Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Application of	)	
	)	
SES Americom, Inc.	)	File No. SAT-RPL-__________
	)	
For Authority to Launch and Operate a Replacement Satellite at 101° W.L.	))	

APPLICATION OF SES AMERICOM, INC.

SES Americom, Inc. ("SES Americom," doing business as "SES WORLD SKIES"),[1] hereby applies for authority under the Communications Act of 1934, as amended, and the Federal Communications Commission's regulations thereunder, to launch and operate a replacement spacecraft for AMC-4 at 101° W.L., to be designated SES-1. SES-1 will operate in the conventional C- and Ku-bands.[2] Construction of the SES-1 satellite (formerly known as AMC-24) is nearly complete, and SES WORLD SKIES currently expects to launch the spacecraft in the mid-April to mid-May 2010 timeframe.

A completed FCC Form 312 is attached, and technical information relating to the proposed spacecraft is provided on Schedule S and in narrative form pursuant to Section 25.114 of the Commission's Rules. Grant of this application is in the public interest because it will permit SES WORLD SKIES to provide continuity of service to customers at 101° W.L.

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1 On September 7, 2009, SES S.A. announced that the newly integrated operations of its two indirect subsidiaries, New Skies Satellites B.V. and SES Americom would be conducted under a single brand name, SES WORLD SKIES. The new brand name does not affect the underlying legal entities that hold Commission authorizations or U.S. market access rights.

2 The "conventional C-band" refers to the 3700-4200 MHz and 5925-6425 MHz frequencies. The "conventional Ku-band" refers to the 11.7-12.2 GHz and 14.0-14.5 GHz frequencies. In addition to the C- and Ku-band payloads, the SES-1 spacecraft is being built with a 17/24 GHz Broadcasting Satellite Service ("BSS") payload. SES WORLD SKIES does not propose to use this payload at 101° W.L.

INTRODUCTION

SES WORLD SKIES is a leading provider of satellite services in the United States. Headquartered in Princeton, New Jersey, SES WORLD SKIES provides U.S. and international services through a fleet of geosynchronous communications satellites. For most of its more than 30 years of operation (first as RCA American Communications, Inc., then as GE American Communications, Inc.), SES WORLD SKIES has provided service to broadcast and cable television programmers, as well as to the federal government and others.

Commercial and educational television broadcasters use SES WORLD SKIES satellites both to distribute programming and for specialized satellite newsgathering services. SES WORLD SKIES established one of the first cable satellite "neighborhoods" more than 20 years ago, and today distributes cable television programming for the major cable networks. Virtually every U.S. cable and DBS household receives some of its programming via the SES WORLD SKIES fleet. SES WORLD SKIES also has the largest satellite "neighborhood" for the U.S. radio programming industry.

Dozens of specialized satellite-based communication networks have been designed, installed, maintained and serviced by SES WORLD SKIES for governmental organizations as diverse as NASA, NOAA, and the U.S. Armed Forces, as well as for commercial customers such as the publishing industry.[3] The company has a long history of providing communications for the telephone industry, and, more recently, SES WORLD SKIES' satellites have been used for data communications, VSAT services, and Internet transmissions. As the demand increases for high-quality telecommunications, SES WORLD SKIES' technical

[3] Government services are provided by SES WORLD SKIES' wholly-owned subsidiary, Americom Government Services, Inc.

experts continue to develop innovative and cost-effective solutions to address customers' evolving needs.

SES WORLD SKIES has operated AMC-4 at 101° W.L. since late 1999, and the satellite's license term extends to December of 2014. However, in late 2006 the satellite began to experience solar array circuit failures. These failures have affected the total power available to the spacecraft. To avoid any service outages that might be triggered by the AMC-4 power deficiency, SES WORLD SKIES requested authority to move its AMC-2 C/Ku-band hybrid spacecraft and collocate it with AMC-4. The Commission authorized the relocation, and SES WORLD SKIES currently operates both AMC-2 and AMC-4 at the nominal 101° W.L. orbital location.[4]

SES WORLD SKIES requests a license to launch and operate SES-1 in order to ensure continuity of service at 101° W.L.[5] SES-1 will provide a variety of high-quality services to users in the U.S., Mexico (C-band service only) and parts of the Caribbean.[6] SES-1 will not operate in new frequencies or service areas,[7] and therefore is a straight replacement satellite not

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4 *See* File Nos. SAT-MOD-20080314-00072, SAT-MOD-20080124-00030, and SAT-AMD-20080311-00070, all grant-stamped May 19, 2008. While AMC-2 and AMC-4 are collocated at the nominal 101° W.L. orbital location the Commission authorized operation of the two spacecraft in the total stationkeeping volume bounded by 100.90° W.L. and 101.05° W.L. to conserve fuel and facilitate joint stationkeeping. *See id*.

5 SES WORLD SKIES expects to seek authority to allow it to relocate AMC-2 and AMC-4 to other orbital locations once SES-1 is in place at 101.0° W.L.

6 To the extent necessary, SES WORLD SKIES seeks authority to provide capacity for the delivery of direct-to-home ("DTH") services using SES-1. The International Bureau has granted SES Americom authority to provide capacity for the delivery of DTH service over its existing fixed-satellite service spacecraft, including AMC-4. *See SES Americom, Inc., Order and Authorization*, 18 FCC Rcd 16589 (Int'l Bur. 2003) at ¶ 1 (authorizing the use of SES Americom's fleet for DTH would "promote fair and increased competition in the provision of satellite service in the United States" and would "provide benefits to the public by maximizing consumer choice."). Grant of DTH authority for SES-1 is consistent with this precedent.

7 SES WORLD SKIES seeks to operate SES-1 in the conventional C- and Ku-band frequencies currently used by AMC-4 (3.7-4.2 GHz; 5.925-6.425 GHz; 11.7-12.2 GHz; and 14-

subject to the bond requirement for new satellite networks.[8] As in the case of its predecessor AMC-4, SES-1 will operate on a non-common carrier basis.

INFORMATION REQUIRED BY SECTION 25.114(c)

The information required by Section 25.114(c) is contained in the Schedule S database being submitted with this application.

INFORMATION REQUIRED BY SECTION 25.114(d)

The information required by Section 25.114(d) is contained herein and in the narrative Technical Appendix being submitted with this application.

PUBLIC INTEREST CONSIDERATIONS

SES WORLD SKIES launched its first domestic communications satellite in December 1975. Since that time, it has successfully launched more than two dozen spacecraft. SES WORLD SKIES was a pioneer in the satellite communications industry and continues to be an industry leader.

The application to launch and operate the proposed SES-1 satellite reflects SES WORLD SKIES' continuing commitment to serving the existing and future needs of customers. Deployment of SES-1 as proposed will enable SES WORLD SKIES to provide service continuity for users from 101° W.L.

14.5 GHz). Unlike AMC-4, SES-1 does not include an extended Ku-band payload (11.45-12.2 GHz and 13.75-14.5 GHz). SES-1 also will have a more limited coverage area than AMC-4, which has the capability of covering South America. As discussed above, SES WORLD SKIES does not seek Commission authority to operate the 17/24 GHz BSS payload of SES-1.

[8] 47 C.F.R. § 25.165(a) and (e). *See also Amendment of the Commission's Space Station Licensing Rules and Policies*, First Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 10760, 10825 (2003) ("We will apply this bond requirement to new satellite licensees only, not replacement satellites. Once a licensee has begun to provide service, we are confident that its replacement satellite application will be intended to continue service, and would not be filed for speculative purposes.").

The Commission has expressly recognized a replacement expectancy for geostationary ("GSO") satellite operators:

> Given the huge costs of building and operating GSO space stations, we have found that there should be some assurance that operators will be able to continue to serve their customers. Therefore, the Commission has stated that, when an orbit location remains available for a U.S. satellite with the technical characteristics of the proposed replacement satellite, it will generally authorize the replacement satellite at the same location.[9]

Consequently, grant of authority for SES-1 is consistent with Commission precedent and with policies designed to maximize the efficient use of spectrum and orbital resources.

CONCLUSION

SES WORLD SKIES is requesting here, and in the related materials attached hereto, authority to launch and operate the SES-1 replacement satellite at 101º W.L. Such authority will enable SES WORLD SKIES to provide continuity of service to customers. In view of the foregoing, SES WORLD SKIES submits that the public interest, convenience, and necessity will be served by a grant, in accordance with this Application, of authority to launch and operate the proposed satellite.

Respectfully submitted,

SES Americom, Inc.

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9 *Id.* at 10854-55 (footnotes omitted).

ATTACHMENT A

TECHNICAL APPENDIX

IN SUPPORT OF SES-1 (101°W.L.)

TECHNICAL APPENDIX

1.0 Overall Description

SES-1 is a hybrid C- and Ku-band communications satellite to be operated at 101° W.L. with coverage of the Continental USA, Alaska, Hawaii, Mexico (C-band only), and parts of the Caribbean.

The spacecraft will operate in the following frequency bands:

- Conventional Ku-band frequencies with downlink frequencies from 11.70 to 12.20 GHz and uplink frequencies from 14.0 to 14.5 GHz
- Conventional C-band frequencies with downlink frequencies from 3.70 to 4.20 GHz and uplink frequencies from 5.925 to 6.425 GHz

Dual linear polarization is used in both the C- and Ku-bands. The spacecraft also has a 17/24 GHz BSS payload, but SES WORLD SKIES is not seeking operating authority for that payload.

Tables 1 and 2 show the frequency plan of the satellite. The frequency bands are divided into 24 C-band transponders of 36 MHz bandwidth each, and 24 Ku-band transponders of 36 MHz bandwidth each. Transponders 14, 16, 18, 20, 22, and 24 can be operated in cross-strap mode.[1]

2.0 Schedule S

The Schedule S database is attached as an electronic file. The following items supplement the information provided in Schedule S.

1. *Transponder frequency plan.*

Sections S9 and S10 of Schedule S show the transponder frequency plans. Beams with IDs KRV, KTV, KRH and KTH provide coverage over CONUS, Alaska, Hawaii, and parts of the Caribbean. Beams with IDs CRV, CTV, CRH and CTH provide coverage of CONUS, Mexico, Alaska, Hawaii, and parts of the Caribbean.

Transponders K01 to K24 connect beams KRV and KTH, and KRH and KTV. Transponders C01 to C24 connect beams CRV and CTH, and CRH and CTV. Cross-strapped transponders X01 to X06 connect uplinks KR14, KR16, KR18, KR20, KR22, and KR24, respectively, to downlinks CT14, CT16, CT18, CT20, CT22, and CT24, respectively. Transponders X07 to X12

[1] A cross-strapped transponder has C-band uplink and Ku-band downlink, or Ku-band uplink and C-band downlink.

connect uplinks CR14, CR16, CR18, CR20, CR22, and CR24, respectively, to downlinks KT14, KT16, KT18, KT20, KT22, and KT24, respectively.

Table 1: Ku-band Frequency Plan

Channel	Receive Frequency (MHz)	Polarization	Transmit Frequency (MHz)	Polarization
1	14020	H	11720	V
2	14040	V	11740	H
3	14060	H	11760	V
4	14080	V	11780	H
5	14100	H	11800	V
6	14120	V	11820	H
7	14140	H	11840	V
8	14160	V	11860	H
9	14180	H	11880	V
10	14200	V	11900	H
11	14220	H	11920	V
12	14240	V	11940	H
13	14260	H	11960	V
14	14280	V	11980	H
15	14300	H	12000	V
16	14320	V	12020	H
17	14340	H	12040	V
18	14360	V	12060	H
19	14380	H	12080	V
20	14400	V	12100	H
21	14420	H	12120	V
22	14440	V	12140	H
23	14460	H	12160	V
24	14480	V	12180	H

Table 2: C-band Frequency Plan

Channel	Receive Frequency (MHz)	Polarization	Transmit Frequency (MHz)	Polarization
1	5945	H	3720	V
2	5965	V	3740	H
3	5985	H	3760	V
4	6005	V	3780	H
5	6025	H	3800	V
6	6045	V	3820	H
7	6065	H	3840	V
8	6085	V	3860	H
9	6105	H	3880	V
10	6125	V	3900	H
11	6145	H	3920	V
12	6165	V	3940	H
13	6185	H	3960	V
14	6205	V	3980	H
15	6225	H	4000	V
16	6245	V	4020	H
17	6265	H	4040	V
18	6285	V	4060	H
19	6305	H	4080	V
20	6325	V	4100	H
21	6345	H	4120	V
22	6365	V	4140	H
23	6385	H	4160	V
24	6405	V	4180	H

2. TWTA redundancy.

Ku-band

The communications receivers are configured in a 4-for-2 redundancy (as a minimum) with cross-strapping between polarizations and coverage beams such that any two receivers can complete the mission. Twenty-four (24) operational frequencies utilizing 36 MHz bandwidth are provided by thirty-two (32) High Power Amplifiers (HPAs) arranged in two groups of 16-for-12.

C-band

The communications receivers are configured in a 4-for-2 redundancy (as a minimum) with cross-strapping between polarizations and coverage beams such that any two receivers can complete the mission. Twenty-four (24) operational frequencies utilizing 36 MHz bandwidth are provided by thirty-two (32) High Power Amplifiers (HPAs) arranged in two groups of 16-for-12.

3. *Saturation Flux Density values.*

SFD values can be obtained by using the expression

Ku-band

SFD = -94 – (G/T) +Transponder Gain Setting, dBW/m2

C-band

SFD = -96 – (G/T) +Transponder Gain Setting, dBW/m2

4. *Transponder frequency response.*

The frequency response and total group delay, specified over the transponder bandwidth, are provided in Tables 3 to 6 below.

Table 3: Ku-band Transponder Frequency Response

	Frequency Offset (MHz)	dB p-p
36 MHz channel	±14	1.2
	±16	1.5
	±18	3.6

Table 4: C-band Transponder Frequency Response

	Frequency Offset (MHz)	dB p-p
36 MHz channel	±14	1.0
	±16	1.3
	±18	2.4

Table 5: Ku-band Transponder Total Group Delay

	Frequency Offset (MHz)	Relative Group Delay (ns p-p)
36 MHz channel	0	6.0
	±8	9.0
	±12	16.0
	±16	45.0
	±18	85.0

Table 6: C-band Transponder Total Group Delay

	Frequency Offset (MHz)	Relative Group Delay (ns p-p)
36 MHz channel	0	4.0
	±8	8.5
	±12	16.0
	±16	50.0
	±18	84.0

5. *Telemetry and Telecommand (TT&C) frequencies and beams.*

Table 7 shows the TT&C carrier center frequencies and bandwidths. The TT&C carriers use communication antennas during normal operation.

Table 7: TT&C Carrier Frequencies[2]

	Frequency, MHz	Nominal polarization
Command carriers (bandwidth: 800 KHz, capture range)		
C-band	6423.5	H
Ku-band	14499.0	V
Beacons/Telemetry (bandwidth: 400 KHz)		
C-band pair	3700.5	H
	4199.5	V
Ku-band pair	11701.0	V
	12199.0	H

5.1 Command carrier characteristics and link budgets

1. Bandwidth (2-sided): 800 KHz
2. Capture range (2-sided): 2.0 MHz

[2] SES WORLD SKIES will advise the Commission of any changes to these frequencies after coordination has been completed.

3. Transmit Earth Station sidelobe envelope: 29 – 25 log θ, dB
4. Uplink power flux at the satellite:

   -92 dBW/m^2 to -60 dBW/m^2

Tables 8 and 9 show the command carrier link budgets in the Ku- and C-bands, respectively.

Table 8: Ku-band Command Carrier Link Budget

Tx ES dia (typical), m	8.4
Tx ES gain, dBi	59.5
Tx ES antenna input power, dBW	10
Tx ES EIRP, dBW	69.5
Link loss, dB	207.5
Satellite G/T, dB/K	-7
Command carrier bandwidth, MHz	0.8
Tx ES antenna input power density, dBW/Hz	-49.03
Carrier-to-Noise Ratio, dB	24.57
Required CNR, dB	10
Margin	14.57

Table 9: C-band Command Carrier Link Budget

Tx ES dia (typical), m	13
Tx ES gain, dBi	56
Tx ES antenna input power, dBW	10
Tx ES EIRP, dBW	66
Link loss, dB	200.1
Satellite G/T, dB/K	-5
Command carrier bandwidth, MHz	0.8
Tx ES antenna input power density, dBW/Hz	-49.03
Carrier-to-Noise Ratio, dB	30.47
Required CNR, dB	10
Margin	20.47

5.2 Telemetry/Beacon carrier link budgets

Tables 10 and 11 show telemetry link budgets, with an EIRP minimum of 10 dBW in the coverage area.

Table 10: Ku-band Telemetry Link Budget

EIRP	dBW	17.0
Carrier bandwidth	MHz	0.5
EIRP density	dBW/4KHz	-3.99
Rx ES antenna gain	dB	55.0
Rx ES G/T	dB/K	33.2
Rain fade	dB	8.0
CNR	dB	11.1
CNR (required)	dB	9.0
Margin	dB	2.1

Table 11: C-band Telemetry Link Budget

EIRP	dBW	12.0
Carrier bandwidth	MHz	0.5
EIRP density	dBW/4KHz	-8.99
Rx ES antenna gain	dB	43.0
Rx ES G/T	dB/K	23.0
Rain fade	dB	1.0
CNR	dB	11.5
CNR (required)	dB	9.0
Margin	dB	2.5

3.0 Satellite Antenna Gain Contours

Annex 1 shows the antenna gain contours for 8 different cases: transmit and receive beams, H- and V-polarizations for Ku- and C-bands. Table 12 shows the correspondence between peak gains of the antennas and maximum EIRP or G/T values.

Table 12: Maximum Co-pol Gain, EIRP and G/T Values

		Ku-band		C-band	
		H-pol	V-pol	H-pol	V-pol
Transmit beam	Gain (max.), dBi	35.40	34.40	31.2	31.1
	EIRP (max.), dBW	53.58	52.29	41.68	41.59
Receive beam	Gain (max.), dBi	33.90	33.60	32.20	32.50
	G/T (max), dB/K	7.0	6.8	4.9	4.79

These files with co-pol data are also provided as gxt files in Schedule S:

1. CRV.gxt (V-pol, C-band receive beam)
2. CTV.gxt (V-pol, C-band transmit beam)

3. KRH.gxt (H-pol, Ku-band receive beam)
4. KTH.gxt (H-pol, Ku-band transmit beam)
5. CRH.gxt (H-pol, C-band receive beam)
6. CTH.gxt (H-pol, C-band transmit beam)
7. KRV.gxt (V-pol, Ku-band receive beam)
8. KTV.gxt (V-pol, Ku-band transmit beam)

4.0 Emission Designators and Link Budgets

The services provided by SES-1 will be wide ranging, including digital TV and digital transmission services ranging from 56 KBPS to high-speed. Sample link budgets for these services follow. Table 13 provides the characteristics of the earth stations used for this analysis and estimated link margins for Ku-band carriers. Table 14 shows similar results for C-band carriers.

Tables 15 and 16 show analog TV/FM (emission designator 36M0F3F) link budgets for Ku-band and C-band carriers, respectively.

Table 13: Ku-band Link Budgets for 7 Typical Links

Parameter	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56Kbps QPSK ¾ RS	1.544 MBPS QPSK ¾ RS	Digital TV MCPC 50 MBPS 8PSK 2/3 RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Throughput rate, Mbps	40	32	8	6	0.0562	1.5440	50
Symbol rate, MHz	28.8	22.9	5.7	4.2	0.0407	1.1	27.1
Uplinks:							
Transmit Power (dBW)	20	20	8.9	8.9	-2	8	20
Transmit Loss (dB)	-1	-1	-1	-1	-1	-1	-1
Antenna diameter	6.1	6.1	3.7	3.7	1.8	1.8	6.1
Antenna Gain (dBi)	57.2	57.2	52.9	52.9	46.6	46.6	57.2
Ground Station EIRP (dBW)	76.2	76.2	60.8	60.8	43.6	53.6	76.2
Uplink Rain Loss (dB)	-2	-2	-2	-2	-2	-2	-2
Free Space Loss (dB)	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5
Satellite G/T (dB/K)	3	3	3	3	3	3	3
Data Rate (dB-Hz)	76	75	69	67.6	47.5	61.9	76
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6
Eb/No (dB)	22.3	23.3	13.9	15.3	18.2	13.8	21.3
Eb/Io (dB)	18	18	16	16	16	16	18
Total Eb/(No + Io) (dB) For 10-7	16.6	16.9	11.8	12.6	14.0	11.8	16.3

Table 13 (cont'd): Ku-band Link Budgets for 7 Typical Links

Parameter	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56Kbps QPSK ¾ RS	1.544 MBPS QPSK ¾ RS	Digital TV MCPC 50 MBPS 8PSK 2/3 RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Downlinks:							
Satellite Carrier EIRP (dBW)	49.4	49.4	35.7	34.3	18.5	28.5	49.4
Interference bandwidth (MHz)	36	27	6.95	5	0.1	1.6	36
Satellite EIRP density (dBW/4KHz)	9.84	11.09	3.28	3.31	4.50	2.46	9.84
Downlink Rain Loss (dB)	-3	-3	-3	-3	-3	-3	-3
Free Space Loss (dB)	-206.3	-206.3	-206.3	-206.3	-206.3	-206.3	-206.3
Ground station antenna dia, m	0.9	0.9	2.4	2.4	1.2	2.4	2.4
Ground Station G/T (dB/K)	17.1	17.1	25.6	25.6	19.6	25.6	25.6
Eb/No (dB)	9.8	10.8	11.6	11.6	9.9	11.5	17.3
C/IM			18	18	18	18	
Eb/Imo (dB)			16.6	16.6	16.6	16.6	
C/I	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Eb/Io(ASI)	13.6	13.6	13.6	13.6	13.6	13.6	12.3
Eb/Io (dB)	13.6	13.6	11.8	11.8	11.8	11.8	12.3
Eb/(No + Io) (dB)	8.3	9.0	8.7	8.7	7.7	8.7	11.1
Total Up/Down Eb/(No+Io)(dB)	7.7	8.3	7.0	7.2	6.8	6.9	10.0
Required	5.4	5.4	5.4	5.4	5.4	5.4	7.2
Margin	2.3	2.9	1.6	1.8	1.4	1.5	2.8

Table 14: C-band Link Budgets for 7 Typical Links

Parameter	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56Kbps QPSK ¾ RS	1.544 MBPS QPSK ¾ RS	Digital TV MCPC 50 MBPS 8PSK 2/3 RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Throughput rate, Mbps	40	32	8	8	0.0562	1.5440	50
Symbol rate, MHz	28.8	22.9	5.7	5.7	0.0407	1.1	27.2
Uplinks:							
Transmit Power (dBW)	25.1	20	9.6	12	-3.4	11.8	25.1
Transmit Loss (dB)	-0.5	-0.5	-0.5	-1	-0.5	-0.5	-0.5
Antenna diameter	9	9	9	9	4.5	4.5	9
Antenna Gain (dBi)	53.2	53.2	53.2	53.2	47.2	47.2	53.2
Ground Station EIRP (dBW)	77.8	72.7	62.3	64.2	43.3	58.5	77.8
Uplink Rain Loss (dB)	-1	-1	-1	-1	-1	-1	-1
Free Space Loss (dB)	-200.1	-200.1	-200.1	-200.1	-200.1	-200.1	-200.1
Satellite G/T (dB/K)	-2	-2	-2	-2	-2	-2	-2
Data Rate (dB-Hz)	76	75	69	69	47.5	61.9	77
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6
Eb/No (dB)	27.3	23.2	18.8	20.7	21.3	22.1	26.3
Eb/Io (dB)	18	18	18	16	16	16	16.35
Total Eb/(No + Io) (dB) For 10-7	17.5	16.9	15.4	14.7	14.9	15.0	15.9

Table 14 (cont'd): C-band Link Budgets for 7 Typical Links

Parameter	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV MCPC 40 MBPS QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56Kbps QPSK ¾ RS	1.544 MBPS QPSK ¾ RS	Digital TV MCPC 50 MBPS 8PSK 2/3 RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Downlinks:							
Satellite Carrier EIRP (dBW)	37	37	25.8	25.8	6.8	22	37
Interference bandwidth (MHz)	36	27	6.95	5	0.1	1.6	36
Satellite EIRP density (dBW/4KHz)	-2.56	-1.31	-6.62	-5.19	-7.20	-4.04	-2.56
Downlink Rain Loss (dB)	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Free Space Loss (dB)	-196.3	-196.3	-196.3	-196.3	-196.3	-196.3	-196.3
Ground station antenna dia, m	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Ground Station G/T (dB/K)	21.8	21.8	21.8	21.8	21.8	21.8	21.8
Eb/No (dB)	14.6	15.6	10.4	10.4	12.9	13.7	13.6
C/IM			18	18	18	18	
Eb/Imo (dB)			16.6	16.6	16.6	16.6	
C/I(ASI)	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Eb/Io(ASI)	14.6	14.6	14.6	14.6	14.6	14.6	13.3
Eb/Io (dB)	14.6	14.6	12.5	12.5	12.5	12.5	13.3
Eb/(No + Io) (dB)	11.6	12.1	8.3	8.3	9.7	10.0	10.5
Total Up/Down Eb/(No+Io)(dB)	10.6	10.8	7.5	7.4	8.5	8.9	9.4
Required	5.4	5.4	5.4	5.4	5.4	5.4	7.2
Margin	5.2	5.4	2.1	2.0	3.1	3.5	2.2

Table 15: Ku-band Link Budgets for TV/FM

Parameter	Typical TV/FM link
Carrier designation	36M0F3F
Uplinks:	
Transmit Power (dBW)	22
Transmit Loss (dB)	-1
Antenna diameter	6.1
Antenna Gain (dBi)	57.2
Ground Station EIRP (dBW)	78.2
Uplink Rain Loss (dB)	-2
Free Space Loss (dB)	-207.5
Satellite G/T (dB/K)	3
Bandwidth (dB-Hz)	75.6
Boltzmann's Constant (dBW/K-Hz)	-228.6
C/N, uplink (dB)	24.7
Downlinks:	
Satellite Carrier EIRP (dBW)	49.4
Downlink Rain Loss (dB)	-3
Free Space Loss (dB)	-206.3
Ground station antenna dia, m	1.2
Ground Station G/T (dB/K)	19.6
C/N, DL (dB)	12.7
C/I ASI (dB)	18.0
C/Ntot, dB	11.4
Required (dB)	11
Margin (dB)	0.4

Table 16: C-band Link Budgets for TV/FM

Parameter	Typical TV/FM link
Carrier designation	36M0F3F
Uplinks:	
Transmit Power (dBW)	25
Transmit Loss (dB)	-0.5
Antenna diameter	9
Antenna Gain (dBi)	53.2
Ground Station EIRP (dBW)	77.7
Uplink Rain Loss (dB)	-1
Free Space Loss (dB)	-200.1
Satellite G/T (dB/K)	-3
Bandwidth (dB-Hz)	75.6
Boltzmann's Constant (dBW/K-Hz)	-228.6
C/N, uplink (dB)	26.6
Downlinks:	
Satellite Carrier EIRP (dBW)	37
Downlink Rain Loss (dB)	-0.5
Free Space Loss (dB)	-196.3
Ground station antenna dia, m	3.8
Ground Station G/T (dB/K)	21.8
C/N, DL (dB)	15.1
C/I ASI (dB)	16.0
C/Ntot, dB	12.3
Required(dB)	11
Margin(dB)	1.3

5.0 Power Flux Density Limits in C-band

Section 25.208 of the Commission's Rules specifies the maximum allowed PFD in C-band. Table 17 shows the PFD and margin computations. The margins are all positive.

Table 17: C-band PFD and Margin Values

Elevation angle, deg.	5.00	10.00	15.00	20.00	25.00	Max. EIRP
Max. EIRP*, dBW	41.70	41.70	41.70	41.70	41.70	41.70
EIRP at elevation angle, dBW	34.20	34.60	35.30	36.20	37.40	41.80
Minimum spreading loss, dB/m2	-163.3	-163.1	-163.1	-162.9	-162.8	-162.1
25.208 PFD limit	-152.0	-149.5	-147.0	-144.5	-142.0	-142.00
Digital Carriers						
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
PFD, dBW/m2/4KHz	-168.6	-168.1	-167.3	-166.3	-165.0	-159.9
Margin, dB, relative to 25.208	16.64	18.62	20.32	21.80	23.00	17.86
Analog TV/FM(2 MHz spreading)						
Carrier bandwidth, MHz	2.00	2.00	2.00	2.00	2.00	2.00
PFD, dBW/m2/4KHz	-156.2	-155.6	-154.8	-153.7	-152.5	-147.3
Margin, dB, relative to 25.208	4.08	6.06	7.77	9.25	10.45	5.31

* The maximum EIRP values shown are in H-pol. The maximum EIRP values in V-pol are 0.1 dB lower.

6.0 Cessation of Emissions

Each TWTA is commandable to apply or remove RF drive of the associated amplifier as required under § 25.207. Each TWTA can also be commanded on and off, although they are normally powered for the entire mission, after the satellite arrives on station.

7.0 Interference Analysis

Annex 2 shows the results of an interference analysis for operations in a 2-degree spacing environment. Using C/I metrics, the analysis shows that the interference can be restricted to no more than 6% of the noise plus interference at threshold.[3]

8.0 Mitigation of Orbital Debris

This section provides the information required under Section 25.114(d)(14) of the Commission's Rules.

§ 25.114(d)(14)(i): SES WORLD SKIES has assessed and limited the amount of debris released in a planned manner during normal operations of SES-1. During the satellite ascent, after separation from the launcher, no debris would be generated. As with all recent SES WORLD SKIES satellite launches, all deployments would be conducted using pyrotechnic devices

[3] The interference analysis is done assuming digital wanted and interfering carriers. Analog carriers will be coordinated on a case-by-case basis, and are not addressed here.

designed to retain all physical debris. No debris is generated during normal on-station operations, and the spacecraft will be in a stable configuration. On-station operations require stationkeeping within the +/- 0.05 degree N-S and E-W control box, thereby ensuring adequate collision avoidance distance from other satellites in geosynchronous orbit. In the event that the co-location of SES-1 with another satellite is required, the proven Inclination-Eccentricity (I-E) separation method can be used. This strategy is presently in use by SES WORLD SKIES and its affiliates to ensure proper operation and safety of multiple satellites within one orbital box.

SES WORLD SKIES has also assessed and limited the probability of the space station becoming a source of orbital debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. The design of SES WORLD SKIES' recent spacecraft locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris. SES WORLD SKIES requires that spacecraft manufacturers assess the probability of micrometeorite damage that can cause any loss of functionality. This probability is then factored into the ultimate spacecraft probability of success. Any significant probability of damage would need to be mitigated in order for the spacecraft design to meet SES WORLD SKIES' required probability of success of the mission. SES WORLD SKIES has taken steps to limit the effects of any collisions through shielding, the placement of components, and the use of redundant systems.

§ 25.114(d)(14)(ii): SES WORLD SKIES has assessed and limited the probability of accidental explosions during and after completion of mission operations. As part of the Safety Data Package submission for SES WORLD SKIES spacecraft, an extensive analysis is completed by the spacecraft manufacturer, reviewing each potential hazard relating to accidental explosions. A matrix is generated indicating the worst-case effect, the hazard cause, and the hazard controls available to minimize the severity and the probability of occurrence. Each subsystem is analyzed for potential hazards, and the Safety Design Package is provided for each phase of the program running from design phase, qualification, manufacturing and operational phase of the spacecraft. Also, the spacecraft manufacturer generates a Failure Mode Effects and Criticality Analysis for the spacecraft to identify all potential mission failures. The risk of accidental explosion is included as part of this analysis. This analysis indicates failure modes, possible causes, methods of detection, and compensating features of the spacecraft design.

The design of the SES-1 spacecraft is such that the risk of explosion is minimized both during and after mission operations. In designing and building the spacecraft, the manufacturer takes steps to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. All propulsion subsystem pressure vessels, which have high margins of safety at launch, have even higher margins in orbit, since use of propellants and pressurants during launch decreases the propulsion system pressure. Burst tests are performed on all pressure vessels during qualification testing to demonstrate a margin of safety against burst. Bipropellant mixing is prevented by the use of valves that prevent backwards flow in propellant and pressurization lines. All pressures, including those of the batteries, will be monitored by telemetry.

At the end of operational life, after the satellite has reached its final disposal orbit, all on-board sources of stored energy will be depleted or secured, excess propellant will be vented, pressure vessels will be relieved, and the batteries will be discharged.

§ 25.114(d)(14)(iii): SES WORLD SKIES has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Specifically, SES WORLD SKIES has assessed the possibility of collision with satellites located at, or reasonably expected to be located at, the requested orbital location or assigned in the vicinity of that location.

Regarding avoidance of collisions with controlled objects, in general, if a geosynchronous satellite is controlled within its specified longitude and latitude stationkeeping limits, collision with another controlled object (excluding where the satellite is collocated with another object) is the direct result of that object entering the allocated space.

The instant application seeks authority for operation of SES-1 at the 101° W.L. orbital location, where it will replace SES WORLD SKIES' AMC-4 spacecraft. AMC-2 also is currently positioned at the nominal 101° W.L. orbital location. SES WORLD SKIES expects to request authority to allow it to relocate both AMC-4 and AMC-2 once SES-1 is operational at 101° W.L. SES is not aware of any other FCC- or non-FCC licensed spacecraft that are operational or planned to be deployed at 101° W.L. or to nearby orbital locations such that there would be an overlap with the requested stationkeeping volume of SES-1.

SES WORLD SKIES uses the SOCRATES system offered by the Center for Space Standards and Innovation to monitor the risk of close approach of its satellites with other objects. Any close encounters (separation of less than 5 km.) are flagged and investigated in more detail. If required, avoidance maneuvers are performed to eliminate the possibility of collisions.

During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. In addition, the SOCRATES system is used to ensure no close encounter occurs during the move.

When de-orbit of a spacecraft is required, the initial phase is treated as a satellite move, and the same precautions are used to ensure collision avoidance.

§ 25.114(d)(14)(iv): Post-mission disposal of the satellite from operational orbit will be accomplished by carrying out maneuvers to a higher orbit. The upper stage engine remains part of the satellite, and there is no re-entry phase for either component. The fuel budget for elevating the satellite to a disposal orbit is included in the satellite design. SES WORLD SKIES plans to maneuver SES-1 to a disposal orbit with a minimum perigee of 259 km above the normal operational altitude. The proposed disposal orbit altitude complies with the altitude resulting from application of the IADC formula based on the following calculation:

Area of the satellite (average aspect area): 25.4 m^2

Mass of the spacecraft: 1362.7 kg

C_R (solar radiation pressure coefficient): 1.3

Therefore the Minimum Disposal Orbit Perigee Altitude, as calculated under the IADC formula is:

36,021 km + (1000 x C_R x A/m) = 36045 km, or 259 km above the GSO arc (35,786 km)

SES WORLD SKIES intends to reserve 29.4 kg of fuel in order to account for post-mission disposal of SES-1. SES WORLD SKIES has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

ANNEX 1

COVERAGE MAPS

Fig 1. C-band, Receive beam, H-pol (CRH)
G/T max. 4.9 dB/K, Antenna gain max. 32.2 dBi

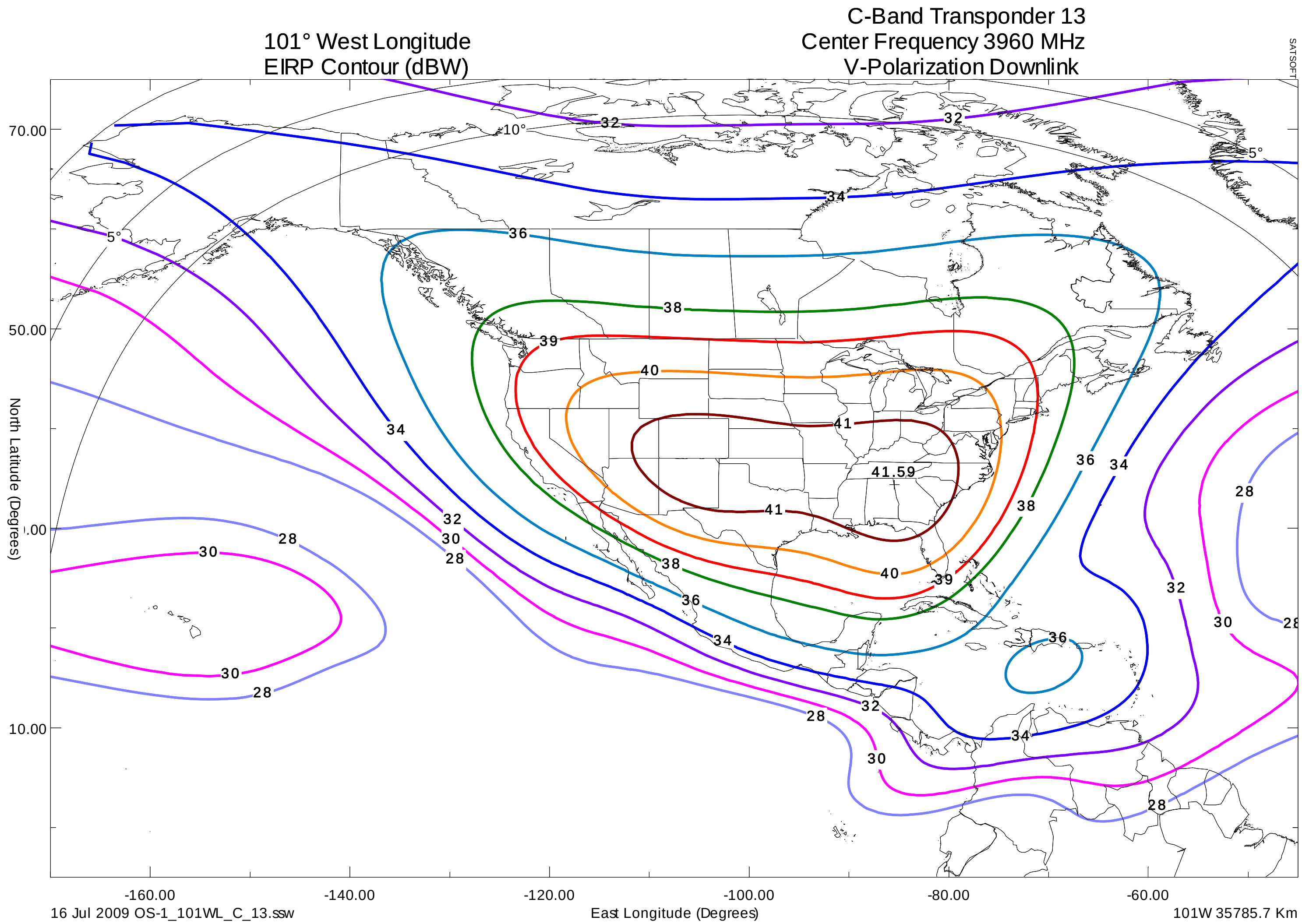


Fig 2. C-band, Receive beam, V-pol (CRV)
G/T max. 4.8 dB/K, Antenna gain max. 32.5 dBi

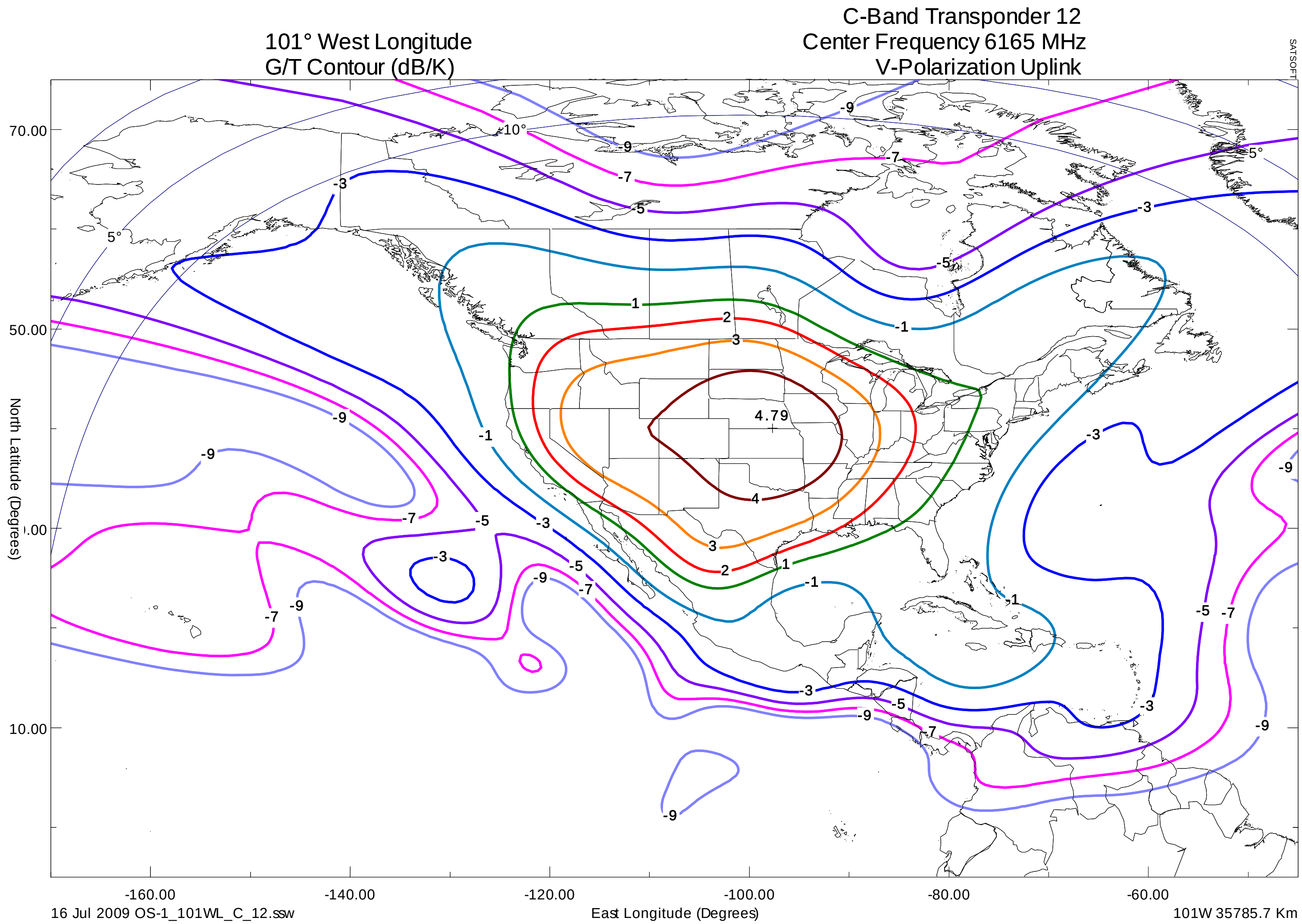


Fig 3. C-band, Transmit beam, H-pol (CTH)
EIRP max. 41.7 dBW, Antenna gain max. 31.2 dBi

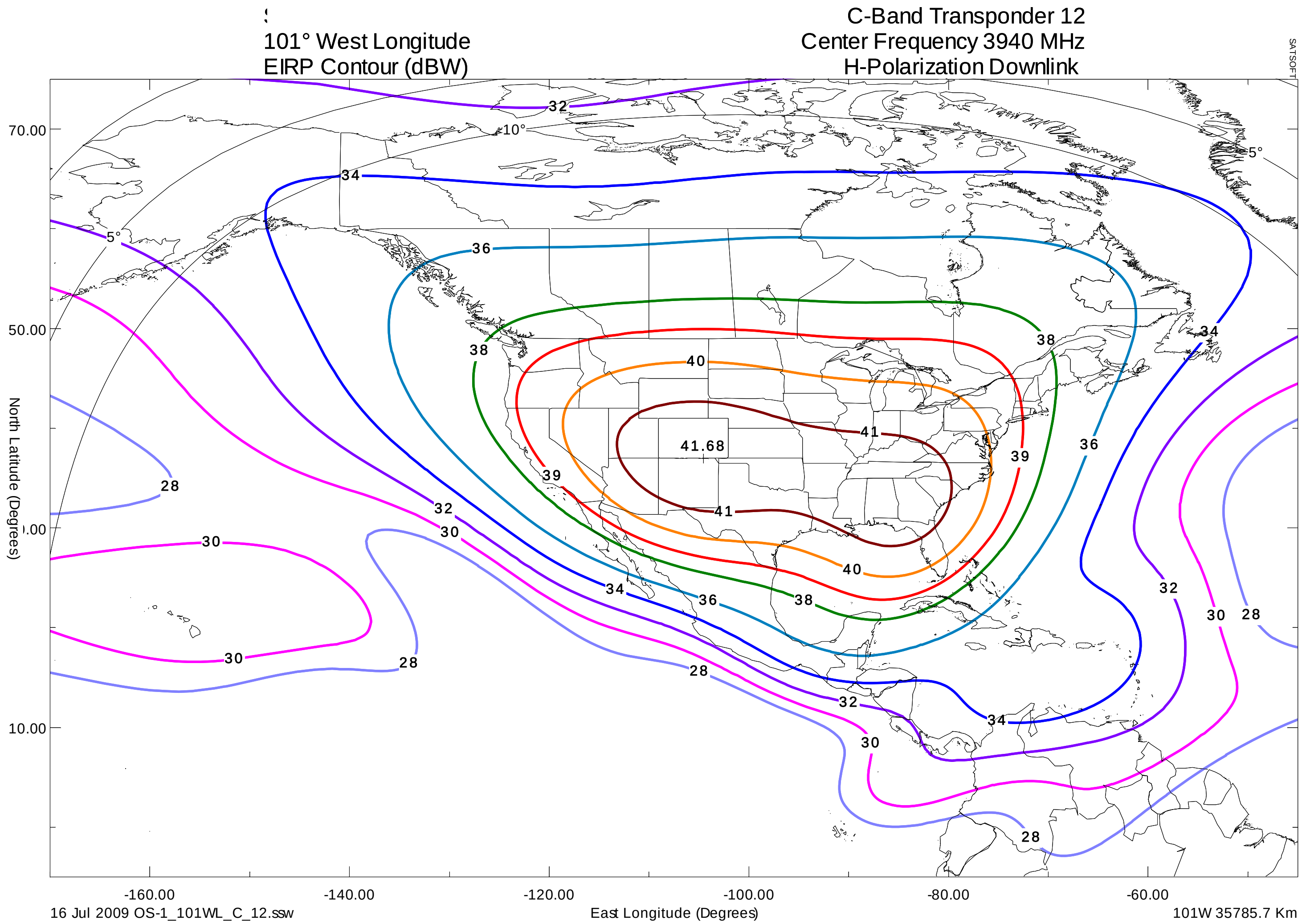


Fig. 4. C-band, Transmit beam, V-pol (CTV)
EIRP max. 41.6 dBW, Antenna gain max. 31.1 dBi

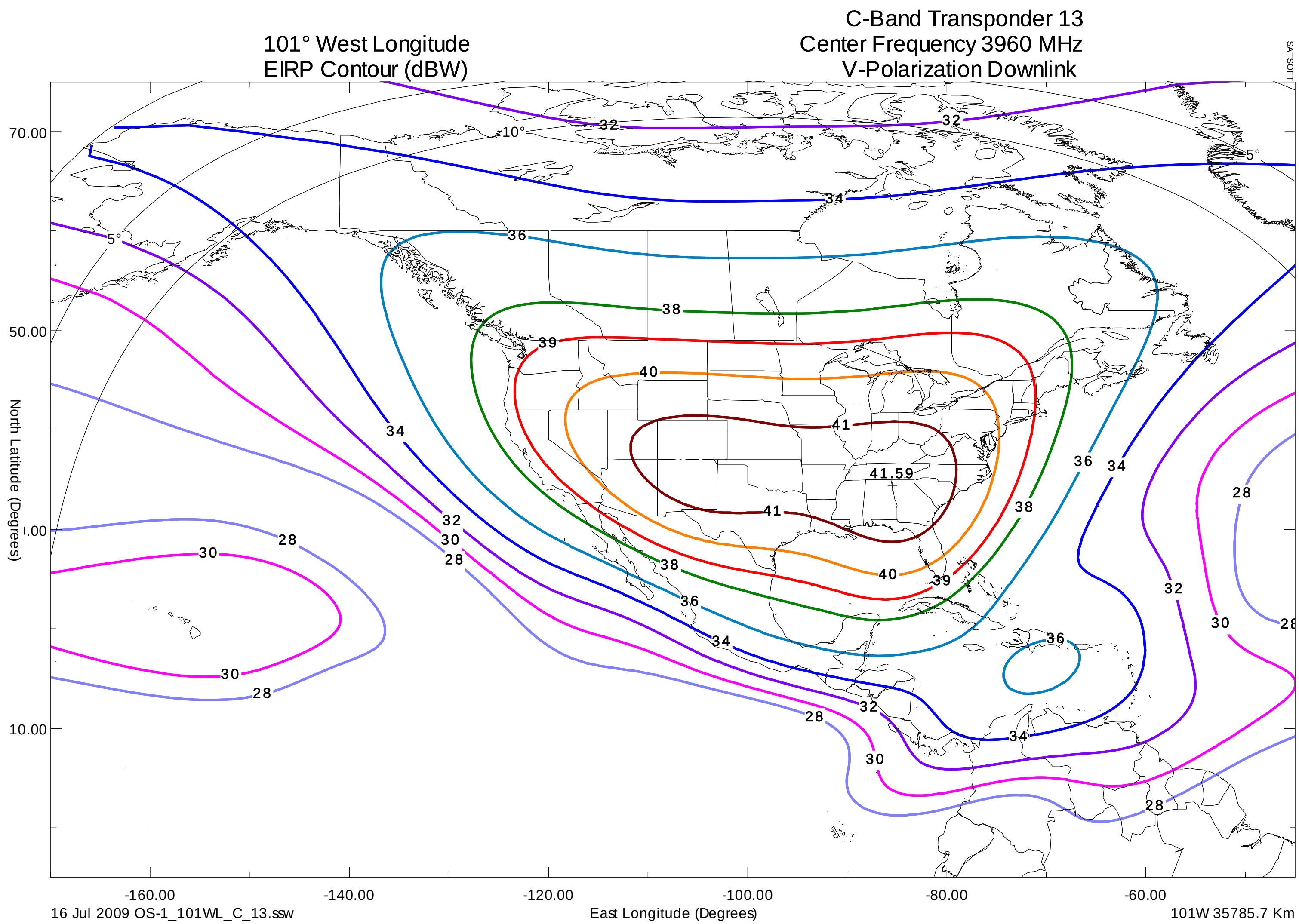


Fig. 5. Ku-band, Receive beam, H-pol (KRH)
G/T max.7.0 dB/K, Antenna Gain max.33.9 dBi

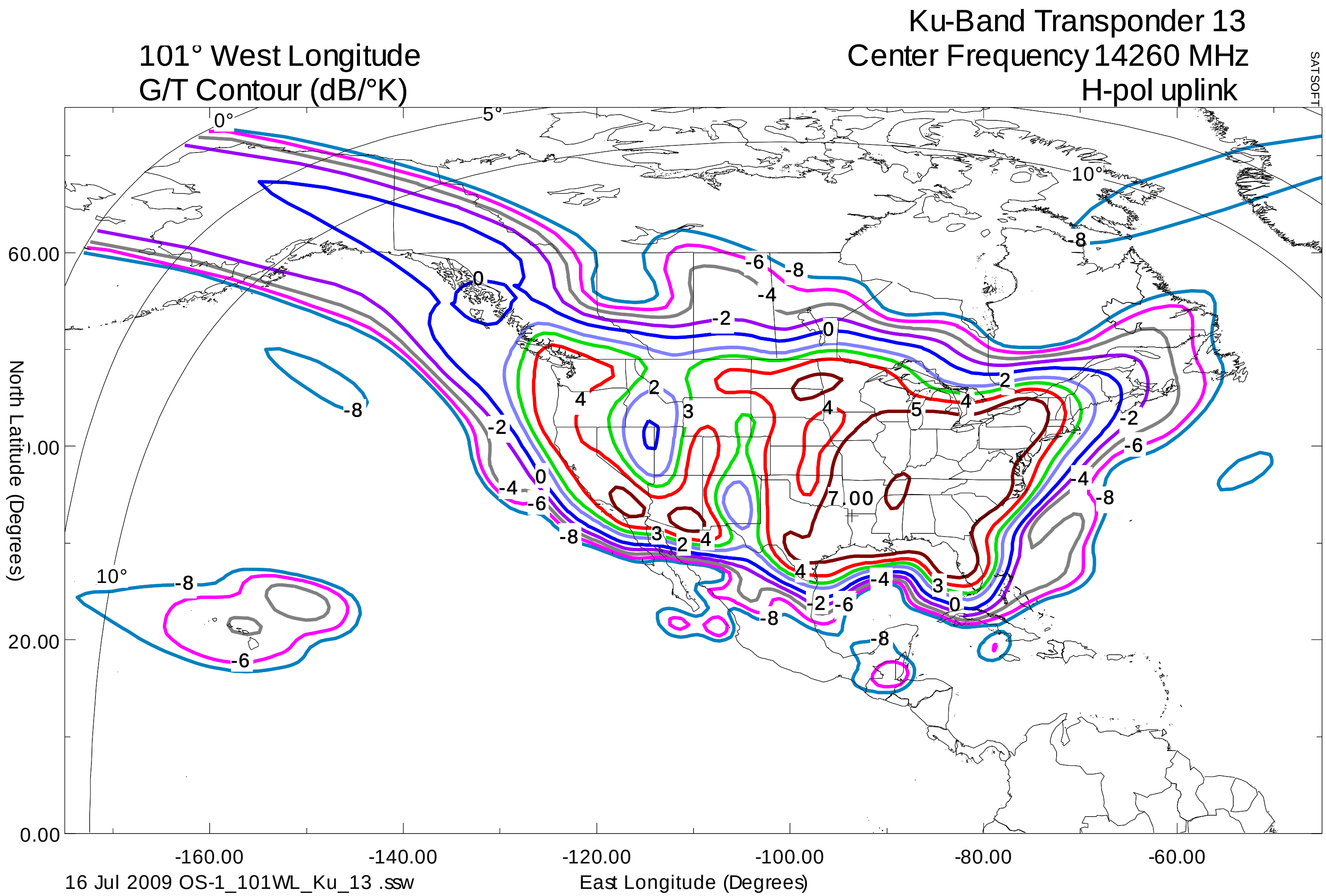


Fig. 6. Ku-band, Receive beam, V-pol (KRV)
G/T max 6.8 dB/K, Antenna Gain max. 33.6 dBi

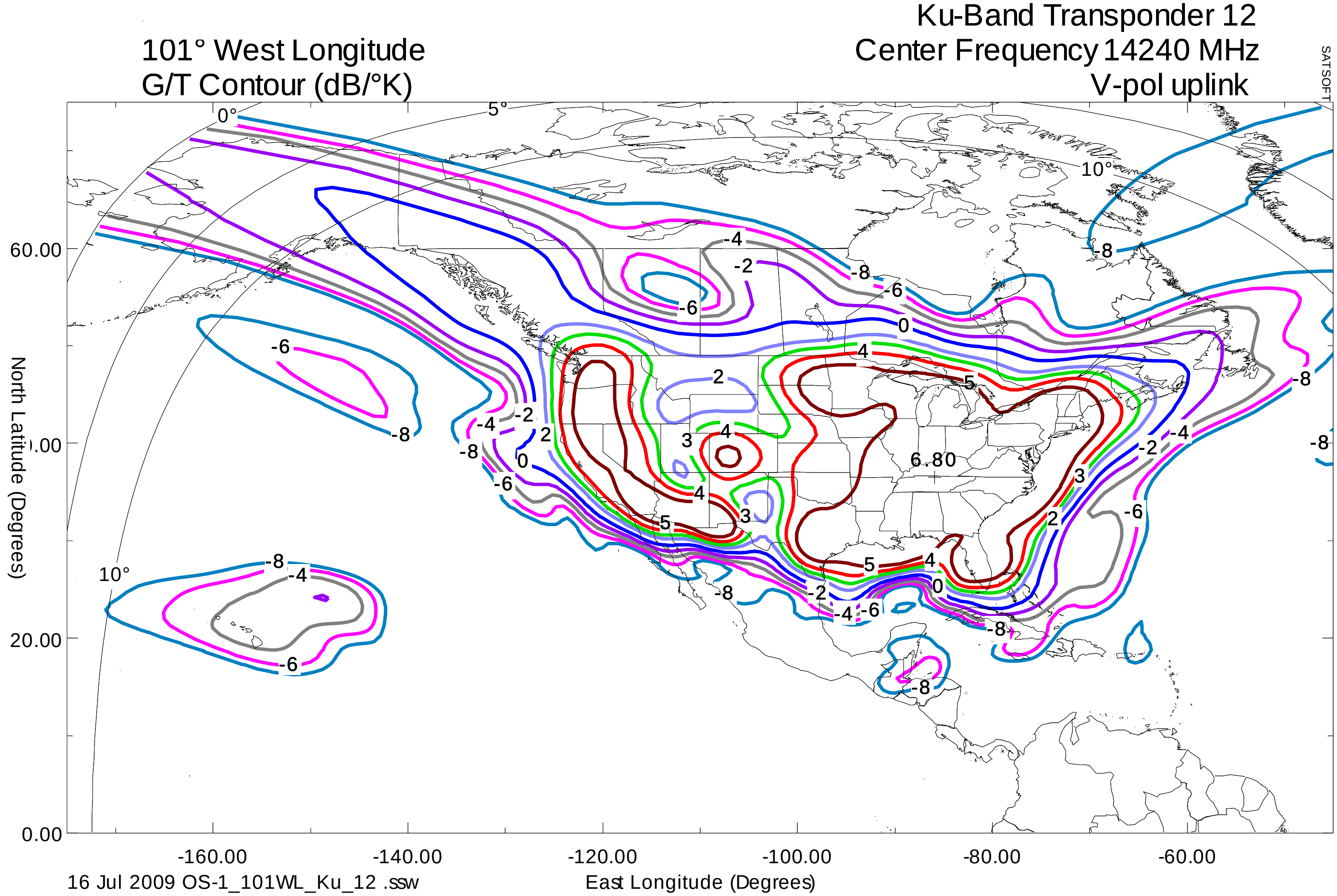


Fig. 7. Ku-band, Transmit beam, H-pol (KTH)
EIRP max. 53.6 dBW, Antenna Gain max. 35.4 dBi

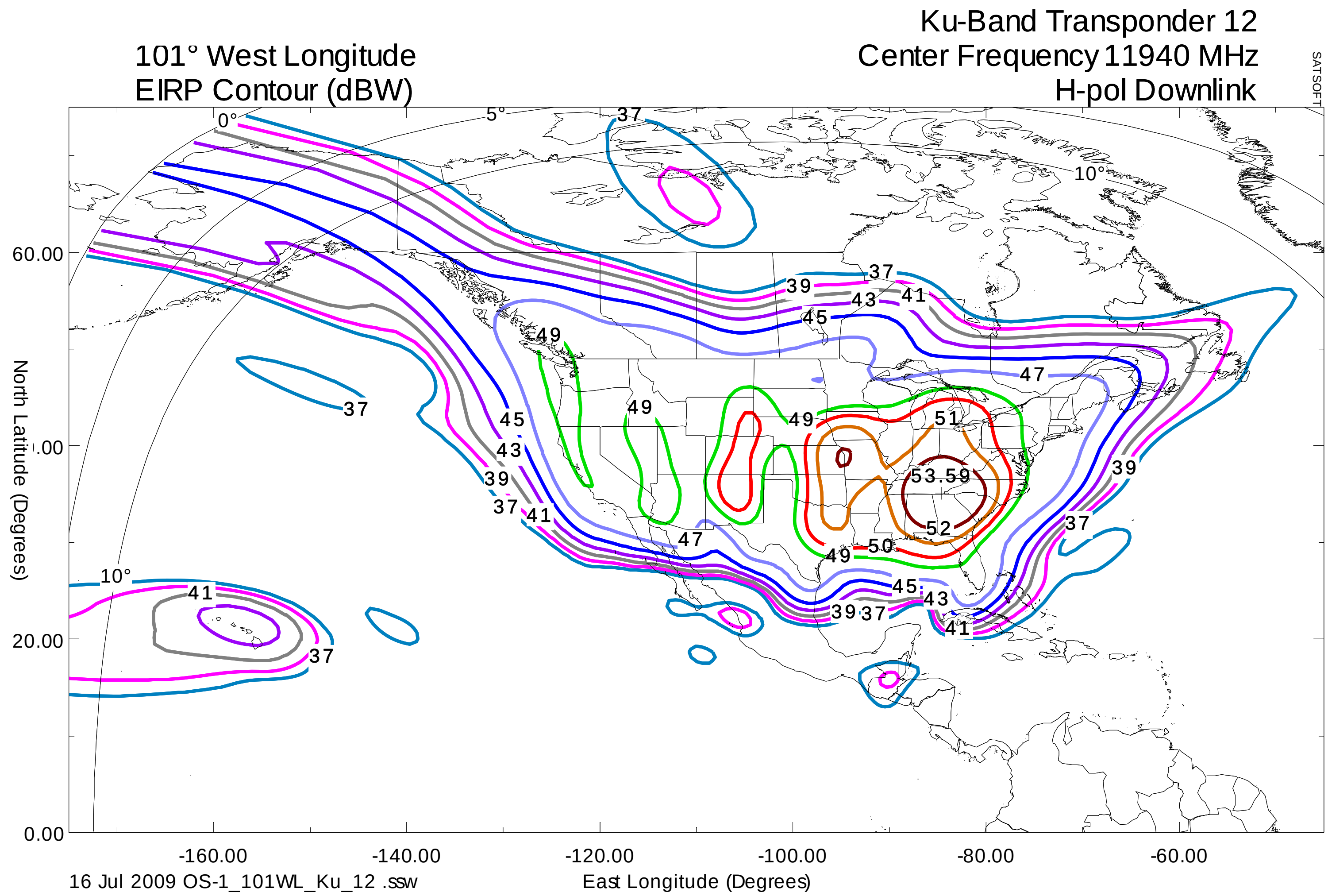
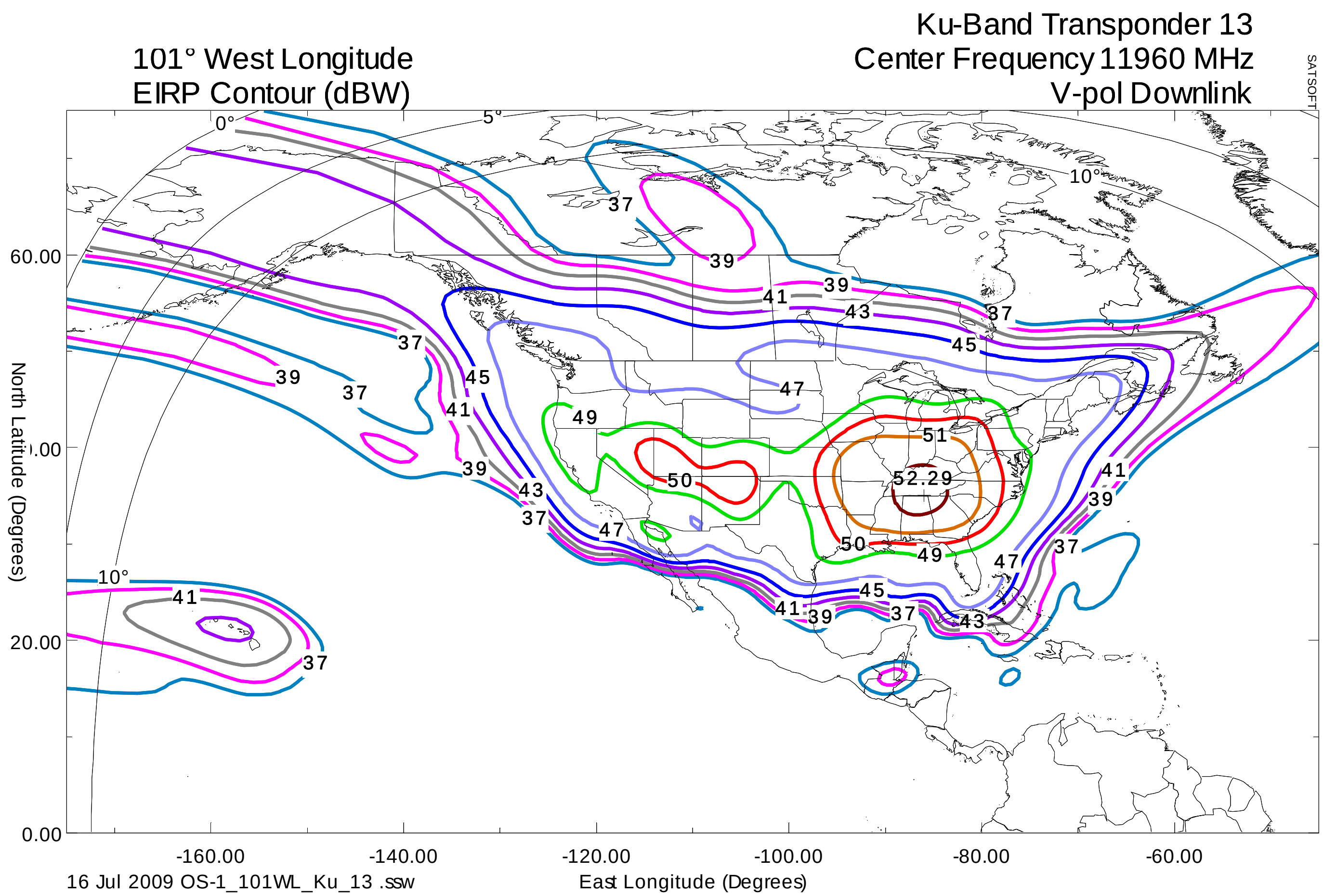


Fig. 8. Ku-band, Transmit beam, V-pol (KTV)
EIRP max. 52.3 dBW, Antenna Gain max. 34.4 dBi



ANNEX 2

INTERFERENCE ANALYSIS

IN SUPPORT OF SES-1

Two-degree Spacing Analysis

The operational Ku-band satellites adjacent to the 101° W.L. position are Intelsat's Galaxy 16 at 99° W.L. and SES WORLD SKIES' AMC-1 at 103° W.L. SES-1 will replace SES WORLD SKIES' AMC-4 spacecraft. Operations of SES-1 at this location will conform to the existing coordination arrangements SES WORLD SKIES has with adjacent satellite networks. SES WORLD SKIES will advise Intelsat of its intention to deploy SES-1 to replace AMC-4 and will exchange technical data with Intelsat. SES WORLD SKIES has successfully coordinated AMC-4 at 101°W.L. with Intelsat's adjacent satellite. It is therefore expected that any necessary additional coordination with Intelsat will be concluded without major problems.

Satellite transponders of SES-1 will be operated at power no higher than that allowed by the FCC, or generally coordinated with adjacent satellite operators.

The following analysis will demonstrate that the SES-1 network is compatible with a co-coverage, co-frequency satellite, spaced two degrees away. This analysis has been performed for digital signals in both networks. Analog TV/FM signals are coordinated on a case-by-case basis with nearby spacecraft, and are therefore not addressed in this analysis. Digital signals are more robust and operate typically down to much lower C/N ratios than analog signals. They are therefore more tolerant of interference, thereby improving the ability to coordinate at 2º orbit spacing.

1 Uplink analysis

This scenario addresses uplink interference between digital carriers in both the wanted and victim satellite networks. The analysis assumes that the transponder gains can be matched to give similar wanted input signal spectral density levels at the two satellites. The Uplink C/I will be a function of the difference between the gain of the transmitting earth stations at boresight and the gain at the off-axis (topocentric) angle.

1.1 Ku-band uplink C/I estimates

The topocentric angle for a geocentric separation of 2º is approximately 2.2º. The sidelobe envelope at 2.2º off boresight for an antenna that meets the 29-25 log (θ) reference pattern is 20.9 dBi. The boresight gain will be a function of the size of the transmitting earth station. The following Table 1 lists the boresight gain, the off-axis gain and the corresponding C/I that would result in this interference scenario:

Table 1: Ku-band uplink C/I for 2-degree geocentric spacing

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	C/I (dB)
1.2	43.04	20.94	22.09
1.8	46.56	20.94	25.61
2.4	49.06	20.94	28.11
4.5	54.52	20.94	33.57
6.0	57.02	20.94	36.07

Assuming that the minimum (i.e., threshold) C/N for a digital service is 8 dB, the effect of the C/I (22.09 dB) from the 1.2 meter earth station in Table 1 above would only degrade the C/N by 0.17 dB, equivalent to an increase of 3.7% in the victim system's noise temperature. This is less than the ITU coordination trigger criteria; i.e., internationally, if a 6% increase in noise temperature is not exceeded, then coordination is not needed between the concerned networks.

1.2 C-band uplink C/I estimates

The topocentric angle for a geocentric separation of 2º is approximately 2.2º. The sidelobe envelope at 2.2º off boresight for an antenna that meets the 29-25 log (θ) reference pattern is 20.9 dBi. The boresight gain will be a function of the size of the transmitting earth station. The following Table 2 lists the boresight gain, the off-axis gain and the corresponding C/I that would result in this interference scenario:

Table 2: C-band uplink C/I for 2-degree geocentric spacing

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	C/I (dB)
3.8	46.04	20.94	25.10
4.5	47.51	20.94	26.57
6.0	50.01	20.94	29.07
7.5	51.95	20.94	31.01
9.0	53.53	20.94	32.59

Assuming that the minimum (i.e., threshold) C/N for a digital service is 8 dB, the effect of the C/I (25.10 dB) from the 3.8 meter earth station in Table 2 above would only degrade the C/N by 0.1 dB, equivalent to an increase of 1.9% in the victim system's noise temperature. This is less than the ITU coordination trigger criteria; i.e., internationally, if a 6% increase in noise temperature is not exceeded, then coordination is not needed between the concerned networks.

2 Downlink analysis

This scenario addresses downlink interference between digital carriers in both the wanted and victim satellite networks. The analysis assumes that the EIRPs of the two satellites are either similar, or the wanted network has an EIRP of 2 dB lower than SES-1. Similar to the uplink, the downlink C/I will be a function of the difference between the gain of the receiving earth stations at boresight and the gain at the off-axis angle, as well as any difference in EIRP between the two networks.

The topocentric angle for a geocentric separation of 2º is approximately 2.2º. The gain at 2.2º off boresight for an antenna that meets the 29-25 log (θ) reference pattern is 20.9 dBi. The boresight gain will be a function of the size of the receiving earth station.

2.1 Ku-band

The following Tables list the boresight gain, the off-axis gain and the corresponding C/I that would result in this interference scenario, where the EIRP of the two networks is similar (Table 3) and where the EIRP of the two networks is different by 2 dB (Table 4):

Table 3: Ku-band downlink C/I for 2-degree geocentric spacing
EIRP of the wanted and interfering satellites is the same

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	Off-axis discrimination (dB)	C/I (dB)
1.2	41.70	20.94	20.75	20.75
1.8	45.22	20.94	24.27	24.27
2.4	47.72	20.94	26.77	26.77
4.5	53.18	20.94	32.23	32.23
6.0	55.68	20.94	34.73	34.73

Table 4: Ku-band downlink C/I for 2-degree geocentric spacing
EIRP of the wanted satellite is 2 dB lower than that of the interfering satellite

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	Off-axis discrimination (dB)	C/I (dB)
1.2	41.70	20.94	20.75	18.75
1.8	45.22	20.94	24.27	22.27
2.4	47.72	20.94	26.77	24.77
4.5	53.18	20.94	32.23	30.23
6.0	55.68	20.94	34.73	32.73

Again, assuming that the minimum (i.e., threshold) C/N for a digital service is 8 dB, the effect of the C/I (18.75 dB) into the 1.2 meter earth station in Table 4 above would only degrade the C/N by 0.35 dB, equivalent to an increase of 7.8% in the victim system's noise temperature. Although this does exceed the normal criteria of 6% by a small amount, the victim system's link degradation is still less than 0.5 dB, which is significantly less than the likely link margin.

2.2 C-band

The following Tables list the boresight gain, the off-axis gain and the corresponding C/I that would result in this interference scenario, where the EIRP of the two networks is similar (Table 5) and where the EIRP of the two networks is different by 2 dB (Table 6):

Table 5: C-band downlink C/I for 2-degree geocentric spacing
EIRP of the wanted and interfering satellites is the same

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	Off-axis discrimination (dB)	C/I (dB)
3.8	42.16	20.94	21.22	21.22
4.5	43.64	20.94	22.69	22.69
6.1	46.28	20.94	25.33	25.33
7.5	48.07	20.94	27.13	27.13

Table 6: C-band downlink C/I for 2-degree geocentric spacing
EIRP of the wanted satellite is 2 dB lower than that of the interfering satellite

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	Off-axis discrimination (dB)	C/I (dB)
3.8	42.16	20.94	21.22	19.22
4.5	43.64	20.94	22.69	20.69
6.1	46.28	20.94	25.33	23.33
7.5	48.07	20.94	27.13	25.13

Again, assuming that the minimum (i.e., threshold) C/N for a digital service is 8 dB, the effect of the C/I (19.22 dB) into the 3.8 meter earth station in Table 6 above would only degrade the C/N by 0.32 dB, equivalent to an increase of 7% in the victim system's noise temperature. Although this does exceed the normal criteria of 6% by a small amount, the victim system's link degradation is still less than 0.5 dB, which is significantly less than the likely link margin.

3. Additional examples of C/I estimates

Attached tables 7 to 14 show some examples of single-entry C/I analysis for typical carriers on the satellite networks. The adjacent satellite is assumed to be at 99° W.L., but the same results apply to the 103° W.L neighbor also. The uplink sites of SES-1 can be in the 50-state or the Caribbean regions.

3.1 Ku-band

Table 7 shows the key uplink parameters of SES-1 and adjacent satellite carriers. Table 8 shows C/I estimates in SES-1 and adjacent satellite carrier uplinks. The C/I values in the adjacent carriers are at least 20.0 dB.

Table 9 shows the key downlink parameters of SES-1 and adjacent satellite carriers. Table 10 shows C/I estimates in SES-1 and adjacent satellite carrier uplinks. The C/I values in the adjacent carriers are minimally about 20.0 dB.

Table 7: SES-1 and adjacent satellite uplink carrier characteristics – Ku-band (SES-1 at 101° W.L., Adjacent satellite at 99° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES-1 carriers								
		36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W	
Bandwidth	MHz	36.0	27.0	6.0	5.0	1.6	0.1	
UL EIRP	dBW	78	76.8	70.2	69.4	58	42	
UL flange power	dBW	20.7	19.5	17.2	16.4	11.4	-0.8	
UL flange power dens.	dBW/Hz	-54.9	-54.8	-50.6	-50.6	-50.6	-50.8	
UL ant. Dia	m	6.1	6.1	3.7	3.7	1.8	1.2	
UL ant. Gain	dBi	57.3	57.3	53	53	46.6	42.8	
UL EIRP density	dBW/Hz	2.4	2.5	2.4	2.4	-4.0	-8.0	
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6	22.6	22.6	
Off-ax. EIRP dens	dBW/Hz	-32.2	-32.2	-28.0	-28.0	-28.0	-28.2	
G/T	dB/K	2.0	2.0	2.0	2.0	2.0	2.0	
C/N (thermal)	dB	25.5	25.6	25.5	25.5	19.1	15.1	
Adj. Satellite carriers								
		25M0G7W	17M5G7W	Dig. TV(20.0)	Dig. TV(3.95)	TDMA	64Kbps	9.6Kbps
Bandwidth	MHz	25.0	17.5	14.9	3.4	36.0	0.1	0.0235
UL EIRP	dBW	75	67.9	75	60	75	42	36
UL flange power	dBW	15.6	8.5	15.6	13.4	21.2	-0.8	-6.8
UL flange power dens.	dBW/Hz	-58.4	-63.9	-56.1	-51.9	-54.4	-50.8	-50.5
UL ant. Dia	m	7.5	7.5	7.5	1.8	4.5	1.2	1.2
UL ant. Gain	dBi	59.4	59.4	59.4	46.6	53.8	42.8	42.8
UL EIRP density	dBW/Hz	1.0	-4.5	3.3	-5.3	-0.6	-8.0	-7.7
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6	22.6	22.6	22.6
Off-ax. EIRP dens	dBW/Hz	-35.8	-41.3	-33.5	-29.3	-31.7	-28.2	-27.9
G/T	dB/K	0.5	0.5	0.5	0.5	0.5	0.5	0.5
C/N (thermal)	dB	22.6	17.1	24.9	16.3	21.0	13.6	13.9

Table 8: Ku-band uplink C/I estimates in carriers shown in Table 7

Uplink C/I in SES-1 carriers due to interference from adj. satellite							
	SES-1 carriers						
Adj. Sat carriers		36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W		38.2	38.2	38.2	38.2	31.7	27.8
27M0G7W		43.7	43.8	43.7	43.7	37.3	33.3
Dig. TV (20.0)		36.0	36.0	35.9	35.9	29.5	25.5
Dig. TV (3.95)		31.7	31.8	31.7	31.7	25.3	21.3
TDMA		34.2	34.2	34.2	34.2	27.7	23.7
64Kbps		30.6	30.7	30.6	30.6	24.1	20.2
9.6Kbps		30.3	30.4	30.3	30.3	23.9	19.9
Uplink C/I in adj. sat carriers due to interference from SES-1 carriers							
	SES-1 carriers						
Adj. Sat carriers		36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W		33.3	33.2	29.0	29.0	29.0	29.2
27M0G7W		27.7	27.7	23.4	23.4	23.5	23.7
Dig. TV (20.0)		35.5	35.5	31.2	31.2	31.3	31.4
Dig. TV (3.95)		26.9	26.9	22.6	22.7	22.7	22.9
TDMA		31.7	31.6	27.4	27.4	27.5	27.6
64Kbps		24.2	24.2	20.0	20.0	20.0	20.2
9.6Kbps		24.5	24.5	20.3	20.3	20.3	20.5

Table 9: SES-1 and adjacent satellite downlink carrier characteristics – Ku-band (SES-1 at 101° W.L., Adjacent satellite at 99° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES-1 Carriers		36M0G7W	36M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
Bandwidth(occupied)	MHz	36.0	36.0	6.0	5.0	1.6	0.1
Satellite EIRP max	dBW	52.8	52.8	52.8	52.8	52.8	52.8
Carrier EIRP	dBW	50.0	50.0	40.7	39.2	36.0	24.0
Carrier EIRP dens	dBW/Hz	-25.6	-25.6	-27.1	-27.8	-26.0	-26.0
Rx ES ant. Dia	m	1.2	1.2	1.8	1.8	1.2	1.2
Rx ES ant. Gain	dBi	41.2	41.2	44.7	44.7	41.2	41.2
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6	22.6	22.6
C/N (thermal)	dB	16.2	16.2	18.1	17.5	15.7	15.7
Adj. Satellite carriers		36M0G7W	36M0G7W	27M0G7W	Dig. TV(20.0)	Dig. TV(3.95)	TDMA
Bandwidth (occupied)	MHz	36.0	36.0	27.0	14.9	3.4	36.0
Satellite EIRP max	dBW	51.0	51.0	51.0	51.0	51.0	51.0
Carrier EIRP	dBW	48.0	48.0	48.0	44.2	36.8	47.0
Carrier EIRP dens	dBW/Hz	-27.6	-27.6	-26.3	-27.6	-28.6	-28.6
Rx ES ant. Dia	m	1.8	2.4	1.2	1.8	1.8	4.5
Rx ES ant. Gain	dBi	44.72	47.22	41.20	44.72	44.72	52.68
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6	22.6	22.6
C/N (thermal)	dB	17.7	20.2	15.4	17.7	16.7	24.7

Table 10: Ku-band downlink C/I estimates in carriers shown in Table 9

Downlink C/I in SES-1 carriers due to interference from adj. satellite						
	SES-1 carriers					
Adj. Sat carriers	36M0G7W	36M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W(1)	20.6	20.6	22.5	21.9	20.1	20.1
36M0G7W(2)	20.6	20.6	22.5	21.9	20.1	20.1
27M0G7W	19.3	19.3	21.3	20.7	18.9	18.9
Dig. TV (20.0)	20.6	20.6	22.5	21.9	20.1	20.1
Dig. TV (3.95)	21.6	21.6	23.5	22.9	21.1	21.1
TDMA	21.6	21.6	23.5	22.9	21.1	21.1
64Kbps	21.0	21.0	23.0	22.3	20.5	17.6
9.6Kbps	20.7	20.7	22.7	22.1	20.3	20.3
Downlink C/I in adj. sat carriers due to interference from SES-1 carriers						
	SES-1 carriers					
Adj. Sat carriers	36M0G7W	36M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W(1)	20.1	20.1	21.7	22.3	20.6	20.5
36M0G7W(2)	22.6	22.6	24.2	24.8	23.1	23.0
27M0G7W	17.8	17.8	19.4	20.0	18.3	18.3
Dig. TV (20.0)**	20.1	20.1	21.7	22.3	20.6	20.5
Dig. TV (3.95)**	19.1	19.1	20.7	21.3	19.6	19.5
TDMA	27.1	27.1	28.6	29.3	27.5	27.5
64Kbps	19.1	19.1	20.7	21.3	19.6	19.6
9.6Kbps	19.4	19.4	21.0	21.6	19.9	19.9

3.2 C-band

Table 11 shows the key uplink parameters of SES-1 and adjacent satellite carriers. Table 12 shows C/I estimates in SES-1 and adjacent satellite carrier uplinks. The C/I values in the adjacent carriers are at least 23 dB.

Table 13 shows the key downlink parameters of SES-1 and adjacent satellite carriers. Table 14 shows C/I estimates in SES-1 and adjacent satellite carrier uplinks. The C/I values in the adjacent carriers are minimally about 19.0 dB.

Table 11: SES-1 and adjacent satellite uplink carrier characteristics –C-band (SES-1 at 101° W.L., Adjacent satellite at 99° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES-1 Carriers		36M0G7W	6M95G1W	1M60G1W	100KG1W
Bandwidth	MHz	36.0	6.0	1.6	0.1
UL EIRP	dBW	69	57.1	50.6	38.6
UL flange power	dBW	19.2	11.6	5.6	-6.3
UL flange power dens.	dBW/Hz	-56.4	-56.2	-56.4	-56.3
UL ant. Dia	m	6.1	3.7	3.4	3.4
UL ant. Gain	dBi	49.8	45.46	44.72	44.72
UL EIRP density	dBW/Hz	-6.6	-10.7	-11.4	-11.4
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6
Off-ax. EIRP dens	dBW/Hz	-33.7	-33.6	-33.8	-33.7
G/T	dB/K	2.0	2.0	2.0	2.0
C/N (thermal)	dB	16.5	12.4	11.7	11.7
Adj. Satellite carriers		36M0G7W	6M5G1W	1M50G1W	100K50G1W
Bandwidth	MHz	32.6	5.8	1.3	0.1
UL EIRP	dBW	70	58.1	51.7	39.6
UL flange power	dBW	13.42	1.52	2.61	-8.77
UL flange power dens.	dBW/Hz	-61.71	-66.11	-58.53	-58.77
UL ant. Dia	m	9.00	9.00	3.80	3.50
UL ant. Gain	dBi	56.58	56.58	49.09	48.37
UL EIRP density	dBW/Hz	-5.1	-9.5	-9.4	-10.4
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6
Off-ax. EIRP dens	dBW/Hz	-39.1	-43.5	-35.9	-36.2
G/T	dB/K	0.5	0.5	0.5	0.5
C/N (thermal)	dB	16.5	12.1	12.2	11.2

Table 12: C-band uplink C/I estimates in carriers shown in Table 11

Uplink C/I in SES-1 carriers due to interference from adj. satellite				
	SES-1 carriers			
Adj. Sat carriers	36M0G7W	6M5G1W	1M50G1W	100KG1W
36M0G7W	32.5	28.4	27.7	27.7
6M5G1W	36.9	32.8	32.1	32.1
1M50G1W	29.3	25.2	24.5	24.5
100K50G1W	29.6	25.5	24.7	24.8
Uplink C/I in adj. sat carriers due to interference from SES-1 carriers				
	SES-1 carriers			
Adj. Sat carriers	36M0G7W	6M5G1W	1M50G1W	100KG1W
36M0G7W	28.6	28.4	28.7	28.5
6M5G1W	24.2	24.0	24.3	24.1
1M50G1W	24.3	24.1	24.4	24.2
100K50G1W	23.3	23.2	23.4	23.3

Table 13: SES-1 and adjacent satellite downlink carrier characteristics – C-band (SES-1 at 101° W.L., Adjacent satellite at 99° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES-1 Carriers		36M0G7W	6M95G1W	1M60G1W	100KG1W
Bandwidth (occupied)	MHz	32.6	5.8	1.3	0.1
Satellite EIRP max	dBW	41.5	41.5	41.5	41.5
Carrier EIRP	dBW	40.0	30.5	25.7	12.7
Carrier EIRP dens	dBW/Hz	-35.1	-37.1	-35.4	-37.3
Rx ES ant. Dia	m	6.1	7	5.4	4.5
Rx ES ant. Gain	dBi	46.28	47.48	45.22	43.64
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6
C/N (thermal)	dB	21.7	20.9	20.4	16.9
Adj. Satellite carriers		36M0G7W	6M95G1W	1M60G1W	100KG1W
Bandwidth (occupied)	MHz	32.6	5.8	1.3	0.1
Satellite EIRP max	dBW	41.5	41.5	41.5	41.5
Carrier EIRP	dBW	40.0	30.5	25.7	12.7
Carrier EIRP dens	dBW/Hz	-35.1	-37.1	-35.4	-37.3
Rx ES ant. Dia	m	6.1	7	5.4	4.5
Rx ES ant. Gain	dBi	46.28	47.48	45.22	43.64
Sidelobe gain (at 1.8 deg)	dBi	22.6	22.6	22.6	22.6
C/N (thermal)	dB	21.7	20.9	20.4	16.9

Table 14: C-band downlink C/I estimates in carriers shown in Table 13

Downlink C/I in SES-1 carriers due to interference from adj. satellite				
	SES-1 carriers			
Adj. Sat carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
36M0G7W	23.7	22.9	22.3	18.9
6M95G1W	25.7	24.9	24.3	20.9
1M60G1W	23.9	23.1	22.6	19.2
100KG1W	25.8	25.0	24.5	21.0
Downlink C/I in adj. sat carriers due to interference from SES-1 carriers				
	SES-1 carriers			
Adj. Sat carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
36M0G7W	23.7	25.7	23.9	25.8
6M95G1W	22.9	24.9	23.1	25.0
1M60G1W	22.3	24.3	22.6	24.5
100KG1W	18.9	20.9	19.2	21.0

Engineering Declaration

Declaration of Krish Jonnalagadda

I, Krish Jonnalagadda, hereby certify under penalty of perjury that I am the technically qualified person responsible for preparation of the technical information contained in the foregoing exhibit; that I am familiar with the technical requirements of Part 25; and that I either prepared or reviewed the technical information contained in the exhibit and that it is complete and accurate to the best of my knowledge, information and belief.

_/s/_*Krish Jonnalagadda*____________________

Manager, Spectrum Development

SES Americom, Inc.

Dated: January 20, 2010