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

In the Matter of	)	
	)	
SES AMERICOM, INC.	)	File No. SAT-MOD-_____
	)	Call Sign S2135
Application for Modification of AMC-4	)	
Fixed-Satellite Space Station License	)	

APPLICATION OF SES AMERICOM, INC.

SES Americom, Inc. ("SES Americom," doing business as "SES WORLD SKIES"),[1] hereby respectfully requests a modification of its license for the AMC-4 fixed-satellite space station to reassign the spacecraft to the 67º W.L. orbital location. Specifically, SES WORLD SKIES requests authority to perform Tracking, Telemetry, Command, and Monitoring ("TTC&M") in order to relocate AMC-4 from 101º W.L. to 67º W.L. and authority to operate both the TTC&M and Ku-band communications payloads on AMC-4 after it has arrived at 67º W.L. SES WORLD SKIES will operate AMC-4 at 67º W.L. in accordance with the International Telecommunication Union ("ITU") filings of the Colombian Administration, as Notifying Administration for the Andean Community ("CAN"). Grant of the requested authority will serve the public interest by allowing SES WORLD SKIES to use AMC-4 to provide service to the United States from a location where no service is currently being provided.

[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.

A completed FCC Form 312 is attached, and SES WORLD SKIES incorporates by reference the technical information previously provided in support of AMC-4.[2] In addition, SES WORLD SKIES is providing here technical information relating to the proposed modification to the AMC-4 license on Schedule S and in narrative form pursuant to Section 25.114 of the Commission's Rules.

MODIFICATION

SES WORLD SKIES currently operates the AMC-4 C/Ku-band hybrid satellite at 101º W.L.,[3] where it is collocated with SES WORLD SKIES' AMC-2 spacecraft.[4] SES WORLD SKIES has requested Commission authority to launch and operate SES-1 in order to replace AMC-4, at 101º W.L.,[5] and launch of SES-1 is currently scheduled for April 24, 2010.

SES WORLD SKIES proposes to relocate AMC-4 to 67º W.L. once it has been replaced at 101º W.L. by SES-1. At its new location, AMC-4 will operate in the conventional Ku-band and the extended Ku-band with coverage of North and South America. SES WORLD SKIES is not seeking authorization to operate the AMC-4 C-band communications payload at 67º W.L.

Operations of AMC-4 at 67º W.L. will be in accordance with ITU filings of the Colombian Administration as Notifying Administration for the Andean Community, whose

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2 *See* File Nos. SAT-LOA-19940310-00007; SAT-AMD-19941114-00064; SAT-MOD-19970130-00012; SAT-MOD-19981023-00076; & SAT-MOD-20080314-00072.

3 AMC-4 is licensed to operate in the conventional C-band (3700-4200 MHz and 5925-6425 MHz), conventional Ku-band (11.7-12.2 GHz and 14.0-14.5 GHz), and extended Ku-band (11.45-11.7 GHz and 13.75-14.0 GHz) frequencies.

4 *See* File Nos. SAT-MOD-20080314-00072, SAT-MOD-20080124-00030, and SAT-AMD-20080311-00070, all grant-stamped May 19, 2008.

5 *See* File Nos. SAT-RPL-20100120-00014; SAT-AMD-20100309-00040 (Call Sign S2807).

members are Bolivia, Colombia, Ecuador, and Peru (the "Andean Community"). The Andean Community has granted SES WORLD SKIES' affiliate, New Skies Satellites B.V. ("New Skies"), exclusive authorization for commercial utilization of the 67º W.L. orbital location for a thirty-year term. SES WORLD SKIES provides as Attachment 1 hereto a copy of the unofficial English translation of Decision 725, the Andean Community's grant of authority to New Skies.[6]

Modification of the AMC-4 license will serve the public interest by allowing SES WORLD SKIES to initiate service to the United States from 67° W.L. – a location where no service is currently being provided. The Commission has generally permitted satellite operators the flexibility to design and modify their networks in response to customer requirements, provided there are no compelling countervailing public interest considerations.[7] Here, grant of the modification will allow SES WORLD SKIES to expand its provision of capacity to the U.S., including capacity for direct-to-home video services, in order to meet customer demand for those services. Further, SES WORLD SKIES will operate AMC-4 in conformance with the relevant coordination agreements Colombia has reached with other administrations with affected ITU filings regarding operations at 67° W.L. Thus, the requested modification will not adversely affect any party. Under these circumstances, grant of the requested modification is consistent with the Commission's policy of allowing satellite operators to maximize the efficient use of spectrum and orbital resources consistent with customer requirements.

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[6] New Skies and SES Americom are under common ownership and have made intra-company arrangements to allow deployment of AMC-4 to 67° W.L. for use under the New Skies authorization from the Andean Community.

[7] *See, e.g. AMSC Subsidiary Corporation*, 13 FCC Rcd 12316 at ¶ 8 (IB 1998) (the Commission generally leaves space station design decisions to the licensee "because the licensee is in a better position to determine how to tailor its system to meet the particular needs of its customers.") (footnote omitted).

WAIVER REQUEST

SES WORLD SKIES requests a limited waiver of the Commission's requirements in connection with the instant modification application. Grant of the waiver 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.[8]

SES WORLD SKIES requests a limited waiver of Section 25.114(d)(3) of the Commission's rules. That provision requires submission of predicted antenna gain contours for each transmit and receive antenna beam and specifies that for geostationary orbit satellites, the information must be provided in a .gxt format. As discussed in Section 3.0 of the Technical Appendix, SES WORLD SKIES has provided antenna gain information in the required .gxt format with one exception. The gain characteristics for the global horn antenna are not provided as a .gxt file because the .gxt data is not available from the spacecraft manufacturer. Instead, gain versus off-set angle information is provided as a figure in Annex 1 to the Technical Appendix.

The Commission has previously waived the requirements of Section 25.114(d)(3) in similar factual circumstances.[9] In acting on these requests, the Commission recognized that

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

[9] *See, e.g.*, Application of PanAmSat Licensee Corp., File No. SAT-RPL-20061219-00155, Call Sign S2715, grant stamp dated April 24, 2007 ("*Galaxy 17 Grant*") at ¶ 5 (waiving Section 25.114(d)(3) to allow submission of gain information for omni antenna in non-.gxt format where manufacturer did not provide .gxt data); *see also Spectrum Five, LLC*, Order and

the purpose of the rule is to ensure that adequate information is available to allow evaluation of the potential for harmful interference.[10] Here, in lieu of the single .gxt file that cannot be provided, SES WORLD SKIES has submitted alternative data sufficient to permit the Commission and any interested party to evaluate the antenna's interference potential. Accordingly, SES WORLD SKIES requests that the Commission grant a limited waiver of Section 25.114(d)(3).

CONCLUSION

For the foregoing reasons, SES WORLD SKIES seeks a modification of the AMC-4 license to permit relocation of the spacecraft from 101º W.L. to 67º W.L. and operations in the conventional and extended Ku-band, as described in the attached materials.

Respectfully submitted,

SES AMERICOM, INC.

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Dated: April 21, 2010

Authorization, DA 06-2439, 21 FCC Rcd 14023, 14033 at ¶ 17 (IB 2006) (conditionally accepting antenna gain information not filed in .gxt format).

[10] *Galaxy 17 Grant* at n.5.

Attachment 1

COMUNIDAD ANDINA
SECRETARIA GENERAL

Decision 725
27 November 2009
10 December 2009
Lima – Peru
DECISION 725

DECISION 725

Community Authorization for Operation and Commercialization of the Member Countries' Spectrum-Orbit Resources at the 67° West Orbital Location

ONE HUNDRED AND THIRD PERIOD
COMMUNITY ORDINARY SESSIONS
27 November 2009
10 December 2009
Lima - Peru

DECISION 725

Community Authorization for Operation and Commercialization of the Member Countries' Spectrum-Orbit Resources at the 67° West Orbital Location

THE ANDEAN COMMUNITY COMMISSION,

CONSIDERING: Articles 3 (f), 22 (a) and (h), 30 (b), and Chapter XI of the Cartagena Agreement, and the Andean Community Commission Decisions 654, 672, 707, and 724; and:

WHEREAS: Decision 654, dated 15 November 2006, approved the "Regulatory Framework for Commercial Utilization of Member Countries' Orbit-Spectrum Resources", which sets forth the basic conditions for the operation of Member Countries' Orbit-Spectrum Resources by satellite service providers;

Pursuant to Decision 672, the General Secretariat was authorized to undertake, with support from the Andean Committee of Telecommunications Authorities, direct negotiations with the interested enterprise(s), within the framework of Decision 654, regarding Community Authorization conditions, under the most favorable terms for the interests of Member-Country Administrations, with the basic objective of preserving the Orbit-Spectrum Resources at the 67° West Orbital Location;

Based on the above-mentioned framework, and particularly its transitional provisions modified by means of Decision 672, the Andean Community General Secretariat, with the support of the Andean Committee of Telecommunications Authorities CAATEL, undertook a process to select a satellite-service operator that is to be in charge of preserving and operating the Member Countries' Orbit-Spectrum Resources at the 67° West Orbital Location;

At its XXIII Ordinary Meeting, CAATEL issued its opinion concerning the conditions for preserving and operating the Orbit-Spectrum Resources at the 67º West Orbital Location. CAATEL also agreed that the Community Authorization for operating the above-mentioned orbital location be granted to NEW SKIES SATELLITES B.V., a Dutch limited liability corporation headquartered in The Hague, Netherlands;

Based on CAATEL's favorable opinion, the General Secretariat submitted its recommendations and Proposal 230 concerning the regulatory framework for operating the 67° West Orbital Location, as well as the Community Authorization in favor of NEW SKIES SATELLITES B.V.;

Special conditions need to be established for the Plurinational State of Bolivia concerning the obligations and legal effects derived from the contractual relationship with the Authorized Enterprise;

DECIDES THE FOLLOWING:

Article 1.- NEW SKIES SATELLITES B.V., a Dutch limited liability corporation headquartered in The Hague, Netherlands (or "SES NEW SKIES"), is hereby granted the Community Authorization for commercial utilization of the Member Countries' Orbit-Spectrum Resources at the 67° West Orbital Location, pursuant to the conditions set forth herein and in the respective Agreement.

Article 2.- Pursuant to Decision 654 Article 6 (c), the Andean Community Secretary General is entrusted with executing the Agreement with NEW SKIES SATELLITES B.V. on behalf of the Andean Community, which Agreement shall set forth the terms and conditions of the Community Authorization granted by means of Article 1 herein.

In executing the above-mentioned Agreement, the Secretary General shall take into account the following conditions, as well as the respective report of the Andean Committee of Telecommunications Authorities CAATEL:

a) The Authorized Enterprise shall have the exclusive rights to operate the 67° West Orbital Location, for a thirty-year term, which may be extended pursuant to the provisions in the Regulatory Framework for Commercial Utilization of Member Countries' Orbit-Spectrum Resources. This term shall be counted from the moment defined in the Agreement to be executed by the Enterprise and the Commission, the latter represented by the General Secretariat.

b) The Community Authorization grants the Authorized Enterprise the right to operate on a commercial basis the 67° West Orbital Location. Said right may be exercised by the Authorized Enterprise or its successor, pursuant to the time-frames and conditions set forth in the Agreement and herein.

c) The Community Authorization shall become null and void in the event that the Authorized Enterprise fails to comply with this Decision or the terms set forth in the Agreement. In addition, the Community Authorization shall become null and void pursuant to the pertinent causes set forth in the Agreement.

d) Without prejudice to the provisions in subparagraph (e) below, the Authorized Enterprise shall determine the prices, terms and conditions under which it shall provide capacity and services from the 67° West Orbital Location, and shall have the right to keep for itself all the revenue it receives for said capacity and services.

e) In consideration for the Community Authorization, the Authorized Enterprise shall provide the Member Countries free-of-charge satellite capacity, pursuant to the terms and conditions to be set forth in the Agreement.

f) With the prior favorable report of CAATEL, the General Secretariat shall

establish the necessary provisions for the equitable distribution of the capacity mentioned in subparagraph (e) above among the Member Countries.

g) In the Agreement, the General Secretariat and the Authorized Enterprise shall determine the applicable laws, their application rules and other related provisions, as well as an arbitration mechanism to resolve any potential disputes. The General Secretariat, pursuant to CAATEL's recommendations, and the Authorized Enterprise shall agree upon the arbitration venue and pertinent procedures.

h) Pursuant to Decision 654, Article 5, third paragraph, added by means of Decision 724, the Agreement to be executed on behalf of the Commission, with the exception of Bolivia, shall not generate any obligations for the Plurinational State of Bolivia. The Authorized Enterprise shall not have any rights to invoke against the Plurinational State of Bolivia the dispute resolution mechanism to be set forth in the Agreement.

i) The Authorized Enterprise shall not have any rights to invoke against the Plurinational State of Bolivia nor against the remaining Member Countries the dispute resolution mechanism to be set forth in the Agreement. Likewise, no Member Country shall have the right to invoke against the Authorized Enterprise the dispute resolution mechanism to be set forth in the Agreement.

Article 3.- Without prejudice to the provisions in Article 2 subparagraphs (h) and (i) herein, the Member Countries, with the exception of Bolivia, and the Andean institutions shall respect the rights granted to the Authorized Enterprise by means of this Decision and the Agreement.

Article 4.- With the prior favorable opinion of the Member Countries that assume obligations pursuant to this Decision, the General Secretariat shall adopt the measures required for the proper fulfillment, follow-up, evaluation or amendment of the obligations stemming from the Agreement.

The Representative Administration referred to in Decision 654 Article 12 shall undertake the actions and procedures set forth in the ITU Radio Regulations with a view to obtaining the filing and registration of the frequency assignments and the related orbital characteristics, so as to obtain international recognition of the utilization of the allotted Orbit-Spectrum Resources, in order to enable the Authorized Enterprise to utilize and operate the Orbit-Spectrum Resources to its greatest possible commercial potential.

Article 5.- Member Countries, with the exception of Bolivia, shall endeavor to establish reciprocity agreements with third countries to foster the commercial operation of the Orbit-Spectrum Resources, pursuant to the Reciprocity Principle set forth in Article 3 of the Andean Community Commission's Decision 707.

Article 6.- The satellite capacity referred to in Article 2 (e) herein shall be distributed in equal parts among all the Member Countries and shall be used exclusively for non-commercial governmental purposes, in social connectivity projects or for other governmental purposes.

Done at Lima, Peru, on this tenth day of December, 2009.

ATTACHMENT A

TECHNICAL APPENDIX

IN SUPPORT OF AMC-4 (67°W.L.)

TECHNICAL APPENDIX

1.0 Overall Description (§25.114(d)(1))

This technical appendix is submitted in support of the modification application of SES Americom, Inc. ("SES Americom," doing business as SES WORLD SKIES) seeking reassignment of AMC-4 to 67°W.L. from its current orbital position of 101°W.L. SES WORLD SKIES hereby incorporates by reference the technical information it has already provided with respect to AMC-4,[1] and provides here technical information relating to operation of AMC-4 at 67°W.L. consistent with the proposed modification.

AMC-4 is a hybrid C and Ku-band communications satellite. At 67°W.L. SES WORLD SKIES proposes to operate AMC-4 using 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
- Extended Ku-band frequencies with downlink frequencies from 11.45 to 11.7 GHz and uplink frequencies from 13.75 to 14.0 GHz[2]
- Telemetry carriers (beacons) in the conventional Ku-band at 11702.0 MHz and 12198.0 MHz
- Telecommand carriers in the conventional C-band at 6423.5 MHz. SES WORLD SKIES may also operate C-band telemetry beacons at 3700.5 MHz and 4199.5 MHz provided that coordination of the beacons with adjacent satellite operations can be completed.

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[1] *See* File Nos. SAT-LOA-19940310-00007; SAT-AMD-19941114-00064; SAT-MOD-19970130-00012; SAT-MOD-19981023-00076; & SAT-MOD-20080314-00072.

[2] SES WORLD SKIES will comply with the conditions applicable to operations in the 13.75-14.0 GHz band. Specifically, any earth station in the United States and its Possessions ("US&P") communicating with AMC-4 in the 13.75 GHz-14.0 GHz band will be coordinated with the National Telecommunications and Information Administration's Interdepartment Radio Advisory Committee's Frequency Assignment Subcommittee pursuant to footnote US337 of the U.S. Table of Allocations, 47 C.F.R. § 2.106. Furthermore, any earth station in the US&P communicating with AMC-4 in the 13.75 GHz-14.0 GHz band will comply with footnotes US356 and US357 of the U.S. Table of Allocations, which specifies a minimum antenna diameter of 4.5 meters and a minimum EIRP. Operations of any earth station located outside the US&P communicating with AMC-4 in the 13.75 GHz-14.0 GHz band will conform to footnotes 5.502 and 5.503 to the ITU Radio Regulations, which allow minimum antenna diameter as small as 1.2 meters. Compliance with the PFD limits in footnote 5.502 will be determined using the methodology described in Recommendation ITU-R S.1712.

SES WORLD SKIES is not seeking authority to operate the C-band communications payload (3700-4200 MHz and 5925-6425 MHz) at 67°W.L. However, the general characteristics of the C-band payload are described herein and in the attached Schedule S in order to present a complete technical summary of the spacecraft.

The Ku-band transponders of AMC-4 are capable of being switched on a transponder-by-transponder basis between coverage of North and South America. Switching between the uplink and downlink service areas is independently controlled.

The C-band transponders of AMC-4 are capable of providing coverage of North America (CONUS, Puerto Rico, Central America and the Caribbean), but are not proposed to be used at 67°W.L.

Dual linear polarization is used in both the C- and Ku-bands.

Tables 1 and 2 show the frequency plan of the satellite. The frequency bands are divided into 24 transponders operating in C-band with 36 MHz bandwidth each, and 28 Ku-band transponders, of which 24 operate in the standard Ku-band with bandwidth of 36 MHz each, and 4 operate in the extended Ku-band with bandwidth of 72 MHz each.

The C-band transponders have 20 watt SSPA amplifiers, and the Ku-band transponders will be operated with 110 watt TWT amplifiers.

Polarizations shown in the frequency plans can be reversed using a switch in the satellite.

2.0 Schedule S (§25.114(c))

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. The following beams and transponders are defined:

- Beams with IDs KNRV, KNTV, KNRH and KNTH provide Ku-band coverage over North America
- Beams with IDs KSRV, KSTV, KSRH and KSTH provide Ku-band coverage over parts of South America; these are steerable antennas
- Channels with IDs KNR01 to KNR28 use beams KNRV and KNRH
- Channels with IDs KSR01 to KSR28 use beams KSRV and KSRH
- Transponders KNN01 to KNN28 connect beams KNRV and KNTH, and KNRH and KNTV

- Transponders KSS01 to KSS28 connect beams KSRV and KSTH, and KSRH and KSTV
- Transponders KNS01 to KNS28 connect beams KNRV and KNTH, and KSRH and KSTV
- Transponders KSN01 to KSN28 connect beams KSRV and KSTH, and KNRH and KNTV
- Beams with IDs CRV, CTV, CRH and CTH represent C-band coverage over North America. Again, C-band services are not proposed at 67°W.L.
- Channels with IDs CR01 to CR24 use beams CRV and CRH
- Channels with IDs CT01 to CT24 use beams CTV and CTH
- Transponders C01 to C24 connect beams CRV and CTH, and CRH and CTV

Table 1: Ku-band Frequency Plan in North America

(The frequency plan in South America is identical to that of North America)

	Uplinks		Downlinks	
Channel number	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
25	13875	V	11575	H
26	13875	H	11575	V
27	13955	V	11655	H
28	13955	H	11655	V

Table 2: Nominal C-band Frequency Plan in North America

(There is no C-band coverage in South America)

	Uplinks		Downlinks	
Channel number	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 6-for-4 redundancy (as a minimum) with cross-strapping between polarizations and coverage beams such that any four receivers can complete the mission. Twenty-eight (28) operational frequencies utilizing 36 MHz or 72 MHz bandwidth are provided by thirty-six (36) High Power Amplifiers (HPAs) arranged in two groups of 18-for-14.

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 = -93 – (G/T) +Transponder Gain Setting, dBW/m^2

C-band

SFD = -95.7 – (G/T) +Transponder Gain Setting, dBW/m^2

4. Transponder frequency response.

The frequency response and total group delay, specified over the transponder bandwidth, are provided in Tables 3 to 8 below.

Table 3: Ku-band Transponder (36MHz bandwidth) Frequency Response

	Frequency Offset (MHz)	dB p-p
36 MHz channel	±14	1.8
	±16	2.6
	±18	5.6

Table 4: Ku-band Transponder (72 MHz bandwidth) Frequency Response

	Frequency Offset (MHz)	dB p-p
72 MHz channel	±28	1.8
	±32	2.2
	±36	3.4

Table 5: C-band Transponder Frequency Response

	Frequency Offset (MHz)	dB p-p
36 MHz channel	±14	1.3
	±16	1.7
	±18	3.2

Table 6: Ku-band Transponder (36 MHz) Total Group Delay

	Frequency Offset (MHz)	Relative Group Delay (ns p-p)
36 MHz channel	0	5.0
	±8	13.0
	±12	22.0
	±16	60.0
	±18	120.0

Table 7: Ku-band Transponder (72 MHz) Total Group Delay

	Frequency Offset (MHz)	Relative Group Delay (ns p-p)
36 MHz channel	0	4.5
	±8	9.5
	±12	16.5
	±16	34.5
	±18	69.5

Table 8: C-band Transponder Total Group Delay

	Frequency Offset (MHz)	Relative Group Delay (ns p-p)
36 MHz channel	0	4.0
	±8	11.0
	±12	16.0
	±16	41.0
	±18	74.0

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

Table 9 shows the TT&C carrier center frequencies and bandwidths. The command carrier uses a horn antenna ("GBLR"), and the communication antennas are used for telemetry carriers during normal operation.

Table 9: TT&C Carrier Frequencies

	Frequency, MHz	Nominal polarization
Command carriers (bandwidth: 800 kHz, capture range)		
C-band	6423.5	H
Beacons/Telemetry (bandwidth: 400 kHz)		
C-band pair	3700.5	H
	4199.5	V
Ku-band pair	11702.0	H
	12198.0	V

5.1 Command carrier characteristics and link budgets (threshold analysis)

1. Bandwidth (2-sided): 800 kHz
2. Capture range (2-sided): 2.0 MHz
3. Transmit Earth Station sidelobe envelope: $29 - 25 \log \theta$, dB
4. Uplink power flux at the satellite:
   -92 dBW/m^2 to -60 dBW/m^2

Table 10 shows the command carrier threshold analysis.

Table 10: C-band Command Carrier Threshold Analysis

Flux density at satellite, dBW/m^2	-80.0
Isotropic aperture gain, dB	-37.61
Pol. And pointing loss, dB	-0.5
Multipath loss, dB	-1.88
Receive antenna (horn) gain, dBi	6.5
Circuit losses, dB	-10.53
Receiver input power, dBW	-129.81
CMR threshold, dBW	-138.0
Margin, dB	8.19

5.2 Telemetry/Beacon carrier link budgets

Tables 11 and 12 show telemetry link budgets, with an EIRP minimum of 10 dBW in the coverage area.

Table 11: 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 12: C-band Telemetry Link Budget

EIRP[3]	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 (§25.114(d)(3))

Annex 1 shows the antenna gain contours. For Ku-band, contours are provided for 8 different cases: transmit and receive beams, H- and V-polarizations for North and South America. For C-band telemetry beacons, contours are provided for the transmit beam, H- and V-polarizations. SES WORLD SKIES does not propose to operate the AMC-4 C-band communications payload at 67°W.L., and is providing the other C-band contours in Schedule S for informational purposes only. Table 13 shows the correspondence between peak gains of the antennas and maximum EIRP or G/T values.

[3] The EIRP value shown is nominal.

Table 13: Maximum Co-pol Gain, EIRP and G/T Values

		Ku-band (North America)		Ku-band (South America)		C-band (North America)	
		H-pol	V-pol	H-pol	V-pol	H-pol	V-pol
Transmit beam	Gain (max.), dBi	33.6	33.47	32.35	32.43	29.87	29.83
	EIRP (max.), dBW	52.47	52.39	50.91	51.21	41.52	41.72
Receive beam	Gain (max.), dBi	33.87	33.60	33.51	33.8	32.66	33.0
	G/T (max), dB/K	5.92	5.59	4.85	5.16	5.86	5.46

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

- Beams with IDs KNRV, KNTV, KNRH and KNTH provide Ku-band coverage over North America
- Beams with IDs KSRV, KSTV, KSRH and KSTH provide Ku-band coverage over parts of South America
- Beams with IDs CRV, CTV, CRH and CTH represent C-band coverage over North America

1. CRV.gxt (V-pol, C-band receive beam)
2. CTV.gxt (V-pol, C-band transmit beam)
3. CRH.gxt (H-pol, C-band receive beam)
4. CTH.gxt (H-pol, C-band transmit beam)
5. KNRV.gxt (V-pol, Ku-band receive beam, North America coverage)
6. KNTV.gxt (V-pol, Ku-band transmit beam, North America coverage)
7. KNRH.gxt (H-pol, Ku-band receive beam, North America coverage)
8. KNTH.gxt (H-pol, Ku-band transmit beam, North America coverage)
9. KSRV.gxt (V-pol, Ku-band receive beam, South America coverage)
10. KSTV.gxt (V-pol, Ku-band transmit beam, South America coverage)
11. KSRH.gxt (H-pol, Ku-band receive beam, South America coverage)
12. KSTH.gxt (H-pol, Ku-band transmit beam, South America coverage)

The gain characteristics for the global horn antenna ("GBLR") are not provided as a gxt file because the gxt data is not available from the spacecraft manufacturer. Instead, gain vs. off-set angle information is provided as a figure in Annex 1. SES WORLD SKIES requests a waiver to permit this substitution. As discussed in the narrative section of this modification application, grant of the requested waiver is consistent with Commission precedent.

4.0 Emission Designators and Link Budgets (§25.114(d)(4))

The Ku-band services provided by AMC-4 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 14 provides the characteristics of the earth stations used for this analysis

and estimated link margins for Ku-band carriers.[4] No analog TV/FM services will be provided by AMC-4 at the 67°W.L. orbital location.

Again, no C-band communications services are proposed at 67°W.L., so no C-band link budgets are provided.

[4] Note that earth stations described in Table 14 with diameters of less than 4.5 m will not be used for transmitting earth stations in the US&P in the 13.75-14 GHz band, as they do not meet the requirements of footnote US356 to Section 2.106.

Table 14: 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	Digital TV MCPC 50 MBPS 8PSK 2/3 RS
Digital MOD ID	A_Ku	B_Ku	C_Ku	D_Ku	E_Ku	F_Ku	G_Ku
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	-5	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	40.6	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	15.2	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	12.6	11.8	16.3
Downlinks:							
Satellite Carrier EIRP (dBW)	48.7	48.7	35.7	34.3	18.5	28.5	48.7
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)	9.1	10.1	11.6	11.6	9.9	11.5	16.6
C/IM			18	18	18	18	
Eb/IModB)			16.6	16.6	16.6	16.6	
C/I(dB)	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)	7.8	8.5	8.7	8.7	7.7	8.7	11.0
Total UP/DOWN Eb/(No+Io)(dB)	7.2	7.9	7.0	7.2	6.5	6.9	9.9
Required (dB)	5.4	5.4	5.4	5.4	5.4	5.4	7.2
Margin (dB)	1.8	2.5	1.6	1.8	1.1	1.5	2.7

5.0 PFD limits (§25.114(d)(5), §25.208)

Section 25.208(b) of the Commission's Rules specifies the maximum allowed PFD in the extended Ku-band (11.45-11.7 GHz). Carriers in the extended Ku-band will be operated in compliance with this section. Table 15 shows the maximum PFD values in each of the North and South American beams as a function of the elevation angles. The margins are all positive. Section S8 of the attached Schedule S shows maximum PFD values as a function of the elevation angles and polarization. The values shown for the Ku-band are applicable to the extended frequency range (11.45-11.7 GHz) only. Section S13 of the attached Schedule S shows typical PFD values in C-band and Ku-band. TV/FM carriers will not be implemented in extended-Ku band.

Section 25.208(a) of the Commission's Rules specifies the maximum allowed PFD in C-band. SES WORLD SKIES does not seek authority to operate in the C-band communications payload at 67°W.L. The results of the nominal PFD and margin computations for AMC-4's C-band TT&C transmissions are provided in Table 16. The margins are all positive.

Table 15: Extended Ku-band (11.45-11.7 GHz PFD and Margin Values

North America beam						
Elevation angle, deg	5.00	10.00	15.00	20.00	25.00	Maximum EIRP
Max. EIRP, dBW	52.47	52.47	52.47	52.47	52.47	52.47
EIRP at elevation angle, dBW	48.60	49.00	49.50	50.27	51.47	52.47
Minimum spreading loss, dB/m2	-163.27	-163.15	-163.06	-162.94	-162.84	-162.00
25.208(b) PFD limit, dBW/m2/4KHz	-150.00	-147.50	-145.00	-142.50	-140.00	-140.00
Digital Carriers						
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
PFD, dBW/m2/4KHz	-154.24	-153.72	-153.12	-152.23	-150.93	-149.09
Margin, dB, relative to 25.208(b)	4.24	6.22	8.12	9.73	10.93	9.09
South America beam						
Elevation angle, deg	5.00	10.00	15.00	20.00	25.00	Maximum EIRP
Max. EIRP, dBW	51.21	51.21	51.21	51.21	51.21	51.21
EIRP at elevation angle, dBW	29.25	29.7	31.5	32.2	32.75	51.21
Minimum spreading loss, dB/m2	-163.27	-163.15	-163.06	-162.94	-162.84	-162.00
25.208(b) PFD limit, dBW/m2/4KHz	-150.00	-147.50	-145.00	-142.50	-140.00	-140.00
Digital Carriers						
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
PFD, dBW/m2/4KHz	-172.2	-173.0	-171.1	-170.3	-169.6	-150.35
Margin, dB, relative to 25.208(b)	22.2	25.5	26.1	27.8	29	10.35

Table 16: C-band Telemetry PFD and Margin Values

Elevation angle, deg	5.00	10.00	15.00	20.00	25.00	Maximum EIRP
Max. EIRP, dBW	18.3	18.3	18.3	18.3	18.3	18.3
EIRP at elevation angle, dBW	16.1	16.35	16.7	17.2	17.7	18.3
Minimum spreading loss, dB/m2	-163.27	-163.15	-163.06	-162.94	-162.84	-162.00
25.208 PFD limit	-152.00	-149.50	-147.00	-144.50	-142.00	-142.00
Telemetry Carrier						
Carrier bandwidth, MHz	0.5	0.5	0.5	0.5	0.5	0.5
PFD, dBW/m2/4KHz	-168.2	-167.8	-167.4	-166.7	-166.2	-164.7
Margin, dB, relative to 25.208	16.2	15.8	15.3	14.7	14.1	12.7

6.0 Cessation of Emissions (§25.207)

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 Two Degree Spacing Analysis (§25.114(d)(7) and §25.140(b)(2))

Annex 2 shows the results of an interference analysis for Ku-band operations in a 2-degree spacing environment.

8.0 Mitigation of Orbital Debris (§25.114(d)(14))

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 AMC-4. No debris is generated during normal on-station operations, and the spacecraft will be in a stable configuration. Onstation operations require stationkeeping within the +/- 0.05 degree N-S and E-W control 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. 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. The design of AMC-4 locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris. 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 AMC-4 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 were 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, are monitored by telemetry.

At the end of operational life, after the satellite has reached its final disposal orbit, onboard sources of stored energy will be depleted or secured, and the batteries will be discharged. However, at the end of AMC-4's operational life, there will be oxidizer remaining in the tank that cannot be vented. Following insertion of the spacecraft into orbit, the spacecraft

manufacturer permanently sealed the oxidizer tank by firing pyrotechnic valves. At a later date prior to commencing maneuvers to put AMC-4 in a disposal orbit, SES WORLD SKIES will seek any necessary waiver of Section 25.283(c) in connection with the residual oxidizer that will remain in the tank at end of life.

§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 AMC-4 at the 67° W.L. orbital location with a stationkeeping volume bounded by 66.95° W.L. and 67.05° W.L. SES WORLD SKIES is not aware of any other FCC- or non-FCC licensed spacecraft that are operational or planned to be deployed at 67° W.L. or to nearby orbital locations such that there would be an overlap with the requested stationkeeping volume of AMC-4.

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 AMC-4 to a disposal orbit at end of life and has selected a target minimum perigee of 150 km above the normal operational altitude. Fuel gauging uncertainty has been

taken into account in these calculations, as discussed below. However, as the Commission is aware, there is no mechanism that allows precise calculations of the amount of fuel left on a spacecraft once it is in-orbit, and therefore it is possible that the AMC-4 spacecraft will not reach the targeted minimum de-orbit altitude.

AMC-4 is not subject to the minimum perigee requirement of Section 25.283(a) of the Commission's Rules because the satellite was launched prior to March 18, 2002. SES WORLD SKIES intends to reserve 17.2 kg of fuel in order to account for postmission disposal of AMC-4. SES WORLD SKIES has assessed fuel gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

As noted above, AMC-4 is not subject to application of the IADC formula for determining a minimum disposal orbit perigee, but for the Commission's information, the disposal orbit altitude resulting from the IADC formula would be 284 km based on the following calculation:

Area of the satellite (average aspect area): 86.3 m^2

Mass of the spacecraft: 2115 kg

CR (solar radiation pressure coefficient): 1.2

Therefore the disposal altitude as calculated under the IADC formula is:

36,021 km + (1000 x CR x A/m) = 36,069 km, or 284 km above the GSO arc (35,786 km).

ANNEX 1

COVERAGE MAPS

Fig 1. Ku-band North America, Receive beam, H-pol (KNRH)
G/T max. 5.92 dB/K, Antenna gain max. 33.87 dBi

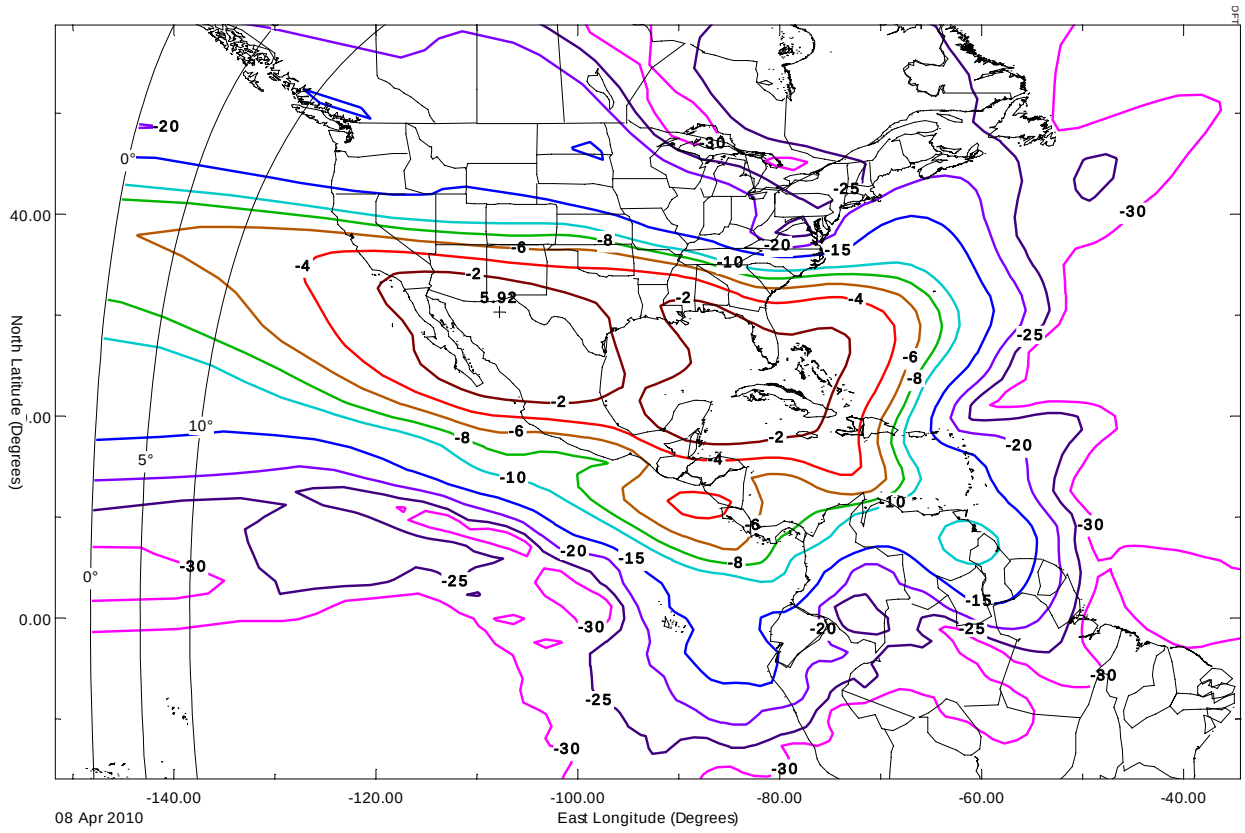

Fig 2. Ku-band North America, Receive beam, V-pol (KNRV)
G/T max. 5.59 dB/K, Antenna gain max. 33.60 dBi

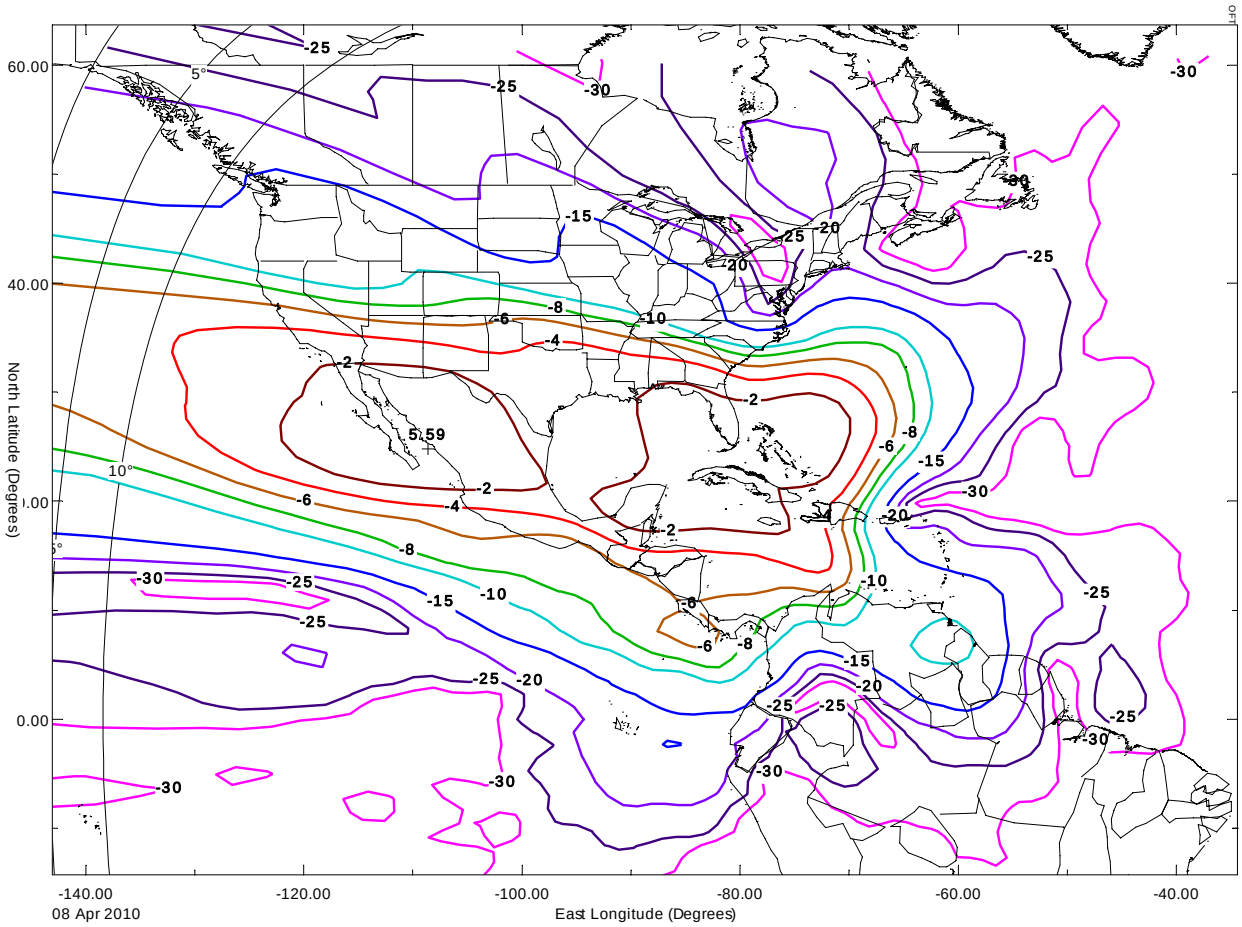

Fig 3. Ku-band North America, Transmit beam, H-pol (KNTH)
EIRP max. 52.47 dBW, Antenna gain max. 33.60 dBi

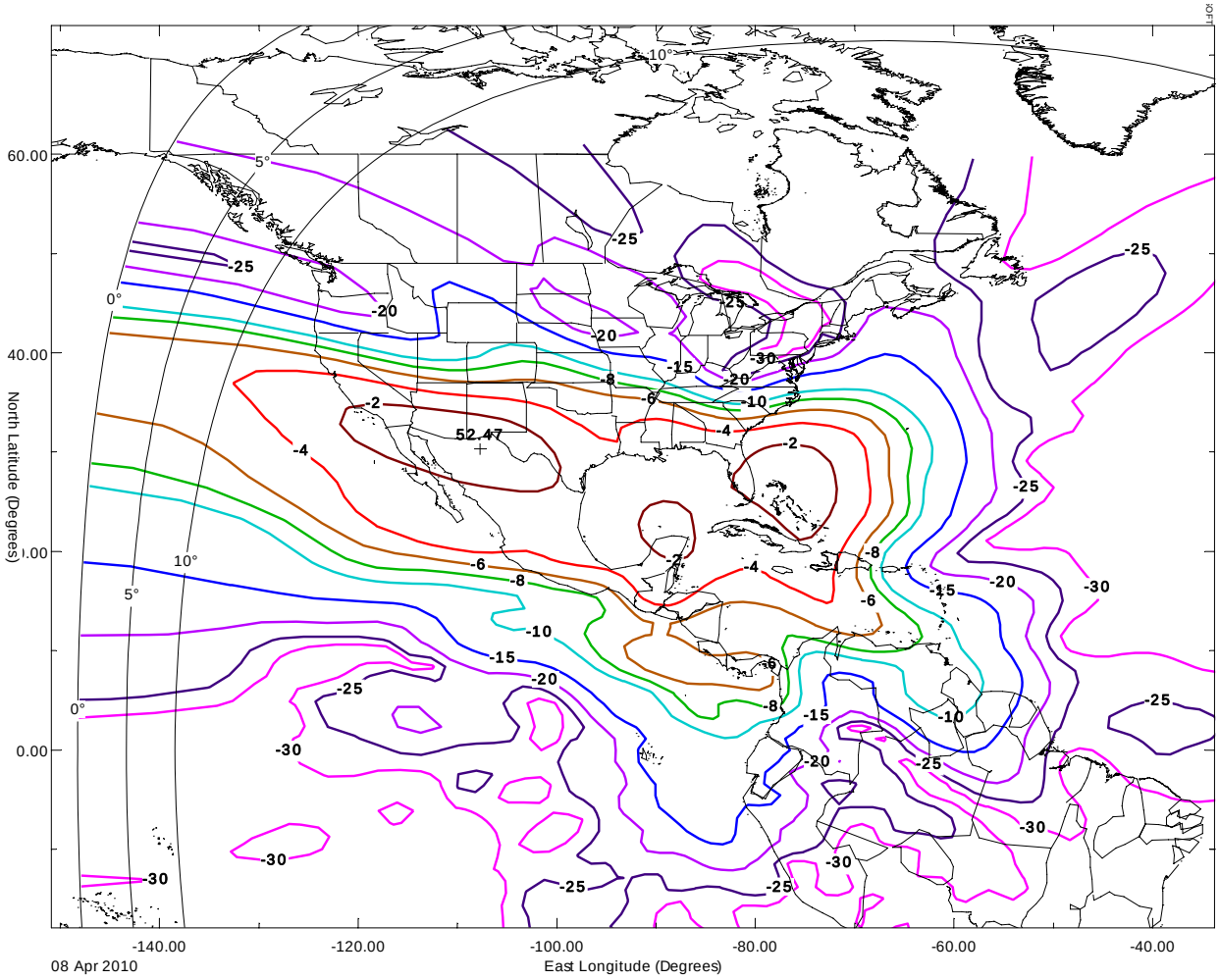

Fig 4. Ku-band North America, Transmit beam, V-pol (KNTV)
EIRP max. 52.39 dBW, Antenna gain max. 33.47 dBi

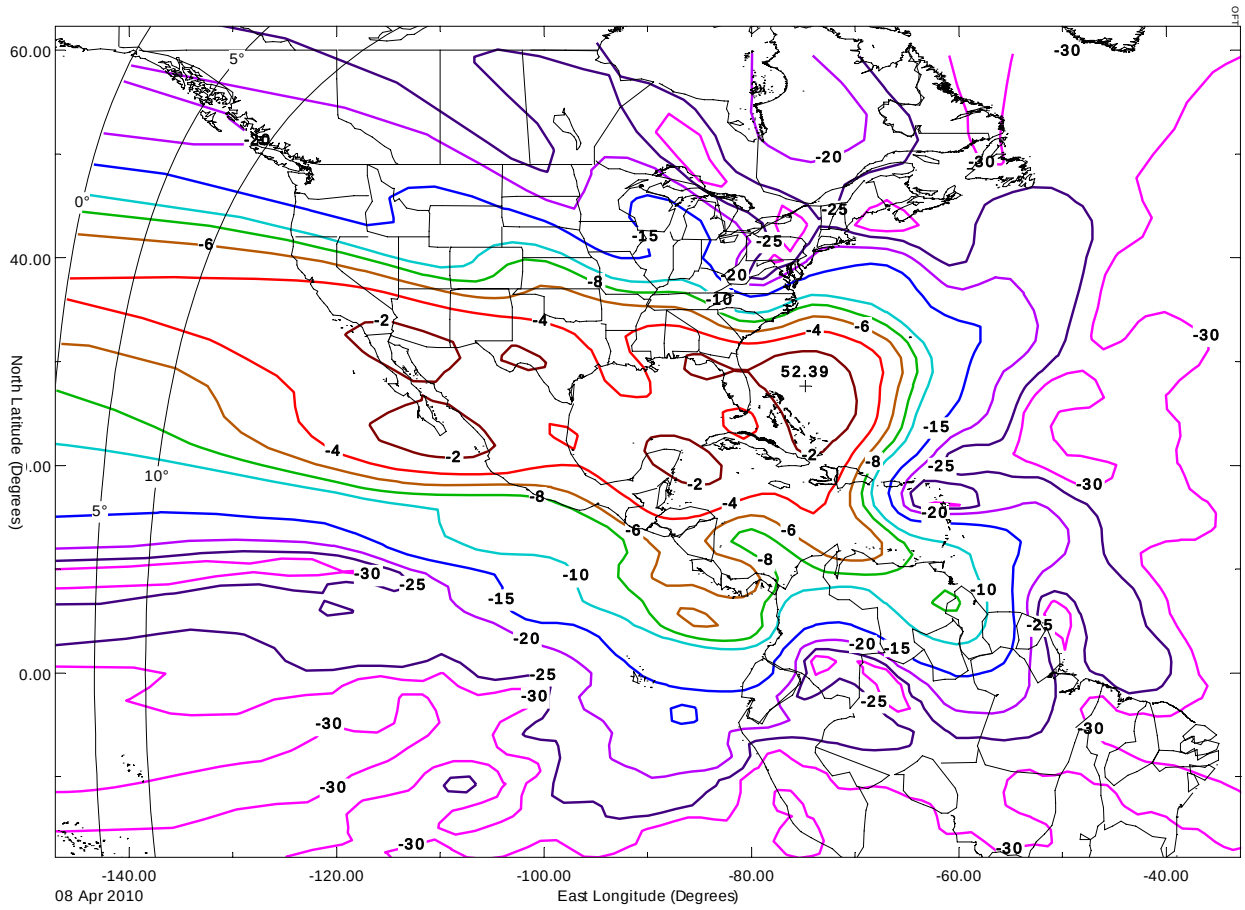

Fig 5. Ku-band South America, Receive beam, H-pol (KSRH)
G/T max. 4.85 dB/K, Antenna gain max. 33.51 dBi

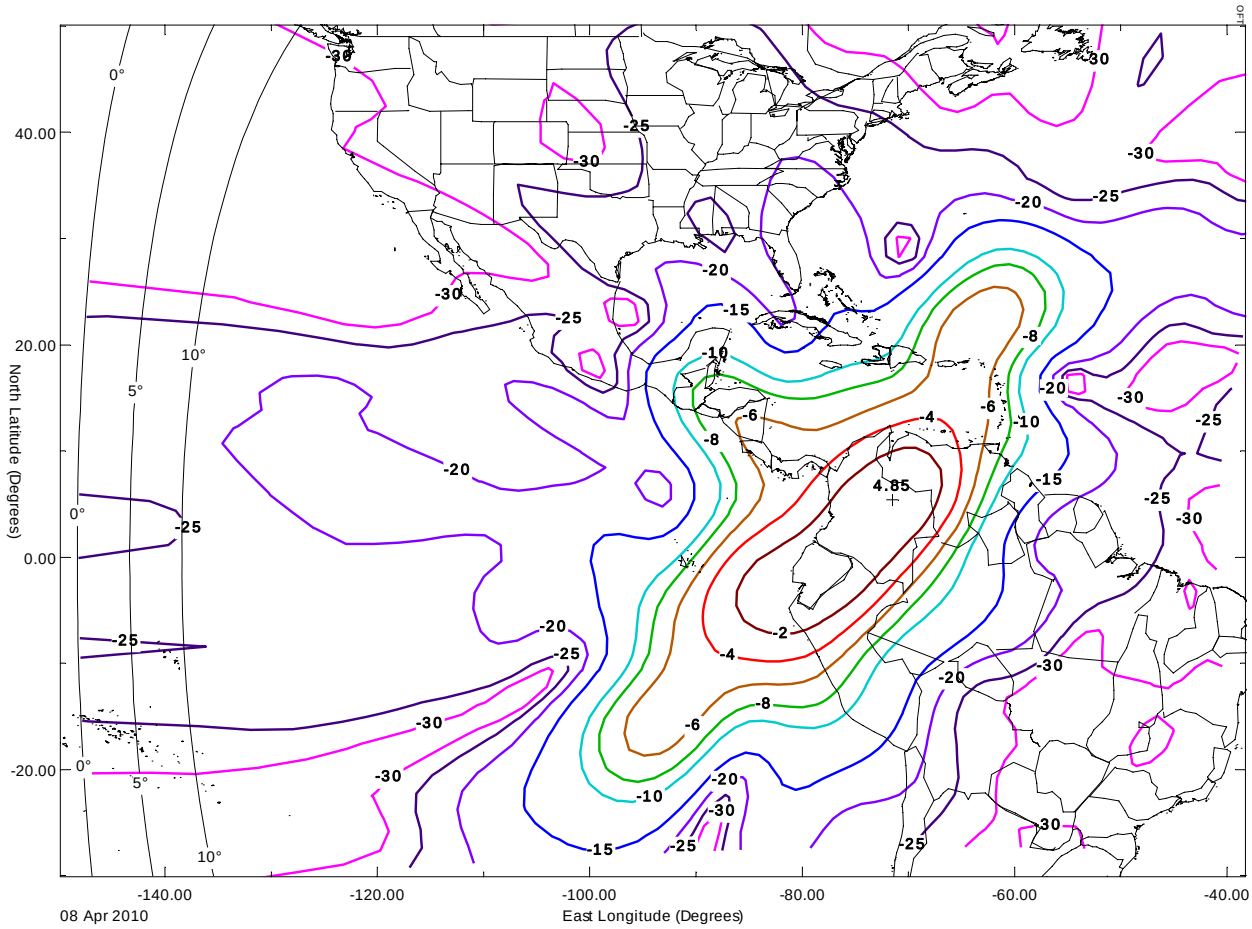

Fig 6. Ku-band South America, Receive beam, V-pol (KSRV)
G/T max. 5.16 dB/K, Antenna gain max. 33.8 dBi

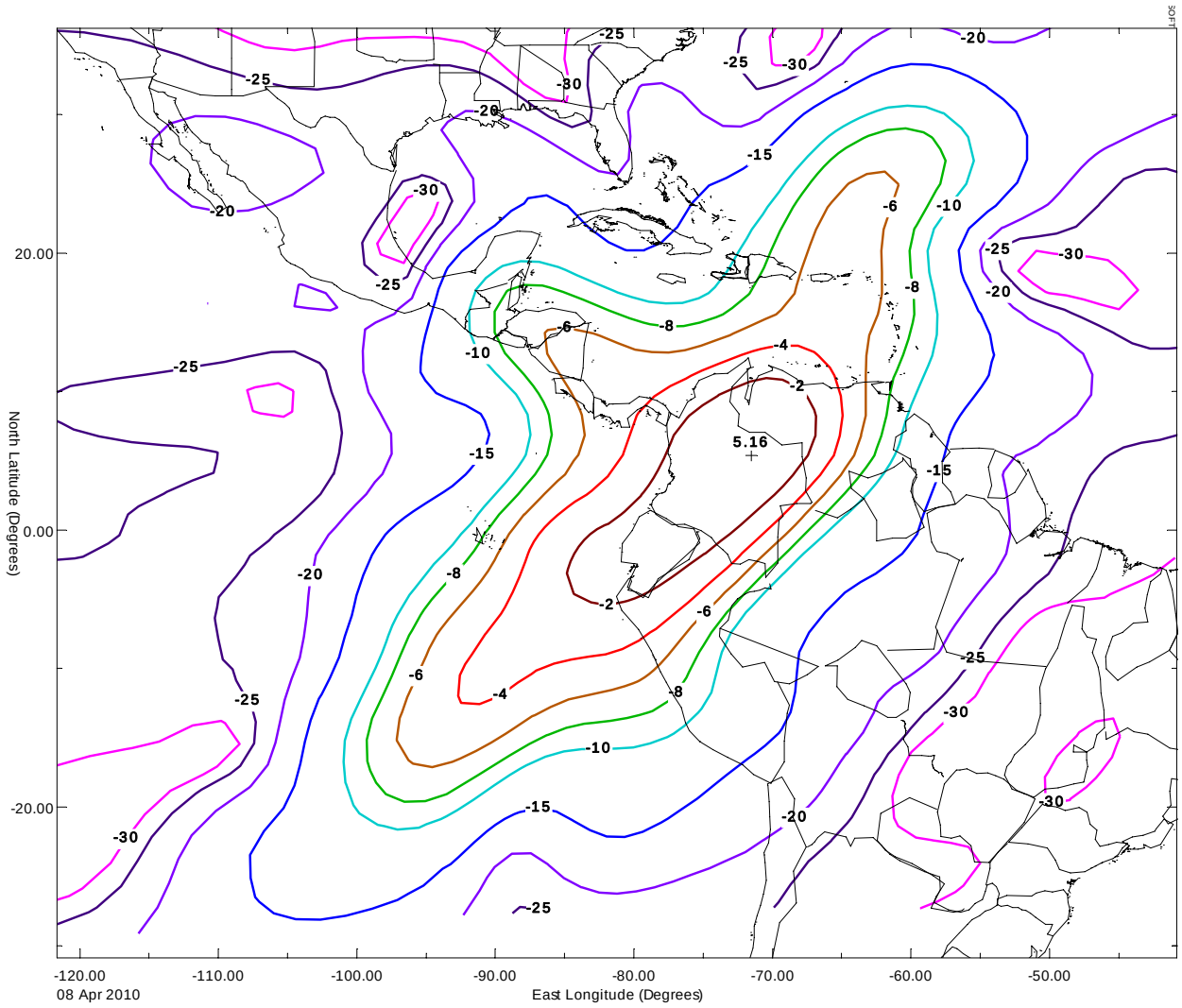

Fig 7. Ku-band South America, Transmit beam, H-pol (KSTH)
EIRP max. 50.91 dBW, Antenna gain max. 32.35 dBi

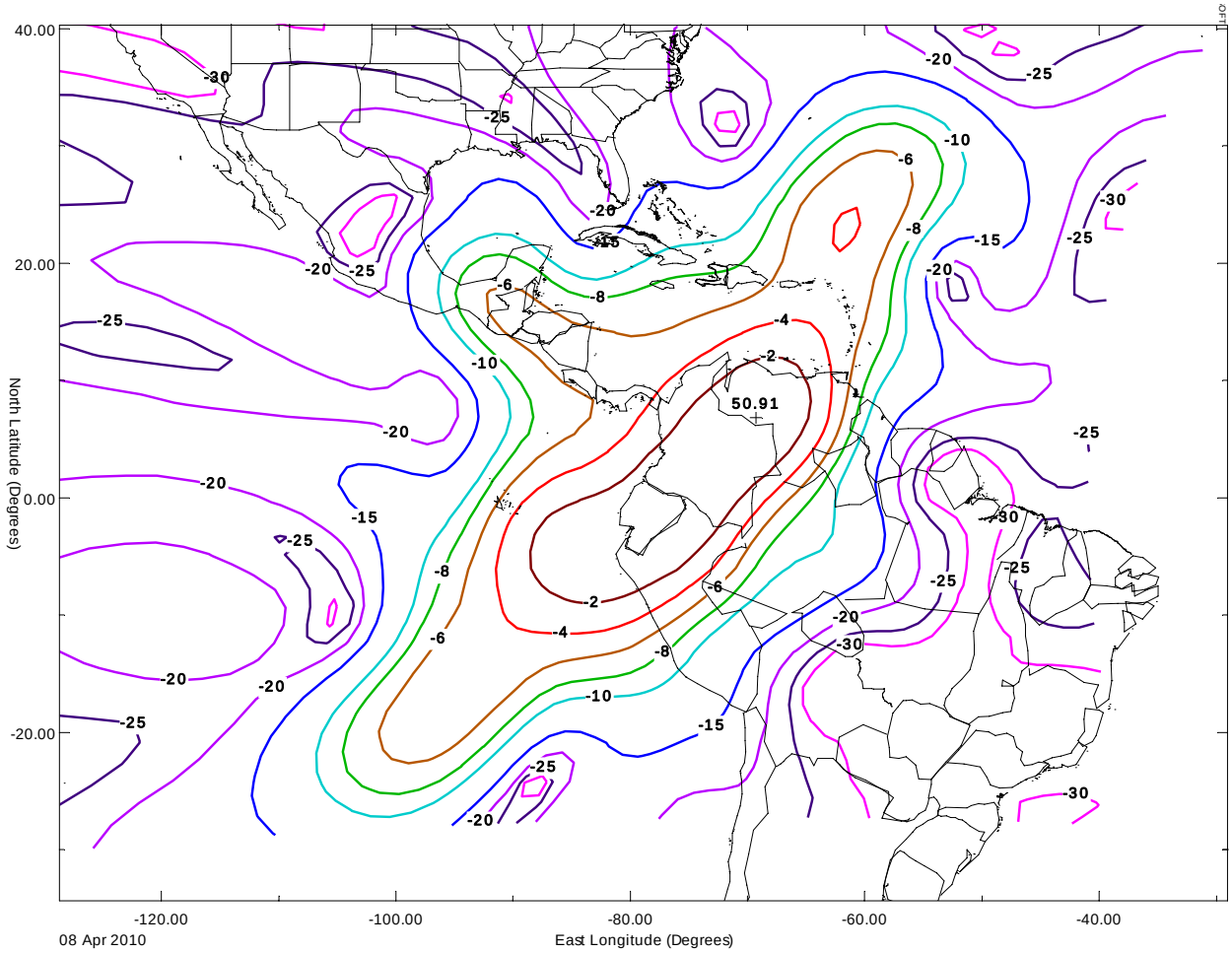

Fig 8. Ku-band South America, Transmit beam, V-pol (KSTV)
EIRP max. 51.21 dBW, Antenna gain max. 32.43 dBi

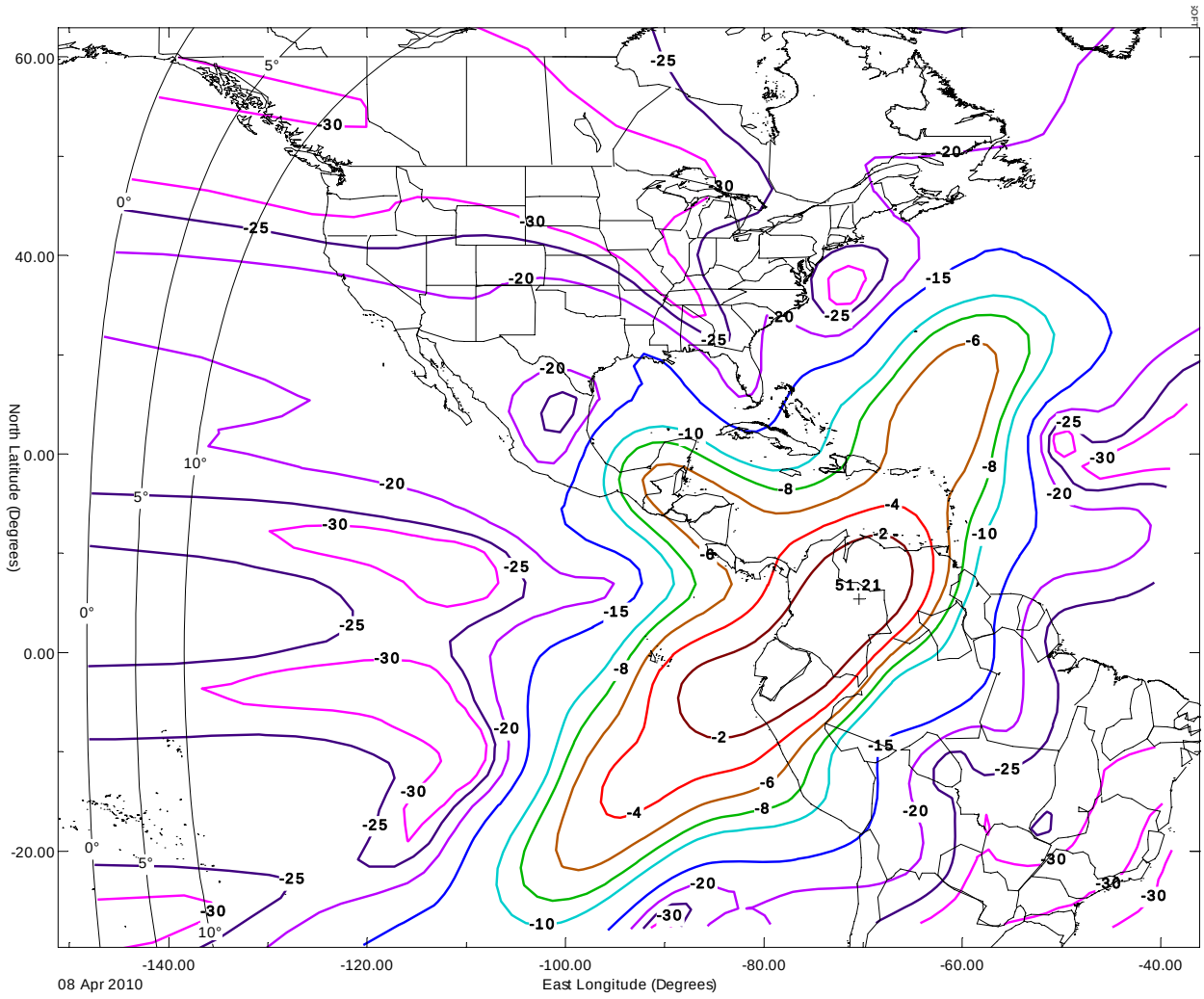

Fig 9. C-band North America, Telemetry beam, H-pol (CTH)
EIRP max. 41.52 dBW, Antenna gain max. 29.87 dBi

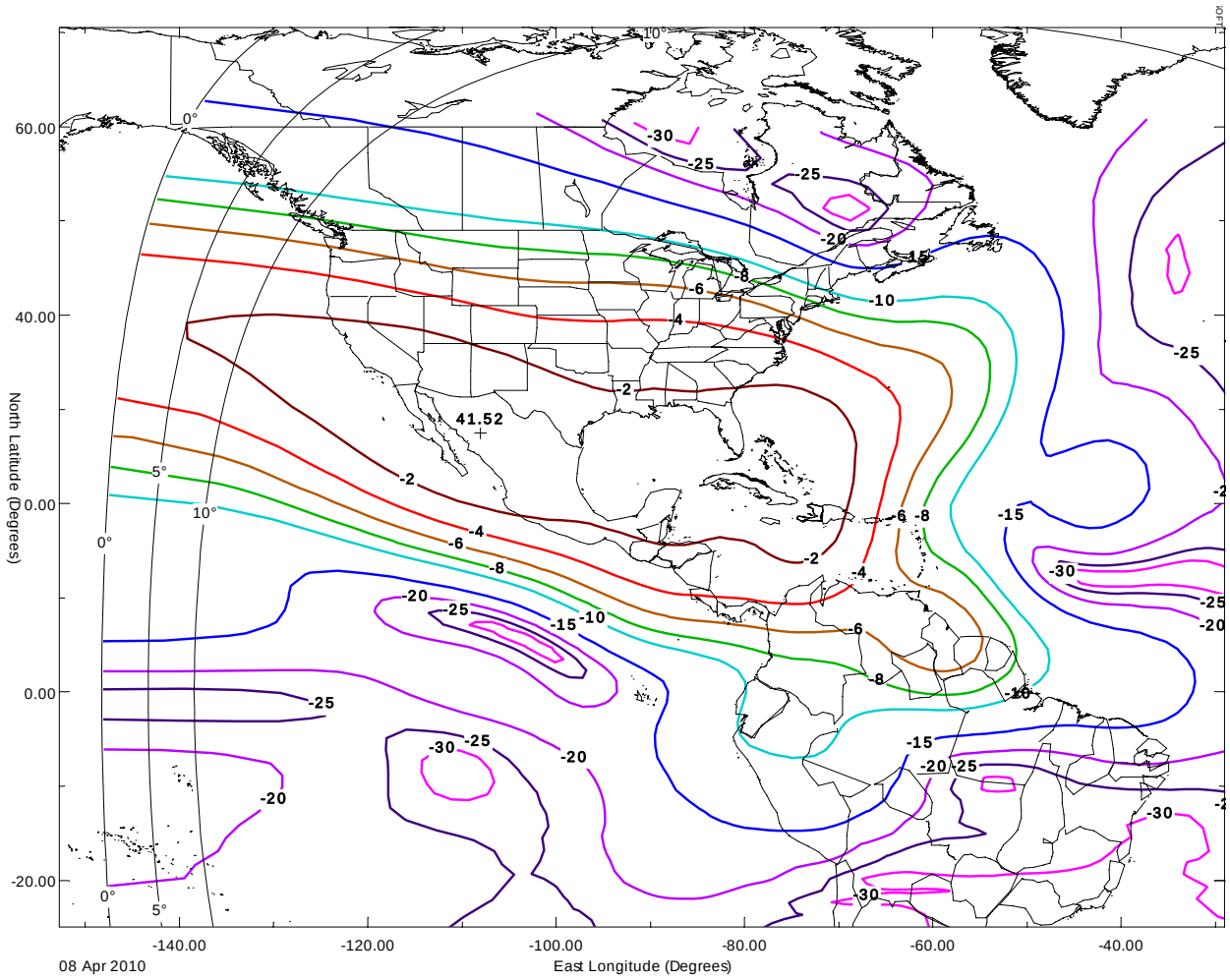

Fig 10. C-band North America, Telemetry beam, V-pol (CTV)
EIRP max. 41.72 dBW, Antenna gain max. 29.83 dBi

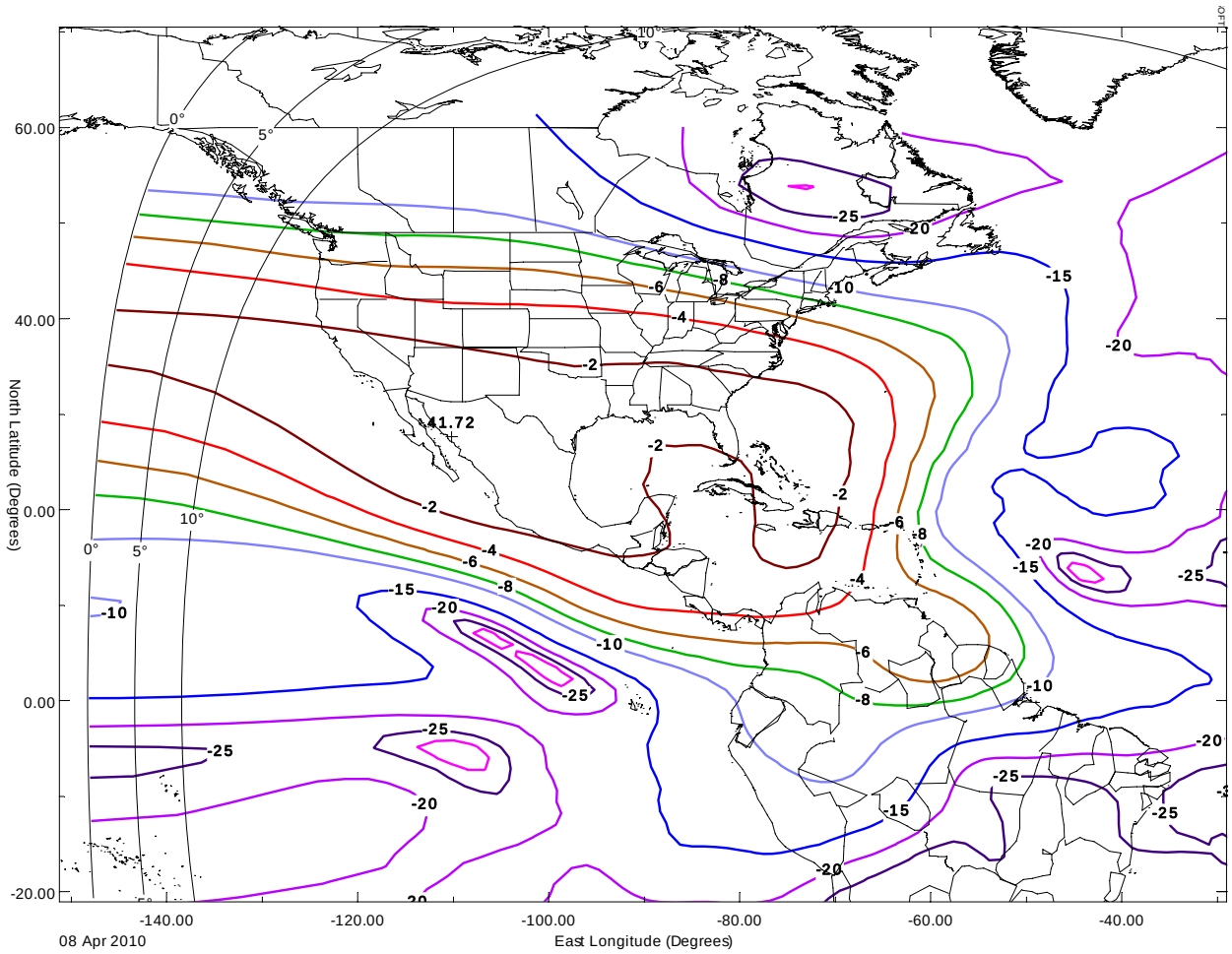

Fig 11. Global Horn Characteristics

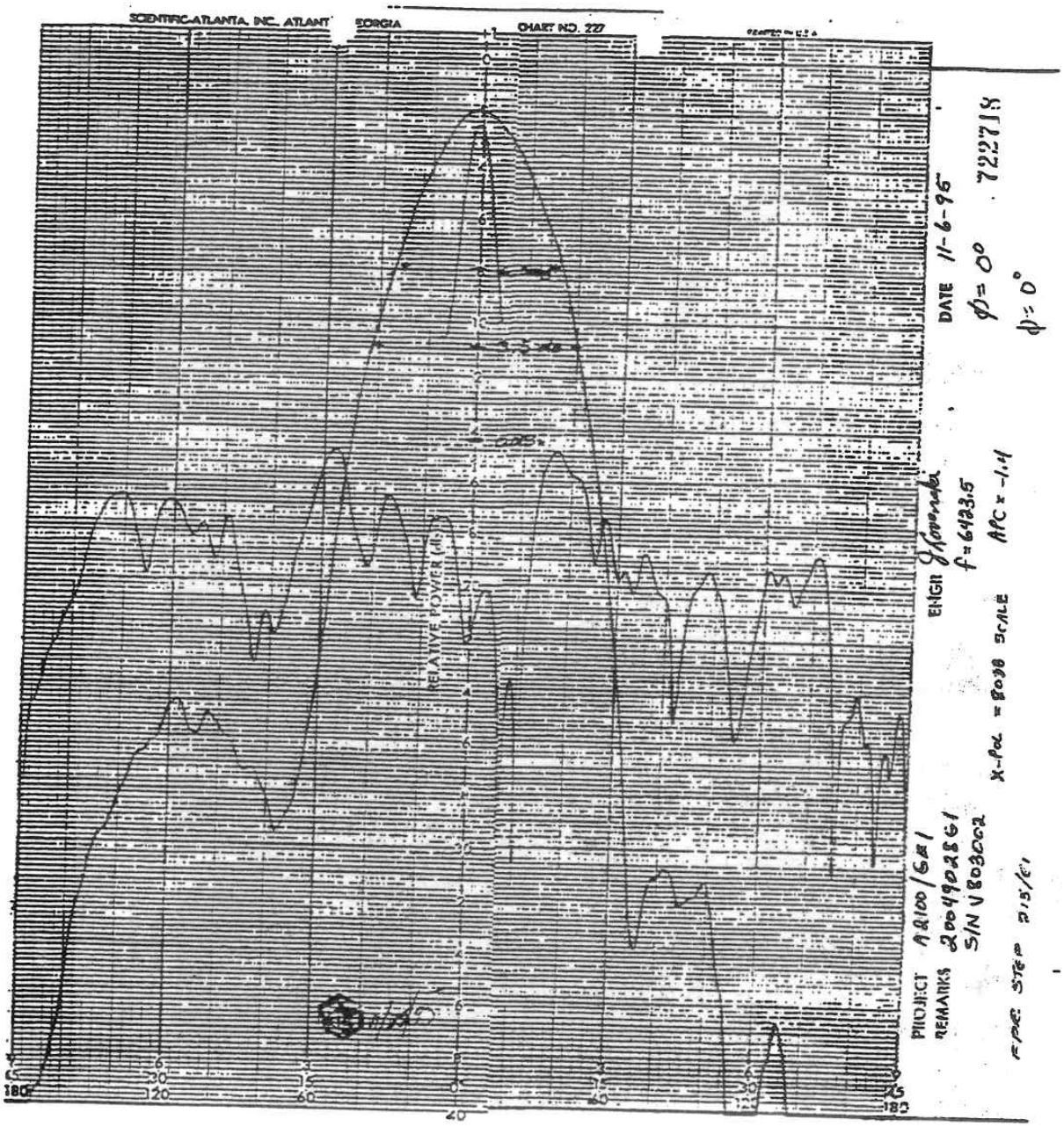

Figure 2.4.2.3 TT&C Receive Horn Gain.

ANNEX 2

INTERFERENCE ANALYSIS
IN SUPPORT OF AMC-4 AT 67°W.L.

Two-degree Spacing Analysis

The operational Ku-band satellites adjacent to the 67° W.L. position are: Star One C1 at 65°W.L., and Star One C2 at 70°W.L. Operations of AMC-4 at 67° W.L. will conform to the existing and future coordination arrangements with these neighbors. It should be noted that except for TT&C carriers, SES WORLD SKIES does not propose to operate the C-band communication payload of AMC-4 at 67° W.L. Accordingly, no C-band analysis is included in this document.

The following analysis will demonstrate that the AMC-4 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.

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.

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

* Note that earth stations described in Table 1 with diameters of less than 4.5 m will not be used for transmitting earth stations in the US&P. in the 13.75-14 GHz band, as they do not meet the requirements of footnote US356 to Section 2.106.

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.

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 AMC-4. 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.

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 2) and where the EIRP of the two networks is different by 2 dB (Table 3):

Table 2: 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 3: 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.

3. Additional examples of C/I estimates

Attached tables 4 to 7 show some examples of single-entry C/I analysis for typical carriers on the satellite networks. The adjacent satellite is assumed to be at 65° W.L. The results would be improved for the 70° W.L neighbor, given the increased orbital separation. The uplink sites of AMC-4 can be in the 50-state or the Caribbean regions.

Table 4 shows the key uplink parameters of AMC-4 and adjacent satellite carriers. Table 5 shows C/I estimates in AMC-4 and adjacent satellite carrier uplinks. The C/I values in the adjacent carriers are at least 20.0 dB.

Table 6 shows the key downlink parameters of AMC-4 and adjacent satellite carriers. Table 7 shows C/I estimates in AMC-4 and adjacent satellite carrier uplinks. The C/I values in the adjacent carriers are minimally about 20.0 dB.

Table 4: SES and adjacent satellite uplink carrier characteristics – Ku-band (AMC-4 at 67° W.L., Adjacent satellite at 65° 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	36.0	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 5: Ku-band uplink C/I estimates for carriers shown in Table 4

Uplink C/I in SES carriers due to interference from adj. satellite							
	SES 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 carriers							
	SES 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 6: SES and adjacent satellite downlink carrier characteristics – Ku-band (AMC-4 at 67° W.L., Adjacent satellite at 65° W.L., Topocentric separation at the receiver location 2.2°, antenna pointing error 0.4°)

AMC-4 Carriers		36M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W		
Bandwidth	MHz	36.0	6.0	5.0	1.6	0.1		
Satelllite EIRP max	dBW	52.4	52.4	52.4	52.4	52.4		
Carrier EIRP	dBW	50.0	40.4	38.9	36.0	24.0		
Carrier EIRP dens	dBW/Hz	-26.9	-27.4	-28.1	-26.0	-26.0		
RxES ant. Dia	m	1.2	1.8	1.8	1.2	1.2		
RxES ant. Gain	dBi	41.2	45.1	45.1	41.2	41.2		
Sidelobe gain(at 1.8 deg)	dBi	22.6	22.6	22.6	22.6	22.6		
C/N(thermal)	dB	16.2	18.2	17.6	15.7	15.7		
Adj. Satellite carriers								
		36M0G7W	27M0G7W	Dig. TV(20.0)	Dig. TV(3.95)	TDMA	64Kbps	9.6Kbps
Bandwidth	MHz	36.0	27.0	14.9	3.4	36.0	0.1	0.0235
Satelllite EIRP max	dBW	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Carrier EIRP	dBW	51.0	51.0	44.2	36.8	47.0	25.0	19.0
Carrier EIRP dens	dBW/Hz	-24.6	-23.3	-27.6	-28.6	-28.6	-25.0	-24.7
RxES ant. Dia	m	1.2	1.2	1.8	1.8	4.5	1.2	1.2
RxES ant. Gain	dBi	41.2	41.2	45.1	45.1	52.6	41.2	41.2
Sidelobe gain(at 1.8 deg)	dBi	22.6	22.6	22.6	22.6	22.6	22.6	22.6
C/N(thermal)	dB	17.2	18.4	18.1	17.1	24.6	16.7	17.0

Table 7: Downlink C/I estimates in carriers shown in Table 6

Downlink C/I in AMC-4 carriers due to interference from adj. Satellite					
	AMC-4 carriers				
Adj. Sat carriers	36M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W	16.3	19.6	19.0	17.1	17.1
27M0G7W	15.0	18.4	17.7	15.9	15.9
Dig. TV(20.0)	19.3	22.6	22.0	20.1	20.1
Dig. TV(3.95)	20.3	23.6	23.0	21.1	21.1
TDMA	20.3	23.6	23.0	21.1	21.1
64Kbps	19.7	23.1	22.4	20.5	17.6
9.6Kbps	19.4	22.8	22.1	20.3	20.3
Downlink C/I in Adj. sat carriers due to interference from AMC-4 carriers					
	AMC-4 carriers				
Adj. Sat carriers	36M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
36M0G7W	19.6	21.4	22.1	20.1	20.0
27M0G7W	20.8	22.7	23.3	21.3	21.3
Dig. TV(20.0)	20.5	22.3	23.0	21.0	20.9
Dig. TV(3.95)	19.5	21.3	22.0	20.0	19.9
TDMA	27	28.8	29.5	27.5	27.4
64Kbps	19.1	21.0	21.6	19.6	19.6
9.6Kbps	19.4	21.3	21.9	19.9	19.9

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: April 21, 2010