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

In the Matter of	)	
	)	
SES AMERICOM, INC.	)	File No. SAT-MOD-_____
	)	Call Sign S2134
Application for Modification of AMC-2	)	
Fixed-Satellite Space Station License	)	

APPLICATION OF SES AMERICOM, INC.

SES Americom, Inc. ("SES") respectfully requests a modification of its license for the AMC-2 fixed-satellite space station to reorient the satellite to provide coverage of North America. AMC-2 is currently collocated with SES's AMC-5 Ku-band satellite at 80.85° W.L., with AMC-2 being flown in inverted mode oriented toward South America and AMC-5 oriented toward North America. SES is preparing to retire AMC-5 and will need to reorient AMC-2 in order to transfer the traffic currently being carried on AMC-5 to AMC-2. Grant of the requested modification will serve the public interest by allowing SES to provide service continuity to customers at the 80.85° W.L. orbital location. Because retirement of AMC-5 is currently scheduled to occur in early May, SES seeks action on this application by April 15 to permit the transfer of traffic.

A completed FCC Form 312 is attached, and SES incorporates by reference the technical information previously provided in support of AMC-2.[1] In addition, SES is providing

[1] The most recent technical information regarding AMC-2 is found in File No. SAT-MOD-20130225-00024. *See also* File Nos.SAT-LOA-19940310-00008; SAT-AMD-19941114-00065; SAT-MOD-20050527-00110; SAT-MOD-20080124-00030; SAT-AMD-20080311-00070; SAT-MOD-20100324-00056; SAT-MOD-20101215-00261; SAT-MOD-20111025-00209; & SAT-MOD-20120524-00087.

here technical information relating to the proposed modification to the AMC-2 license on Schedule S and in narrative form pursuant to Section 25.114 of the Commission's Rules.

MODIFICATION

AMC-2 is a hybrid C/Ku-band satellite that is currently licensed by the FCC to operate at 80.85° W.L. with an east-west stationkeeping tolerance of +/- 0.15 degrees under the ITU satellite network filings of the Argentine Administration.[2] SES proposes to maintain AMC-2 at this orbital location but take it out of inverted mode so that it can provide coverage of North America and assume traffic currently being carried on AMC-5. The proposed change in AMC-2's service area will not impact continuity of operations to South America as any traffic currently carried on AMC-2 will be transferred to other spacecraft prior to reorientation.

Reorientation of AMC-2 as proposed will not adversely affect any other operators. The technical appendix includes an interference analysis demonstrating that operation of AMC-2 with coverage of North America will conform to Commission requirements for operations at two-degree spacing. AMC-2 will also be operated consistent with applicable existing and future coordination agreements.

The Commission has generally permitted satellite operators the flexibility to design and modify their networks in response to customer requirements, absent compelling countervailing public interest considerations.[3] Here, grant of the requested modification will

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[2] *See* File No. SAT-MOD-20130225-00024, grant-stamped May 9, 2013.

[3] *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).

permit SES to ensure service continuity and facilitate efficient use of AMC-2 in response to customer requirements.

In connection with this modification, SES seeks continued application of the waivers the Commission has previously granted for AMC-2 operations at 80.85° W.L.[4] In addition, consistent with the policy announced in a recent International Bureau public notice,[5] SES requests a limited waiver of Section 25.114(c)(4) to the extent it requires submission of information that the Commission has deemed unnecessary. Pursuant to the terms of that public notice, SES has omitted certain data elements from the attached Schedule S, or where necessary to permit validation of the Schedule S file, has entered a "1" as a placeholder.[6] The International Bureau has determined that there is good cause to waive rule provisions requiring submission of these data elements and that omission of this data will not be deemed grounds for dismissal.[7]

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4 *See id.,* Attachment to Grant at ¶¶ 7 & 8 (granting waivers of Sections 25.210(j) and 25.114(d)(3) of the Commission's rules).

5 *See* Public Notice, International Bureau Adopts Policy of Granting Interim Waiver of Certain Requirements for Space Station Applications, DA 14-90 (Jan. 28, 2014).

6 *See id*. at 2 n.6 (instructing applicants to enter a "1" in data fields that cannot be left blank using the Schedule S software). The public notice refers specifically to Table S7, columns q and r, and Table S10, column b as places where a "1" would need to be entered for validation purposes, but SES found that the software also required entry of a "1" in columns k, l, and n of Table S7. SES specifies that these "1" data entries are outside the scope of the certifications herein regarding accuracy of the information provided with this modification application. *See id.*

7 *See id*. at 1.

CONCLUSION

For the foregoing reasons, SES seeks a modification of the AMC-2 license to permit reorientation of the satellite to serve North America. To accommodate the schedule for retirement of AMC-5, SES respectfully requests action on this modification by April 15.

Respectfully submitted,

SES AMERICOM, INC.

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TECHNICAL APPENDIX

AMC-2 AT 80.85° W.L.

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

This technical appendix is submitted in support of the modification application of SES Americom, Inc. ("SES") seeking to repoint the beams of AMC-2 at 80.85° W.L. to ensure continuity of service for AMC-5 Ku-band customers following retirement of that satellite. SES hereby incorporates by reference the technical information it has already provided with respect to AMC-2,[1] and provides here technical information relating to operation of AMC-2 at 80.85° W.L consistent with the proposed modification.

AMC-2 is equipped with twenty-four 36 MHz C-band transponders and twenty-four 36 MHz Ku-band transponders. The spacecraft's configuration will be altered to fly in nominal mode (as opposed to the current inverted mode) at 80.85° W.L., and the C- and Ku-band transponders will provide coverage of North America.

2.0 Schedule S (§25.114(c))

The Schedule S database is included with this filing. This section describes the main updates in the Schedule S relating to the proposed operation of AMC-2 at 80.85° W.L. with respect to previous Schedule S submissions for this spacecraft, and addresses some items not covered in the Schedule S.

Note that pursuant to the recent International Bureau public notice,[2] SES has omitted certain data elements from the Schedule S that the Commission has deemed unnecessary. In some instances

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[1] The most recent technical information regarding AMC-2 is found in File No. SAT-MOD-20130225-00024. *See also* File Nos.SAT-LOA-19940310-00008; SAT-AMD-19941114-00065; SAT-MOD-20050527-00110; SAT-MOD-20080124-00030; SAT-AMD-20080311-00070; SAT-MOD-20100324-00056; SAT-MOD-20101215-00261; SAT-MOD-20111025-00209 & SAT-MOD-20120524-00087.

[2] Public Notice, International Bureau Adopts Policy of Granting Interim Waiver of Certain Requirements for Space Station Applications, DA 14-90 (Jan. 28, 2014).

a "1" was entered in the applicable Schedule S data field for these elements because the Schedule S software would not validate the file if the field was left blank.[3]

1. *Transponder frequency plan.* The polarity of the frequency plan in Ku-band will be switched.
2. *Telemetry and Telecommand (TT&C) frequencies and beams.* The TT&C link budgets are included in the Schedule S. A global horn antenna is used for receiving C-band telecommand carriers ("GBLRV"), as well as for C-band telemetry ("GBLTV"). C-band telemetry carriers can also be transmitted through the communications antenna ("CTH"), in which case the 3700.5 MHz carrier is horizontally polarized. The communication antenna ("KTV") is used for transmitting telemetry carriers in Ku-band. The Ku band telemetry carrier at 12198 MHz has not been used for telemetry at 80.85° W.L because the spacecraft's Ku-band communications antennas did not have coverage of the TT&C earth stations. With the proposed repointing, the Ku-band telemetry beam will again have coverage over the TT&C earth station and may be used. This frequency will still be used as a tracking beacon, as needed. Table 1 below shows the TT&C carrier center frequencies and bandwidths.

[3] *See* Schedule S, Table S7, columns k, l, n, q and r, and Table S10, column b.

Table 1: TT&C Carrier Frequencies

	Frequency, MHz	Nominal polarization
Command carriers (bandwidth: 800KHz, 1.2 MHz capture range)		
C-band	6423.5	V
Beacons/Telemetry (bandwidth: 300 KHz)		
C-band pair	3700.5	H
	4199.5	V
Ku-band	12198	V

Note: C-band telemetry carriers can also be transmitted through the omni (horn) antennas. In that case, the 3700.5 MHz carrier is vertically polarized.

3. *PFD limits in C-band.* The C-band PFD values are provided in Section S8 of Schedule S, and Section 3.0 below (Table 2) demonstrates that these values comply with §25.208.
4. *Conversion of G/T values to Saturation Flux Density values.* No change.
5. *Transponder frequency response of C- and Ku-transponder.* No change.
6. *Carrier parameters and link budgets.* The carrier parameters and link budgets as displayed in Sections S11 and S13 have been updated based on the planned operations of AMC-2 at 80.85° W.L.
7. *Beam diagrams.* The attached beam diagrams in Section S8 have been updated to reflect the projected coverage areas at 80.85° W.L after the satellite has been re-inverted to nominal mode.
8. *TT&C Station Locations.* Information is provided in Section S14 regarding the TT&C earth stations in the United States that will be used with AMC-2 at 80.85° W.L.

3.0 PFD limits (§25.114(d)(5) and §25.208)

Table 2 demonstrates that the PFD values for the C-band carriers from AMC-2 at 80.85° W.L. comply with §25.208.

Table 2: Maximum PFD values and margins relative to permissible limits of §25.208

Beam: CTV				
Elevation angle (°)	Max. EIRP density (dBW/4 kHz)	Max. PFD (dBW/m^2-4 kHz)	Permissible PFD (dBW/m^2-4 kHz)	Margin (dB)
5	-1.7	-164.1	-152.0	12.1
10	-1.7	-163.9	-149.5	14.4
15	-1.7	-163.4	-147.0	16.4
20	-1.7	-162.5	-144.5	18.0
25	-1.7	-159.5	-142.0	17.5

Beam: CTH				
Elevation angle (°)	Max. EIRP density (dBW/4 kHz)	Max. PFD (dBW/m^2-4 kHz)	Permissible PFD (dBW/m^2-4 kHz)	Margin (dB)
5	-1.7	-163.6	-152.0	11.6
10	-1.7	-163.4	-149.5	13.9
15	-1.7	-163.1	-147.0	16.1
20	-1.7	-162.8	-144.5	18.3
25	-1.7	-160.8	-142.0	18.8

Beam: GBLTV				
Elevation angle (°)	Max. EIRP density (dBW/4 kHz)	Max. PFD (dBW/m^2-4 kHz)	Permissible PFD (dBW/m^2-4 kHz)	Margin (dB)
5	-7	-170.2	-152.0	18.2
10	-7	-170.1	-149.5	20.6
15	-7	-170.0	-147.0	23.0
20	-7	-169.9	-144.5	25.4
25	-7	-169.8	-142.0	27.8

No PFD limits for the 11700 – 12200 MHz band are specified in Section 25.208 of the FCC Rules or in No. 21.16 of the ITU Radio Regulations with respect to the operation of geostationary satellites.

4.0 Satellite Antenna Gain Contours (§25.114(d)(3))

Annex A shows the typical antenna gain contours for the AMC-2 space station beams.[4] The peak EIRP and G/T values of the beams are shown in Table 3.

Table 3: Maximum EIRP and G/T

Beam ID	Band	Pol	Link Direction	GXT filename	Max. EIRP (dBW)	Max. G/T (dB/K)
KRV	Ku	V	Receive	AMC-2 KRV.gxt		6.8
KRH	Ku	H	Receive	AMC-2 KRH.gxt		7.8
CRV	C	V	Receive	AMC-2 CRV.gxt		4.1
CRH	C	H	Receive	AMC-2 CRH.gxt		5.8
KTV	Ku	V	Transmit	AMC-2 KTV.gxt	50.3	
KTH	Ku	H	Transmit	AMC-2 KTH.gxt	51.5	
CTV	C	V	Transmit	AMC-2 CTV.gxt	42.1	
CTH	C	H	Transmit	AMC-2 CTH.gxt	40.8	

The gain characteristics for the global horn antenna ("GBLR") and ("GBLT") 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 Figure A-7 in Annex A. The Commission has granted a waiver to permit this substitution.

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

Annex B shows typical link budgets, including emissions designators. Further carrier details and the link budgets are included in the Schedule S, Section S13.

6.0 Maximum Theoretical Operation Levels

AMC-2 will be operated consistently with coordination agreements with adjacent satellites. In any case, in the 11.7-12.2 GHz band, the downlink EIRP density of the AMC-2 digital carriers will not exceed -20.3 dBW/Hz; and in the 14-14.5 GHz band, the input power density of the

[4] For several beams in Annex A and in the GXT files included in the Schedule S, certain contours may only show as partial lines at parts of the Earth. This is due to limitations in the available pattern data of these beams.

uplink digital carriers of earth stations operating with AMC-2 will not exceed -45 dBW/Hz. In the 3700-4200 MHz band, the downlink EIRP density of the AMC-2 digital carriers will not exceed -29.7 dBW/Hz; and in the 5925-6425 MHz band, the input power density of the uplink digital carriers of earth stations operating with AMC-2 will not exceed -38.7 dBW/Hz.

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

Annex C provides analyses demonstrating the compatibility of AMC-2 at 80.85° W.L. with neighboring spacecraft.

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

The information required under Section 25.114(d)(14) of the Commission's Rules is already on file with the Commission and is incorporated by reference herein.[5]

[5] *See* File No. SAT-MOD-20100324-00056, Technical Appendix, Section 7 as supplemented by File No. SAT-MOD-20130225-00024, Technical Appendix, Section 8.

ANNEX A

Space Station Antenna Beam Diagrams

Figure A-1
Receive Beam: KRV
Ku-band, V-pol, Peak Gain: 30.9 dBi, Peak G/T = 6.8 dB/K

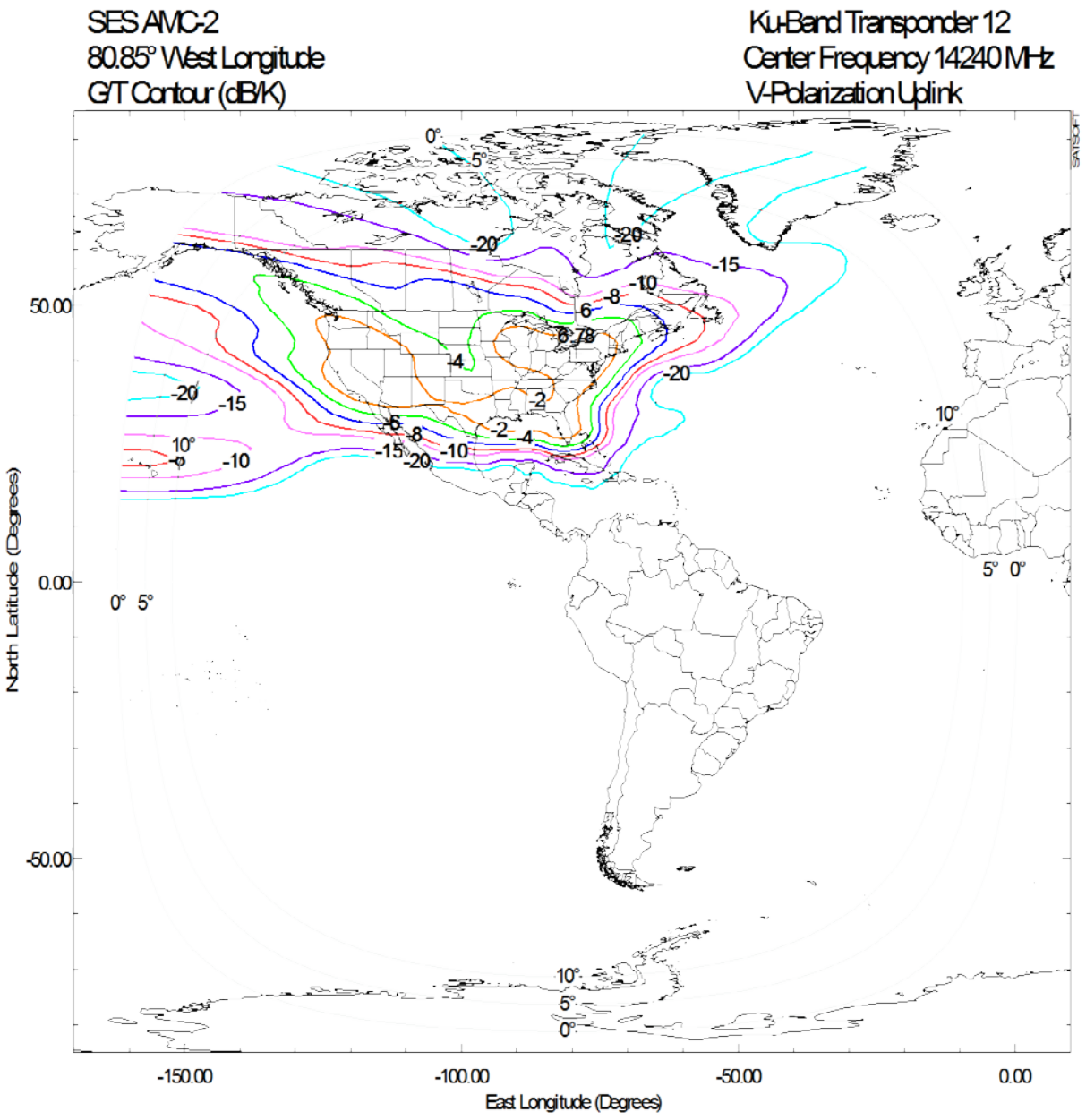

Figure A-2
Receive Beam: KRH
Ku-band, H-pol, Peak Gain: 33.6 dBi, Peak G/T = 7.8 dB/K

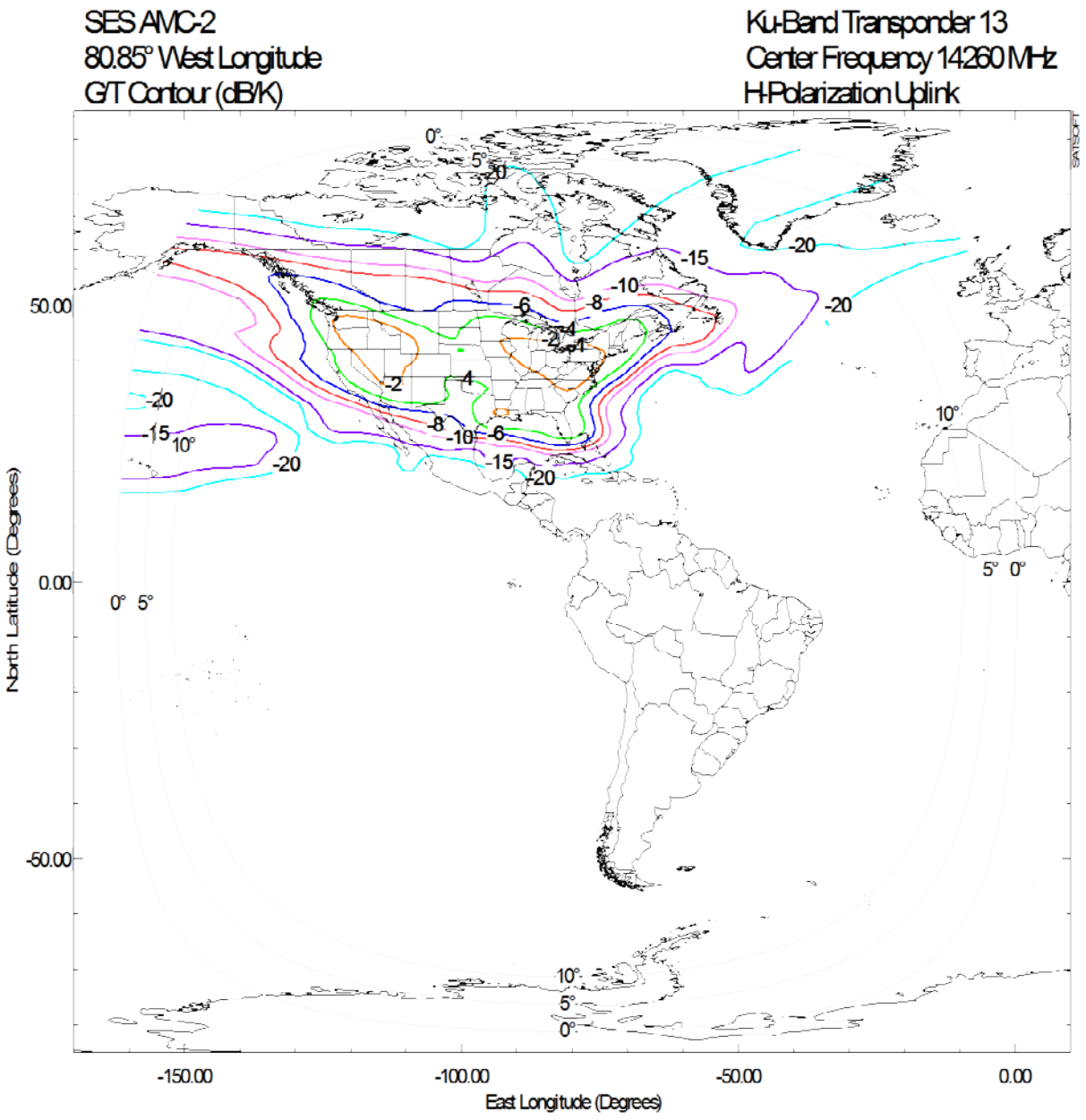

Figure A-3
Transmit Beam: KTV
Ku-band, V-pol, Peak Gain: 33.0 dBi, Peak EIRP = 50.3 dBW

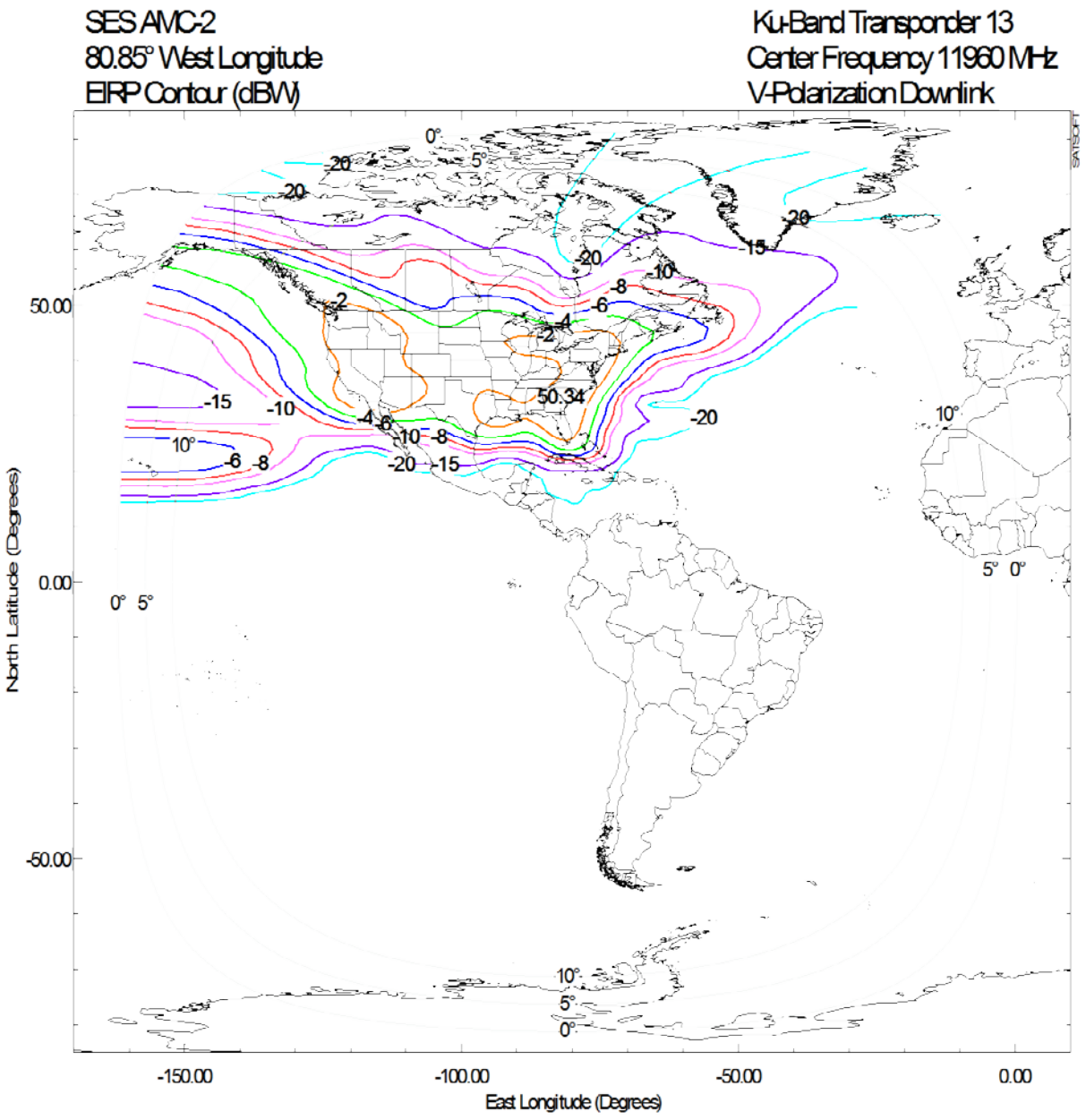

Figure A-4
Transmit Beam: KTH
Ku-band, H-pol, Peak Gain: 33.3 dBi, Peak EIRP = 51.5 dBW

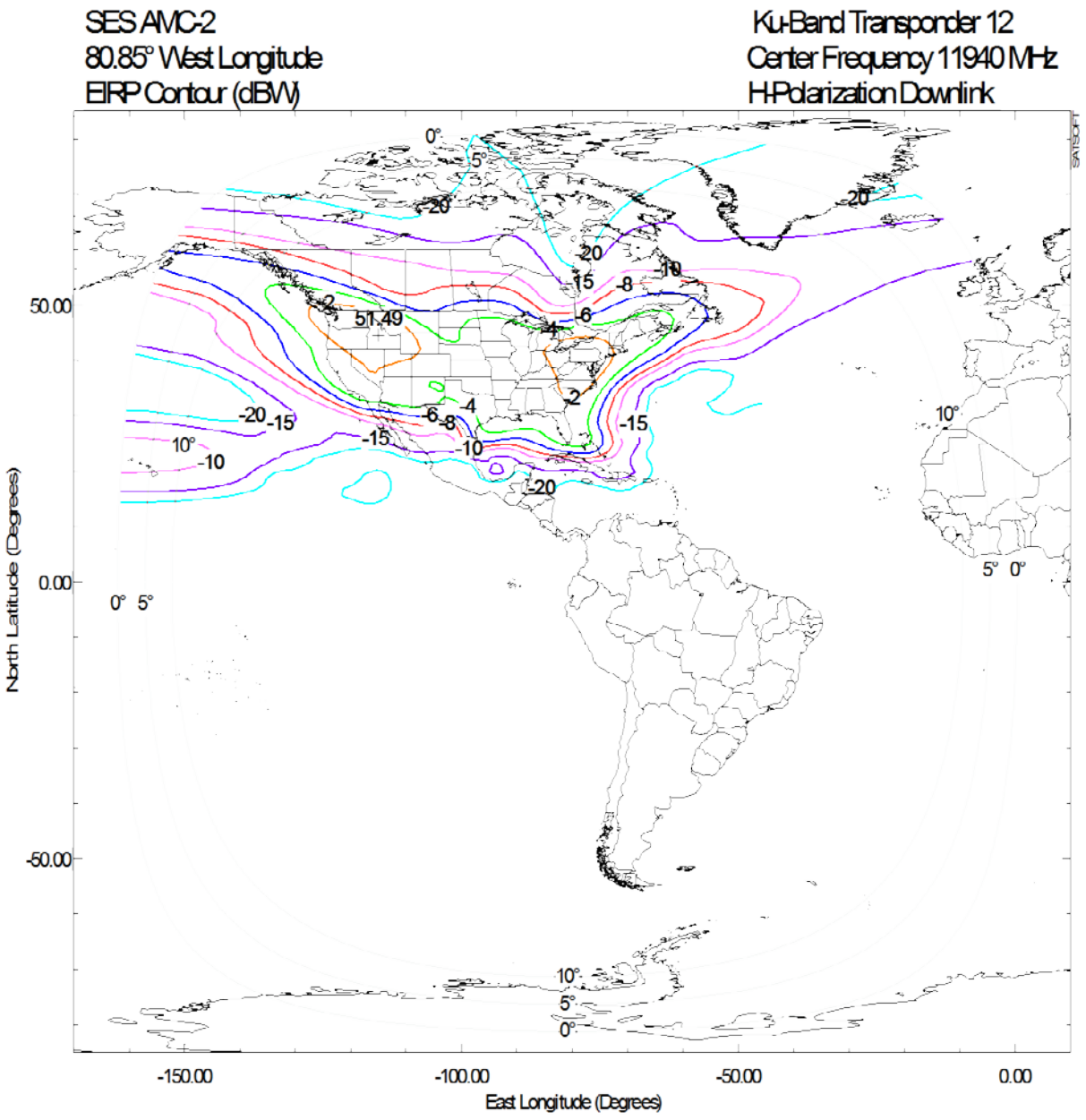

Figure A-5
Receive Beam: CRV
C-band, V-pol, Peak Gain: 31.3 dBi, Peak G/T = 4.1 dB/K

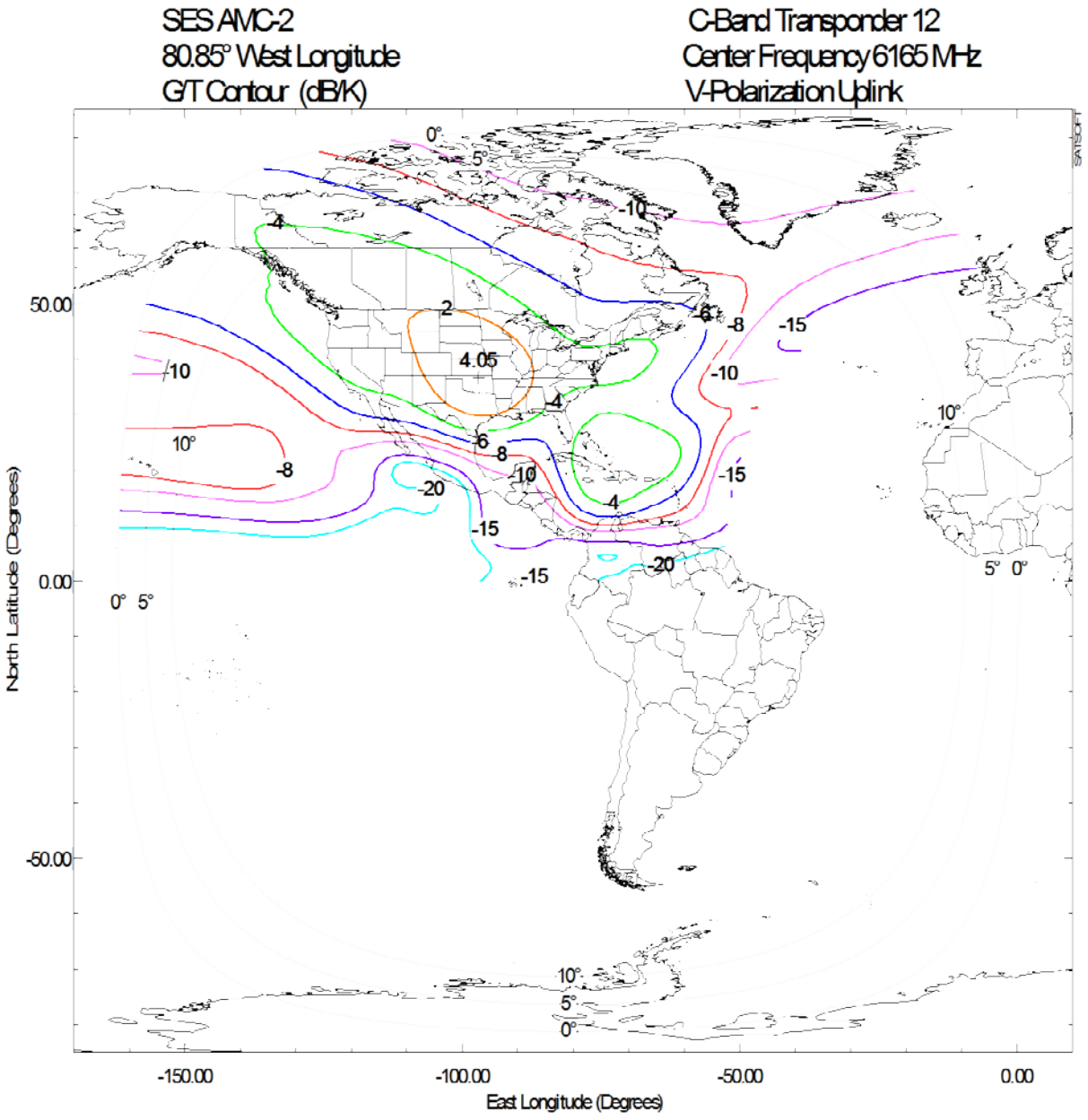

Figure A-6
Receive Beam: CRH
C-band, H-pol, Peak Gain: 32.9 dBi, Peak G/T = 5.8 dB/K

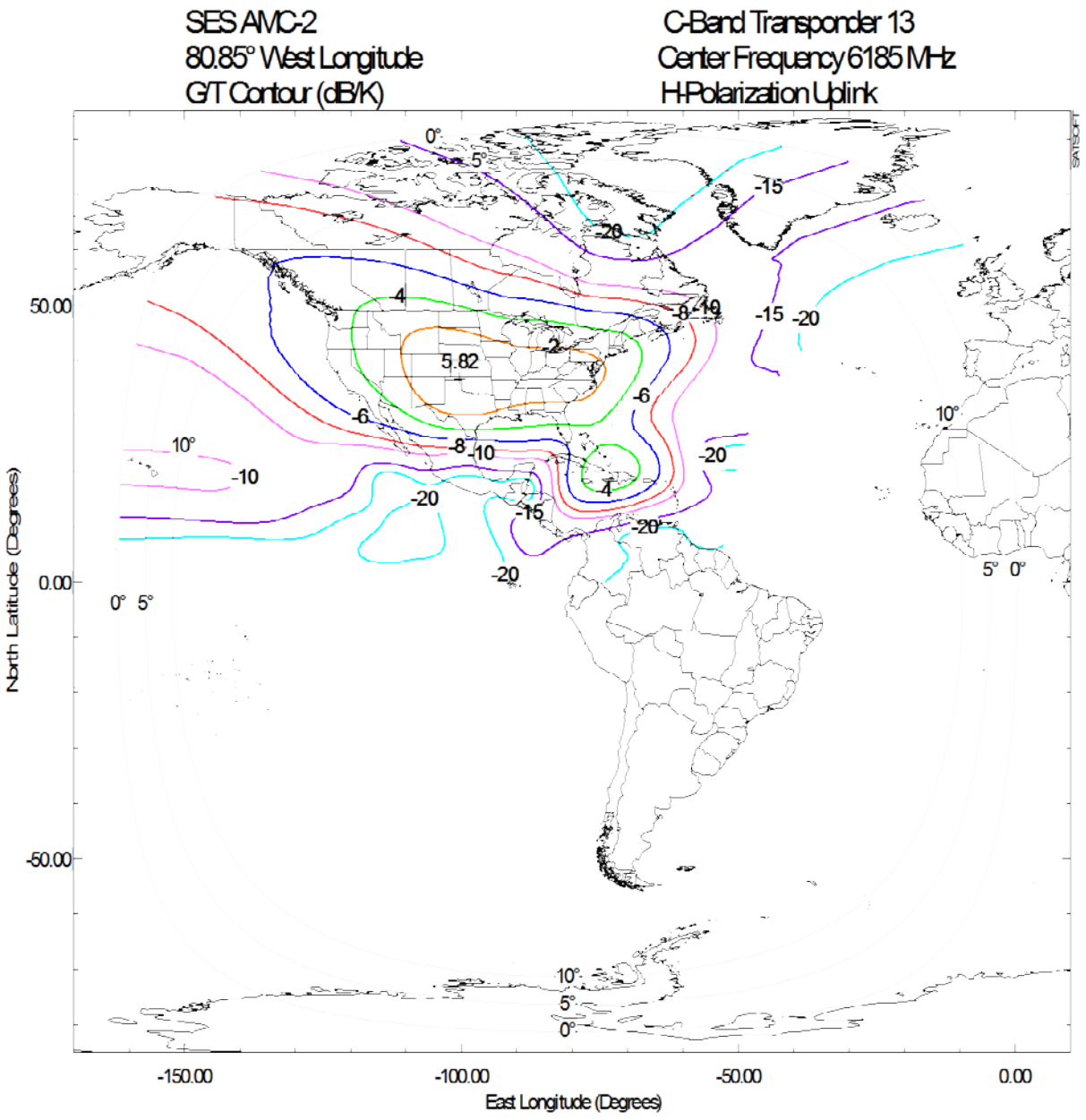

Figure A-7
Transmit Beam: CTV
C-band, V-pol, Peak Gain: 31.0 dBi, Peak EIRP = 42.1 dBW

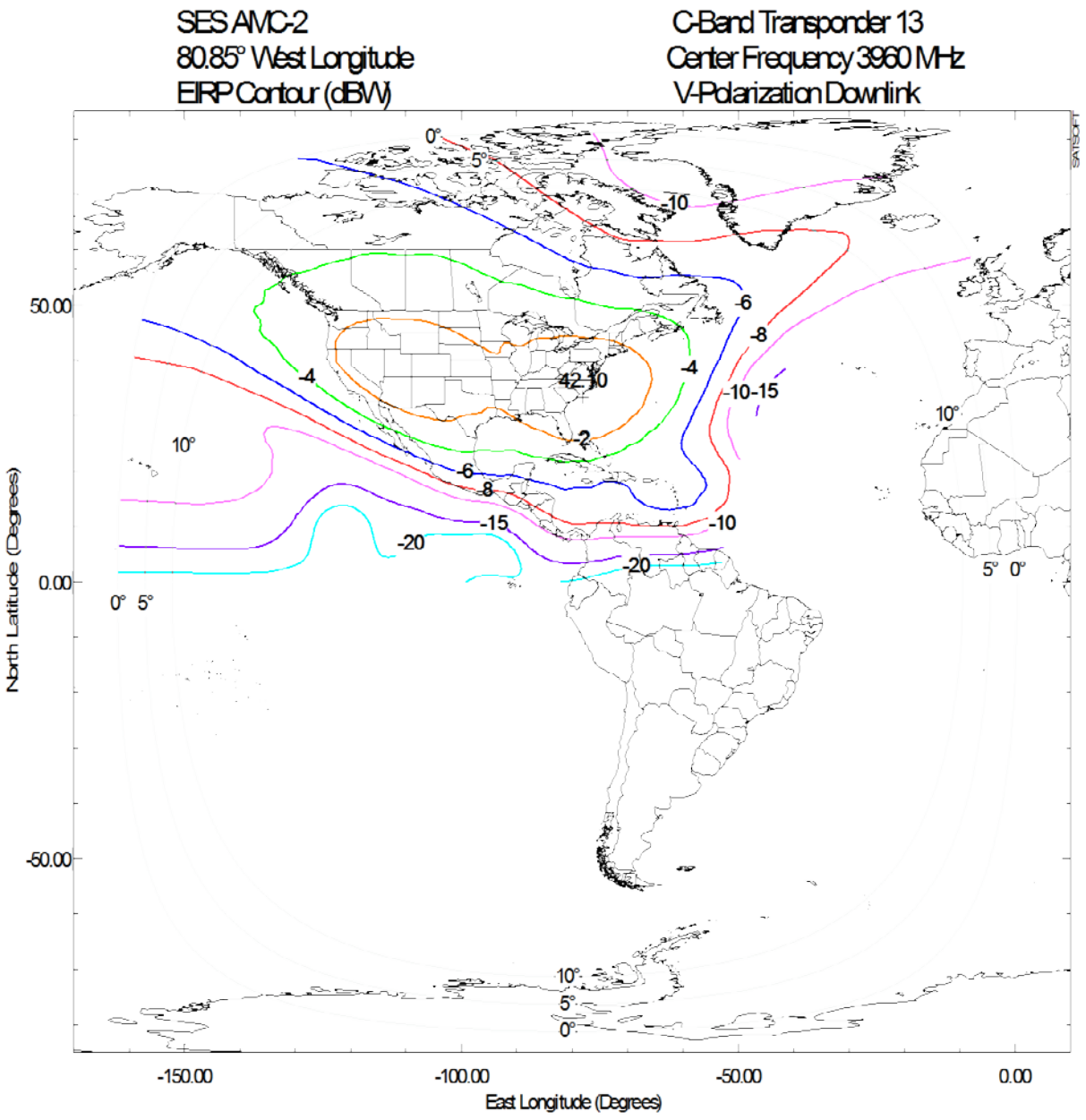

Figure A-8
Transmit Beam: CTH
C-band, H-pol, Peak Gain: 30.3 dBi, Peak EIRP = 40.8 dBW

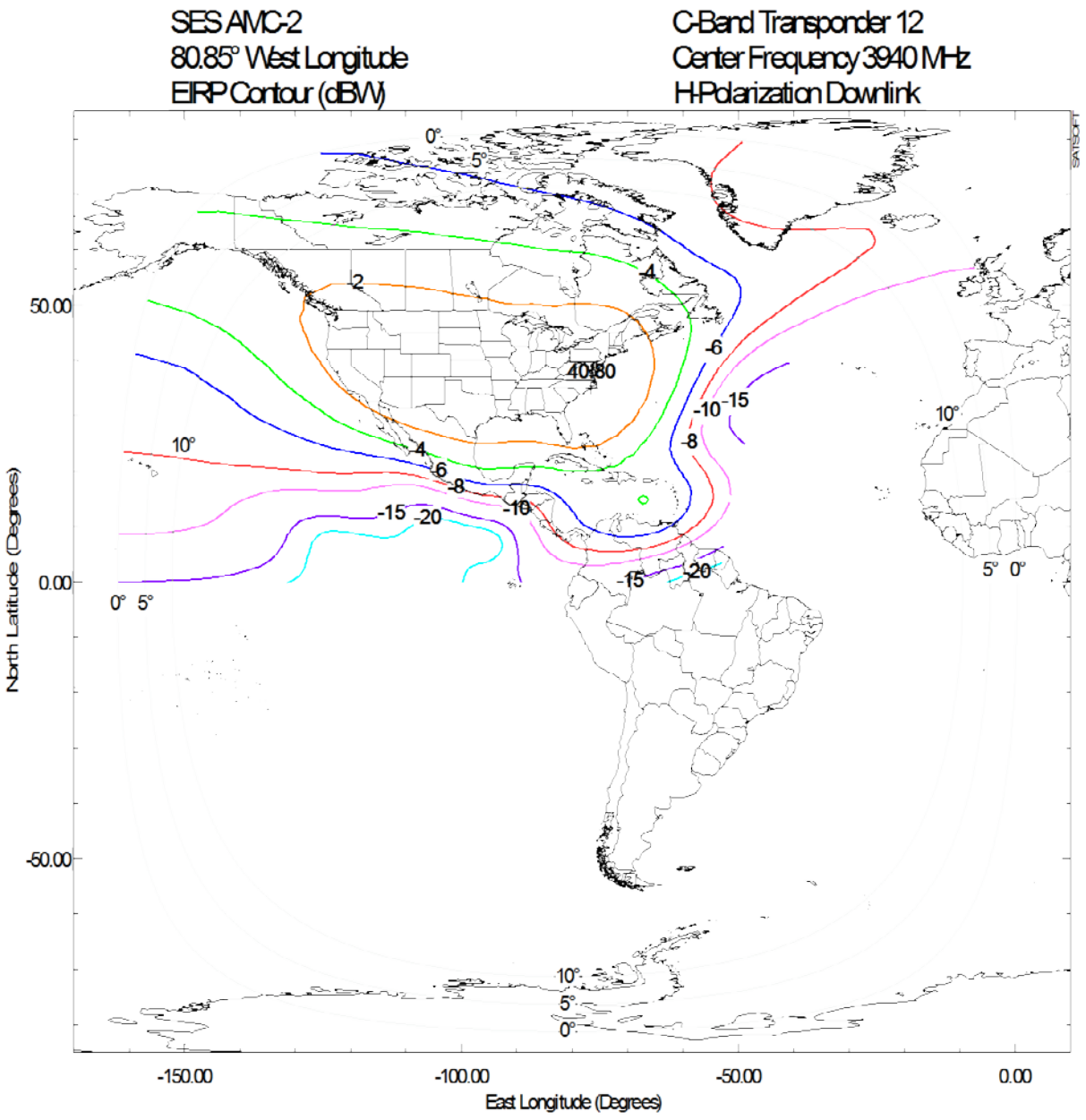

Figure A-9
Global Horn Characteristics

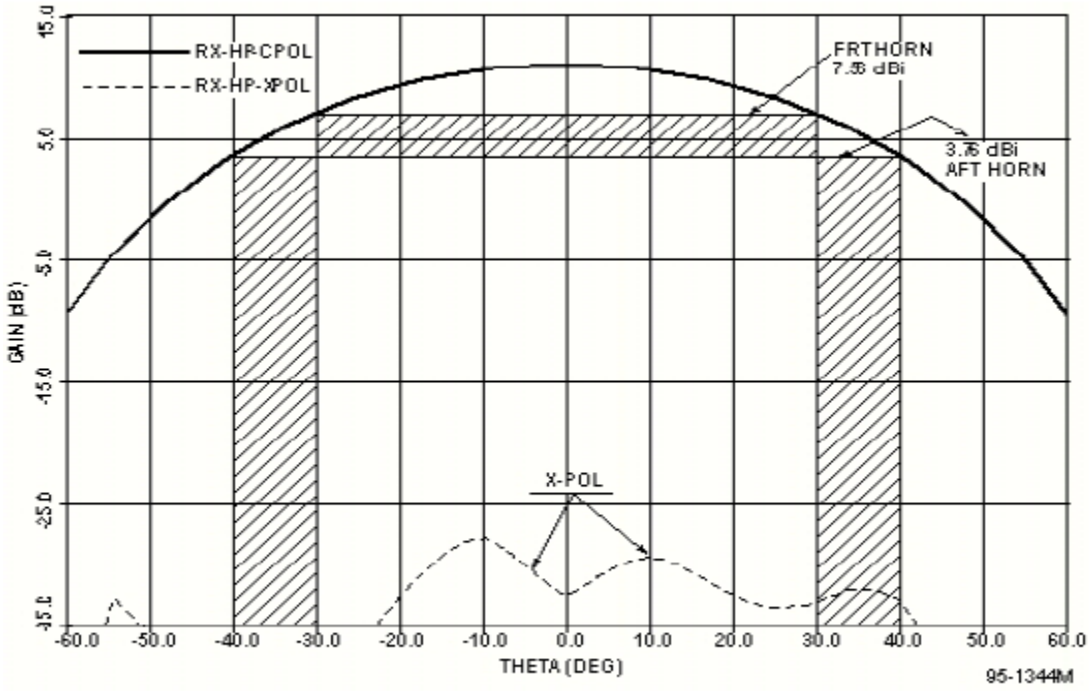

Figure 2.3-4. Measured Performance of Command Horn

ANNEX B

Link Budgets

Table B-1
Ku-Band Link Budgets

Link Parameters	Units	Ku-band				
		6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
Uplink Frequency	GHz	14.240	14.240	14.240	14.240	14.240
Downlink Frequency	GHz	11.940	11.940	11.940	11.940	11.940
Carrier Allocated Bandwidth	kHz	6950.0	5040.0	55.0	1400.0	36000.0
Energy Dispersal	MHz	n/a	n/a	n/a	n/a	n/a
Uplink:						
Nominal E/S e.i.r.p. per carrier	dBW	61.6	60.2	40.1	54.7	74.8
Earth Station Diameter	m	2.4	2.4	2.4	3.8	6.1
Earth Station Gain	dBi	49.1	49.1	49.1	53.1	57.3
Uplink Input Power per Carrier	dBW	12.5	11.1	-9.0	1.5	17.5
Free Space Loss	dB	206.9	206.9	206.9	206.9	206.9
G/T Satellite	dB/K	0.0	0.0	0.0	0.0	3.0
C/N Thermal Uplink	dB	15.6	15.6	15.6	16.2	24.7
C/I XPOL, ACI, IM, ASI	dB	20.0	20.0	20.0	20.6	26.1
C/(N+I) uplink	dB	14.3	14.3	14.3	14.9	22.3
Downlink:						
Satellite e.i.r.p. per carrier	dBW	35.6	34.2	14.0	28.7	48.5
Maximum e.i.r.p. density	dBW/4kHz	6.9	6.9	6.9	7.4	9.7
Free Space Loss	dB	205.5	205.5	205.5	205.5	205.5
Earth Station Diameter	m	2.4	2.4	2.4	3.8	1.2
Earth Station Gain	dBi	47.7	47.7	47.7	51.7	41.7
Noise Temperature	K	120.0	120.0	120.0	120.0	120.0
Earth Station G/T	dB/K	26.9	26.9	26.9	30.9	20.9
C/N Thermal Downlink	dB	18.0	18.0	18.0	22.6	17.7
C/I XPOL, ACI, IM, ASI	dB	17.7	17.7	17.7	22.2	17.4
C/(N+I) downlink	dB	14.8	14.8	14.8	19.4	14.6
Adjacent Satellite Interference:						
Uplink Inp. Pwr. Dens. @ 2 degrees	dBW/Hz	-50	-50	-50	-50	-50
Downlink e.i.r.p. Dens @ 2 degrees	dBW/Hz	-26	-26	-26	-26	-26
C/I up (single satellite)	dB	23.0	23.0	23.0	23.6	29.1
C/I dn (single satellite)	dB	20.7	20.7	20.7	25.2	20.4
Aggregate C/I up	dB	20.0	20.0	20.0	20.6	26.1
Aggregate C/I down	dB	17.7	17.7	17.7	22.2	17.4
Overall:						
C/(N+I) overall	dB	11.5	11.5	11.5	13.5	13.9
C/(N+I) required	dB	6.9	6.9	6.9	9.3	6.9
System Margin	dB	4.6	4.6	4.6	4.3	7.0

Table B-2
C-Band Link Budgets

Link Parameters	Units	C-band				
		9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
Uplink Frequency	GHz	6.185	6.185	6.185	6.185	6.250
Downlink Frequency	GHz	3.960	3.960	3.960	3.960	3.950
Carrier Allocated Bandwidth	kHz	9000.0	1510.0	55.0	4050.0	36000.0
Energy Dispersal	MHz	n/a	n/a	n/a	n/a	n/a
Uplink:						
Nominal E/S e.i.r.p. per carrier	dBW	57.1	52.3	38.7	53.4	76.1
Earth Station Diameter	m	3.8	3.8	3.8	3.8	9.0
Earth Station Gain	dBi	45.9	45.9	45.9	45.9	53.5
Uplink Input Power per Carrier	dBW	11.3	6.4	-7.2	7.5	22.6
Free Space Loss	dB	199.7	199.7	199.7	199.7	199.7
G/T Satellite	dB/K	0.0	0.0	-2.9	2.1	1.3
C/N Thermal Uplink	dB	17.8	20.7	18.6	19.6	31.6
C/I XPOL, ACI, IM, ASI	dB	12.0	14.8	15.7	14.6	24.4
C/(N+I) uplink	dB	11.0	13.8	13.9	13.4	23.7
Downlink:						
Satellite e.i.r.p. per carrier	dBW	25.3	20.5	4.0	17.6	37.0
Maximum e.i.r.p. density	dBW/4kHz	-4.8	-1.9	-4.0	-9.0	-1.8
Free Space Loss	dB	195.9	195.9	195.9	195.9	195.9
Earth Station Diameter	m	3.8	3.8	3.8	3.8	3.8
Earth Station Gain	dBi	42.1	42.1	42.1	42.1	42.1
Noise Temperature	K	100.0	100.0	100.0	100.0	100.0
Earth Station G/T	dB/K	22.1	22.1	22.1	22.1	22.1
C/N Thermal Downlink	dB	11.9	14.8	12.7	7.7	17.0
C/I XPOL, ACI, IM, ASI	dB	12.2	15.1	13.0	9.0	17.3
C/(N+I) downlink	dB	9.1	11.9	9.9	5.3	14.2
Adjacent Satellite Interference:						
Uplink Inp. Pwr. Dens. @ 2 degrees	dBW/Hz	-47	-47	-47	-50	-47
Downlink e.i.r.p. Dens @ 2 degrees	dBW/Hz	-37	-37	-37	-38	-37
C/I up (single satellite)	dB	15.0	17.8	18.7	17.6	27.4
C/I dn (single satellite)	dB	15.2	18.1	16.0	12.0	20.3
Aggregate C/I up	dB	12.0	14.8	15.7	14.6	24.4
Aggregate C/I down	dB	12.2	15.1	13.0	9.0	17.3
Overall:						
C/(N+I) overall	dB	6.9	9.8	8.4	4.7	13.7
C/(N+I) required	dB	4.1	6.9	6.9	4.1	6.9
System Margin	dB	2.7	2.9	1.5	0.5	6.8

Table B-3
TT&C Link Budgets

Link Parameters	Units	TT&C			
		800KF9D	300KF9D	300KF9D	300KF9D
Uplink Frequency	GHz	6.4235			
Downlink Frequency	GHz		3.7005	4.1995	12.198
Carrier Allocated Bandwidth	kHz	800.0	300.0	300.0	300.0
Energy Dispersal	MHz	n/a	n/a	n/a	n/a
Uplink:					
Nominal E/S e.i.r.p. per carrier	dBW	72.0			
Earth Station Diameter	m	9.0			
Earth Station Gain	dBi	53.0			
Uplink Input Power per Carrier	dBW	19.0			
Free Space Loss	dB	199.7			
G/T Satellite	dB/K	-17.5			
C/N Thermal Uplink	dB	24.4			
C/I XPOL, ACI, IM, ASI	dB	36.0			
C/(N+I) uplink	dB	24.1			
Downlink:					
Satellite e.i.r.p. per carrier	dBW		11.8	11.8	12.4
Maximum e.i.r.p. density	dBW/4kHz		-7.0	-7.0	-6.4
Free Space Loss	dB		195.9	195.9	205.5
Earth Station Diameter	m		9.0	9.0	9.0
Earth Station Gain	dBi		49.0	50.1	59.3
Noise Temperature	K		100.0	100.0	120.0
Earth Station G/T	dB/K		29.0	30.1	38.5
C/N Thermal Downlink	dB		18.7	19.8	19.3
C/I XPOL, ACI, IM, ASI	dB		19.0	20.1	19.0
C/(N+I) downlink	dB		15.8	16.9	16.2
Adjacent Satellite Interference:					
Uplink Inp. Pwr. Dens. @ 2 degrees	dBW/Hz	-47	-47	-47	-50
Downlink e.i.r.p. Dens @ 2 degrees	dBW/Hz	-37	-37	-37	-26
C/I up (single satellite)	dB	39.0	999.0	999.0	999.0
C/I dn (single satellite)	dB	999.0	22.0	23.1	22.0
Aggregate C/I up	dB	36.0	999.0	999.0	999.0
Aggregate C/I down	dB	999.0	19.0	20.1	19.0
Overall:					
C/(N+I) overall	dB	24.1	15.8	16.9	16.2
C/(N+I) required	dB	10.0	9.0	9.0	9.0
System Margin	dB	14.1	6.8	7.9	7.2

ANNEX C

Interference Analysis

Interference Analysis

SES previously provided a two-part interference analysis for operations of AMC-2 at this orbital location. The first part estimated interference levels using a generic approach, *i.e.*, the two adjacent systems were assumed to be identical and spaced at two degrees, and the second part considered the specific case of interference between AMC-2 and two adjacent systems, AMC-9 and DIRECTV KU-79, using published emission characteristics. SES incorporates by reference the previously provided generic analysis[1] and provides an updated analysis below for the specific case, taking into account the proposed modification of the AMC-2 beams.

Specific C/I Analysis

For this portion of the analysis, the carrier-to-interference ratio between two adjacent systems is estimated for a set of competing emissions. The analysis methodology consists of defining the emission characteristics for each network and computing the interference levels resulting from co-channel operation. C/I levels are calculated for each combination of overlapping emissions (*i.e.*, the same frequency band and link direction). Results are presented in tables providing the interference levels for combinations of emissions pairs.

The worst-case geometry for the earth and space stations is assumed. That is, the space stations are positioned closer to each other by their respective stationkeeping tolerances and the earth station is mispointed toward the interfering space station by an assumed pointing error.

The equations and parameter definitions presented above can be used to express the uplink and downlink C/I as follows:

$$C/I_{UP} = (PD_{ES,W} - PD_{ES,I}) + (G_{ES,W}(\theta_W) - G_{ES,I}(\theta_I)) + \Delta G/T$$

$$C/I_{DN} = (ED_{SS,W} - ED_{SS,I}) + (G_{ES,W}(\theta_W) - G_{ES,W}(\theta_I)) + \Delta GC$$

[1] *See* File No. SAT-MOD-20130225-00024, Technical Appendix, Annex C.

Here the uplink C/I is estimated using the emission power densities and gains of the earth stations, and an assumption defining the locations of the wanted and interfering earth stations relative to the wanted space station beam boresight. The downlink C/I is estimated using the wanted and interfering space station emission EIRP densities, the gain of the wanted earth station, and an assumption defining the location of the wanted earth station relative to the wanted and interfering space station beam boresights.

The off-axis performance of the earth station antenna is modeled using Part 25 Section 25.209. According to Section 29.209(c)(1), receiving earth stations are afforded protection to the extent that they meet the 25.209(a) and (b) masks at 1.5 degrees off-axis. Therefore, all receiving earth stations are assumed to meet this mask in the interference analysis contained herein. Note that this antenna pattern does not define gain values for angles less than 1.5 degrees. In order to account for earth station pointing errors, a parabolic main beam model is used for gain values at small off-axis angles ($G_{MAX} - 0.0025 * (D/\lambda * \varphi) \wedge 2$).

Earth station topocentric off-axis angles are approximated by adding 10% to the geocentric angular separation, taking into account the satellite stationkeeping tolerance and earth station pointing error.

System characteristics used in the analysis are shown in the following tables. Three networks are considered: AMC-2 and two adjacent systems, AMC-9 and DIRECTV KU-79W. AMC-5 is not considered in the interference analysis as the intent of repointing the beams is to ensure continuity of service for AMC-5 Ku-band customers following retirement of that satellite.

Table C-3 provides the space station name and orbital information, and assumed earth station parameters of the networks.

Table C-3: Station Parameters

Parameter	System 1A	System 1B	System 2
Space station name	AMC-9	DIRECTV KU-79W	AMC-2
Nominal orbit location (+E, -W)	-83.00	-78.80	-80.85
Stationkeeping tolerance (◦)	0.05	0.05	0.15
Earth station pointing error (◦)	0.10	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65	0.65

This analysis considers the digital emissions signals of 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, and therefore are more tolerant of interference.

Tables C-4a and C-4b show the AMC-9 and DIRECTV KU-79W emission characteristics considered here (derived from the respective Schedule S files).

Table C-4a: AMC-9 Typical Emissions

Ku-band							
Uplink				Downlink			
Emission	Frequency (MHz)	ES power density (dBW/Hz)	ES gain (dBi)	Emission	Frequency (MHz)	SS EIRP density (dBW/Hz)	ES gain (dBi)
36M0G7W	14020.0	-57.1	57.3	36M0G7W	11720.0	-22.8	41.7
6M95G1W	14020.0	-57.5	53.0	6M95G1W	11720.0	-27.6	41.7
5M00G1W	14020.0	-51.3	46.7	5M00G1W	11720.0	-27.6	41.7
1M60G1W	14020.0	-51.3	46.7	1M60G1W	11720.0	-27.6	41.7
100KG1W	14020.0	-47.8	43.2	100KG1W	11720.0	-27.6	41.7

C-band							
Uplink				Downlink			
Emission	Frequency (MHz)	ES power density (dBW/Hz)	ES gain (dBi)	Emission	Frequency (MHz)	SS EIRP density (dBW/Hz)	ES gain (dBi)
36M0G7W	5945.0	-56.6	49.8	36M0G7W	3720.0	-33.8	38.2
6M95G1W	5945.0	-57.0	45.5	6M95G1W	3720.0	-38.6	38.2
5M00G1W	5945.0	-57.0	45.5	5M00G1W	3720.0	-38.6	38.2
1M60G1W	5945.0	-55.2	43.6	1M60G1W	3720.0	-38.6	38.2
100KG1W	5945.0	-53.3	41.7	100KG1W	3720.0	-38.6	38.2

Source: AMC-9 FCC Application (SAT-AMD-20040324-00067, Annex 1 to Attachment B)

Table C-4b: DIRECTV KU-79W Typical Emissions

Ku-band							
Uplink				Downlink			
Emission	Frequency (MHz)	ES power density (dBW/Hz)	ES gain (dBi)	Emission	Frequency (MHz)	SS EIRP density (dBW/Hz)	ES gain (dBi)
36M0G7W	14020.0	-58.6	59.8	36M0G7W	11720.0	-21.6	34.8
1M30F9D	14005.0	-48.9	59.8	106KG9D	11704.0	-35.0	55.9

Source: DIRECTV KU-79W Schedule S

Table C-5 shows the AMC-2 emission characteristics considered here (derived from the Schedule S file).

Table C-5: AMC-2 Typical Emissions

Ku-band							
Uplink				Downlink			
Emission	Frequency (MHz)	ES power density (dBW/Hz)	ES gain (dBi)	Emission	Frequency (MHz)	SS EIRP density (dBW/Hz)	ES gain (dBi)
6M95G7W	14020.0	-55.1	49.1	6M95G7W	11720.0	-29.1	47.7
5M04G1W	14020.0	-55.1	49.1	5M04G1W	11720.0	-29.1	47.7
100KG1W	14020.0	-55.1	49.1	100KG1W	11720.0	-29.2	47.7
1M40G7W	14020.0	-58.6	53.1	1M40G7W	11720.0	-28.5	51.7
36M0G7W	14020.0	-57.3	57.3	36M0G7W	11720.0	-26.3	41.7
				300KF9D	12198.0	-42.4	58.5

C-band							
Uplink				Downlink			
Emission	Frequency (MHz)	ES power density (dBW/Hz)	ES gain (dBi)	Emission	Frequency (MHz)	SS EIRP density (dBW/Hz)	ES gain (dBi)
9M00G7W	5945.0	-56.9	45.9	9M00G7W	3720.0	-40.8	42.1
1M51G7W	5945.0	-54.1	45.9	1M51G7W	3720.0	-37.9	42.1
100KG1D	5945.0	-53.3	45.9	100KG1D	3720.0	-40.0	42.1
4M05G7W	5945.0	-57.3	45.9	4M05G7W	3720.0	-45.1	42.1
36M0G7W	5945.0	-52.2	53.5	36M0G7W	3720.0	-37.8	42.1
800KF9D	6423.5	-40.0	53.0	300KF9D	3700.5	-43.0	49.0

Source: AMC-2 Schedule S

Applying the methodology discussed above to the emission characteristics shown in Tables C-4 and C-5 results in the C/I levels shown in Appendix 1 to this Annex (Tables A1-1 through A1-4 for AMC-9/AMC-2 and Tables A1-5 and A1-6 for DIRECTV KU-79W/AMC-2). A separate table is provided for each frequency band/link direction pair that shows the C/I level for each emission pair.

For the various cases the C/I and I/N levels are listed in the tables in Appendix 1 for each band and link direction. The worst-case I/N levels are summarized in Table C-6. This table also shows the resulting impact to the wanted links.

Table C-6: Worst-Case I/N and Impact to Wanted Links

Worst-case interference AMC-2 into AMC-9			
Link	I/N (dB)	ΔT/T (%)	Inc. in Noise (dB)
Ku-band uplink	-20.6	0.9	0.04
Ku-band downlink	-11.1	7.8	0.33
C-band uplink	-11.3	7.5	0.31
C-band downlink	-8.1	15.4	0.62

Worst-case interference AMC-9 into AMC-2			
Link	I/N (dB)	ΔT/T (%)	Inc. in Noise (dB)
Ku-band uplink	-10.9	8.0	0.34
Ku-band downlink	-10.0	9.9	0.41
C-band uplink	-16.4	2.3	0.10
C-band downlink	-5.4	28.6	1.09

Worst-case interference AMC-2 into DIRECTV KU-79W			
Link	I/N (dB)	ΔT/T (%)	Inc. in Noise (dB)
Ku-band uplink	-24.4	0.4	0.02
Ku-band downlink	-15.3	3.0	0.13

Worst-case interference DIRECTV KU-79W into AMC-2			
Link	I/N (dB)	ΔT/T (%)	Inc. in Noise (dB)
Ku-band uplink	-11.5	7.1	0.30
Ku-band downlink	-6.1	24.5	0.95

As can be seen from these results, most of the interference between the networks is well below the 6% coordination threshold. Cases where the threshold is exceeded with respect to AMC-9 will be solved by self-coordination and traffic planning as both AMC-2 and AMC-9 are

operated by SES. Cases where the threshold is exceeded with respect to DIRECTV KU-79W will be solved by adhering to the coordination agreement that is in place.

APPENDIX 1

C/I CALCULATIONS

Table A1-1A: AMC-9/AMC-2 Ku-Band Uplink C/I

Ku-band Uplink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward wanted space station(◦)	2.05	2.05
Difference in wanted space station G/T toward wanted and interfering earth stations (dB)	0.0	0.0

AMC-2 into AMC-9								
Wanted AMC-9 Emisssions				Interfering AMC-2 Emisssions				
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)			14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)		-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)	49.1	49.1	49.1	53.1	57.3
36M0G7W	14020.0	-57.1	57.3	32.0	32.0	32.0	35.5	34.1
6M95G1W	14020.0	-57.5	53.0	28.6	28.6	28.6	32.1	30.8
5M00G1W	14020.0	-51.3	46.7	29.1	29.1	29.1	32.6	31.3
1M60G1W	14020.0	-51.3	46.7	29.1	29.1	29.1	32.6	31.3
100KG1W	14020.0	-47.8	43.2	29.2	29.2	29.2	32.7	31.4

AMC-9 into AMC-2								
Interfering AMC-9 Emisssions				Wanted AMC-2 Emisssions				
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)			14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)		-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)	49.1	49.1	49.1	53.1	57.3
36M0G7W	14020.0	-57.1	57.3	29.5	29.5	29.6	29.5	33.8
6M95G1W	14020.0	-57.5	53.0	29.9	29.9	30.0	29.9	34.2
5M00G1W	14020.0	-51.3	46.7	23.7	23.7	23.8	23.7	28.0
1M60G1W	14020.0	-51.3	46.7	23.7	23.7	23.8	23.7	28.0
100KG1W	14020.0	-47.8	43.2	20.2	20.2	20.3	20.2	24.5

Table A1-1B: AMC-9/AMC-2 Ku-Band Uplink I/N

Ku-band Uplink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward wanted space station(◦)	2.05	2.05
Difference in wanted space station G/T toward wanted and interfering earth stations (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions					Interfering AMC-2 Emisssions				
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)				14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)			-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)		49.1	49.1	49.1	53.1	57.3
				C/N	6.9	6.9	6.9	9.3	6.9
36M0G7W	14020.0	-57.1	57.3	8.0	-24.0	-24.0	-24.0	-27.5	-26.1
6M95G1W	14020.0	-57.5	53.0	8.0	-20.6	-20.6	-20.6	-24.1	-22.8
5M00G1W	14020.0	-51.3	46.7	8.0	-21.1	-21.1	-21.1	-24.6	-23.3
1M60G1W	14020.0	-51.3	46.7	8.0	-21.1	-21.1	-21.1	-24.6	-23.3
100KG1W	14020.0	-47.8	43.2	8.0	-21.2	-21.2	-21.2	-24.7	-23.4

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions					Wanted AMC-2 Emisssions				
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)				14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)			-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)		49.1	49.1	49.1	53.1	57.3
				C/N	6.9	6.9	6.9	9.3	6.9
36M0G7W	14020.0	-57.1	57.3	8.0	-22.6	-22.6	-22.7	-20.2	-26.9
6M95G1W	14020.0	-57.5	53.0	8.0	-23.0	-23.0	-23.1	-20.6	-27.3
5M00G1W	14020.0	-51.3	46.7	8.0	-16.8	-16.8	-16.9	-14.4	-21.1
1M60G1W	14020.0	-51.3	46.7	8.0	-16.8	-16.8	-16.9	-14.4	-21.1
100KG1W	14020.0	-47.8	43.2	8.0	-13.3	-13.3	-13.4	-10.9	-17.6

Table A1-2A: AMC-9/AMC-2 Ku-Band Downlink C/I

Ku-band Downlink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward interfering space station (◦)	2.05	2.05
Difference in wanted and interfering space station gain toward wanted earth station (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions				Interfering AMC-2 Emisssions				
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)			11720.0	11720.0	11720.0	11720.0	11720.0
		SS EIRP density (dBW/Hz)		-29.1	-29.1	-29.2	-28.5	-26.3
			ES gain (dBi)	47.7	47.7	47.7	51.7	41.7
36M0G7W	11720.0	-22.8	41.7	26.7	26.7	26.8	26.1	23.9
6M95G1W	11720.0	-27.6	41.7	21.9	21.9	22.0	21.3	19.1
5M00G1W	11720.0	-27.6	41.7	21.9	21.9	22.0	21.3	19.1
1M60G1W	11720.0	-27.6	41.7	21.9	21.9	22.0	21.3	19.1
100KG1W	11720.0	-27.6	41.7	21.9	21.9	22.0	21.3	19.1

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions				Wanted AMC-2 Emisssions				
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)			11720.0	11720.0	11720.0	11720.0	11720.0
		SS EIRP density (dBW/Hz)		-29.1	-29.1	-29.2	-28.5	-26.3
			ES gain (dBi)	47.7	47.7	47.7	51.7	41.7
36M0G7W	11720.0	-22.8	41.7	19.9	19.9	19.8	24.2	16.9
6M95G1W	11720.0	-27.6	41.7	24.7	24.7	24.6	29.0	21.7
5M00G1W	11720.0	-27.6	41.7	24.7	24.7	24.6	29.0	21.7
1M60G1W	11720.0	-27.6	41.7	24.7	24.7	24.6	29.0	21.7
100KG1W	11720.0	-27.6	41.7	24.7	24.7	24.6	29.0	21.7

Table A1-2B: AMC-9/AMC-2 Ku-Band Downlink I/N

Ku-band Downlink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward interfering space station (◦)	2.05	2.05
Difference in wanted and interfering space station gain toward wanted earth station (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions					Interfering AMC-2 Emisssions				
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)				11720.0	11720.0	11720.0	11720.0	11720.0
		SS EIRP density (dBW/Hz)			-29.1	-29.1	-29.2	-28.5	-26.3
			ES gain (dBi)		47.7	47.7	47.7	51.7	41.7
				C/N	6.9	6.9	6.9	9.3	6.9
36M0G7W	11720.0	-22.8	41.7	8.0	-18.7	-18.7	-18.8	-18.1	-15.9
6M95G1W	11720.0	-27.6	41.7	8.0	-13.9	-13.9	-14.0	-13.3	-11.1
5M00G1W	11720.0	-27.6	41.7	8.0	-13.9	-13.9	-14.0	-13.3	-11.1
1M60G1W	11720.0	-27.6	41.7	8.0	-13.9	-13.9	-14.0	-13.3	-11.1
100KG1W	11720.0	-27.6	41.7	8.0	-13.9	-13.9	-14.0	-13.3	-11.1

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions					Wanted AMC-2 Emisssions				
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)				11720.0	11720.0	11720.0	11720.0	11720.0
		SS EIRP density (dBW/Hz)			-29.1	-29.1	-29.2	-28.5	-26.3
			ES gain (dBi)		47.7	47.7	47.7	51.7	41.7
				C/N	6.9	6.9	6.9	9.3	6.9
36M0G7W	11720.0	-22.8	41.7	8.0	-13.0	-13.0	-12.9	-14.9	-10.0
6M95G1W	11720.0	-27.6	41.7	8.0	-17.8	-17.8	-17.7	-19.7	-14.8
5M00G1W	11720.0	-27.6	41.7	8.0	-17.8	-17.8	-17.7	-19.7	-14.8
1M60G1W	11720.0	-27.6	41.7	8.0	-17.8	-17.8	-17.7	-19.7	-14.8
100KG1W	11720.0	-27.6	41.7	8.0	-17.8	-17.8	-17.7	-19.7	-14.8

Table A1-3A: AMC-9/AMC-2 C-Band Uplink C/I

C-band Uplink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward wanted space station(◦)	2.05	2.05
Difference in wanted space station G/T toward wanted and interfering earth stations (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions				Interfering AMC-2 Emisssions				
Emission				9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)			5945.0	5945.0	5945.0	5945.0	5945.0
		ES power density (dBW/Hz)		-56.9	-54.1	-53.3	-57.3	-52.2
			ES gain (dBi)	45.9	45.9	45.9	45.9	53.5
36M0G7W	5945.0	-56.6	49.8	28.5	25.7	24.9	28.9	23.8
6M95G1W	5945.0	-57.0	45.5	24.1	21.2	20.4	24.4	19.3
5M00G1W	5945.0	-57.0	45.5	24.1	21.2	20.4	24.4	19.3
1M60G1W	5945.0	-55.2	43.6	24.0	21.2	20.4	24.3	19.3
100KG1W	5945.0	-53.3	41.7	24.0	21.2	20.4	24.4	19.3

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions				Wanted AMC-2 Emisssions				
Emission				9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)			5945.0	5945.0	5945.0	5945.0	5945.0
		ES power density (dBW/Hz)		-56.9	-54.1	-53.3	-57.3	-52.2
			ES gain (dBi)	45.9	45.9	45.9	45.9	53.5
36M0G7W	5945.0	-56.6	49.8	24.2	27.0	27.8	23.8	35.8
6M95G1W	5945.0	-57.0	45.5	24.6	27.4	28.2	24.2	36.2
5M00G1W	5945.0	-57.0	45.5	24.6	27.4	28.2	24.2	36.2
1M60G1W	5945.0	-55.2	43.6	22.8	25.6	26.4	22.4	34.4
100KG1W	5945.0	-53.3	41.7	20.9	23.7	24.5	20.5	32.5

Table A1-3B: AMC-9/AMC-2 C-Band Uplink I/N

C-band Uplink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward wanted space station(◦)	2.05	2.05
Difference in wanted space station G/T toward wanted and interfering earth stations (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions					Interfering AMC-2 Emisssions				
Emission					9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)				5945.0	5945.0	5945.0	5945.0	5945.0
		ES power density (dBW/Hz)			-56.9	-54.1	-53.3	-57.3	-52.2
			ES gain (dBi)		45.9	45.9	45.9	45.9	53.5
				C/N	4.1	6.9	6.9	4.1	6.9
36M0G7W	5945.0	-56.6	49.8	8.0	-20.5	-17.7	-16.9	-20.9	-15.8
6M95G1W	5945.0	-57.0	45.5	8.0	-16.1	-13.2	-12.4	-16.4	-11.3
5M00G1W	5945.0	-57.0	45.5	8.0	-16.1	-13.2	-12.4	-16.4	-11.3
1M60G1W	5945.0	-55.2	43.6	8.0	-16.0	-13.2	-12.4	-16.3	-11.3
100KG1W	5945.0	-53.3	41.7	8.0	-16.0	-13.2	-12.4	-16.4	-11.3

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions					Wanted AMC-2 Emisssions				
Emission					9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)				5945.0	5945.0	5945.0	5945.0	5945.0
		ES power density (dBW/Hz)			-56.9	-54.1	-53.3	-57.3	-52.2
			ES gain (dBi)		45.9	45.9	45.9	45.9	53.5
				C/N	4.1	6.9	6.9	4.1	6.9
36M0G7W	5945.0	-56.6	49.8	8.0	-20.1	-20.1	-20.9	-19.7	-28.9
6M95G1W	5945.0	-57.0	45.5	8.0	-20.5	-20.5	-21.3	-20.1	-29.3
5M00G1W	5945.0	-57.0	45.5	8.0	-20.5	-20.5	-21.3	-20.1	-29.3
1M60G1W	5945.0	-55.2	43.6	8.0	-18.7	-18.7	-19.5	-18.3	-27.5
100KG1W	5945.0	-53.3	41.7	8.0	-16.8	-16.8	-17.6	-16.4	-25.6

Table A1-4A: AMC-9/AMC-2 C-Band Downlink C/I

C-band Downlink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward interfering space station (◦)	2.05	2.05
Difference in wanted and interfering space station gain toward wanted earth station (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions				Interfering AMC-2 Emisssions				
Emission				9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)			3720.0	3720.0	3720.0	3720.0	3720.0
		SS EIRP density (dBW/Hz)		-40.8	-37.9	-40.0	-45.1	-37.8
			ES gain (dBi)	42.1	42.1	42.1	42.1	42.1
36M0G7W	3720.0	-33.8	38.2	24.0	21.0	23.1	28.2	20.9
6M95G1W	3720.0	-38.6	38.2	19.2	16.2	18.3	23.4	16.1
5M00G1W	3720.0	-38.6	38.2	19.2	16.2	18.3	23.4	16.1
1M60G1W	3720.0	-38.6	38.2	19.2	16.2	18.3	23.4	16.1
100KG1W	3720.0	-38.6	38.2	19.2	16.2	18.3	23.4	16.1

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions				Wanted AMC-2 Emisssions				
Emission				9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)			3720.0	3720.0	3720.0	3720.0	3720.0
		SS EIRP density (dBW/Hz)		-40.8	-37.9	-40.0	-45.1	-37.8
			ES gain (dBi)	42.1	42.1	42.1	42.1	42.1
36M0G7W	3720.0	-33.8	38.2	13.8	16.7	14.6	9.5	16.8
6M95G1W	3720.0	-38.6	38.2	18.6	21.5	19.4	14.3	21.6
5M00G1W	3720.0	-38.6	38.2	18.6	21.5	19.4	14.3	21.6
1M60G1W	3720.0	-38.6	38.2	18.6	21.5	19.4	14.3	21.6
100KG1W	3720.0	-38.6	38.2	18.6	21.5	19.4	14.3	21.6

Table A1-4B: AMC-9/AMC-2 C-Band Downlink I/N

C-band Downlink C/I	System 1	System 2
Space station name	AMC-9	AMC-2
Nominal orbit location (+E, -W)	-83.00	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-82.95	-81.00
Longitude separation (◦)	1.95	1.95
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward interfering space station (◦)	2.05	2.05
Difference in wanted and interfering space station gain toward wanted earth station (dB)	0.0	0.0

AMC-2 into AMC-9									
Wanted AMC-9 Emisssions					Interfering AMC-2 Emisssions				
Emission					9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)				3720.0	3720.0	3720.0	3720.0	3720.0
		SS EIRP density (dBW/Hz)			-40.8	-37.9	-40.0	-45.1	-37.8
			ES gain (dBi)		42.1	42.1	42.1	42.1	42.1
				C/N	4.1	6.9	6.9	4.1	6.9
36M0G7W	3720.0	-33.8	38.2	8.0	-16.0	-13.0	-15.1	-20.2	-12.9
6M95G1W	3720.0	-38.6	38.2	8.0	-11.2	-8.2	-10.3	-15.4	-8.1
5M00G1W	3720.0	-38.6	38.2	8.0	-11.2	-8.2	-10.3	-15.4	-8.1
1M60G1W	3720.0	-38.6	38.2	8.0	-11.2	-8.2	-10.3	-15.4	-8.1
100KG1W	3720.0	-38.6	38.2	8.0	-11.2	-8.2	-10.3	-15.4	-8.1

AMC-9 into AMC-2									
Interfering AMC-9 Emisssions					Wanted AMC-2 Emisssions				
Emission					9M00G7W	1M51G7W	100KG1D	4M05G7W	36M0G7W
	Frequency (MHz)				3720.0	3720.0	3720.0	3720.0	3720.0
		SS EIRP density (dBW/Hz)			-40.8	-37.9	-40.0	-45.1	-37.8
			ES gain (dBi)		42.1	42.1	42.1	42.1	42.1
				C/N	4.1	6.9	6.9	4.1	6.9
36M0G7W	3720.0	-33.8	38.2	8.0	-9.7	-9.8	-7.7	-5.4	-9.9
6M95G1W	3720.0	-38.6	38.2	8.0	-14.5	-14.6	-12.5	-10.2	-14.7
5M00G1W	3720.0	-38.6	38.2	8.0	-14.5	-14.6	-12.5	-10.2	-14.7
1M60G1W	3720.0	-38.6	38.2	8.0	-14.5	-14.6	-12.5	-10.2	-14.7
100KG1W	3720.0	-38.6	38.2	8.0	-14.5	-14.6	-12.5	-10.2	-14.7

Table A1-5A: DIRECTV KU-79W/AMC-2 Ku-Band Uplink C/I

Ku-band Uplink C/I	System 1	System 2
Space station name	DIRECTV KU-79W	AMC-2
Nominal orbit location (+E, -W)	-78.80	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-78.85	-80.70
Longitude separation (◦)	1.85	1.85
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward wanted space station(◦)	1.93	1.93
Difference in wanted space station G/T toward wanted and interfering earth stations (dB)	0.0	0.0

AMC-2 into DIRECTV KU-79W									
Wanted DIRECTV KU-79W Emisssions				Interfering AMC-2 Emisssions					
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)			14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)		-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)	49.1	49.1	49.1	53.1	57.3
36M0G7W	14020.0	-58.6	59.8	30.8	30.8	30.8	34.3	33.0
1M30F9D	14005.0	-48.9	59.8	40.4	40.4	40.4	43.9	42.6

DIRECTV KU-79W into AMC-2									
Interfering DIRECTV KU-79W Emisssions				Wanted AMC-2 Emisssions					
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)			14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)		-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)	49.1	49.1	49.1	53.1	57.3
36M0G7W	14020.0	-58.6	59.8	30.4	30.4	30.4	30.4	34.7
1M30F9D	14005.0	-48.9	59.8	20.8	20.8	20.8	20.8	25.0

Table A1-5B: DIRECTV KU-79W/AMC-2 Ku-Band Uplink I/N

Ku-band Uplink C/I	System 1	System 2
Space station name	DIRECTV KU-79W	AMC-2
Nominal orbit location (+E, -W)	-78.80	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-78.85	-80.70
Longitude separation (◦)	1.85	1.85
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward wanted space station(◦)	1.93	1.93
Difference in wanted space station G/T toward wanted and interfering earth stations (dB)	0.0	0.0

AMC-2 into DIRECTV KU-79W									
Wanted DIRECTV KU-79W Emisssions					Interfering AMC-2 Emisssions				
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)				14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)			-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)		49.1	49.1	49.1	53.1	57.3
				C/N	6.9	6.9	6.9	9.3	6.9
36M0G7W	14020.0	-58.6	59.8	6.4	-24.4	-24.4	-24.4	-27.9	-26.6
1M30F9D	14005.0	-48.9	59.8	15.5	-24.9	-24.9	-24.9	-28.4	-27.1

DIRECTV KU-79W into AMC-2									
Interfering DIRECTV KU-79W Emisssions					Wanted AMC-2 Emisssions				
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W
	Frequency (MHz)				14020.0	14020.0	14020.0	14020.0	14020.0
		ES power density (dBW/Hz)			-55.1	-55.1	-55.1	-58.6	-57.3
			ES gain (dBi)		49.1	49.1	49.1	53.1	57.3
				C/N	6.9	6.9	6.9	9.3	6.9
36M0G7W	14020.0	-58.6	59.8	6.4	-23.5	-23.5	-23.5	-21.1	-27.8
1M30F9D	14005.0	-48.9	59.8	15.5	-13.9	-13.9	-13.9	-11.5	-18.1

Table A1-6A: DIRECTV KU-79W/AMC-2 Ku-Band Downlink C/I

Ku-band Downlink C/I	System 1	System 2
Space station name	DIRECTV KU-79W	AMC-2
Nominal orbit location (+E, -W)	-78.80	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-78.85	-80.70
Longitude separation (◦)	1.85	1.85
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward interfering space station (◦)	1.93	1.93
Difference in wanted and interfering space station gain toward wanted earth station (dB)	4.0	2.0

AMC-2 into DIRECTV KU-79W									
Wanted DIRECTV KU-79W Emisssions				Interfering AMC-2 Emisssions					
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W	300KF9D
	Frequency (MHz)			11720.0	11720.0	11720.0	11720.0	11720.0	12198.0
		SS EIRP density (dBW/Hz)		-29.1	-29.1	-29.2	-28.5	-26.3	-42.4
			ES gain (dBi)	47.7	47.7	47.7	51.7	41.7	58.5
36M0G7W	11720.0	-21.6	34.8	24.5	24.5	24.6	23.9	21.7	37.8
106KG9D	11704.0	-35.0	55.9	30.7	30.7	30.8	30.1	27.9	44.0

DIRECTV KU-79W into AMC-2									
Interfering DIRECTV KU-79W Emisssions				Wanted AMC-2 Emisssions					
Emission				6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W	300KF9D
	Frequency (MHz)			11720.0	11720.0	11720.0	11720.0	11720.0	12198.0
		SS EIRP density (dBW/Hz)		-29.1	-29.1	-29.2	-28.5	-26.3	-42.4
			ES gain (dBi)	47.7	47.7	47.7	51.7	41.7	58.5
36M0G7W	11720.0	-21.6	34.8	20.1	20.1	20.0	24.3	17.1	15.1
106KG9D	11704.0	-35.0	55.9	33.5	33.5	33.4	37.7	30.5	28.5

Table A1-6B: DIRECTV KU-79W/AMC-2 Ku-Band Downlink I/N

Ku-band Downlink C/I	System 1	System 2
Space station name	DIRECTV KU-79W	AMC-2
Nominal orbit location (+E, -W)	-78.80	-80.85
Stationkeeping tolerance (◦)	0.05	0.15
Assumed orbit location (+E, -W)	-78.85	-80.70
Longitude separation (◦)	1.85	1.85
Earth station pointing error (◦)	0.10	0.10
Earth station antenna efficiency (fraction)	0.65	0.65
Earth station angle toward interfering space station (◦)	1.93	1.93
Difference in wanted and interfering space station gain toward wanted earth station (dB)	4.0	2.0

AMC-2 into DIRECTV KU-79W											
Wanted DIRECTV KU-79W Emisssions					Interfering AMC-2 Emisssions						
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W	300KF9D
	Frequency (MHz)				11720.0	11720.0	11720.0	11720.0	11720.0	12198.0
		SS EIRP density (dBW/Hz)			-29.1	-29.1	-29.2	-28.5	-26.3	-42.4
			ES gain (dBi)		47.7	47.7	47.7	51.7	41.7	58.5
				C/N	6.9	6.9	6.9	9.3	6.9	9.0
36M0G7W	11720.0	-21.6	34.8	6.4	-18.1	-18.1	-18.2	-17.5	-15.3	-31.4
106KG9D	11704.0	-35.0	55.9	10.0	-20.7	-20.7	-20.8	-20.1	-17.9	-34.0

DIRECTV KU-79W into AMC-2											
Interfering DIRECTV KU-79W Emisssions					Wanted AMC-2 Emisssions						
Emission					6M95G7W	5M04G1W	100KG1W	1M40G7W	36M0G7W	300KF9D
	Frequency (MHz)				11720.0	11720.0	11720.0	11720.0	11720.0	12198.0
		SS EIRP density (dBW/Hz)			-29.1	-29.1	-29.2	-28.5	-26.3	-42.4
			ES gain (dBi)		47.7	47.7	47.7	51.7	41.7	58.5
				C/N	6.9	6.9	6.9	9.3	6.9	9.0
36M0G7W	11720.0	-21.6	34.8	6.4	-13.2	-13.2	-13.1	-15.0	-10.2	-6.1
106KG9D	11704.0	-35.0	55.9	10.0	-26.6	-26.6	-26.5	-28.4	-23.6	-19.5

DECLARATION

I, Stefan Brak, hereby certify under penalty of perjury that I am the technically qualified person responsible for 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/

Stefan Brak
Engineer, Spectrum Development and Management
Americas
SES

Dated: February 7, 2014