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 87° 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-3 at 87° W.L., to be designated SES-2. SES-2 will operate in the conventional C- and Ku-bands.[2] Construction of the SES-2 satellite (formerly known as AMC-26) is approaching completion, and SES WORLD SKIES currently expects to launch the spacecraft in August of this year.

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

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[1] SES WORLD SKIES is the commercial brand name for the integrated operations of two indirect subsidiaries of SES S.A.: SES Americom and New Skies Satellites B.V. (effective January 1, 2009). The 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-2 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 87° W.L., but a full technical description of the payload is provided herein. Finally, SES-2 hosts the Air Force's Commercially Hosted Infrared Payload ("CHIRP") Flight Demonstration Program, a wide field-of-view, passive infrared sensor. Additional information about CHIRP can be found at: http://www.space.commerce.gov/general/commercialpurchase/hostedpayloads.shtml.

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 87° 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 one of the largest satellite "neighborhoods" 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 government 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.

[3] Government services are provided by SES WORLD SKIES' wholly-owned subsidiary, Americom Government Services, Inc., d/b/a SES WORLD SKIES U.S. Government Solutions.

As the demand increases for high-quality telecommunications, SES WORLD SKIES' technical experts continue to develop innovative and cost-effective solutions to address customers' evolving needs.

SES WORLD SKIES has operated AMC-3 at 87° W.L. since late 1997, and the satellite's license term extends to September of 2012. SES WORLD SKIES requests a license to launch and operate SES-2 in order to ensure continuity of service at 87° W.L.[4] SES-2 will provide a variety of high-quality services to users in the Continental U.S., Alaska, Hawaii (Ku-band only) and parts of the Caribbean.[5] SES-2 will not operate in new frequencies or service areas,[6] and therefore is a straight replacement satellite not subject to the bond requirement for new satellite networks.[7] As in the case of its predecessor AMC-3, SES-2 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

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[4] SES WORLD SKIES expects to seek authority to allow it to relocate AMC-3 to another orbital location once SES-2 is in place at 87° W.L.

[5] To the extent necessary, SES WORLD SKIES seeks authority to provide capacity for the delivery of direct-to-home ("DTH") services using SES-2. 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-3. *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-2 is consistent with this precedent.

[6] SES WORLD SKIES seeks to operate SES-2 in the conventional C- and Ku-band frequencies currently used by AMC-3 (3.7-4.2 GHz; 5.925-6.425 GHz; 11.7-12.2 GHz; and 14-14.5 GHz). As discussed above, SES WORLD SKIES does not seek Commission authority to operate the 17/24 GHz BSS payload of SES-2.

[7] 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.").

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-2 satellite reflects SES WORLD SKIES' continuing commitment to serving the existing and future needs of customers. Deployment of SES-2 as proposed will enable SES WORLD SKIES to provide service continuity for users from 87° W.L.

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.[8]

Consequently, grant of authority for SES-2 is consistent with Commission precedent and with policies designed to maximize the efficient use of spectrum and orbital resources.

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[8] *Id.* at 10854-55 (footnotes omitted).

WAIVER REQUESTS

As discussed above, SES WORLD SKIES does not seek a license to operate the SES-2 17/24 GHz BSS payload at the satellite's requested 87° W.L. orbital location. In these circumstances, SES WORLD SKIES believes that Commission requirements concerning performance bonds and full frequency reuse are not implicated by the proposed launch of the SES-2 17/24 GHz BSS payload.[9] Nevertheless, out of an abundance of caution, SES WORLD SKIES requests waivers of these rules to the extent necessary, as described in more detail below. SES WORLD SKIES also seeks a waiver of the specification for contour maps for the 17/24 GHz BSS payload.

Grant of the requested waivers is consistent with Commission policy:

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[10]

<u>Section 25.165(a), Performance Bond</u>: Section 25.165(a) generally requires that a performance bond be posted within 30 days of issuance of a satellite license, but exempts

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[9] Similarly, SES WORLD SKIES does not view the requirements of Sections 25.114(d)(16) and 25.225 concerning service to Alaska and Hawaii to be applicable here because they are triggered only in the event an applicant seeks "a license to operate a 17/24 GHz BSS space station that will be used to provide video programming directly to consumers in the United States." 47 C.F.R. § 25.114(d)(16); *see also* 47 C.F.R. § 25.225(a) (requirement to serve Alaska and Hawaii applies to any "operator of a 17/24 GHz BSS space station that is used to provide video programming directly to consumers in the 48 contiguous United States"). Nevertheless, SES WORLD SKIES has included in Section 5 of the Technical Appendix a showing relating to coverage of Alaska and Hawaii. That section demonstrates that although the 17/24 GHz payload is capable of generating sufficient signal power to Alaska and Hawaii, viable BSS service might not be feasible from 87° W.L. due to low earth station elevation angles.

[10] *PanAmSat Licensee Corp.*, 17 FCC Rcd 10483, 10492 (Sat. Div. 2002) (footnotes omitted).

replacement satellites from this obligation.[11] SES-2 will operate at 87° W.L. only in C- and Ku-band frequencies for which AMC-3, the satellite it is replacing, is licensed, and is therefore not subject to a bond requirement.

The presence of a 17/24 GHz BSS payload on the spacecraft should not alter that conclusion. Again, SES WORLD SKIES is not seeking authority to operate the 17/24 GHz BSS payload on SES-2 at 87° W.L., so SES-2 will be operating solely "in the same frequency bands" for which AMC-3 is authorized at that orbital location and will continue to be a "replacement satellite" for purposes of the Commission's bond requirement.[12]

If the bond rule is deemed applicable here, a waiver is clearly appropriate. The Commission has observed that the bond was adopted to discourage speculative applications for satellite licenses that would block use of scarce spectrum and orbital resources by other parties who are ready and able to move forward to introduce service.[13] Because SES WORLD SKIES is not seeking an operating license in the 17/24 GHz BSS band, the authorization for SES-2 will have no preclusive effect on deployment of 17/24 GHz BSS networks by other prospective operators.

Section 25.210(f), Full Frequency Reuse: Section 25.210(f) of the Commission's rules requires space stations using the 17/24 GHz BSS frequencies to "employ state-of-the-art full frequency reuse" through either orthogonal polarizations within the same beam or the use of multiple beams.[14] The SES-2 17/24 GHz BSS payload employs only a single polarization on the uplink.

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[11] 47 C.F.R. § 25.165(a).

[12] *See* 47 C.F.R. § 25.165(e).

[13] *ATCONTACT Communications, LLC*, Opinion, FCC 10-100, at ¶ 42 (rel. June 3, 2010).

[14] 47 C.F.R. § 25.210(f).

A waiver of the rule is consistent with Commission standards and would not undermine the purpose of the rule. The full frequency reuse requirement is intended to ensure efficient use of spectrum, but the Commission has waived the rule in a number of cases, including where permitting the non-compliant operations would not block deployment of a compliant spacecraft.[15] Because SES WORLD SKIES is not seeking an operating license for the SES-2 17/24 GHz BSS payload, grant of a waiver here will not block deployment of compliant 17/24 GHz BSS spacecraft and is therefore consistent with Commission precedent.

Section 25.114(d)(3), Contour Map Specifications: Section 25. 114(d)(3) provides that the space station antenna gain contours "should be plotted on an area map at 2 dB intervals down to 10 dB below the peak value of the parameter and at 5 dB intervals between 10 dB and 20 dB below the peak values."[16] The 17/24 GHz payload coverage maps in the attached Technical Appendix portray the -1, -2, -4, -6, -8, -10, and -12 dB contours but do not include a -15 or -20 dB contour because these contours are beyond the edge of the globe.

The Commission has routinely granted waivers of the contour map specification requirements where the information provided by the applicant sufficiently describes the space station's antenna characteristics.[17] Grant of a waiver here is consistent with this precedent.

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15 *See, e.g.*, *Columbia Communications Corporation*, Memorandum Opinion, Order and Authorization, 7 FCC Rcd 122, 123 (1991) (Commission views full frequency reuse waiver request favorably "as long as the non-compliant satellite is making some use of the orbit/spectrum resource which otherwise would not be used, and as long as such use does not preclude the use of the resource by a satellite which meets the Commission's full frequency reuse requirements.").

16 47 C.F.R. § 25.114(d)(3).

17 *See, e.g.*, *Intelsat North America LLC*, Stamp Grant, File No. SAT-LOA-20090410-00043, Call Sign S2789 (granted Nov. 25, 2009) (waiver of Section 25.114(d)(3) appropriate where technical materials provide "a sufficiently complete description of the transponder characteristics").

CONCLUSION

SES WORLD SKIES is requesting here, and in the related materials attached hereto, authority to launch and operate the SES-2 replacement satellite at 87º 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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ATTACHMENT A

TECHNICAL APPENDIX

IN SUPPORT OF SES-2 (87°W.L.)

TECHNICAL APPENDIX

1.0 Overall Description

SES-2 is a hybrid C and Ku-band communications satellite to be operated at 87° W.L. with coverage of the Continental USA, Hawaii and parts of Alaska in Ku-band and C-band coverage of Continental USA and parts of Canada, Alaska and 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

The spacecraft also has a 17/24 GHz Ka-band payload with downlink frequencies 17.3-17.8 GHz and uplink frequencies 24.75-25.25 GHz, but no operating authority is being sought for this payload.

Dual linear polarization is used in both the C- and Ku-bands. Single circular polarization (LHCP) is used in the 17/24 GHz uplink bands, and dual circular polarization is used in the 17/24 GHz downlink bands.

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, Hawaii and parts of Alaska. Beams with IDs CRRV, CRTV, CRRH and CRTH provide coverage of CONUS and parts of Canada, Alaska and the Caribbean.

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

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. Cross-strapped transponders X07 to X12 connect uplinks CR14, CR16, CR18, CR20, CR22, and CR24, respectively, to downlinks KT14, KT16, KT18, KT20, KT22, and KT24, respectively.

The 17/24 GHz payload consists of a single "transponder" powered by a single TWTA, with a single uplink beam (KAR) and downlink beams in each of the two circular polarizations (KATR and KATL). This single transponder can support multiple carriers of variable bandwidth across the entire band and, thus, a variety of frequency plans. In a typical operational scenario, the uplink and downlink frequencies on this transponder would be divided into 14 uplink and downlink "channels" of 31 MHz bandwidth (consisting of multiple carriers with a total bandwidth of 31 MHz), and 34.3 MHz channel spacing using single polarization. This typical channel plan is depicted at Section S9 of the Schedule S:

- 14 uplink channels labeled as KAR01 through KAR14
- 14 downlink channels labeled as KAT01 through KAT14 with RHCP polarization and
- 14 downlinks labeled KAT15 through KAT28 with LHCP polarization.

Section S10 of the Schedule S shows how each uplink channel would correspond to each downlink channel in the typical scenario. However, due to the limitations in the Schedule S software and form, SES WORLD SKIES was forced to assign a different Transponder ID to each row of Section S10 in order to show this correspondence. These different Transponder IDs in Section S10 should be understood as all referring to the same, single 17/24 GHz BSS transponder on SES-2.

As noted above, the 17/24 GHz payload uses a single TWTA. The payload also has single input and output filters for the entire 500 MHz band. Table 3 shows the filter characteristics.

Table 1: Ku-band Frequency Plan

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

Table 2: C-band Frequency Plan

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

Table 3: Input and output channel filter characteristics (frequency band: 17.3-17.8 GHz)

Offset from center frequency, MHz	Input filter Insertion loss variation, dBp-p, max	Input filter Group delay variation, ns, max	Output filter Insertion loss variation, dBp-p, max	Output filter Group delay variation, ns, max
± 125	0.15	0.8	0.1	0.4
± 150	0.2	1	0.1	0.5
± 175	0.3	1.4	0.15	0.6
± 200	0.4	2	0.2	0.8
± 225	0.55	3	0.25	1.1
± 250	0.8	5	0.4	1.9

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.

17/24 GHz band

The communications receivers are configured in a 2-for-1 redundancy. One (1) operational frequency utilizing 500 MHz bandwidth is provided by one (1) High Power Amplifiers (HPA) arranged in a 2-for-1 configuration.

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

17/24 GHz band

SFD = -103 – (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 4 to 7 below.

Table 4: Ku-band Transponder Frequency Response

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

Table 5: C-band Transponder Frequency Response

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

Table 6: 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 7: 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 8 shows the TT&C carrier center frequencies and bandwidths. The TT&C carriers use communication antennas during normal operation.

Table 8: TT&C Carrier Frequencies

	Frequency, MHz	Nominal polarization
Command carriers (bandwidth: 1.0 MHz, capture range)		
C-band	6423.5	V
Ku-band	14499.0	V
Beacons/Telemetry (bandwidth: 400 KHz)		
C-band pair	3700.5	V
	4199.5	H
Ku-band pair	11701.0	V
	12199.0	H

Note: For emergency mode, TT&C reverts to circular pol; CMD = LHCP and TLM = RHCP

5.1 Command carrier characteristics and link budgets

1. Bandwidth (2-sided): 1.0 MHz
2. Capture range (2-sided): 2.0 MHz
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

Table 9 shows the command carrier link budgets in the Ku- and C-bands, respectively.

Table 9: Ku-band and C-band Command Carrier Link Budgets

	Ku-band	**C-band**
Tx ES dia (typical), m	8.4	13
Tx ES gain, dBi	60.2	57.0
Tx ES antenna input power, dBW	10	10
Tx ES EIRP, dBW	70.2	67.0
Link loss, dB	207.5	200.1
Satellite G/T, dB/K	6	2
Command carrier bandwidth, MHz	1	1
Tx ES antenna input power density, dBW/Hz	-50	-50
Carrier-to-Noise Ratio, dB	37.3	37.5
Required CNR, dB	10	10
Margin	27.3	27.5

5.2 Telemetry/Beacon carrier link budgets

Table 10 shows telemetry link budgets with an EIRP minimum of 10 dBW in the coverage area.

Table 10: Ku-band Telemetry Link Budget

	Ku-band	**C-band**
EIRP, dBW	17	12
Carrier bandwidth, MHz	0.5	0.5
EIRP density, dBW/4kHz	-3.97	-8.97
Tx ES dia (typical), m	5.7	4.5
Rx ES antenna gain, dB	55.0	43.0
Rx ES G/T, dB/K	33.2	23
Rain fade, dB	8	1
CNR, dB	11.1	11.5
CNR (required), dB	9	9
Margin, dB	2.1	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 11 shows the correspondence between peak gains of the antennas and maximum EIRP or G/T values.

Table 11: 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	34.27	35.30	30.12	30.4
	EIRP (max.), dBW	52.17	52.62	43.66	43.85
Receive beam	Gain (max.), dBi	34.37	34.87	31.12	31.4
	G/T (max), dB/K	7.65	7.99	3.39	3.3

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)

Annex 1 also shows the Ka-band antenna gain contours for the transmit and receive beams, which use horn antennas. Schedule S includes the footprints of the receive and transmit antennas (files KAR.gxt, KATR.gxt and KATL.gxt). The gain contours are only shown to -10 dBi instead of down to -20 dBi as requested in 25.114(d)(3), because the -15 and -20 dBi gain contours do not intersect the earth.

In addition, section S7 of Schedule S shows the maximum gains of the receive and transmit antennas, maximum EIRP, and maximum G/T values.

4.0 Emission Designators and Link Budgets

The services provided by SES-2 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 12 provides the characteristics of the earth stations used for this analysis and estimated link margins for Ku-band carriers. Table 13 shows similar results for C-band carriers.

Table 14 shows analog TV/FM (emission designator 36M0F3F) link budgets for Ku-band and C-band carriers. Table 16 shows a typical Ka-band link budget.

5.0 Service to Alaska and Hawaii

SES WORLD SKIES does not seek authority to provide video programming services using the 17/24 GHz payload on SES-2, and accordingly, the requirements of Sections 25.225(a) and (b) relating to design and operation of 17/24 GHz BSS spacecraft to ensure provision of such services to Alaska and Hawaii[2] are not applicable here. If it were to operate from the 87° W.L. orbital location, the 17/24 GHz payload on SES-2 might not be able to provide satisfactory service to Alaska and Hawaii because of the low antenna elevation angles to these territories from the 87° W.L. orbital position. Given these low elevation angles (ranging from 0-16 degrees) it might not be possible to provide a viable BSS service due to the difficulty in locating user receive dishes where buildings and foliage would not block the antennas from "seeing" the satellite at 87° W.L.

Thus, service to Alaska and Hawaii would likely not be technically feasible even though the 17/24 GHz BSS payload's satellite EIRP and G/T values would be sufficiently high over Alaska and Hawaii to provide coverage (see Annex 1). Accordingly, no link budgets for service to Alaska and Hawaii are provided herein.

[2] 47 C.F.R. § 25.225(a) and (b).

Table 12: Ku-band Link Budgets for 7 Typical Links

Parameter	Digital TV MCPC 40 Mbps QPSK ¾ RS	Digital TV MCPC 32 Mbps QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56 Kbps QPSK ¾ RS	1.544 Mbps QPSK ¾ RS	Digital TV MCPC 50 Mbps 8PSK ⅔ RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Data Rate (dB-Hz)	76	75	69	67.6	47.5	61.9	77
Throughput rate (Mbps)	40	32	8	6	0.056	1.544	50
Symbol rate (Msps)	28.8	22.9	5.7	4.2	0.041	1.117	27.2
Uplinks:							
Transmit Power (dBW)	20	20	8.9	8.9	-2	8	20
Transmit Loss (dB)	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
Antenna diameter	6.1	6.1	3.7	3.7	1.8	1.8	6.1
Antenna Gain (dBi)	57.3	57.3	53.0	53.0	46.7	46.7	57.3
Ground Station EIRP (dBW)	74.8	74.8	59.4	59.4	42.2	52.2	74.8
Uplink Rain Loss (dB)	-2	-2	-2	-2	-2	-2	-2
Free Space Loss (dB)	-207	-207	-207	-207	-207	-207	-207
Satellite G/T (dB/K)	3	3	3	3	3	3	3
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6
Eb/N0 (dB)	21.4	22.4	13.0	14.4	17.3	12.9	20.4
Eb/I0 (dB)	18	18	16	16	16	16	18
Total Eb/(N0 + I0) (dB)	16.4	16.7	11.2	12.1	13.6	11.2	16.0

Table 12 (cont'd): Ku-band Link Budgets for 7 Typical Links

Parameter	Digital TV MCPC 40 Mbps QPSK ¾ RS	Digital TV MCPC 32 Mbps QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56 Kbps QPSK ¾ RS	1.544 Mbps QPSK ¾ RS	Digital TV MCPC 50 Mbps 8PSK ⅔ RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Downlinks:							
Satellite Carrier EIRP (dBW)	49.4	48.1	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)	9.86	9.81	3.30	3.33	4.52	2.48	9.86
Downlink Rain Loss (dB)	-3	-3	-3	-3	-3	-3	-3
Free Space Loss (dB)	-205.4	-205.4	-205.4	-205.4	-205.4	-205.4	-205.4
Ground station antenna dia, m	1.2	1.2	2.4	2.4	1.2	2.4	2.4
Ground Station G/T (dB/K)	20.9	20.9	26.9	26.9	20.9	26.9	26.9
Eb/N0 (dB)	14.5	14.2	13.8	13.8	12.1	13.7	19.5
C/IM			18	18	18	18	
Eb/Imo (dB)			16.6	16.6	16.6	16.6	
C/I	15	15	15	15	15	15	15
Eb/I0 (ASI) (dB)	13.6	13.6	13.6	13.6	13.6	13.6	12.3
Eb/I0 (dB)	13.6	13.6	13.6	13.6	13.6	13.6	12.3
Eb/(N0 + I0) (dB)	11.0	10.9	9.7	9.7	9.0	9.7	11.6
Total Up/Down Eb/(N0+Io)(dB)	9.9	9.9	7.4	7.7	7.7	7.4	10.3
Required Eb/N0	5.4	5.4	5.4	5.4	5.4	5.4	7.2
Margin	4.5	4.5	2.0	2.3	2.3	2.0	3.1

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

Parameter	Digital TV MCPC 40 Mbps QPSK ¾ RS	Digital TV MCPC 32 Mbps QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56 Kbps QPSK ¾ RS	1.544 Mbps QPSK ¾ RS	Digital TV MCPC 50 Mbps 8PSK ⅔ RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Data Rate (dB-Hz)	76	75	69	69	47.5	61.9	77
Throughput rate (Mbps)	40	32	8	8	0	2	50
Symbol rate (Msps)	28.8	22.9	5.7	5.7	0.0	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 (m)	9	9	9	9	4.5	4.5	9
Antenna Gain (dBi)	53.5	53.5	53.5	53.5	47.5	47.5	53.5
Ground Station EIRP (dBW)	78.1	73.0	62.6	64.5	43.6	58.8	78.1
Uplink Rain Loss (dB)	-1	-1	-1	-1	-1	-1	-1
Free Space Loss (dB)	-199.7	-199.7	-199.7	-199.7	-199.7	-199.7	-199.7
Satellite G/T (dB/K)	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6
Eb/No (dB)	31.3	27.2	22.8	24.7	25.3	26.1	30.3
Eb/Io (dB)	18	18	18	16	16	16	18
Total Eb/(No + Io) (dB)	17.8	17.5	16.8	15.5	15.5	15.6	17.8

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

Parameter	Digital TV MCPC 40 Mbps QPSK ¾ RS	Digital TV MCPC 32 Mbps QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56 Kbps QPSK ¾ RS	1.544 Mbps QPSK ¾ RS	Digital TV MCPC 50 Mbps 8PSK ⅔ 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)	-2.54	-1.29	-6.60	-5.17	-7.18	-4.02	-2.54
Downlink Rain Loss (dB)	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Free Space Loss (dB)	-195.8	-195.8	-195.8	-195.8	-195.8	-195.8	-195.8
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)	22.1	22.1	22.1	22.1	22.1	22.1	22.1
Eb/No (dB)	15.4	16.4	11.2	11.2	13.7	14.5	14.4
C/IM			18	18	18	18	
Eb/Imo (dB)			16.6	16.6	16.6	16.6	
C/I(ASI)	16	16	16	16	16	16	16
Eb/Io(ASI)	14.6	14.6	14.6	14.6	14.6	14.6	13.3
Eb/Io (dB)	14.6	14.6	14.6	14.6	14.6	14.6	13.3
Eb/(No + Io) (dB)	11.9	12.4	8.8	8.8	10.0	10.3	10.8
Total Up/Down Eb/(No+Io)(dB)	10.9	11.2	8.1	7.9	8.9	9.2	10.0
Required	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Margin	5.5	5.8	2.7	2.5	3.5	3.8	4.6

Table 14: Ku-band & C-band Link Budgets for TV/FM

	Ku-band	C-band
Parameter	Typical TV/FM link	Typical TV/FM link
Carrier designation	36M0F3F	36M0F3F
Uplinks:		
Transmit Power (dBW)	22	25
Transmit Loss (dB)	-1	-0.5
Antenna diameter	6.1	9
Antenna Gain (dBi)	57.3	53.5
Ground Station EIRP (dBW)	78.3	78.0
Uplink Rain Loss (dB)	-2	-1
Free Space Loss (dB)	-207	-199.7
Satellite G/T (dB/K)	3	1.3
Bandwidth (dB-Hz)	75.6	75.6
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6
C/N, uplink (dB)	25.4	31.7
Downlinks:		
Satellite Carrier EIRP (dBW)	48.2	39.7
Downlink Rain Loss (dB)	-3	-0.5
Free Space Loss (dB)	-205.4	-195.8
Ground station antenna dia, m	1.2	3.8
Ground Station G/T (dB/K)	20.9	22.1
C/N, downlink (dB)	13.7	18.5
C/I ASI (dB)	18	16
C/Ntot, dB	12.3	14.1
Required (dB)	11	11
Margin (dB)	1.3	3.1

Table 15: Typical Ka-band link budgets –CONUS

Parameter	KA_1	KA_2
Carrier designation	1M20G1W	5M50G1W
Throughput rate, Mbps	1.43	4.75
Required bandwidth, MHz	1.2	5.5
Allocated bandwidth, MHz	1.2	5.5
FEC code rate	0.5	0.5
C/N required, dB	4.7	1.3
Faded system margin, dB	0.5	0.5
Uplink		
Transmit Power (dBW)	4	10.5
Antenna diameter	9	9
Antenna Gain (dBi)	65.6	65.6
TxES antenna input power density, dBW/MHz	3.2	3.1
Ground Station EIRP (dBW)	69.6	76.1
Uplink Rain Loss (dB)	0	0
Satellite G/T (dB/K)	-8	-8
C/N, dB	17.3	17.2
C/I(X-pol uplink), dB	30	30
Downlink		
Satellite Carrier EIRP (dBW)	31.3	31.3
Ground station antenna dia, m	0.95	1.5
Ground Station G/T (dB/K)	21.2	25.2
C/N(clear weather), dB	11.6	8.9
Min C/N down, dB	2.68	0.43
C/I(ASI), dB	10	10
C/I(total), dB	9.91	9.91
Rain margin to min C/N down, dB	8.9	8.5

6.0 Power Flux Density Limits

Section 25.208 of the Commission's Rules specifies the maximum allowed pfd in C-band. Table 16 shows the pfd and margin computations. The margins are all positive.

Table 16: C-band pfd and Margin Values

Elevation angle, deg	5.00	10.00	15.00	20.00	25.00	Max. EIRP
Max. EIRP, dBW	43.85	43.85	43.85	43.85	43.85	43.85
EIRP at elevation angle, dBW*	36.77	36.96	37.46	38.37	39.62	43.85
Minimum spreading loss, dB/m^2	-163.27	-163.15	-163.06	-162.94	-162.84	-162.10
25.208 pfd limit	-152.00	-149.50	-147.00	-144.50	-142.00	-142.00
Digital Carriers						
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
pfd, dBW/m^2/4KHz	-166.07	-165.76	-165.16	-164.13	-162.78	-157.8
Margin, dB, relative to 25.208	14.07	16.26	18.16	19.63	20.78	15.81
Analog TV/FM(2 MHz spreading)						
Carrier bandwidth, MHz	2.00	2.00	2.00	2.00	2.00	2.00
pfd, dBW/m^2/4KHz	-153.51	-153.20	-152.61	-151.58	-150.23	-145.26
Margin, dB, relative to 25.208	1.51	3.70	5.61	7.08	8.23	3.26

* The maximum EIRP values shown are in H-pol. The maximum EIRP values in V-pol are 0.2 dB lower.

No operating authority is being sought for the 17/24 GHz payload, but SES-2 complies with Section 25.208(w) of the Commission's Rules which specifies the maximum allowable pfd for the 17/24 GHz band. Table 17 shows the pfd levels and margin computations, and the margins are all positive.

Table 17: 17/24 GHz band pfd and Margin Values

Elevation angle, deg	5	10	15	20	25	Max. EIRP
Max. EIRP, dBW	33.28	33.28	33.28	33.28	33.28	33.28
EIRP at elevation angle, dBW	32.18	32.22	32.29	32.38	32.49	33.28
Minimum spreading loss, dB/m2	-163.27	-163.16	-163.04	-162.93	-162.83	-162.41
25.208 pfd limit (17.3-17.7 GHz), $dBW/m^2/MHz$	-121	-121	-121	-121	-121	-121
25.208 pfd limit (17.7-17.8 GHz), $dBW/m^2/MHz$	-115	-115	-115	-115	-115	-115
Carrier bandwidth, MHz	31	31	31	31	31	31
pfd, $dBW/m^2/MHz$	-146.01	-145.85	-145.66	-145.47	-145.25	-144.05
Margin (17.3-17.7 GHz), dB	25.01	24.85	24.66	24.47	24.25	23.05
Margin (17.7-17.8 GHz), dB	31.01	30.85	30.66	30.47	30.25	29.05

7.0 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.

8.0 Interference Analysis

Annex 2 shows the results of an interference analysis for C- and Ku-band 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]

Even though no operating authority is being sought for the 17/24 GHz payload, information is provided here to demonstrate that the payload is capable of complying with Commission rules for operation in a four-degree spacing environment. Specifically, Annex 2 shows C/I and C/(N+I) estimates of the SES-2 17/24 GHz carriers when interfered with by a hypothetical adjacent satellite system operating at 4° orbital separation, and operating at the maximum satellite EIRP density allowed by the FCC. In this conservative model the C/N margin is seen to be positive (approximately 3 dB) in the two typical cases.

[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.

9.0 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 has assessed and limited the amount of debris released in a planned manner during normal operations of SES-2. During the satellite ascent, after separation from the launcher, no debris will be generated. As with all recent SES satellite launches, all deployments will be conducted using pyrotechnic devices 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 co-location of this and another satellite is required, use of the proven Inclination-Eccentricity (I-E) separation method can be employed. This strategy is presently in use by SES to ensure proper operation and safety of multiple satellites within one orbital box.

SES 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's recent spacecraft locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris. SES 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's required probability of success of the mission. SES 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 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 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-2 spacecraft is such that the risk of explosion is minimized both during and after mission operations. In designing and building the spacecraft, the manufacturer took 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 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 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-2 at the 87° W.L. orbital location, where it will replace SES Americom's AMC-3 spacecraft. SES expects to request authority to allow it to relocate AMC-3 once SES-2 is operational at 87° W.L. SES is not aware of any other FCC- or non-FCC licensed spacecraft that are operational or planned to be deployed at 87° W.L. or to nearby orbital locations such that there would be an overlap with the requested stationkeeping volume of SES-2.

SES uses the Space Data Center ("SDC") system from the Space Data Association to monitor the risk of close approach of its satellites with other objects. Any close encounters (separation of less than 10 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 SDC 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 plans to maneuver SES-2 to a disposal orbit with a minimum perigee of 259.3 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: 1445 kg (With CHIRP)

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) = 36043.9 km, or 257.9 km above the GSO arc (35,786 km)

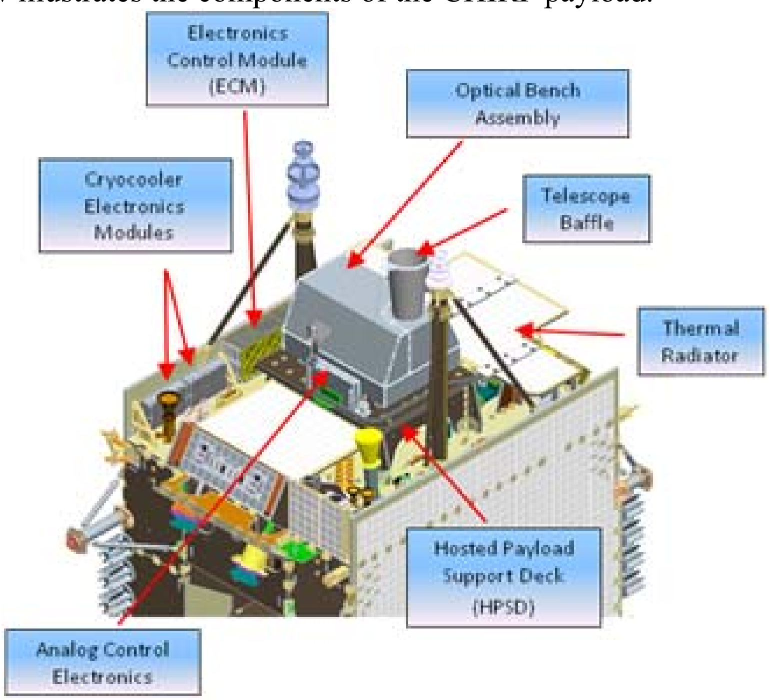
SES intends to reserve 32.8 kg of fuel in order to account for post-mission disposal of SES-2. SES has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

10.0 Commercially Hosted Infrared Payload ("CHIRP")

SES-2 hosts the Commercially Hosted Infrared Payload ("CHIRP"), a wide field-of-view, passive infrared sensor. CHIRP is a proof of concept, technology demonstration payload for the U.S. Air Force's Space and Missile Systems Center designed to improve the Air Force's understanding of wide field-of-view, staring sensor technology. The CHIRP sensor, built by Science Applications International Corp., features a telescope that can view a quarter of the earth from geosynchronous orbit, and is equipped with a four megapixel focal plane array that is sensitive in both short wave and medium wave infrared. The sensor has been integrated onto SES-2, and the data it receives will be transmitted to a ground station for analysis for the US Government.

The payload will be operational during a demonstration period of 12-24 months following the spacecraft launch. The demonstration objectives are to accomplish risk reduction and technology maturation for future wide field-of-view applications, supporting next-generation infrared sensor system development such as the Third Generation Infrared Surveillance system. CHIRP adds approximately 100 kg of weight to the SES-2 spacecraft and requires approximately 250 watts to power the operation of the sensor. Communications with the CHIRP payload are conducted through a standard C-Band transponder. The transmitted information conforms to the typical digital downlink carriers that are described in Table 13 for C-band links.

The drawing below illustrates the components of the CHIRP payload.



ANNEX 1

COVERAGE MAPS

Figure 1: C-band, Receive beam, H-pol (CRH)
G/T max. 3.39 dB/K, Antenna gain max. 31.12 dBi

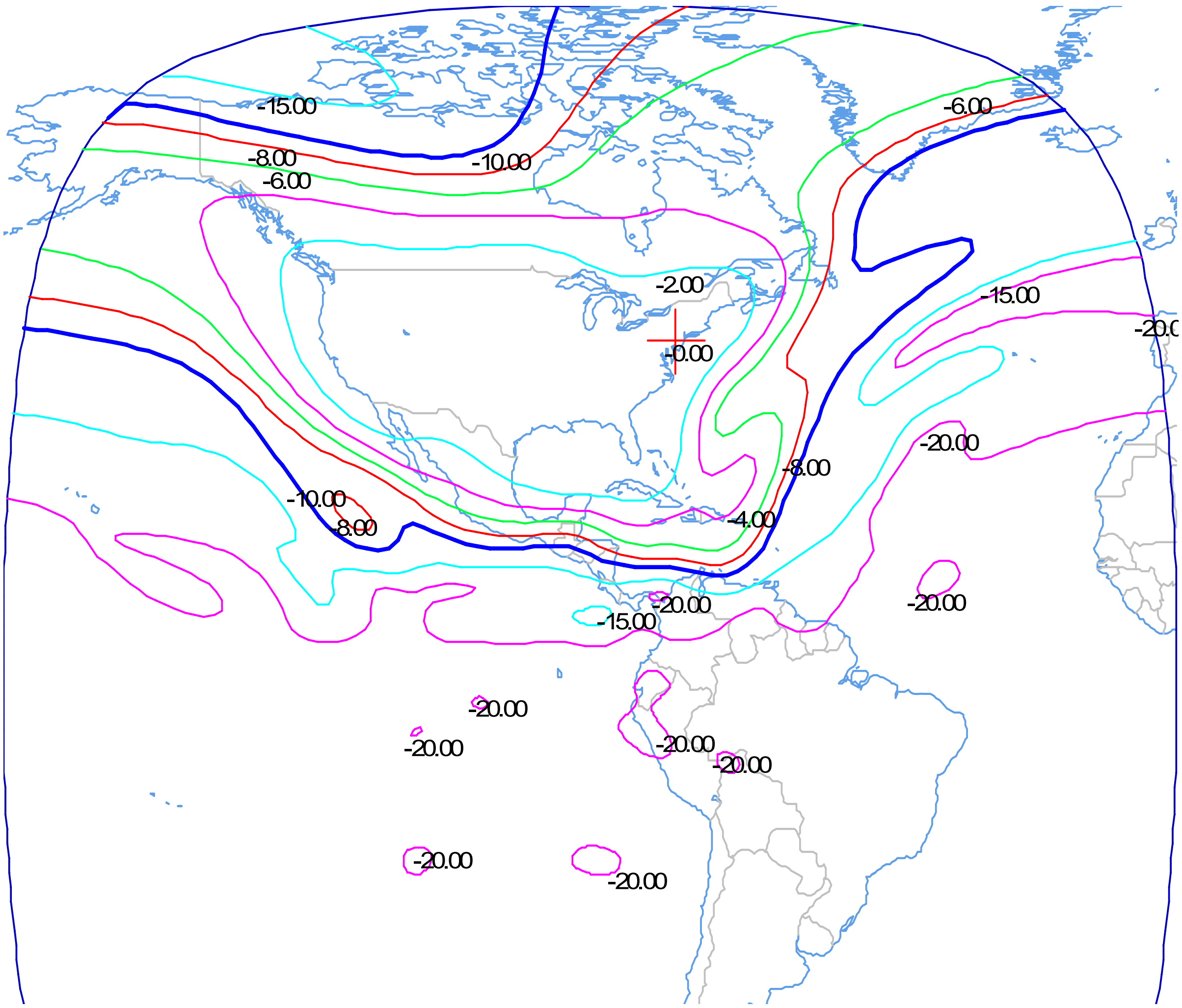


Figure 2: C-band, Receive beam, V-pol (CRV)
G/T max. 3.3 dB/K, Antenna gain max. 31.4 dBi

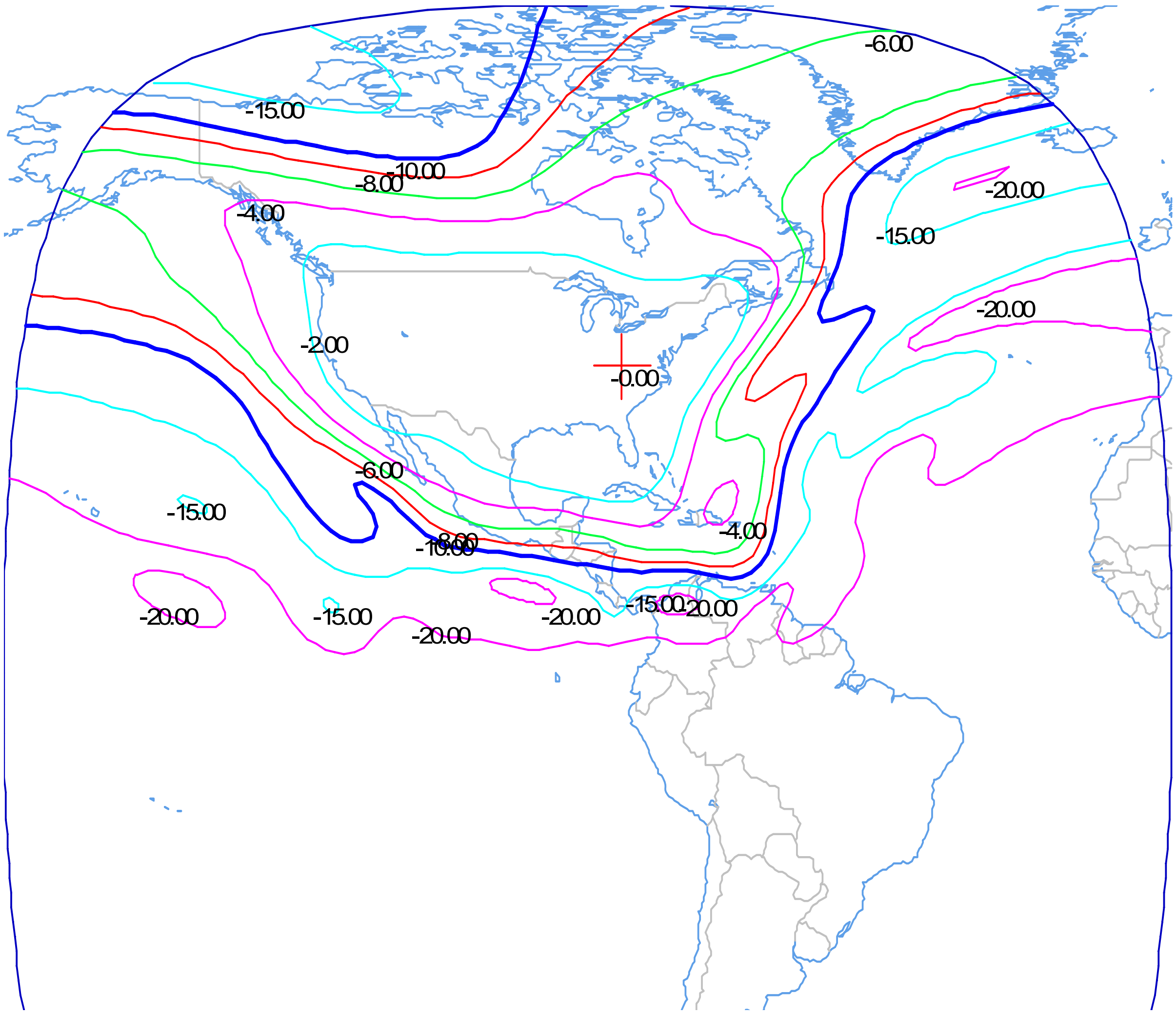


Figure 3: C-band, Transmit beam, H-pol (CTH)
EIRP max. 43.66 dBW, Antenna gain max. 30.12 dBi

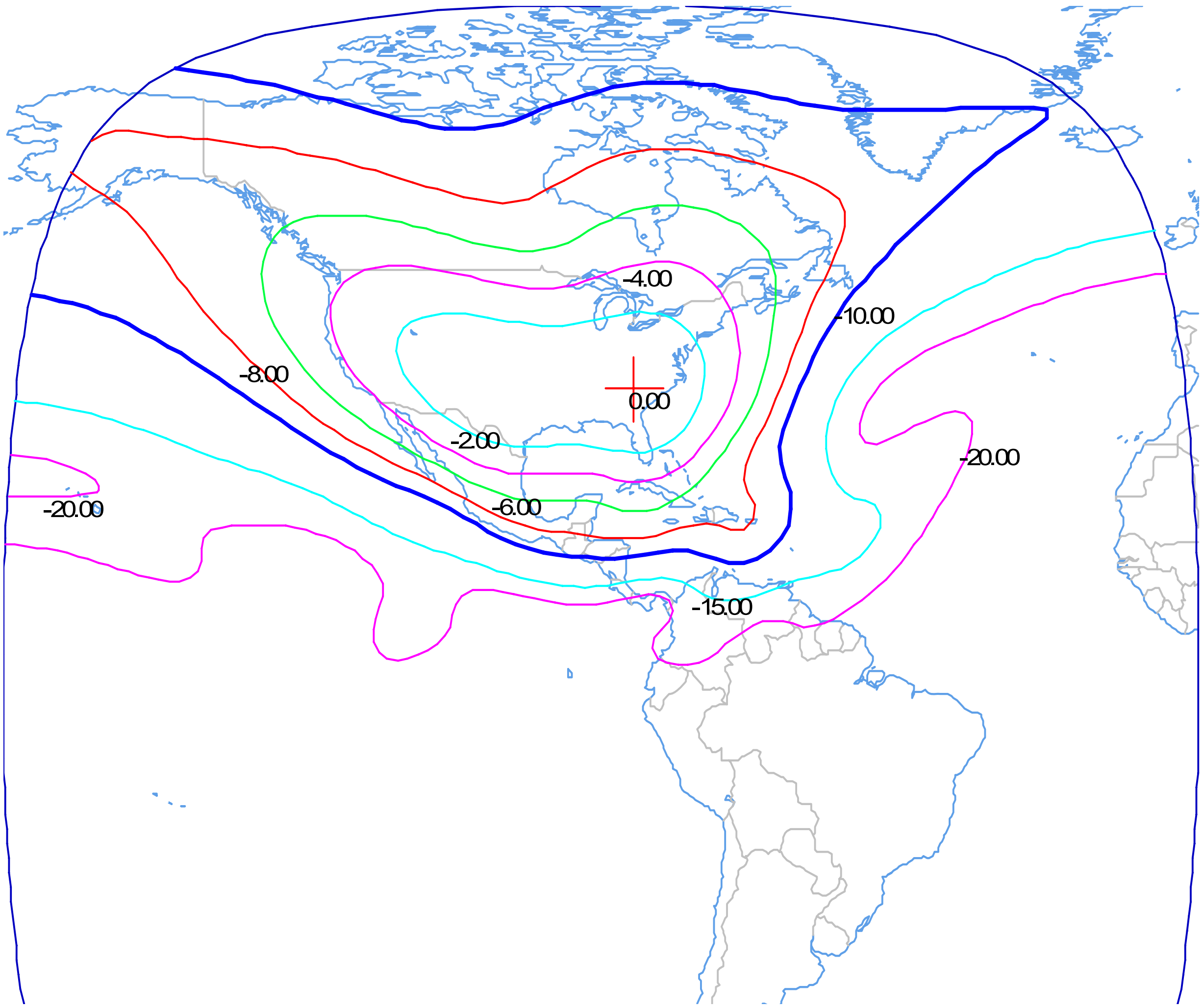


Figure 4: C-band, Transmit beam, V-pol (CTV)
EIRP max. 43.85 dBW, Antenna gain max. 30.4 dBi

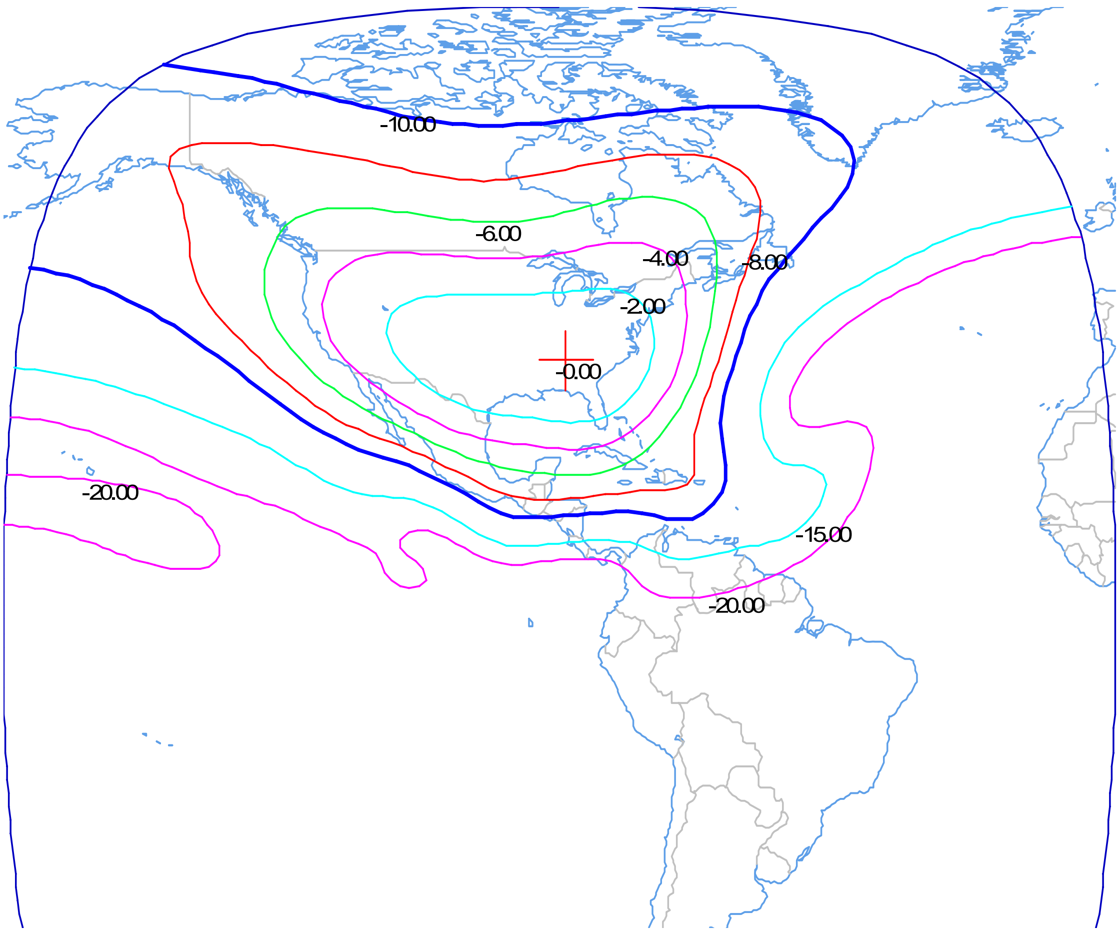


Figure 5: Ku-band, Receive beam, H-pol (KRH)
G/T max.7.65 dB/K, Antenna Gain max. 34.37 dBi

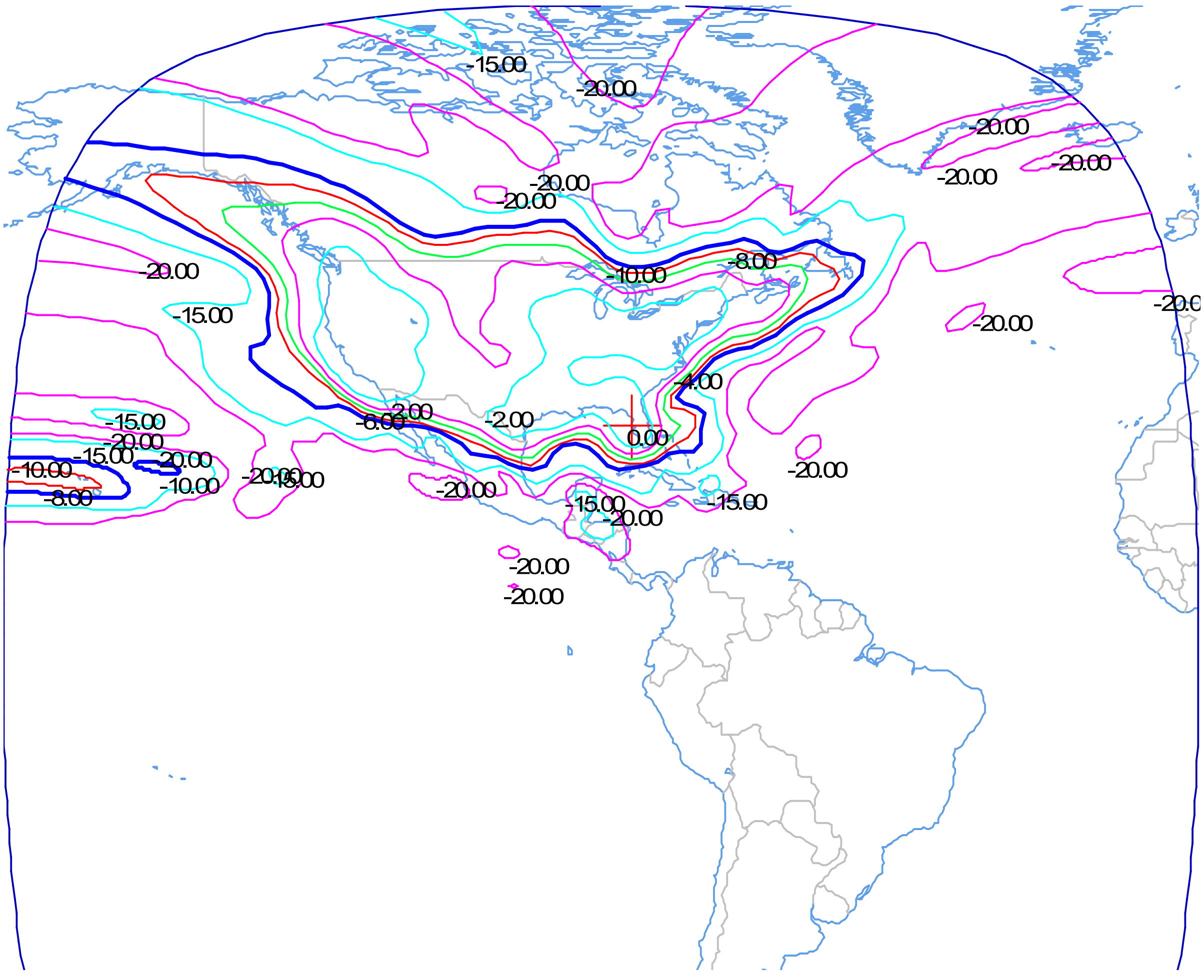


Fig. 6. Ku-band, Receive beam, V-pol (KRV)
G/T max 7.99 dB/K, Antenna Gain max. 34.87 dBi

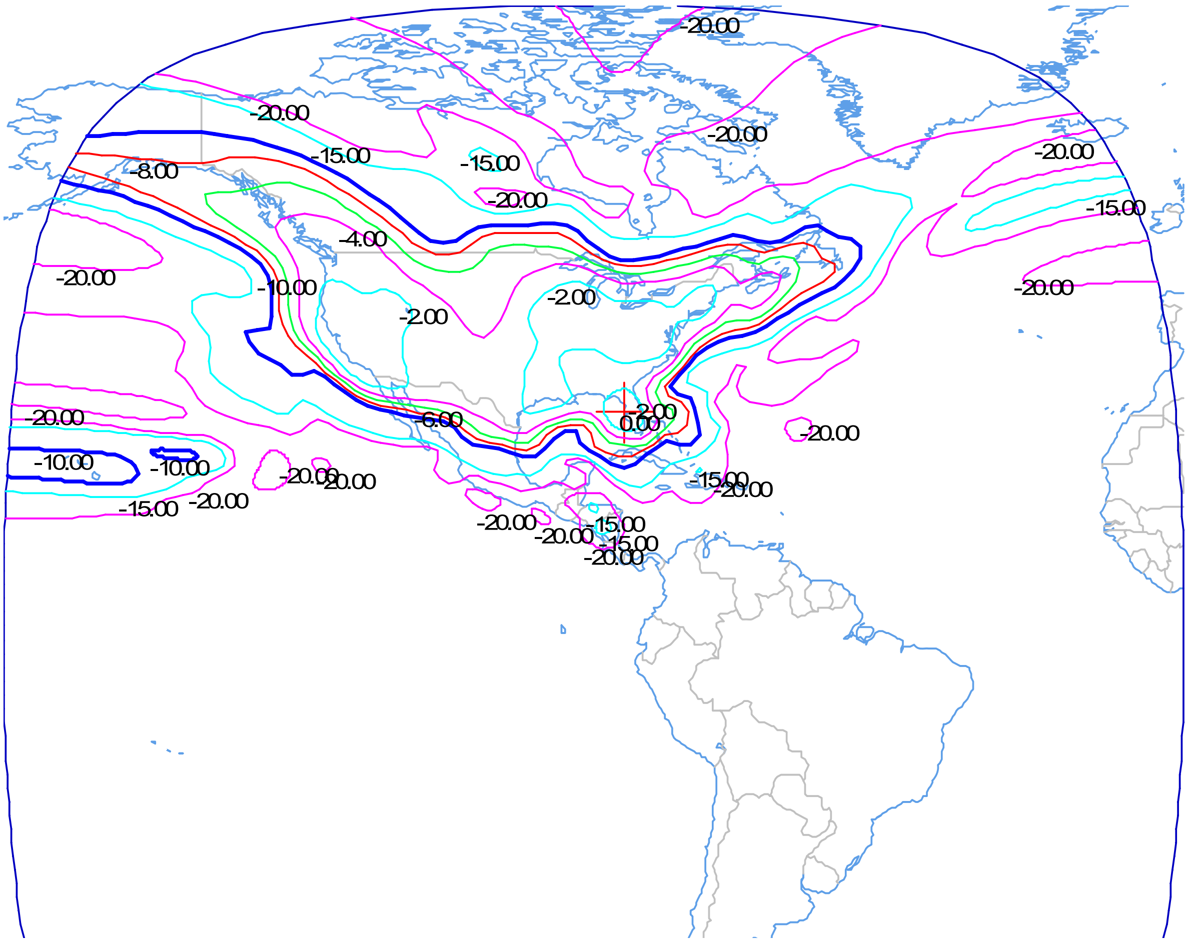


Fig. 7. Ku-band, Transmit beam, H-pol (KTH)
EIRP max. 52.17 dBW, Antenna Gain max. 34.27 dBi

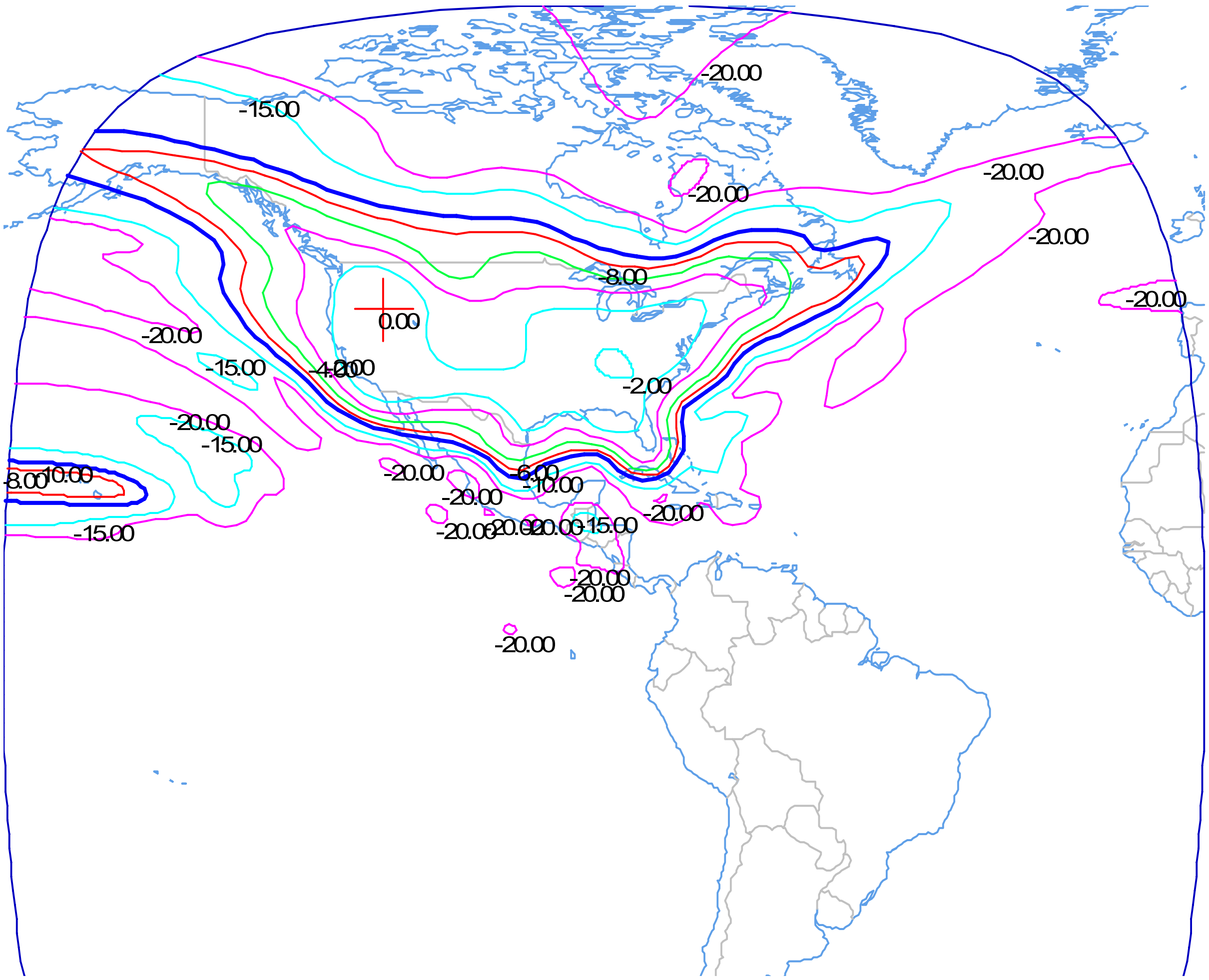


Fig. 8. Ku-band, Transmit beam, V-pol (KTV)
EIRP max. 52.62 dBW, Antenna Gain max. 35.3 dBi

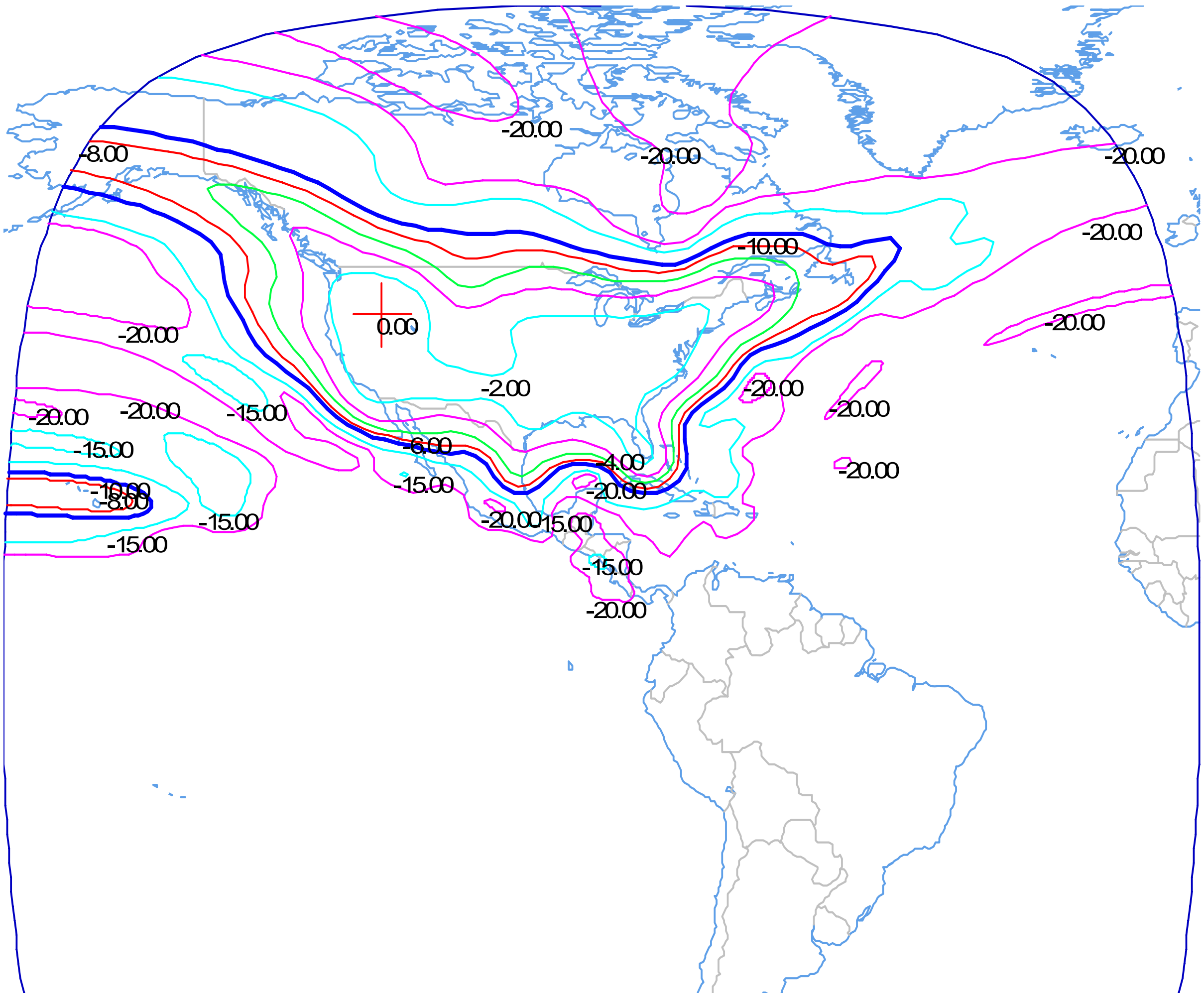
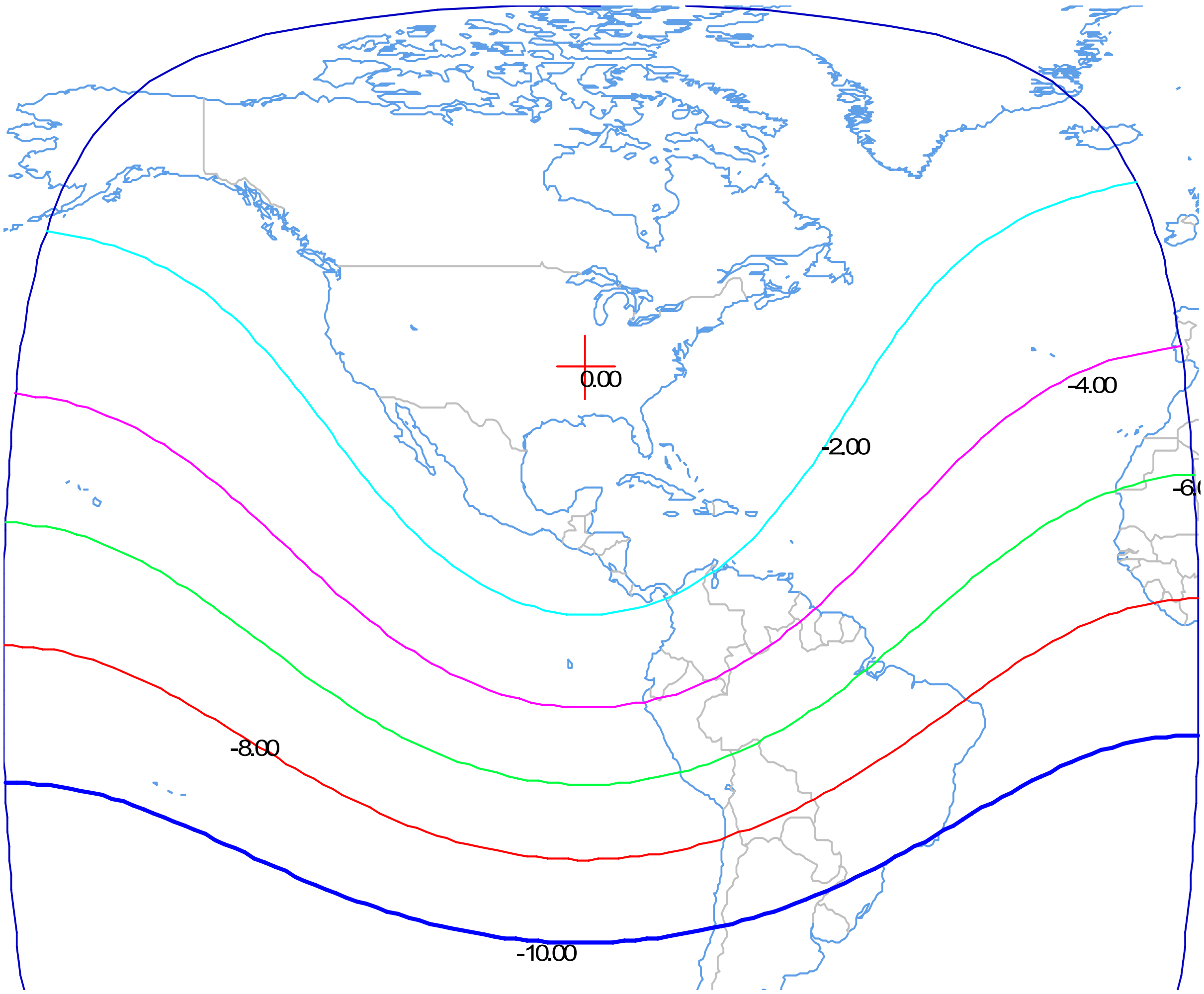
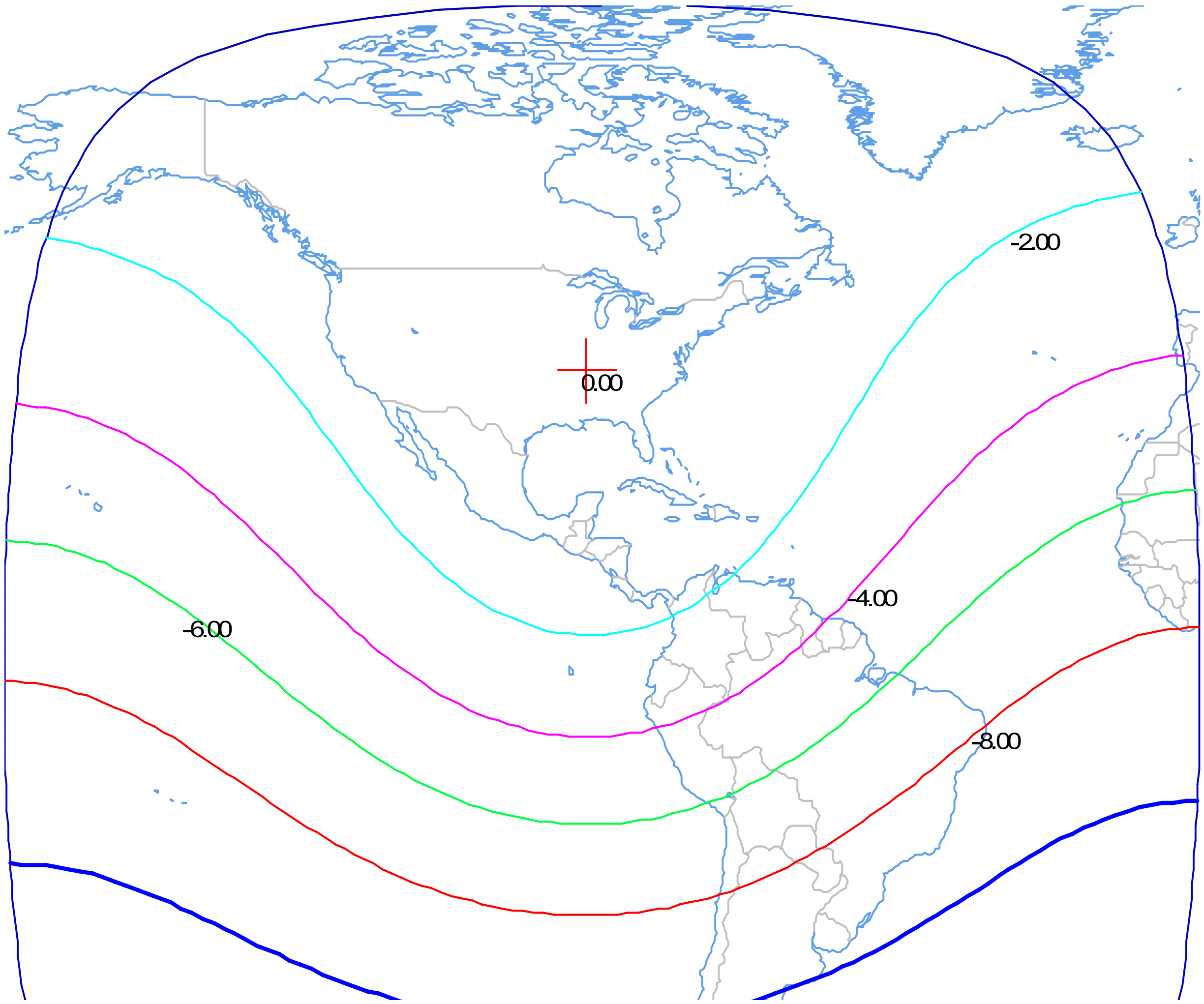


Fig 9. 17/24 GHz Payload, Receive beam, LHCP
G/T max -7.35 dB/K, Antenna gain max. 23.55 dBi[4]



[4] The gain contours are only shown to -10 dBi instead of down to -20 dBi as requested in 25.114(d)(3), because the remaining gain contours do not intersect the Earth.

Fig 10. 17/24 GHz Payload, Transmit beams, RHCP and LHCP
EIRP Max 33.28 dBW, Antenna gain max. 23.48 dBi[5]



[5] The gain contours are only shown to -10 dBi instead of down to -20 dBi as requested in 25.114(d)(3), because the remaining gain contours do not intersect the Earth.

ANNEX 2

INTERFERENCE ANALYSIS

IN SUPPORT OF SES-2

Two-degree Spacing Analysis

The operational C-band satellites adjacent to the 87° W.L. position are Intelsat's Galaxy 28 at 89° W.L. and Star One's Brasilsat B-4 at 84° W.L. The operational Ku-band satellites adjacent to the 87° W.L. position are Intelsat's Galaxy 28 at 89° W.L. and SES Americom's AMC-16 at 85° W.L. SES-2 will take the place of SES Americom's AMC-3 spacecraft, which is currently operating at the 87° W.L. position. Operations of SES-2 at this location will conform to the existing coordination arrangements SES Americom has with adjacent satellite networks. SES Americom has successfully coordinated AMC-3 at 87°W.L. with the adjacent satellites. It is therefore expected that any necessary additional coordination will be concluded without major problems. Satellite transponders of SES-2 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-2 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, 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 20.4 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 the interference scenario with Galaxy-28 having a G/T disadvantage of -4.0 dB/K.

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	43.19	20.44	18.75
1.8	46.71	20.44	22.27
2.4	49.21	20.44	24.77
4.5	54.67	20.44	30.23
6	57.17	20.44	32.73

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) from the 1.2 meter earth station in Table 1 above would only degrade the C/N by 0.35 dB, equivalent to an increase of 8.41% in the victim's system 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.

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 20.4 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 the interference scenario with Galaxy-28 having a G/T disadvantage of -1.4 dB/K:

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	20.44	24.20
4.5	47.51	20.44	25.67
6.0	50.01	20.44	28.17
7.5	51.95	20.44	30.11
9.0	53.53	20.44	31.69

Assuming that the minimum (*i.e.*, threshold) C/N for a digital service is 8 dB, the effect of the C/I (24.20 dB) from the 3.8 meter earth station in Table 2 above would only degrade the C/N by 0.10 dB, equivalent to an increase of 2.4% in the victim's system 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. For the first case, the analysis assumes that the EIRP of the two satellites are similar. For the second case, the Galaxy-28 peak EIRP values are used against the SES-2 values. There is a differential of -1.02 dB in EIRP of Galaxy-28 from SES-2. 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 20.4 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 (dBi)	Off-axis discrimination (dB)	C/I (dB)
1.2	41.66	20.44	21.22	21.22
1.8	45.18	20.44	24.74	24.74
2.4	47.68	20.44	27.24	27.24
4.5	53.14	20.44	32.70	32.70
6	55.64	20.44	35.20	35.20

Table 4: Ku-band downlink C/I for 2-degree geocentric spacing
EIRP of Galaxy-28 is 1.02 dB lower than that of SES-2

Antenna size (m)	On-axis gain (dBi)	Off-axis gain (dBi)	Off-axis discrimination (dB)	C/I (dB)
1.2	41.66	20.44	21.22	20.20
1.8	45.18	20.44	24.74	23.72
2.4	47.68	20.44	27.24	26.22
4.5	53.14	20.44	32.70	31.68
6	55.64	20.44	35.20	34.18

Again, assuming that the minimum (*i.e.*, threshold) C/N for a digital service is 8 dB, the effect of the C/I (20.20 dB) into the 1.2 meter earth station in Table 4 above would only degrade the C/N by

0.25 dB, equivalent to an increase of 6.03% in the victim system's noise temperature. Although this does exceed the normal criteria of 6% by a small amount, the victim's system 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 (dBi)	Off-axis discrimination (dB)	C/I (dB)
3.8	42.06	20.44	21.62	21.62
4.5	43.53	20.44	23.09	23.09
6.1	46.17	20.44	25.73	25.73
7.5	47.96	20.44	27.52	27.52

Table 6: C-band downlink C/I for 2-degree geocentric spacing EIRP of Galaxy-28 is 1.6 dB lower than that of SES-2

Antenna size (m)	On-axis gain (dBi)	Off-axis gain (dBi)	Off-axis discrimination (dB)	C/I (dB)
3.8	42.06	20.44	21.62	20.02
4.5	43.53	20.44	23.09	21.49
6.1	46.17	20.44	25.73	24.13
7.5	47.96	20.44	27.52	25.92

Again, assuming that the minimum (*i.e.*, threshold) C/N for a digital service is 8 dB, the effect of the C/I (20.02 dB) into the 3.8 meter earth station in Table 6 above would only degrade the C/N by 0.26 dB, equivalent to an increase of 6.28% in the victim's system 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 analysis is performed for Galaxy-28 at 89° W.L., but similar results apply to the 85° W.L neighbor also.

3.1 Ku-band

Table 7 shows the key uplink parameters of SES-2 and Galaxy-28 carriers. Table 8 shows C/I estimates in SES-2 and Galaxy-28 carrier uplinks. The C/I values in the Galaxy-28 carriers are at least 20 dB.

Table 9 shows the key downlink parameters of SES-2 and Galaxy-28 carriers. Table 10 shows C/I estimates in SES-2 and Galaxy-28 carrier uplinks. The C/I values in the Galaxy-28 carriers are minimally about 16 dB.

Table 7: SES and adjacent satellite uplink carrier characteristics – Ku-band

(SES-2 at 87° W.L., Galaxy-28 at 89° W.L.,
Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
Bandwidth, MHz	36	27	6.95	5	1.6	0.1
UL flange power dens., dBW/Hz	-55	-55	-50.5	-50.5	-50.5	-50.5
UL ant. Dia, m	6.1	6.1	3.7	3.7	1.8	1.8
UL ant. Gain, dBi	57.3	57.3	53.0	53.0	46.7	46.7
UL EIRP, dBW	77.9	76.6	70.9	69.5	58.3	46.2
UL flange power, dBW	20.6	19.3	17.9	16.5	11.5	-0.5
UL EIRP density, dBW/Hz	2.3	2.3	2.5	2.5	-3.8	-3.8
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	-32.4	-32.4	-27.9	-27.9	-27.9	-27.9
G/T, dB/K	4	4	4	4	4	4
C/N (thermal), dB	27.9	27.9	28.1	28.1	21.8	21.8

Galaxy-28 carriers	25M0G7W	17M5G7W	Dig. TV(20.0)	Dig. TV(3.95)	TDMA	64Kbps	9.6Kbps
Bandwidth, MHz	25	17.5	14.9	3.4	36	0.1	0.0235
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	7	7	1.8	4.5	1.2	1.2
UL ant. Gain, dBi	58.5	58.5	58.5	46.7	54.7	43.2	43.2
UL EIRP, dBW	74.1	67.0	74.1	60.1	75.8	42.4	36.4
UL flange power, dBW	15.6	8.5	15.6	13.4	21.2	-0.8	-6.8
UL EIRP density, dBW/Hz	0.1	-5.4	2.4	-5.2	0.3	-7.6	-7.3
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	-31.8	-28.2	-27.9
G/T, dB/K	0	0	0	0	0	0	0
C/N (thermal), dB	21.7	16.2	24.0	16.4	21.9	14.0	14.3

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

Uplink C/I into SES carriers due to interference from Galaxy-28

	SES carriers					
Adj. Sat carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
25M0G7W	38.1	38.1	38.3	38.3	32.0	32.0
17M5G7W	43.6	43.6	43.8	43.8	37.5	37.5
Dig. TV(20.0)	35.8	35.8	36.0	36.0	29.7	29.7
Dig. TV(3.95)	31.6	31.6	31.8	31.8	25.5	25.5
TDMA	34.1	34.1	34.3	34.3	28.0	28.0
64Kbps	30.5	30.5	30.7	30.7	24.4	24.4
9.6Kbps	30.2	30.2	30.4	30.4	24.1	24.1

Uplink C/I into Galaxy-28 carriers due to interference from SES carriers

	SES carriers					
Galaxy-28 carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
25M0G7W	32.5	32.5	28.0	28.0	28.0	28.0
17M5G7W	27.0	27.0	22.5	22.5	22.5	22.5
Dig. TV(20.0)	34.8	34.8	30.3	30.3	30.3	30.3
Dig. TV(3.95)	27.2	27.2	22.7	22.7	22.7	22.7
TDMA	32.7	32.7	28.2	28.2	28.2	28.2
64Kbps	24.8	24.8	20.3	20.3	20.3	20.3
9.6Kbps	25.1	25.1	20.6	20.6	20.6	20.6

Table 9: SES and adjacent satellite downlink carrier characteristics – Ku-band (SES-2 at 87° W.L., Galaxy-28 at 89° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
Bandwidth, MHz	36	27	6.95	5	1.6	0.1
Carrier EIRP density, dBW/Hz	-26.0	-26.0	-27.7	-27.7	-26.0	-26.0
Satellite EIRP max, dBW	52.6	52.6	52.6	52.6	52.6	52.6
Carrier EIRP, dBW	49.6	48.3	40.7	39.3	36.0	24.0
Rx ES ant. Dia., m	1.2	1.2	1.8	1.8	1.2	1.2
Rx ES ant. Gain, dBi	41.7	41.7	45.2	45.2	41.7	41.7
Sidelobe gain (at 1.8 deg), dBi	22.6	22.6	22.6	22.6	22.6	22.6
Noise Temp, K	110	110	110	110	110	110
C/N (thermal), dB	16.8	16.8	18.7	18.7	16.8	16.8

Galaxy-28 carriers	36M0G7W	36M0G7W	27M0G7W	Dig. TV(20.0)	Dig. TV(3.95)	TDMA
Bandwidth, MHz	36	36	27	14.9	3.4	36
Carrier EIRP density, dBW/Hz	-27.6	-27.6	-26.0	-27	-27	-28.6
Satellite EIRP max, dBW	51.6	51.6	51.6	51.6	51.6	51.6
Carrier EIRP, dBW	48.0	48.0	48.3	44.7	38.3	47.0
Rx ES ant. Dia., m	1.8	2.4	1.2	1.8	1.8	4.5
Rx ES ant. Gain, dBi	45.2	47.7	41.7	45.2	45.2	53.1
Sidelobe gain (at 1.8 deg), dBi	22.6	22.6	22.6	22.6	22.6	22.6
Noise Temp, K	110	110	110	110	110	110
C/N (thermal), dB	18.8	21.3	16.8	19.4	19.4	25.7

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

Downlink C/I into SES carriers due to interference from Galaxy-28						
	SES carriers					
Galaxy-28 carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W (1)	20.6	20.6	22.5	22.5	20.6	20.6
36M0G7W (2)	20.6	20.6	22.5	22.5	20.6	20.6
27M0G7W	19.1	19.0	20.9	20.9	19.0	19.0
Dig. TV(20.0)	20.0	20.0	21.9	21.9	20.0	20.0
Dig. TV(3.95)	20.0	20.0	21.9	21.9	20.0	20.0
TDMA	21.6	21.6	23.5	23.5	21.6	21.6
Downlink C/I into Galaxy-28 carriers due to interference from SES carriers						
	SES carriers					
Galaxy-28 carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W (1)	21.0	21.0	22.7	22.7	21.0	21.0
36M0G7W (2)	23.5	23.5	25.2	25.2	23.5	23.5
27M0G7W	19.0	19.0	20.7	20.7	19.0	19.0
Dig. TV(20.0)	21.6	21.6	23.3	23.3	21.6	21.6
Dig. TV(3.95)	21.6	21.6	23.3	23.3	21.6	21.6
TDMA	27.9	27.9	29.6	29.6	27.9	27.9

3.2 C-band

Table 11 shows the key uplink parameters of SES-2 and Galaxy-28 carriers. Table 12 shows C/I estimates in SES-2 and Galaxy-28 carrier uplinks. The C/I values in the Galaxy-28 are at least 20 dB.

Table 13 shows the key downlink parameters of SES-2 and Galaxy-28 carriers. Table 14 shows C/I estimates in SES-2 and Galaxy-28 carrier uplinks. The C/I values in the Galaxy-28 carriers are minimally about 18 dB.

Table 11: SES and adjacent satellite uplink carrier characteristics –C-band (SES-2 at 87° W.L., Galaxy-28 at 89° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
Bandwidth, MHz	36	6.95	1.6	0.1
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	50.0	45.7	44.9	44.9
UL EIRP, dBW	69.2	57.9	50.6	38.6
UL flange power, dBW	19.2	12.2	5.6	-6.3
UL EIRP density, dBW/Hz	-6.4	-10.5	-11.5	-11.4
Sidelobe gain (at 1.8 deg), dBi	22.6	22.6	22.6	22.6
Off-ax. EIRP dens, dBW/Hz	-33.8	-33.6	-33.8	-33.7
G/T, dB/K	2	2	2	2
C/N (thermal), dB	17.2	13.1	12.1	12.2

Galaxy-28 carriers	36M0G7W	6M5G1W	1M50G1W	100K5G1W
Bandwidth, MHz	36	6.5	1.5	0.1
UL flange power dens., dBW/Hz	-61.7	-66.1	-58.5	-58.77
UL ant. Dia, m	9	9	3.8	3.5
UL ant. Gain, dBi	53.4	53.4	45.9	45.2
UL EIRP, dBW	67.3	55.4	49.2	36.4
UL flange power, dBW	13.9	2.0	3.3	-8.8
UL EIRP density, dBW/Hz	-8.3	-12.7	-12.6	-13.6
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	13.8	9.4	9.5	8.5

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

Uplink C/I into SES carriers due to interference from Galaxy-28				
	SES carriers			
Galaxy-28 carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
36M0G7W	32.7	28.6	27.6	27.7
6M5G1W	37.1	33.0	32.0	32.1
1M50G1W	29.5	25.4	24.4	24.5
100K5G1W	29.8	25.6	24.7	24.8
Uplink C/I into Galaxy-28 carriers due to interference from SES carriers				
	SES carriers			
Galaxy-28 carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
36M0G7W	25.5	25.3	25.5	25.4
6M5G1W	21.1	20.9	21.1	21.0
1M50G1W	21.2	21.0	21.2	21.1
100K5G1W	20.2	20.0	20.2	20.1

Table 13: SES and adjacent satellite downlink carrier characteristics – C-band (SES-2 at 87° W.L., Galaxy-28 at 89° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

SES carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
Bandwidth, MHz	36	6.95	1.6	0.1
Carrier EIRP density, dBW/Hz	-34.0	-37.0	-35.0	-37.0
Satellite EIRP max, dBW	43.85	43.85	43.85	43.85
Carrier EIRP, dBW	41.6	31.4	27.0	13.0
Rx ES ant. Dia., m	6.1	7.0	5.4	4.5
Rx ES ant. Gain, dBi	46.2	47.4	45.1	43.5
Sidelobe gain (at 1.8 deg), dBi	22.6	22.6	22.6	22.6
Noise Temp, K	120	120	120	120
C/N (thermal), dB	13.0	11.2	10.9	7.3

Galaxy-28 carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
Bandwidth, MHz	36	6.95	1.6	0.1
Carrier EIRP density, dBW/Hz	-34.4	-37	-33.5	-37
Satellite EIRP max, dBW	41.2	41.2	41.2	41.2
Carrier EIRP, dBW	41.2	31.4	28.5	13.0
Rx ES ant. Dia., m	6.1	7.0	5.4	4.5
Rx ES ant. Gain, dBi	46.2	47.4	45.1	43.5
Sidelobe gain (at 1.8 deg), dBi	22.6	22.6	22.6	22.6
Noise Temp, K	120	120	120	120
C/N (thermal), dB	12.6	11.2	12.4	7.3

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

Downlink C/I into SES carriers due to interference from Galaxy-28				
	SES carriers			
Galaxy-28 carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
36M0G7W	23.6	21.7	21.5	17.9
6M95G1W	26.6	24.7	24.5	20.9
1M60G1W	324.6	322.7	322.5	318.9
100KG1W	26.6	24.7	24.5	20.9
Downlink C/I into Galaxy-28 carriers due to interference from SES carriers				
	SES carriers			
Galaxy-28 carriers	36M0G7W	6M95G1W	1M60G1W	100KG1W
36M0G7W	23.6	26.6	24.6	26.6
6M95G1W	21.7	24.7	22.7	24.7
1M60G1W	-278.5	-275.5	-277.5	-275.5
100KG1W	17.9	20.9	18.9	20.9

17/24 GHz Interference Analysis

Even though no operating authority is being sought for the 17/24 GHz payload, information is provided here to demonstrate that the payload is capable of complying with Commission rules for operation in a four-degree spacing environment at an Appendix F grid location. The allowable off-axis eirp density limit in the uplinks that are in the frequency range 24.75-25.25 GHz is 32.5 – 25 log(θ) dBW/MHz for off-axis angle range 2° ≤ θ < 7°. Since large antennas would be used in the uplinks, the sidelobe envelope is 29 – 25 log(θ). As a result, the allowable power density at the input to the transmit earth station is 3.5 dBW/MHz. The system would be operated such that this limit[6] will not be exceeded.

In the hypothetical case of operations of the SES-2 17/24 GHz payload with adjacent satellites less than 4 degrees away, SES WORLD SKIES would conform its operations to comply with Section 25.262(d) of the Commission's rules as required. As noted above, SES WORLD SKIES is not seeking authority to operate the 17/24 GHz payload on SES-2 at 87° W.L. If SES WORLD SKIES in the future decides to pursue authority to operate the 17/24 GHz payload, SES WORLD SKIES will submit an application supported by an interference analysis for the specific orbital location and operating levels proposed. Table 15 shows C/I and C/(N+I) estimates of the SES-2 carriers when interfered with by a hypothetical adjacent satellite system operating at 4° orbital separation, and operating at the maximum satellite eirp density allowed by the FCC.

[6] The actual off-axis eirp density levels will meet the entire mask in § 25.223, taking into account that the limits apply over the range of the off-axis angles (2° to 180°).

Table 15: Single-entry interference analysis (wanted carrier: SES-2)

	1M20G1W	5M50G1W
Bandwidth, MHz	1.2	5.5
Uplink		
Uplink EIRP, dBW	77.5	75.5
Uplink EIRP density, dBW/MHz	76.7	68.1
ASI off-axis EIRP density, dBW/MHz	17.4	17.4
UL C/I, dB	59.3	50.6
Downlink		
SES Satellite EIRP, dBW	33	33
SES Satellite EIRP density, dBW/MHz	32.2	25.6
Interfering satellite PFD, dBW/m2/MHz	-115	-115
Interfering satellite EIRP density, dBW/MHz	48.5	48.5
RxES antenna diameter, m	0.8	1.3
RxES antenna gain, dBi	41.5	45.7
Geocentric angle of neighboring satellite, deg	4	4
Topocentric angle (10% greater than geo. Angle)	4.4	4.4
Max satellite station keeping error, deg	0.1	0.1
RxES Pointing error, deg	0.5	0.5
Net off-axis angle, deg	3.8	3.8
Sidelobe (29-25 log theta), dB	14.5	14.5
DL C/I, dB	10.7	8.3
C/N clear weather, dB	11.8	9.4
C/(N+I), clear weather, dB	8.20	5.81
Up and downlink		
C/N required, dB	4.7	1.3
C/(N+I), clear weather, dB	8.20	5.81
C/(N+I) margin, dB	3.5	4.5

Engineering Declaration

DECLARATION OF Zachary Rosenbaum

I, Zachary Rosenbaum, 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/______________________

Engineer, Spectrum Development

SES Americom, Inc.

Dated: April 29, 2011