	73.7/48.0
3: GE-K	QPSK/ 27 MBPS (2)	23.500	4.5/ 3.7	71.7/44.0
4: GE-K	QPSK/ 30 MBPS	24.000	7.0/ 3.7	78.0/48.0
5: GE-K	QPSK/ 1.544 MBPS (20)	1.029	5.5/ 5.5	56.1/25.4
6: GE-K	QPSK/512 KBPS (50)	.384	1.8/ 1.8	50.8/28.8
7: TEL5	QPSK/ 1.544 MBPS (24)	1.240	2.4/ 2.4	56.9/29.6
8: TEL5	QPSK/ 3 MBPS (16)	1.800	4.6/ 2.4	61.6/31.4
9: TEL5	QPSK/ 4.500 MBPS (8)	3.900	3.8/ 1.8	64.6/34.4
10: TEL5	QPSK/ 4.500 MBPS (11)	3.900	3.6/ 3.5	63.3/33.0
11: TEL5	BPSK/250 KBPS (45)	.600	6.1/ 1.2	54.1/26.9
12: TEL5	BPSK/125 KBPS (150)	.300	1.2/ 8.1	42.9/21.7
13: TEL5	BPSK/ 64 KBPS (400)	.115	1.8/ 9.2	41.6/18.4
14: TEL5	BPSK/ 32 KBPS (1125)	.038	1.8/ 9.0	40.2/12.9
15: LOR	QPSK/ 40 MBPS	24.000	7.7/ 1.8	74.0/53.0
16: LOR	QPSK/ 40 MBPS	24.000	7.7/ 3.5	74.0/48.2

L I N K P A R A M E T E R S 10:34:14 13-DEC-97

CARRIER	COMPANY	TYPE	RF BANDWIDTH (MHz)	NO. OF CHAN	CODE RATE/ MOD. INDEX	BOT MOD. FREQ. (MHz)	TOP MOD. FREQ. (MHz)	AVE. TALKER LEVEL (dBm0)	CPAND PREMP NOISE WEIGH (dB)	PHASE	DATA RATE (MBPS)	CHAN. SPACE (MHz)	TRANSPONDER FREQUENCY UP (GHz)	TRANSPONDER FREQUENCY DN (GHz)	POL UP	POL DN	EARTH STATION TRANSMITTER POWR (dBW)	EARTH STATION TRANSMITTER DIAM (m)	EARTH STATION TRANSMITTER GAIN (dB)	--SATELLITE--- RECEIVER GAIN (dB)	--SATELLITE--- RECEIVER TEMP (K)	--SATELLITE--- XMTR EIRP (dBW)	-EARTH STATION RECEIVER DIAM (m)	-EARTH STATION RECEIVER GAIN (dB)	-EARTH STATION RECEIVER TEMP (K)
1	GE-K	1	36.000	1	2.560	.025	4.200	.0	12.8	0	.000	.000	14.250	11.950	0	1	20.0	6.1	56.8	29.8	510.	48.0	6.1	56.3	190
2	GE-K	1	27.000	1	2.200	.001	4.200	.0	12.8	0	.000	.000	14.250	11.950	0	1	16.6	6.1	57.1	29.8	510.	48.0	2.4	47.7	250
3	GE-K	3	23.500	2	.690	.000	.000	.0	.0	4	27.000	27.000	14.250	11.950	0	1	16.9	4.5	54.8	29.8	510.	44.0	3.7	51.8	250
4	GE-K	2	24.000	1	.750	.000	.000	.0	.0	4	30.000	.000	14.250	11.950	0	1	20.0	7.0	58.0	29.8	510.	48.0	3.7	51.8	250
5	GE-K	2	1.029	20	.750	.000	.000	.0	.0	4	1.544	1.500*	14.250	11.950	0	1	.2	5.5	55.9	29.8	510.	25.4	5.5	54.5	250
6	GE-K	3	.384	50	.750	.000	.000	.0	.0	4	.512	.500*	14.250	11.950	0	1	4.6	1.8	46.2	29.8	510.	28.8	1.8	44.8	250
7	TEL5	3	1.240	24	.750	.000	.000	.0	.0	4	1.544	2.000*	14.250	11.950	0	1	7.7	2.4	49.2	26.6	457.	29.6	2.4	47.7	200
8	TEL5	3	1.800	16	1.000	.000	.000	.0	.0	4	3.000	3.000	14.250	11.950	0	1	6.7	4.6	54.9	26.6	457.	31.4	2.4	47.1	281
9	TEL5	3	3.900	8	.690	.000	.000	.0	.0	4	4.500	6.000	14.250	11.950	0	1	11.6	3.8	53.0	26.6	457.	34.4	1.8	44.8	295
10	TEL5	3	3.900	11	.690	.000	.000	.0	.0	4	4.500	4.500	14.250	11.950	0	1	10.8	3.6	52.5	26.6	457.	33.0	3.5	50.3	250
11	TEL5	3	.600	45	.500	.000	.000	.0	.0	2	.250	1.000*	14.250	11.950	0	1	-3.0	6.1	57.1	26.6	457.	26.9	1.2	41.0	280
12	TEL5	3	.300	150	.500	.000	.000	.0	.0	2	.125	.360*	14.250	11.950	0	1	.4	1.2	42.5	26.6	457.	21.7	8.1	58.5	204
13	TEL5	3	.115	400	.667	.000	.000	.0	.0	2	.064	.135*	14.250	11.950	0	1	-4.6	1.8	46.2	26.6	457.	18.4	9.2	59.5	174
14	TEL5	3	.038	1125	1.000	.000	.000	.0	.0	2	.032	.045*	14.250	11.950	0	1	-6.0	1.8	46.2	26.6	457.	12.9	9.0	59.2	209
15	LOR	2	24.000	1	.750	.000	.000	.0	.0	4	40.000	.000	14.250	11.950	0	1	15.4	7.7	58.6	26.4	515.	53.0	1.8	44.8	225
16	LOR	2	24.000	1	.750	.000	.000	.0	.0	4	40.000	.000	14.250	11.950	0	1	15.4	7.7	58.6	26.4	515.	48.2	3.5	50.3	225

THERMAL NOISE SUMMARY

10:34:14 13-DEC-97

CARRIER	COMPANY	EARTH-TO-SHACE EIRP (dBW)	PATH LOSS* (dB)	RCV G/T (dB/K)	SPACE-TO-EARTH EIRP (dBW)	PATH LOSS* (dB)	RCV G/T (dB/K)	C/No - (dB-Hz) UP	DN	TOTAL	C/N - (dB) UP	DN	TOTAL	LINK THERMAL NOISE (pW0p)	S/N (dB)	Eb/No (dB)	SINGLE ENTRY INTERFERENCE OBJ+ (pW0p)	S/I (dB)	C/In (dB)	C/Itv (dB)	IMPAIR-MENT GRADE
1	GE-K	76.8	208.1	2.7	48.0	206.3	33.5	100.0	103.8	98.5	24.5	28.2	22.9		60.2			59.2	=21.9	=28.0<4.52>	
2	GE-K	73.7	208.1	2.7	48.0	206.2	23.7	96.9	94.1	92.3	22.6	19.8	18.0		53.5			51.8	=16.4	=22.0<4.18>	
3	GE-K	71.7	208.1	2.7	44.0	206.3	27.8	94.9	94.1	91.5	21.2	20.4	17.8			17.2			22.0		
4	GE-K	78.0	208.1	2.7	48.0	206.3	27.8	101.2	98.1	96.4	27.4	24.3	22.6			21.6			26.0		
5	GE-K	56.1	208.1	2.7	25.4	206.3	30.5	79.3	78.2	75.7	19.2	18.1	15.6			13.8			19.7		
6	GE-K	50.8	207.8	2.7	28.8	206.1	20.8	74.3	72.1	70.1	18.5	16.3	14.2			13.0			19.9		
7	TEL5	56.9	207.8	.0	29.6	206.2	24.7	77.7	76.7	74.2	16.8	15.8	13.2			12.3			20.0		
8	TEL5	61.6	208.1	.0	31.4	206.2	22.6	82.1	76.4	75.4	19.5	13.9	12.8			10.6			20.0		
9	TEL5	64.6	208.1	.0	34.4	206.1	20.1	85.1	77.0	76.4	19.2	11.1	10.5			9.8			20.0		
10	TEL5	63.3	208.1	.0	33.0	206.3	26.3	83.8	81.6	79.6	17.9	15.7	13.7			13.0			20.0		
11	TEL5	54.1	208.1	.0	26.9	206.1	16.5	74.6	65.9	65.4	16.8	8.1	7.6			11.4			20.0		
12	TEL5	42.9	207.8	.0	21.7	206.3	35.4	63.7	79.4	63.6	8.9	24.6	8.8			12.6			20.0		
13	TEL5	41.6	207.8	.0	18.4	206.3	37.1	62.4	77.8	62.3	11.8	27.2	11.7			14.2			20.0		
14	TEL5	40.2	207.8	.0	12.9	206.3	36.0	61.0	71.2	60.6	15.2	25.4	14.8			15.6			20.0		
15	LOR	74.0	208.1	-.7	53.0	206.1	21.3	93.8	96.8	92.0	20.0	23.0	18.2			16.0			27.2		
16	LOR	74.0	208.1	-.7	48.2	206.3	26.8	93.8	97.3	92.2	20.0	23.5	18.4			16.2			27.2		

*** F O O T N O T E S ***

L I N K P A R A M E T E R S

SIGNAL TYPE INDEX	POLARIZATION TYPE INDEX
0 = FDM/FM	0 = HORIZONTAL
1 = TV/FM	1 = VERTICAL
2 = DIGITAL	
3 = SCPC/PSK	2 = 20 DEG CANTED HORIZONTAL
4 = SCPC/FM	3 = 20 DEG CANTED VERTICAL
5 = CSSB/AM	
6 = SS/PSK	4 = LEFT-HAND CIRCULAR
	5 = RIGHT-HAND CIRCULAR

POLARIZATION ISOLATION MATRIX (dB)

		INTERFERING SENSE 0	1	2	3	4	5
DESIRED SENSE	0	.0	.0	.0	.0	.0	.0
	1	.0	.0	.0	.0	.0	.0
	2	.0	.0	.0	.0	.0	.0
	3	.0	.0	.0	.0	.0	.0
	4	.0	.0	.0	.0	.0	.0
	5	.0	.0	.0	.0	.0	.0

SPECTRA ASSUMMED FOR INTERFERENCE INTO SCPC & PSK

TV/FM: FCC ADVISORY COMMITTEE

FDM/FM: GAUSSIAN, EXCEPT FOR THOSE MARKED WITH "+" UNDER SIGNAL TYPE

* INDICATES SCPC AND SMALL FDMA CARRIERS WHOSE TRANSPONDER FREQUENCY PLANS AVOID +- 1.0 MHz AT THE TRANSPONDER CENTER.

"PLAN" UNDER CHANNEL SPACING INDICATES A FIXED FREQUENCY PLAN.

T H E R M A L N O I S E S U M M A R Y

* PATH LOSSES INCLUDE FREE SPACE LOSS FOR A 20 DEGREE ELEVATION ANGLE, CLEAR SKY ATMOSPHERIC LOSSES, AND ANTENNA POINTING LOSSES IN THE RANGE OF 0.0-0.5 dB. POINTING LOSSES ARE INCLUDED ONLY FOR THE THERMAL NOISE C/N, NOT IN INTERFERENCE CALCULATIONS.

UPLINK LOSSES = 207.6 + .2 dB + Pointing Loss
DOWNLINK LOSSES = 205.9 + .2 dB + Pointing Loss

+ THE TV/FM INTERFERENCE OBJECTIVE IS EITHER THE S/I OR C/I VALUE(S) WITHOUT THE "=". THE VALUE(S) WITH THE "=" ARE FOR COMPARISON ONLY. IF THE S/I HAS THE "=", THEN THE C/I OBJECTIVE IS USED AND THE S/I IS THE EQUIVALENT LEVEL FROM A CO-CHANNEL TV/FM INTERFERER. IF THE C/Is HAVE "=", THEN THE S/I OBJECTIVE IS USED AND THE C/Is INDICATE THE EQUIVALENT SINGLE ENTRY LEVELS IN FOR A NOISE-LIKE INTERFERER (C/In) AND FOR A CO-CHANNEL TV/FM INTERFERER (C/Itv). CCIR Rec. 500-1 IMPAIRMENT GRADES ARE GIVEN FOR THE AGGREGATE TV/FM C/I = C/Itv - 4 dB INTO A "REASONABLELY CRITICAL STILL SCENE". THE IMPAIRMENT GRADES ARE:

5.0 = IMPERCEPTIBLE (Never achieved)
4.6 = JUST PERCEPTIBLE OR JUST UNPERCEPTIBLE (Highest achievable grade)
4.3 = APPROXIMATE GRADE FOR CATV AGGREGATE OBJECTIVE OF 18 dB
4.0 = PERCEPTIBLE, BUT NOT ANNOYING
3.0 = SLIGHTLY ANNOYING
2.0 = ANNOYING
1.0 = VERY ANNOYING

SINGLE ENTRY MARGIN (dB) (2.00 DEGREE SPACING) 10:34:14 13-DEC-97

Antenna Patterns as given ; A = Geocentric Angle

WANTED	INTERFERING 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	4.1	5.3	11.9	10.2	18.2	10.2	12.1	14.1	12.8	12.5	16.6	12.3	12.7	10.1	7.5	11.6
2	3.3	3.8	12.7	8.9	18.2	10.0	13.8	15.1	14.7	14.2	16.2	14.3	14.2	12.7	4.8	9.3
3	2.8	3.6	6.6	6.9	14.9	10.2	8.1	9.4	8.4	8.2	14.0	15.6	19.9	22.7	3.0	7.4
4	3.4	3.9	8.1	3.4	13.3	5.0	9.0	10.1	9.4	9.4	11.2	9.4	9.3	7.8	-.8	3.8
5	-7.8	-7.1	5.1	1.5	11.0	3.9	5.4	7.7	5.5	6.5	10.6	7.8	8.0	6.1	-1.7	2.8
6	-9.8	-9.2	3.2	-.5	8.2	1.1	2.8	3.9	3.4	4.4	5.6	6.7	6.1	4.5	-3.9	.7
7	-10.8	-10.4	2.2	-1.5	9.2	1.1	3.9	3.9	3.1	4.2	8.5	6.5	6.0	8.7	-5.3	-.6
8	-10.9	-10.7	2.2	-1.5	9.9	2.2	6.2	5.0	3.8	5.1	8.0	7.0	7.3	11.6	-5.6	-.9
9	-10.5	-10.4	-.2	-3.8	8.1	-.4	4.6	5.9	2.7	4.0	4.9	4.8	8.3	13.0	-8.1	-3.4
10	-6.8	-6.5	3.3	-.4	11.4	2.8	7.3	9.2	5.6	6.8	8.7	7.3	11.2	14.9	-4.2	.4
11	-16.5	-16.4	-3.4	-7.2	2.3	-2.8	-1.8	-1.9	-1.9	-.5	-.6	2.4	.8	1.9	-11.5	-6.7
12	-10.8	-7.9	1.5	-1.5	5.3	-2.8	-1.7	.8	-.7	.1	5.6	.9	2.1	-1.0	1.0	2.8
13	-8.1	-5.3	4.3	1.2	8.0	-.7	1.0	3.5	2.1	2.9	7.9	2.5	4.5	1.6	3.3	5.4
14	-5.6	-3.4	6.9	3.7	10.9	2.1	4.2	6.5	5.2	6.1	10.0	5.4	6.3	4.5	3.7	7.0
15	-.3	.4	4.3	-.3	9.3	1.0	4.7	6.1	5.2	5.2	7.7	5.1	5.1	3.2	-4.1	.4
16	.2	1.0	4.8	.2	9.7	1.3	4.9	6.5	5.5	5.4	8.2	5.3	5.5	3.4	-3.4	1.0

COMBINATIONS FAILING TO MEET SINGLE ENTRY INTERFERENCE OBJECTIVES (dB) 10:34:14 13-DEC-97

(2.00 DEGREE SPACING) Antenna Patterns as given ; A = Geocentric Angle

| INTERFERING LINK -->

									1	1	1	1	1	1
WANTED LINK	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
GE-K	1															
GE-K	2															
GE-K	3															
GE-K	4														1	
GE-K	5	8	7												2	
GE-K	6	*	9		1										4	
TEL5	7	*	*		2										5	1
TEL5	8	*	*		2										6	1
TEL5	9	*	*	1	4		1								8	3
TEL5	10	7	6		1										4	
TEL5	11	*	*	3	7		3	2	2	2	1	1			*	7
TEL5	12	*	8		2		3	2		1				1		
TEL5	13	8	5				1									
TEL5	14	6	3													
LOR	15	1			1										4	
LOR	16														3	

10:34:14 13-DEC-97

FAILURE SUMMARY*
(NUMBER)

	SATELLITE SPACING				
	2.00 DEG	.00 DEG	.00 DEG	.00 DEG	.00 DEG
TOTAL COMBINATIONS	256	256	256	256	256
TOTAL FAILURES	57	0	0	0	0
FAILS BY:					
.0 - 1.5 dB	14				
1.5 - 2.5 dB	8				
2.5 - 3.5 dB	6				
3.5 - 4.5 dB	4				
4.5 - 5.5 dB	2				
5.5 - 6.5 dB	3				
6.5 - 7.5 dB	4				
7.5 - 8.5 dB	4				
8.5 - 9.5 dB	1				
MORE THAN 9.5 dB	11				

(PERCENT)

	SATELLITE SPACING				
	2.00 DEG	.00 DEG	.00 DEG	.00 DEG	.00 DEG
TOTAL FAILURES	22.3 %	.0 %	.0 %	.0 %	.0 %
FAILS BY:					
.0 - 1.5 dB	5.5 %				
1.5 - 2.5 dB	3.1 %				
2.5 - 3.5 dB	2.3 %				
3.5 - 4.5 dB	1.6 %				
4.5 - 5.5 dB	.8 %				
5.5 - 6.5 dB	1.2 %				
6.5 - 7.5 dB	1.6 %				
7.5 - 8.5 dB	1.6 %				
8.5 - 9.5 dB	.4 %				

MORE THAN 9.5 dB 4.3 %

* Antenna Patterns as given ; A = Geocentric Angle

ATTACHMENT D
INTERFERENCE ANALYSIS
FOR SN-3
C-BAND TRANSPONDERS

D.1 Introduction

It is shown in this analysis that SN-3 at 79° W.L. will not cause harmful interference into Loral 1 at 77° W.L.

GE Americom has undertaken an analysis of traffic listed for Loral spacecraft and has determined that the SN-3 satellite can co-exist under standard coordination criteria. GE Americom will coordinate its traffic with Loral.

D.1.1 Interference into SCPC Carriers

As described below, the worst case of adjacent satellite interference is that in which a saturated analog video carrier is co-frequency and –co-polarized with respect to the interfered-with-single channel per carrier (SCPC) traffic on the adjacent, interfered-with satellite. The region experiencing the greatest interference in the SCPC transponder is that region immediately adjacent to the center frequency of the video carrier. Satellite operators universally recognize this fact, and it is general operational practice not to assign SCPC traffic to these high energy density regions of video transmissions. Indeed, in the revised Part 25 rules for C-band, the FCC indicates that no protection will be afforded for narrow band carriers located within +/- 1 MHz of the center frequency of the video carrier. The amount of frequency offset from the center of the interfering video carrier required to achieve a desired protection ration is determined by the robustness of the SCPC carrier.

D.1.2 C-Band Satellites Adjacent to SN-3

The only C-band satellite orbital slot adjacent to the west of SN-3 at 79° W.L. is 85° West Longitude. This slot is currently occupied by GE-2. The only C-band orbital slot immediately adjacent on the east of the 79° West Longitude is Loral 1 at 77° W.L. In the case where incompatibilities exist, GE Americom has some flexibility to move some traffic to transponders, which are compatible with the traffic plans of other operators as part of any required coordination agreement.

D.2 Frequency Offsets of SCPC Carriers

The issue of frequency offsets of SCPC carriers to minimize adjacent satellite interference from analog video carriers was previously addressed by the Advisory Committee for the implementation of Reduced Orbital Spacing

Between United States Domestic Fixed-Satellites To The Federal Communications Commission (FCC 2° Spacing Advisory Committee). The Phase One Report of the Committee, published in September 1985, recommended that the SCPC carriers should not be assigned with +/- 1.0 MHz of the center frequencies of the interfering video carriers, and cautioned that the SCPC carrier placed within +/- 3.) MHz of the video carriers be designed with sufficient protection to withstand the high level of interference to be encountered in this region.

Several comments are in order concerning the above recommendation. Since the recommendation concerns video interference into C-band, for which there is a standard satellite transponder frequency plan, reference to transponder center frequency is equivalent to reference to the center frequency of the interfering video carrier.

SCPC carriers that are not robust and not designed with sufficient protection to withstand the high energy transmissions of video on adjacent satellite will require frequency offsets greater than he +/- 1.0 MHz or +/- 3.0 MHz recommended by the 2° Spacing Advisory Committee.

Table D-1

Protection Ratios

COMMUNICATIONS TRAFFIC MODE	SINGLE-ENTRY CO-FREQUENCY PROTECTION RATIO
1. Frequency Modulated Television (FM-TV)	C/I_{SE} = 22.0 dB to 28.0 dB[1]
2. Frequency Division Multiplexed frequency Modulated (FDM-FM) Channels	Interference from an adjacent satellite shall contribute a maximum of 1000 picowatts of noise in the worst baseband channel.
3. Digital Data Channels- Full transponder Power Occupying Full Transponder Bandwidth	E_B/I_o = 25 dB
4. Single Channel Per Carrier (SCPC) T1(1.544 MBps) Digital Data	E_B/I_o = 20 dB
5. Single Channel Per Carrier (SCPC) 56 KBps Digital Data	E_B/I_o = 20 dB
6. Frequency Modulated Single Channel per Carrier (FM-SCPC) Message Voice Service	Interference from an adjacent satellite shall contribute a maximum of 1000 picowatts of noise in the worst baseband channel.
7. Frequency Modulated Single Channel per Carrier (FM-SCPC) Program Audio	C/I_{SE} = 24.0 dB
8. Companded Single Sideband Channels	Interference from an adjacent satellite shall contribute a maximum of 1000 picowatts of noise in the worst baseband channel.
9. Spread Spectrum Channels	E_B/I_o = 20 dB[2]

NOTES:

1. The single entry co-frequency protection ratio for desired television transmission shall be in the range of C/I_{SE} = 22.0 dB to 28.0 dB. The single entry co-frequency protection ration for point to multipoint (Cable, SMATV, and Direct to Home) transmission shall be C/I_{SE} = 22.0 dB. The single entry co-frequency protection ratio for point-to-point transmission shall be a maximum of C/I_{SE} = 28.0 dB. These protection ratios apply for television interference into television. It appears that non-television interference may allow lower protection ratios. Comments are invited as to what these protection ratios should be.

   Those system operators demanding a particular protection ratio must employ an antenna diameter such that the single entry carrier to adjacent satellite interference ratio for co-frequency TV into TV interference in a homogeneous satellite environment shall be that value.

2. This is a preliminary number that will be refined by further technical analysis in the second phase of the work of the Advisory Committee.

D.3 Interference into Adjacent Satellites

The analysis was performed using a FCC Video Mask. Data used in the analysis was taken from either the Loral or Hughes filings.

GE Americom performed the analysis using the George Sharp ASIA Program.

D.3.1 Interference BETWEEN SN-3 and Loral

2° Spacing Cross Polarized

The first Sharp analysis is for SN-3 into Loral with 2° spacing. It was assumed that the SCPC carriers were located at least 1.0 MHz from the center frequency of an analog video signal. Signals were considered to be cross polarized.

Table 1: Domestic Satellite R.F. Carrier Listing - 6 / 4 GHz

Carrier Number	Signal Type & (channels)	Bandwidth (MHz)	E.S. Antennas (m) up/down	EIRP (dBW) up/down
1: SPC	TV/FM (1)	36.000	10.0/ 7.0	81.0/34.0
2: SPC	TV/FM (1)	36.000	10.0/ 5.0	81.0/34.0
3: SPC	QPSK/ 30 MBPS	27.000	10.0/ 5.0	81.0/34.0
4: SPC	QPSK/ 1.544 MBPS	1.544	9.2/ 3.5	61.3/22.7
5: SPC	QPSK/128 KBPS	.128	9.2/ 3.5	56.3/17.7
6: SPC	QPSK/384 KBPS	.384	4.5/ 4.5	49.1/11.1
7: SPC	QPSK/ 15.500 MBPS	7.750	10.0/11.0	66.0/28.1
8: LOR	TV/FM (1)	30.000	10.0/ 6.0	68.5/41.5
9: LOR	TV/FM (1)	36.000	10.0/ 6.0	68.5/41.5
10: LOR	TV/FM (1)	30.000	10.0/ 6.0	68.5/39.0
11: LOR	TV/FM (1)	36.000	10.0/ 6.0	68.5/39.0
12: LOR	QPSK/ 1.544 MBPS (10)	.850	7.0/ 6.0	62.0/27.5
13: LOR	QPSK/ 1.544 MBPS (10)	1.030	7.0/ 6.0	62.0/27.5
14: LOR	SCPC/FM (620)	.037	10.0/ 6.0	44.7/ 7.5
15: LOR	QPSK/ 60 MBPS	36.000	10.0/ 6.0	68.5/41.5
16: LOR	QPSK/ 40 MBPS	24.000	10.0/ 6.0	67.5/41.5

L I N K P A R A M E T E R S 13:35:32 9-JAN-98

CAR IER	COM- PANY	T Y P E	RF BAND- WIDTH (MHz)	NO. OF CHAN	CODE RATE/ MOD. INDEX	BOT MOD. FREQ. (MHz)	TOP MOD. FREQ. (MHz)	AVE. TALKER LEVEL (dBm0)	CPAND PREMP NOISE WEIGH (dB)	H A S E	DATA RATE (MBPS)	CHAN. SPACE (MHz)	TRANSPONDER FREQUENCY UP (GHz)	DN (GHz)	POL U P	POL D N	EARTH STATION TRANSMITTER POWR (dBW)	DIAM (m)	GAIN (dB)	--SATELLITE--- RECEIVER GAIN (dB)	TEMP (K)	-EARTH STATION XMTR EIRP (dBW)	DIAM (m)	RECEIVER GAIN (dB)	TEMP (K)
1	SPC	1	36.000	1	2.690	.025	4.200	.0	13.0	0	.000	.000	6.145	3.920	1	0	27.0	10.0	54.0	29.0	645.	34.0	7.0	47.5	120
2	SPC	1	36.000	1	2.690	.025	4.200	.0	13.0	0	.000	.000	6.145	3.920	1	0	27.0	10.0	54.0	29.0	645.	34.0	5.0	45.0	120
3	SPC	2	27.000	1	.750	.000	.000	.0	.0	4	30.000	.000	6.145	3.920	1	0	27.0	10.0	54.0	29.0	645.	34.0	5.0	45.0	120
4	SPC	3	1.544	1	.500	.000	.000	.0	.0	4	1.544	2.150	6.145	3.920	1	0	8.2	9.2	53.1	29.0	645.	22.7	3.5	40.7	125
5	SPC	3	.128	1	.500	.000	.000	.0	.0	4	.128	.200*	6.145	3.920	1	0	3.2	9.2	53.1	29.0	645.	17.7	3.5	40.7	125
6	SPC	3	.384	1	.500	.000	.000	.0	.0	4	.384	.475*	6.145	3.920	1	0	2.3	4.5	46.8	29.0	645.	11.1	4.5	42.8	125
7	SPC	2	7.750	1	1.000	.000	.000	.0	.0	4	15.500	11.000	6.145	3.920	1	0	12.0	10.0	54.0	29.0	645.	28.1	11.0	50.9	125
8	LOR	1	30.000	1	2.560	.025	4.200	.0	.0	0	.000	.000	6.145	3.920	1	0	14.5	10.0	54.0	28.1	600.	41.5	6.0	46.0	120
9	LOR	1	36.000	1	3.286	.025	4.200	.0	.0	0	.000	.000	6.145	3.920	1	0	14.5	10.0	54.0	28.1	600.	41.5	6.0	46.0	120
10	LOR	1	30.000	1	2.560	.025	4.200	.0	.0	0	.000	.000	6.145	3.920	1	0	14.5	10.0	54.0	27.2	600.	39.0	6.0	46.0	120
11	LOR	1	36.000	1	3.286	.025	4.200	.0	.0	0	.000	.000	6.145	3.920	1	0	14.5	10.0	54.0	27.2	600.	39.0	6.0	46.0	120
12	LOR	3	.850	10	1.000	.000	.000	.0	.0	4	1.544	2.000*	6.145	3.920	1	0	10.9	7.0	51.1	28.1	600.	27.5	6.0	46.0	120
13	LOR	3	1.030	10	.875	.000	.000	.0	.0	4	1.544	2.000*	6.145	3.920	1	0	10.9	7.0	51.1	28.1	600.	27.5	6.0	46.0	120
14	LOR	4	.037	620	4.412	.000	.003	.0	25.8	0	.000	.048*	6.145	3.920	1	0	-9.3	10.0	54.0	28.1	600.	7.5	6.0	46.0	120
15	LOR	2	36.000	1	.000	.000	.000	.0	.0	4	60.000	.000	6.145	3.920	1	0	14.5	10.0	54.0	28.1	600.	41.5	6.0	46.0	120
16	LOR	2	24.000	1	.750	.000	.000	.0	.0	4	40.000	.000	6.145	3.920	1	0	14.0	10.0	53.5	28.1	600.	41.5	6.0	46.0	120

T H E R M A L N O I S E S U M M A R Y 13:35:32 9-JAN-98

CAR- RIER	COM- PANY	EARTH-TO-SHACE EIRP (dBW)	PATH LOSS* (dB)	RCV G/T (dB/K)	SPACE-TO-EARTH EIRP (dBW)	PATH LOSS* (dB)	RCV G/T (dB/K)	C/No - (dB-Hz) UP	DN	TOTAL	C/N - (dB) UP	DN	TOTAL	LINK THERMAL NOISE (pW0p)	S/N (dB)	Eb/No (dB)	(pW0p)	SINGLE ENTRY INTERFERENCE OBJ+ S/I (dB)	C/In (dB)	C/Itv (dB)	IMPAIR- MENT GRADE
1	SPC	81.0	200.1	.9	34.0	196.3	26.7	110.4	93.0	92.9	34.8	17.4	17.4		55.4			59.6	=21.5	=28.0	<4.53>
2	SPC	81.0	200.1	.9	34.0	196.2	24.2	110.4	90.6	90.6	34.8	15.0	15.0		53.1			53.6	=15.5	=22.0	<4.33>
3	SPC	81.0	200.1	.9	34.0	196.2	24.2	110.4	90.6	90.6	36.1	16.3	16.2			15.8			22.0		
4	SPC	61.3	200.1	.9	22.7	196.2	19.7	90.7	74.8	74.7	28.8	12.9	12.8			12.8			20.0		
5	SPC	56.3	200.1	.9	17.7	196.2	19.7	85.7	69.8	69.7	34.6	18.8	18.6			18.6			20.0		
6	SPC	49.1	199.8	.9	11.1	196.2	21.8	78.8	65.3	65.1	23.0	9.5	9.3			9.3			20.0		
7	SPC	66.0	200.1	.9	28.1	196.4	29.9	95.4	90.2	89.1	26.5	21.3	20.2			17.2			25.0		
8	LOR	68.5	200.1	.3	41.5	196.3	25.2	97.3	99.0	95.1	22.5	24.2	20.3		44.8			59.2	=34.7	=28.0	<4.52>
9	LOR	68.5	200.1	.3	41.5	196.3	25.2	97.3	99.0	95.1	21.8	23.4	19.5		47.0			61.3	=33.9	=28.0	<4.58>
10	LOR	68.5	200.1	-.6	39.0	196.3	25.2	96.4	96.5	93.5	21.6	21.7	18.7		43.2			59.2	=34.7	=28.0	<4.52>
11	LOR	68.5	200.1	-.6	39.0	196.3	25.2	96.4	96.5	93.5	20.9	20.9	17.9		45.3			61.3	=33.9	=28.0	<4.58>
12	LOR	62.0	200.1	.3	27.5	196.3	25.2	90.8	85.0	84.0	31.5	25.7	24.7			22.1			22.6		

											Sn3lorc				
13	LOR	62.0	200.1	.3	27.5	196.3	25.2	90.8	85.0	84.0	30.7	24.9	23.9		22.1	21.8
14	LOR	44.7	200.1	.3	7.5	196.3	25.2	73.5	65.0	64.4	27.8	19.3	18.8	101. 70.0		24.0
15	LOR	68.5	200.1	.3	41.5	196.3	25.2	97.3	99.0	95.1	21.8	23.4	19.5		17.3	27.2
16	LOR	67.5	200.1	.3	41.5	196.3	25.2	96.3	99.0	94.4	22.5	25.2	20.6		18.4	27.2

*** F O O T N O T E S ***

L I N K P A R A M E T E R S

SIGNAL TYPE INDEX

0 = FDM/FM
1 = TV/FM
2 = DIGITAL
3 = SCPC/PSK
4 = SCPC/FM
5 = CSSB/AM
6 = SS/PSK

POLARIZATION TYPE INDEX

0 = HORIZONTAL
1 = VERTICAL
2 = 20 DEG CANTED HORIZONTAL
3 = 20 DEG CANTED VERTICAL
4 = LEFT-HAND CIRCULAR
5 = RIGHT-HAND CIRCULAR

POLARIZATION ISOLATION MATRIX (dB)

DESIRED \ INTERFERING SENSE	0	1	2	3	4	5
0	10.0	10.0	10.0	10.0	10.0	10.0
1	10.0	10.0	10.0	10.0	10.0	10.0
2	10.0	10.0	10.0	10.0	10.0	10.0
3	10.0	10.0	10.0	10.0	10.0	10.0
4	10.0	10.0	10.0	10.0	10.0	10.0
5	10.0	10.0	10.0	10.0	10.0	10.0

SPECTRA ASSUMMED FOR INTERFERENCE INTO SCPC & PSK

TV/FM: FCC ADVISORY COMMITTEE

FDM/FM: GAUSSIAN, EXCEPT FOR THOSE MARKED WITH "+" UNDER SIGNAL TYPE

* INDICATES SCPC AND SMALL FDMA CARRIERS WHOSE TRANSPONDER FREQUENCY PLANS AVOID +- 1.0 MHz AT THE TRANSPONDER CENTER.

"PLAN" UNDER CHANNEL SPACING INDICATES A FIXED FREQUENCY PLAN.

T H E R M A L N O I S E S U M M A R Y

* PATH LOSSES INCLUDE FREE SPACE LOSS FOR A 10 DEGREE ELEVATION ANGLE, CLEAR SKY ATMOSPHERIC LOSSES, AND ANTENNA POINTING LOSSES IN THE RANGE OF 0.0-0.5 dB. POINTING LOSSES ARE INCLUDED ONLY FOR THE THERMAL NOISE C/N, NOT IN INTERFERENCE CALCULATIONS.

UPLINK LOSSES = 199.6 + .2 dB + Pointing Loss
DOWNLINK LOSSES = 196.1 + .1 dB + Pointing Loss

+ THE TV/FM INTERFERENCE OBJECTIVE IS EITHER THE S/I OR C/I VALUE(S) WITHOUT THE "=". THE VALUE(S) WITH THE "=" ARE FOR COMPARISON ONLY. IF THE S/I HAS THE "=", THEN THE C/I OBJECTIVE IS USED AND THE S/I IS THE EQUIVALENT LEVEL FROM A CO-CHANNEL TV/FM INTERFERER. IF THE C/Is HAVE "=", THEN THE S/I OBJECTIVE IS USED AND THE C/Is INDICATE THE EQUIVALENT SINGLE ENTRY LEVELS IN FOR A NOISE-LIKE INTERFERER (C/In) AND FOR A CO-CHANNEL TV/FM INTERFERER (C/Itv). CCIR Rec. 500-1 IMPAIRMENT GRADES ARE GIVEN FOR THE AGGREGATE TV/FM C/I = C/Itv - 4 dB INTO A "REASONABLELY CRITICAL STILL SCENE". THE IMPAIRMENT GRADES ARE:

5.0 = IMPERCEPTIBLE (Never achieved)
4.6 = JUST PERCEPTIBLE OR JUST UNPERCEPTIBLE (Highest achievable grade)
4.3 = APPROXIMATE GRADE FOR CATV AGGREGATE OBJECTIVE OF 18 dB
4.0 = PERCEPTIBLE, BUT NOT ANNOYING
3.0 = SLIGHTLY ANNOYING
2.0 = ANNOYING

1.0 = VERY ANNOYING

W A N T E D

SINGLE ENTRY MARGIN (dB) (2.00 DEGREE SPACING) 13:35:32 9-JAN-98
Antenna Patterns as given ; A = Geocentric Angle

	INTERFERING 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	7.1	7.1	13.6	25.6	30.6	36.8	20.3	.5	.5	3.0	3.0	10.9	10.9	13.0	7.0	7.0
2	11.0	11.0	17.5	29.2	34.2	40.5	23.8	4.0	4.0	6.5	6.5	14.4	14.4	16.5	10.5	10.5
3	11.0	11.0	11.0	22.7	27.7	34.1	17.4	4.0	4.0	6.5	6.5	8.0	8.0	10.8	4.6	4.0
4	-2.2	-2.2	7.2	9.0	14.0	20.0	9.6	-8.5	-8.5	-6.0	-6.0	4.3	4.3	13.9	2.5	1.4
5	3.6	3.6	13.0	13.7	9.0	18.8	15.4	-2.7	-2.7	-.2	-.2	6.2	6.9	14.6	8.3	7.2
6	-6.5	-6.5	2.9	4.3	4.3	9.9	6.0	-11.9	-11.9	-9.5	-9.5	-2.9	-2.3	5.6	-.9	-2.1
7	1.6	1.6	5.2	17.5	22.5	25.8	12.7	.9	.9	3.2	3.2	7.4	7.4	12.7	6.1	5.0
8	1.8	1.8	-4.9	12.8	17.8	19.6	8.5	5.9	5.9	7.9	7.9	-.5	-.5	1.9	-.5	-.7
9	1.8	1.8	-4.1	13.6	18.6	20.4	9.3	5.9	5.9	7.9	7.9	.3	.3	2.5	.0	.1
10	1.6	1.6	-5.1	12.0	17.0	19.4	7.5	3.7	3.7	5.9	5.9	-1.6	-1.6	.8	-2.7	-3.0
11	1.6	1.6	-4.3	12.8	17.8	20.2	8.3	3.7	3.7	5.9	5.9	-.8	-.8	1.4	-2.2	-2.2
12	3.3	3.3	12.8	16.8	20.0	23.8	18.8	1.5	1.5	3.9	3.9	10.8	11.2	20.4	12.5	11.4
13	3.3	3.3	12.7	16.9	20.8	24.6	18.7	1.5	1.5	3.9	3.9	11.6	11.6	21.2	12.5	11.4
14	-2.7	-2.7	6.8	9.4	3.7	13.0	11.5	-6.2	-6.2	-3.8	-3.8	2.1	2.8	9.9	4.8	3.7
15	2.6	2.6	2.6	20.3	25.3	27.1	16.0	6.7	6.7	8.7	8.7	7.0	7.0	9.2	6.7	6.8
16	1.6	1.6	1.8	19.5	24.5	26.2	15.3	6.5	6.5	8.5	8.5	6.3	6.3	9.8	7.5	6.6

COMBINATIONS FAILING TO MEET SINGLE ENTRY INTERFERENCE OBJECTIVES (dB) 13:35:32 9-JAN-98
(2.00 DEGREE SPACING) Antenna Patterns as given ; A = Geocentric Angle

WANTED LINK	INTERFERING LINK --> 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
SPC 1	
SPC 2	
SPC 3	
SPC 4	2 2 8 8 6 6
SPC 5	3 3 1 1
SPC 6	6 6 * * 9 9 3 2 1 2
SPC 7	
LOR 8	5 1 1 1 1
LOR 9	4 1
LOR 10	5 2 2 3 3
LOR 11	4 1 1 2 2
LOR 12	
LOR 13	
LOR 14	3 3 6 6 4 4
LOR 15	
LOR 16	

13:35:32 9-JAN-98

FAILURE SUMMARY*
(NUMBER)

	SATELLITE SPACING 2.00 DEG	.00 DEG	.00 DEG	.00 DEG	.00 DEG
TOTAL COMBINATIONS	256	256	256	256	256
TOTAL FAILURES	43	0	0	0	0
FAILS BY:					
.0 - 1.5 dB	10				

1.5 - 2.5 dB	8
2.5 - 3.5 dB	7
3.5 - 4.5 dB	4
4.5 - 5.5 dB	2
5.5 - 6.5 dB	6
6.5 - 7.5 dB	0
7.5 - 8.5 dB	2
8.5 - 9.5 dB	2
MORE THAN 9.5 dB	2

(PERCENT)

S A T E L L I T E S P A C I N G

	2.00 DEG	.00 DEG	.00 DEG	.00 DEG	.00 DEG
TOTAL FAILURES	16.8 %	.0 %	.0 %	.0 %	.0 %
FAILS BY:					
.0 - 1.5 dB	3.9 %				
1.5 - 2.5 dB	3.1 %				
2.5 - 3.5 dB	2.7 %				
3.5 - 4.5 dB	1.6 %				
4.5 - 5.5 dB	.8 %				
5.5 - 6.5 dB	2.3 %				
6.5 - 7.5 dB	.0 %				
7.5 - 8.5 dB	.8 %				
8.5 - 9.5 dB	.8 %				
MORE THAN 9.5 dB	.8 %				

* Antenna Patterns as given ; A = Geocentric Angle