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 Americom," doing business as "SES") respectfully requests a modification of its license for the AMC-2 fixed-satellite space station to reassign the spacecraft to the nominal 19.2° E.L.,[1] where it will be flown in inverted mode in order to provide Ku-band coverage of Southern Africa, and to authorize the deorbit of the satellite at end of life. SES requests authority to perform Telemetry, Tracking and Command ("TT&C") using certain C-band and Ku-band frequencies[2] in order to relocate AMC-2 from 4.98º E.L. to the nominal 19.2° E.L., and to operate both the C- and Ku-band TT&C and Ku-band communications payloads on AMC-2 after it has arrived. SES will operate AMC-2 at the nominal 19.2° E.L. location in accordance with the International Telecommunication Union ("ITU") filings and coordination agreements of the Luxembourg Administration. Grant of the requested authority

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[1] Specifically, in view of the multiple SES satellites operating at the nominal 19.2° E.L. orbital location, SES is seeking authority to operate the AMC-2 satellite at a slight offset at 19.0º E.L.+/-0.1 degrees.

[2] The AMC-2 TT&C frequencies and nominal polarizations are as follows:
Command: 6423.5 MHz (vertical polarization; uplink)
Telemetry: 3700.5 MHz (vertical polarization; downlink), 4199.5 MHz (vertical polarization; downlink), and 12198.0 MHz (horizontal polarization; downlink).

will serve the public interest by allowing SES to use AMC-2 to expand service to Southern Africa from the nominal 19.2º E.L. orbital location.

A completed FCC Form 312 is attached, and SES incorporates by reference the technical information previously provided in support of AMC-2.[3] In addition, SES is providing 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 the nominal 5° E.L. location under the ITU satellite network filings of the Administration of Sweden.[4] SES deployed AMC-2 to that location in order to augment existing services pending launch and operation of the new SES-5 satellite, which had been delayed. SES-5 is currently scheduled for launch in June of this year. Following SES-5's arrival at the nominal 5° E.L. location, SES proposes to relocate AMC-2 to the nominal 19.2° E.L. orbital location. The redeployment of AMC-2 will not impact continuity of operations at the nominal 5° E.L. location because SES will not move AMC-2 until after SES-5 is operational.

Relocation Authority. Grant of the requested authority to relocate and operate AMC-2 will serve the public interest and is consistent with Commission precedent. The Commission has repeatedly observed that its policy is to allow "satellite operators to rearrange

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[3] The most recent technical information regarding AMC-2 is found in File No. SAT-MOD-20111025-00209.*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.

[4] *See* File No. SAT-MOD-20111025-00209 (the "AMC-2 4.98° E.L. Application"), grant-stamped Feb. 24, 2012 (the "*AMC-2 4.98° E.L. Grant*").

satellites in their fleet to reflect business and customer considerations where no public interest factors are adversely affected."[5] As the International Bureau has explained:

> the Commission attempts, when possible, to leave spacecraft design decisions to the space station licensee because the licensee is in a better position to determine how to tailor its system to meet the particular needs of its customers. Consequently the Commission will generally grant a licensee's request to modify its system, provided there are no compelling countervailing public interest considerations.[6]

Pursuant to this policy, the Commission has routinely authorized satellite operators to configure or reconfigure their fleets in order to satisfy customer demand, including demand for capacity outside the U.S. For example, the Commission has authorized U.S. licensees to relocate satellites from orbital positions over the U.S. to locations without U.S. coverage in order to respond to existing or potential demand for capacity.[7] Similarly, the

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[5] *SES Americom, Inc.*, Order and Authorization, DA 06-757 (IB rel. Apr. 7, 2006) at 4, ¶ 8,*citing Amendment of the Commission's Space Station Licensing Rules and Policies,* Second Report and Order, 18 FCC Rcd 12507, 12509, ¶ 7 (2003).

[6] *AMSC Subsidiary Corp.*, Order and Authorization, DA 98-493, 13 FCC Rcd 12316 (IB 1998)("*AMSC Modification Order*")at 12318, ¶ 8 (footnote omitted). Although AMSC never implemented the relocation authorized in this case, the Commission has repeatedly reaffirmed its policy of allowing licensees to change their fleet configurations to accommodate customer requirements. *See, e.g., Space Station Licensing Rules and Policies,* First Reconsideration Order and Fifth Report and Order, FCC 04-147, 19 FCC Rcd 12637, 12653, ¶ 39 ("we generally permit licensees to modify their systems to adapt to changing business and customer needs," citing *AMSC Modification Order* and other cases).

[7] *See, e.g.,AMC-2 4.98° E.L. Grant* (authorizing relocation of AMC-2 from 78.95° W.L. to 4.98° E.L.)*; Intelsat North America LLC,* Call Sign S2159, File No. SAT-T/C-20100112-00009 ("Galaxy 27 Relicensing Application"), grant-stamped July 30, 2010 (authorizing Intelsat to relocate Galaxy 27 from 129° W.L. to 45.10° E.L.); *PanAmSat Licensee Corp.*, Call Sign S2253, File No. SAT-MOD-20080225-00051, grant-stamped July 22, 2008 (authorizing relocation of Galaxy 11 from 91° W.L. to 32.80° E.L. in order to supplement service provided there by Intelsat 802, which had suffered an anomaly that reduced its available power); *AMSC Modification Order* (authorizing AMSC to relocate its satellite away from 101° W.L. in order to provide service to southern Africa).

Commission has granted U.S. licenses to operators for satellites at locations from which no U.S. coverage is planned or possible.[8]

Here, the proposed change will allow SES to make efficient use of AMC-2 in order to expand the available capacity at the nominal 19.2° E.L. orbital location. Because the move will not occur until SES-5 is operating at the nominal 5° E.L. location, the relocation of AMC-2 will not have any impact on existing services.

Reassignment of AMC-2 to the nominal 19.2º E.L. orbital location will not adversely affect other operators. SES will operate only the TT&C frequencies of AMC-2 during the drift. SES will follow standard industry practices for coordination of TT&C transmissions during the relocation process. Furthermore, as discussed in the Technical Appendix, the proposed stationkeeping volume for AMC-2 will not overlap with that of any other spacecraft.[9]

At the nominal 19.2° E.L. orbital location, SES will operate the AMC-2 satellite under Luxembourg's ITU satellite network filings and coordination agreements. The nominal 19.2° E.L. orbital location is a core orbital location for SES Americom's commonly owned affiliate, SES ASTRA S.A. ("SES ASTRA"). SES ASTRA already operates a number of other satellites at that location under the authority of the Luxembourg Administration for the provision of DTH and other services in Europe. In addition, the Luxembourg Ministry of Communications and Media has acknowledged that the FCC-licensed AMC-2 satellite may operate at the nominal

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[8] *See, e.g., Afrispace, Inc.*, Order and Authorization, DA 06-4, 21 FCC Rcd 7 (IB 2006) (authorizing launch and operation of AfriStar-2 satellite for service to Africa and Europe from 21° E.L.); *Assignment of Orbital Locations to Space Stations in the Ka-Band*, Order, DA 96-708 (IB 1996) (assigning 33 orbital locations between 62° W.L. and 175.25° E.L. to 13 Ka-band applicants, finding that the public interest would be served by authorizing international operations pending the development of policies for Ka-band satellite service within the U.S.).

[9] *See* Technical Appendix at Section 8.0 (noting that the SES spacecraft ASTRA 1H, ASTRA 1KR, ASTRA 1L, ASTRA 1M and ASTRA 2C will be positioned at 19.2° E.L. +/- 0.10 degrees, adjacent to the stationkeeping volume proposed for AMC-2).

19.2° E.L. orbital position utilizing the Ku-band communications payload and the C-band TT&C frequencies of the satellite.[10] The Technical Appendix demonstrates that the AMC-2 network is compliant with Commission rules for operation in a two-degree spacing environment and is compatible with co-frequency satellites adjacent to the nominal 19.2º E.L. orbital location.

SES proposes to operate AMC-2 specifically at 19.0º E.L. with an east-west stationkeeping tolerance of +/- 0.1 degrees. As discussed above, the stationkeeping volume proposed for AMC-2 will not overlap with that of any other spacecraft. This relaxed stationkeeping tolerance will extend the fuel life of AMC-2 and will not adversely affect any other operators. SES herein seeks a waiver of Section 25.210(j) of the Commission's rules to permit AMC-2 to operate with a +/- 0.1 degree stationkeeping tolerance at 19.0º E.L.

Deorbit Authority. SES seeks Commission authority to relocate AMC-2 at its end of life to a disposal orbit with a minimum perigee altitude of at least 150 km above the geostationary arc.[11] Because AMC-2 was launched before March 18, 2002, the spacecraft is not subject to the minimum perigee requirements of Section 25.283(a).[12] The Commission has previously authorized the use of a 150-km deorbit altitude for spacecraft launched prior to

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[10] *See* Letter of Pierre Goerens to Robert G. Nelson dated May 15, 2012, attached as Exhibit 1 hereto.

[11] SES previously requested deorbit authority for AMC-2 in the AMC-2 4.98° E.L. Modification. *See* AMC-2 4.98° E.L. Modification, Narrative at 6-7. However, in granting that application, the Commission did not explicitly address the deorbit authority request or specifically provide such authority in the terms and conditions of grant. *See AMC-2 4.98° E.L. Grant*. Accordingly, out of an abundance of caution, SES is repeating its request in the instant modification application. The Commission has previously addressed another aspect of the AMC-2 deorbit plan, granting a waiver of the venting requirements of Section 25.283(c) of the rules with respect to oxidizer tanks on board the spacecraft that cannot be vented at the end of the satellite's useful life. *See* File No. SAT-MOD-20100324-00056, grant-stamped June 21, 2010, Attachment at ¶ 8.

[12] *See* 47 C.F.R. § 25.283(d).

March 18, 2002.[13] Calculations performed by SES indicate that at the conclusion of the requested extension period, the spacecraft will have sufficient fuel to reach the proposed deorbit altitude, barring a catastrophic failure of satellite components. Grant of the requested deorbit authority is consistent with Commission precedent and will facilitate placement of AMC-2 in a disposal orbit at its end of life.

WAIVER REQUESTS

SES requests limited waivers of the Commission's requirements in connection with the instant modification application. Grant of the waivers is consistent with Commission policy:

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[14]

Section 25.114(d)(3): SES 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 4.0 of the Technical Appendix, SES 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

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[13] *See, e.g., SES Americom, Inc.,* Application for Modification of Satcom SN-4 Fixed Satellite Space Station License, DA 05-1812, 20 FCC Rcd 11542 (Sat. Div. 2005) at ¶ 15.

[14] *PanAmSat Licensee Corp*., 17 FCC Rcd10483, 10492 (Sat. Div. 2002) (footnotes omitted).

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, including with respect to AMC-2.[15] In acting on these requests, the Commission recognized that the purpose of the rule is to ensure that adequate information is available to allow evaluation of the potential for harmful interference.[16] Here, in lieu of the single .gxt file that cannot be provided, SES has submitted alternative data sufficient to permit the Commission and any interested party to evaluate the antenna's interference potential. Accordingly, SES requests that the Commission grant a limited waiver of Section 25.114(d)(3).

Section 25.202(g): SES also requests any necessary waiver of Section 25.202(g) of the Commission's rules. That rule provides that "[t]elemetry, tracking and telecommand functions for U.S. domestic satellites shall be conducted at either or both edges of the allocated band(s)."[17] The Commission has explained that:

> The purpose of this rule is to simplify the coordination process for satellite systems, to provide an incentive for an operator to maximize the efficiency of its system's TT&C operations, and to minimize the constraints placed on other satellite operations.[18]

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[15] *See, e.g., AMC-2 4.98° E.L. Grant*, Attachment at ¶ 12 (waiving Section 25.114(d)(3) with respect to AMC-2 global horn antenna); *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 Authorization, DA 06-2439, 21 FCC Rcd 14023, 14033 at ¶ 17 (IB 2006) (conditionally accepting antenna gain information not filed in .gxt format).

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

[17] 47 C.F.R. § 25.202(g).

[18] *Orbcomm License Corp*., 23 FCC Rcd 4804 at ¶ 20 (IB & OET 2008).

Here, SES does not propose to operate the AMC-2 C-band communications payload while the spacecraft is located at the nominal 19.2º E.L. orbital location, but does propose to use limited C-band frequencies for TT&C. SES submits that this configuration conforms to Section 25.202(g), which does not require TT&C to be conducted in a space station's operating bands but simply in "either or both ends of the allocated bands for the service."[19] SES's intention to perform TT&C functions at the edge of the C-band, which is allocated for FSS service and for which AMC-2 has been licensed, is therefore consistent with the plain language of Section 25.202(g).[20]

SES is aware, however, that in some decisions the Commission has characterized Section 25.202(g) as requiring "FSS systems to operate their tracking, telemetry, and command (TT&C) links at the edges of the frequency bands *in which they are providing service*."[21] Accordingly, SES requests grant of any necessary waiver of Section 25.202(g) to allow use of AMC-2 C-band channels for TT&C at the nominal 19.2º E.L. orbital location.

Grant of a waiver will not undermine the objectives of the rule, which include facilitating coordination, avoiding undue constraints on other satellite operations, and ensuring efficient use of spectrum for TT&C. As discussed in the Technical Appendix, the proposed AMC-2 TT&C operations in the C-band are compatible with adjacent C-band spacecraft and will

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19 *DIRECTV Enterprises, LLC*, DA 06-1493, 21 FCC Rcd 8028 (Sat. Div. 2006) at ¶ 11.

20 It is also consistent with the Commission's prior action in a similar factual scenario involving AMC-2. Specifically, the Commission authorized SES to use C-band channels for TT&C during interim operations of AMC-2 at 105º W.L. but did not authorize use of the spacecraft's C- band communications payload. *See SES Americom, Inc.*, DA 03-2197, 18 FCC Rcd 13143 (Sat. Div. 2003). There is no suggestion in that decision that the use of C-band for TT&C only required a waiver of Section 25.202(g).

21 *See, e.g.*, *Northrop Grumman Space & Mission Systems Corp.*, DA 09-428, 24 FCC Rcd 2330 (IB 2009) at ¶ 94 (emphasis added).

be individually coordinated consistent with industry practice. Thus, no concerns about coordination or constraining other satellite operations are raised here.[22] Furthermore, AMC-2 was designed to operate with both service links and TT&C functions in the C-band. As a result, SES had every incentive to ensure that the AMC-2 TT&C subsystem uses spectrum efficiently, and grant of a waiver now will not impair that efficiency.

Grant of a waiver will also serve the public interest. By allowing SES to use diverse TT&C frequencies, the waiver will enhance the reliability of TT&C functions, facilitating the safe operation of AMC-2 at the nominal 19.2º E.L. orbital location.

Section 25.210(j): Section 25.210(j) specifies that geostationary space stations "must be maintained within 0.05º of their assigned orbital longitude in the east/west direction, unless specifically authorized by the Commission to operate with a different longitudinal tolerance." 47 C.F.R. § 25.210(j). The Commission has previously waived this rule based on a finding that allowing an increased stationkeeping volume would "not adversely affect the operations of other spacecraft, and would conserve fuel for future operations."[23] Indeed, it has granted such a waiver previously for AMC-2 at its current 4.98° E.L. orbital location[24] and at its previous 100.95° W.L. orbital location.[25]

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22 *See, e.g., INTELSAT LLC*, FCC 00-287, 15 FCC Rcd 15460 (2000) at ¶¶ 95-100 (granting a waiver of § 25.202(g) where TT&C operations were already coordinated with adjacent operators).

23 *See, e.g., SES Americom, Inc. Application for Modification of Satcom SN-4 Fixed Satellite Space Station License*, 20 FCC Rcd 11542, 11545 (Sat. Div. 2005).

24 *See AMC-2 4.98° E.L. Grant*, Attachment at ¶ 11.

25 *See* File Nos. SAT-MOD-20080124-00030 & SAT-AMD-20080311-00070, grant-stamped May 19, 2008, Attachment at ¶ 1.

The facts here fit squarely within this precedent. As discussed above, allowing AMC-2 to be maintained within an increased stationkeeping volume will not harm other operators. AMC-2's stationkeeping volume will not overlap with that of any other satellites. Allowing AMC-2 to be flown at 19.0° E.L. in an expanded east-west stationkeeping volume of +/-0.1 degrees will result in fuel savings for the spacecraft. This will prolong the time during which AMC-2 will be available to provide service in response to customer requirements. Under these circumstances, grant of any necessary waiver of Section 25.210(j) will serve the public interest.

CONCLUSION

For the foregoing reasons, SES seeks a modification of the AMC-2 license to reassign the spacecraft to the nominal 19.2° E.L. (at 19.0º E.L.+/- 0.1 degrees to be precise) for operations in the Ku-band and limited TT&C operations in the C-band, as described in the attached materials. SES also requests authority to deorbit AMC-2 at its end of life.

Respectfully submitted,

SES AMERICOM, INC.

By: */s/ Daniel C.H. Mah*

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Dated: May 24, 2012

Exhibit 1

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère d'État
Commissaire du Gouvernement
auprès de SES Astra

Luxembourg, 15 May 2012

Robert G. Nelson
Chief, Satellite Division
International Bureau
Federal Communications Commission
445 12th Street S.W.
Washington, D.C. 20554

Re: SES ASTRA S.A.

Dear Mr. Nelson:

I hereby confirm that SES ASTRA S.A., itself or through its affiliates, may operate the FCC-licensed AMC-2 satellite at the nominal 19.2° E.L. orbital location (specifically, the 19.0° E.L. orbital location) using the Ku-band frequencies for communications (11.7-12.2 GHz downlink / 14.0-14.5 GHz uplink) and certain C-band frequencies for Telemetry, Tracking & Command (6423.5 MHz telecommand; 3700.5 MHz, 4199.5 MHz, and 12198 MHz telemetry/tracking).

The satellite will be operating consistent with the following ITU satellite network filings submitted on behalf of Luxembourg: DBL-G3-19.2E published in Special Section AP30/E/363 of IFIC 2545, LUX-G3-19.2E published in Special Section CR/C/1380 of IFIC 2540, and LUX-G6-5 published in Special Section CR/C2239 of IFIC 2632 (for TT&C only).

Yours sincerely,

The Commissioner of the Government at SES ASTRA

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ATTACHMENT A

TECHNICAL APPENDIX

IN SUPPORT OF AMC-2 AT 19.0°E.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) seeking reassignment of AMC-2 to 19.0° E.L. from its current orbital position of 4.98º E.L. 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 19.0°E.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. From the orbital location 19.0° E.L, the spacecraft will be flown in inverted mode, and the Ku-band transponders will provide coverage of Southern Africa. The C-band communications transponders will not be used at 19.0° E.L. A small portion of the C-band frequencies will be used for TT&C.

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 19.0°E.L. with respect to previous Schedule S submissions for this spacecraft, and addresses some items not covered in the Schedule S.

1. *Transponder frequency plan.* No changes.
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 telecommand carriers ("GBLR"), as well as for C-band telemetry ("GBLT"). A typical plot of the global horn used for the command function is shown in Annex 1, Figure 9. The communication antennas ("KTV" and "KTH") are used for transmitting telemetry carriers in Ku-band. Table 1 below shows the TT&C carrier center frequencies and bandwidths.

[1] The most recent technical information regarding AMC-2 is found in File No. SAT-MOD-20111025-00209. *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.

Table 1: TT&C Carrier Frequencies

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

Note: Although not proposed to be used at 19.0° E.L., the C-band telemetry carriers can also be transmitted through the communications antennas. In that case, the 3700.5 MHz carrier is horizontally 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.* Same as at 101° W.L.[2]
5. *Transponder frequency response of C- and Ku-transponder*. Same as at 101° W.L.[3]
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 19.0° E.L. C-band link budgets (other than for TT&C) are not provided because C-band service will not be provided at 19° E.L.
7. *Beam diagrams.* The attached beam diagrams in Section S8 have been updated to reflect the projected coverages at 19.0° E.L.
8. *TT&C Station Locations*. Information is provided in Section S14 regarding the TT&C earth stations in Luxembourg and Greece that will be used with AMC-2 at19.0° E.L.

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

Table 2 demonstrates that the PFD values for the C-band TT&C carriers from AMC-2 at 19.0° E.L. comply with §25.208. No C-band operations are planned at 19.0° E.L.

[2] File No. SAT-MOD-20080124-00030, Technical Appendix at Page 3.

[3] *Id*.

Table 2: Maximum PFD values and margins relative to permissible limits of §25.208 (Max. PFD computed based on equal power distribution across the telemetry bandwidth[4])

Elevation angle (degrees)	Max. EIRP (dBW)	MAX. PFD (dBW/m2/4KHz)	Permissible max PFD (dBW/m2/4KHz) from §25.208)	Margin (dB)
5	12.0	-170.04	-152.0	18.04
10	12.0	-169.92	-149.5	20.42
15	12.0	-169.83	-147.0	22.83
20	12.0	-169.71	-144.5	25.21
25	12.0	-169.61	-142.0	27.61

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 1 shows the typical antenna gain contours for 8 different cases: transmit and receive beams, H- and V-polarizations, and C- and Ku-beams. The peak EIRP and G/T values in different beams are shown in Table 2.

1. CRV.gxt (V-pol, receive beam)
2. CTV.gxt (V-pol, transmit beam)
3. KRH.gxt (H-pol, receive beam)
4. KTH.gxt (H-pol, transmit beam)
5. CRH.gxt (H-pol, receive beam)
6. CTH.gxt (H-pol, transmit beam)
7. KRV.gxt (V-pol, receive beam)
8. KTV.gxt (V-pol, transmit beam)

[4] For example, if the maximum EIRP is 12 dBW at the 5 degrees elevation contour, it was assumed that this power was evenly spread over the 300 KHz telemetry bandwidth. The EIRP density in 4 kHz would then be calculated as follows:

$12 - 10\log(0.3*10^6/4*10^3) = -6.75$dBW/4kHz.

Table 3: Maximum EIRP and G/T values

Beam	File name in Schedule S[5]	Max. EIRP, dBW	Max. G/T, dB/K
CRV (C-band, V-pol, receive beam)	CRV.gxt		4.05
CTV (C-band, V-pol, transmit beam)	CTV.gxt	42.10	
KRH (Ku-band, H-pol, receive beam)	KRH.gxt		5.93
KTH (Ku-band, H-pol, transmit beam)	KTH.gxt	49.68	
CRH (C-band, H-pol, receive beam)	CRH.gxt		5.82
CTH (C-band, H-pol, transmit beam)	CTH.gxt	40.80	
KRV (Ku-band, V-pol, receive beam)	KRV.gxt		3.46
KTV (Ku-band, V-pol, transmit beam)	KTV.gxt	49.20	

The .gxt files for the C-band beams are provided for information purposes only. No C-band operations (except for TT&C on the GBLR and GBLT beams) are planned at 19.0° E.L.
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 a figure in Annex 1. SES 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.

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

Tables 4 and 5 show the emission designators and typical link budgets. Further carrier details and the TT&C link budgets are included in the Schedule S, Page S13.

[5] Because of technical difficulties with uploading the GXT files to Schedule S, copies of the GXT files are being provided to the Commission as a separate data package.

Table 4: Link budgets for Ku-band carriers

Link budgets for 4 typical Ku-band carriers

Link Parameters	**Units**	**6M95G1W**	**5M00G1W**	**100KG1W**	**1M60G1W**
Uplink Frequency	GHz	14.240	14.240	14.240	14.240
Downlink Frequency	GHz	11.940	11.940	11.940	11.940
Carrier Allocated Bandwidth	kHz	6945.0	5035.0	55.0	1390.0
Energy Dispersal	MHz	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
Earth Station Diameter	m	2.4	2.4	2.4	3.8
Earth Station Gain	dBi	49.1	49.1	49.1	53.1
Uplink Input Power per Carrier	dBW	12.5	11.1	-9.0	1.5
Free Space Loss	dB	206.9	206.9	206.9	206.9
G/T Satellite	dB/K	0.0	0.0	0.0	0.0
C/N Thermal Uplink	dB	15.6	15.6	15.6	16.2
C/I XPOL, ACI, IM, ASI	dB	20.0	20.0	20.0	20.6
C/(N+I) uplink	dB	14.3	14.3	14.3	14.9
Downlink:					
Satellite e.i.r.p. per carrier (-2.9dB contour)	dBW	35.6	34.2	14.0	28.7
Maximum e.i.r.p. density	dBW/4kHz	6.9	6.9	6.9	7.4
Free Space Loss	dB	205.5	205.5	205.5	205.5
Earth Station Diameter	m	2.4	2.4	2.4	3.8
Earth Station Gain	dBi	47.7	47.7	47.7	51.7
Noise Temperature	kHz	120.0	120.0	120.0	120.0
Earth Station G/T	dB/K	26.9	26.9	26.9	30.9
C/N Thermal Downlink	dB	18.0	18.0	18.0	22.6
C/I XPOL, ACI, IM, ASI	dB	17.7	17.7	17.7	22.2
C/(N+I) downlink	dB	14.8	14.8	14.8	19.4
Adjacent Satellite Interference:					
Uplink Inp. Pwr. Dens. @ 2 degrees	dBW/Hz	-50	-50	-50	-50
Downlink e.i.r.p. Dens @ 2 degrees	dBW/Hz	-26	-26	-26	-26
C/I up (single satellite)	dB	23.0	23.0	23.0	23.6
C/I dn (single satellite)	dB	20.7	20.7	20.7	25.2
Aggregate C/I up	dB	20.0	20.0	20.0	20.6
Aggregate C/I down	dB	17.7	17.7	17.7	22.2
Overall:					
C/(N+I) overall	dB	11.5	11.5	11.5	13.5
C/(N+I) required	dB	6.9	6.9	6.9	9.3
System Margin	dB	4.6	4.6	4.6	4.3

Link budgets for typical Ku-band carriers (Full Transponder)

Carrier Bandwidth	MHz	36.00
Uplink Frequency	MHz	14240.00
Downlink Frequency	MHz	11240.00
Satellite SFD	dBW/m2	-93.45
Satellite G/T	dB/K	2.34
Uplink EIRP	dBW	74.05
Uplink Antenna size	m	6.1
Uplink C/N	dB	23.41
C/I system	dB	14
C/N system required	dB	6.58
Faded system margin	dB	65.00%
Receive antenna size	dBi	1.20
Receive antenna G/T	dB/K	18.13
Satellite EIRP	dBW	44.94
Clear sky downlink C/N	dB	12.04
Minimum downlink C/N	dB	8.85
Downlink C/N margin	dB	3.19
Total System C/N	dB	9.71
Total System C/N margin	dB	2.13

Table 5: Link budgets for 4 typical TT&C carriers

Command carrier link budget (C-band, uplink)

Uplink Flux Density	dBW/m^2	-75.0
Isotropic Aperture	$dB\text{-}m^2$	-37.3
Polarization loss	dB	-0.2
S/C antenna gain	dB	6.5
On-board losses	dB	-20.0
Received input power	dBW	-126.0
Required input power	dBW	-135.0
Margin	dB	9.0

Budget for C-band telemetry (downlink)

S/C EIRP	dBW	0.0
Path Loss	dB	-196.0
Rain Loss	dB	-1.1
Polarization loss	dB	-0.3
Ground station pointing loss	dB	-0.5
Ground station G/T	dB/K	33.0
Boltzmann constant	dB-Hz K/W	228.6
Carrier to noise density	dB-Hz	63.7
Modulation loss	dB	-10.0
1/bitrate (4096 BPS Telemetry)	dB-bps	-36.1
Implementation loss	dB	-2.0
Received Eb/No	dB	15.6
Required Eb/No	dB	11.3
Eb/No margin	dB	4.3

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 -22.8 dBW/Hz; and in the 14-14.5 GHz band, the input power density of the uplink digital carriers of earth stations operating with AMC-2 will not exceed -47 dBW/Hz.

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

Annexes 2 and 3 to this Technical Appendix provide analyses demonstrating the compatibility of AMC-2 at 19.0° E.L. with neighboring spacecraft. Annex 2 addresses Ku-band, and Annex 3 addresses C-band.

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.[6] SES incorporates that information by reference and provides below a few minor updates to its previous showing.

[6] *See* File No. SAT-MOD-20100324-00056, Technical Appendix, Section 7.

§25.114(d)(14)(i): Onstation operations require stationkeeping within the +/- 0.1 degree E-W control box.

§25.114(d)(14)(iii): The instant application seeks authority for operation of AMC-2 at the 19.0° E.L. orbital location. SES currently operates ASTRA 1H, ASTRA 1KR, ASTRA 1L, ASTRA 1M and ASTRA 2C in the vicinity of the planned orbital location for AMC-2. When AMC-2 arrives at 19.0° E.L., ASTRA 1H, ASTRA 1KR, ASTRA 1L, ASTRA 1M and ASTRA 2C will be positioned at 19.2 ° E.L. with a station keeping accuracy of +/- 0.10 degree. There will therefore be no overlap of the AMC-2 stationkeeping volume with that of the other ASTRA satellites. SES is not aware of any other FCC- or non-FCC licensed spacecraft that are operational or planned to be deployed at 19.0° E.L. or to nearby orbital locations such that there would be an overlap with the requested stationkeeping volume of AMC-2.

§25.114(d)(14)(iv): SES plans to relocate AMC-2 at its end of life to a disposal orbit with a minimum perigee altitude of at least 150 km above the geostationary arc. SES has previously provided the supporting information for this disposal plan.[7]

[7] *See id.*

ANNEX 1

COVERAGE MAPS

Figure 1.
Transmit beam CTH
C-band, H-pol, Antenna peak gain: 30.31 dB, peak EIRP: 40.8dBW

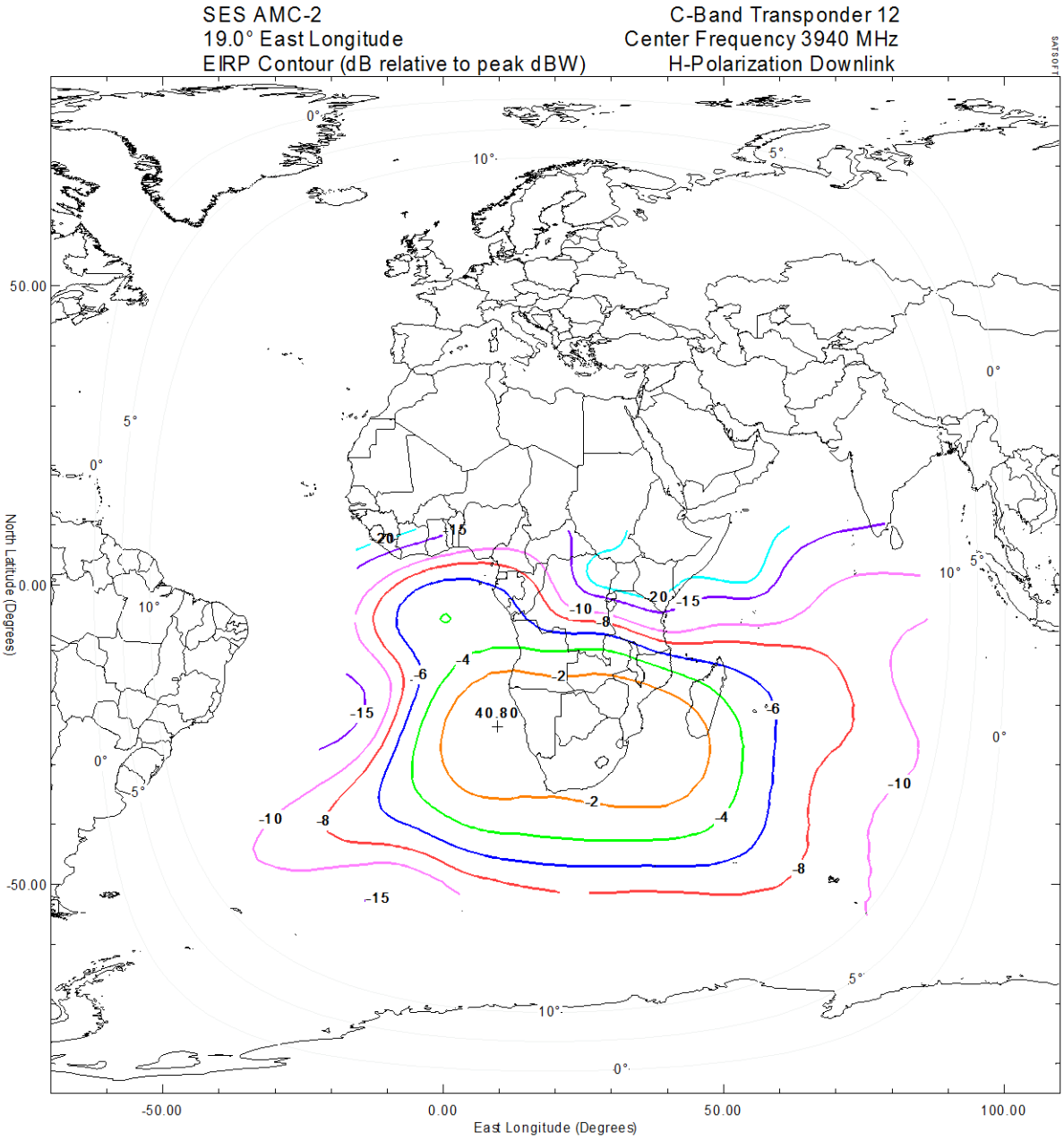

Figure 2.
Receive beam CRV
C-band, V-pol, Antenna peak gain: 31.3 dB, peak G/T: 4.05 dB/K

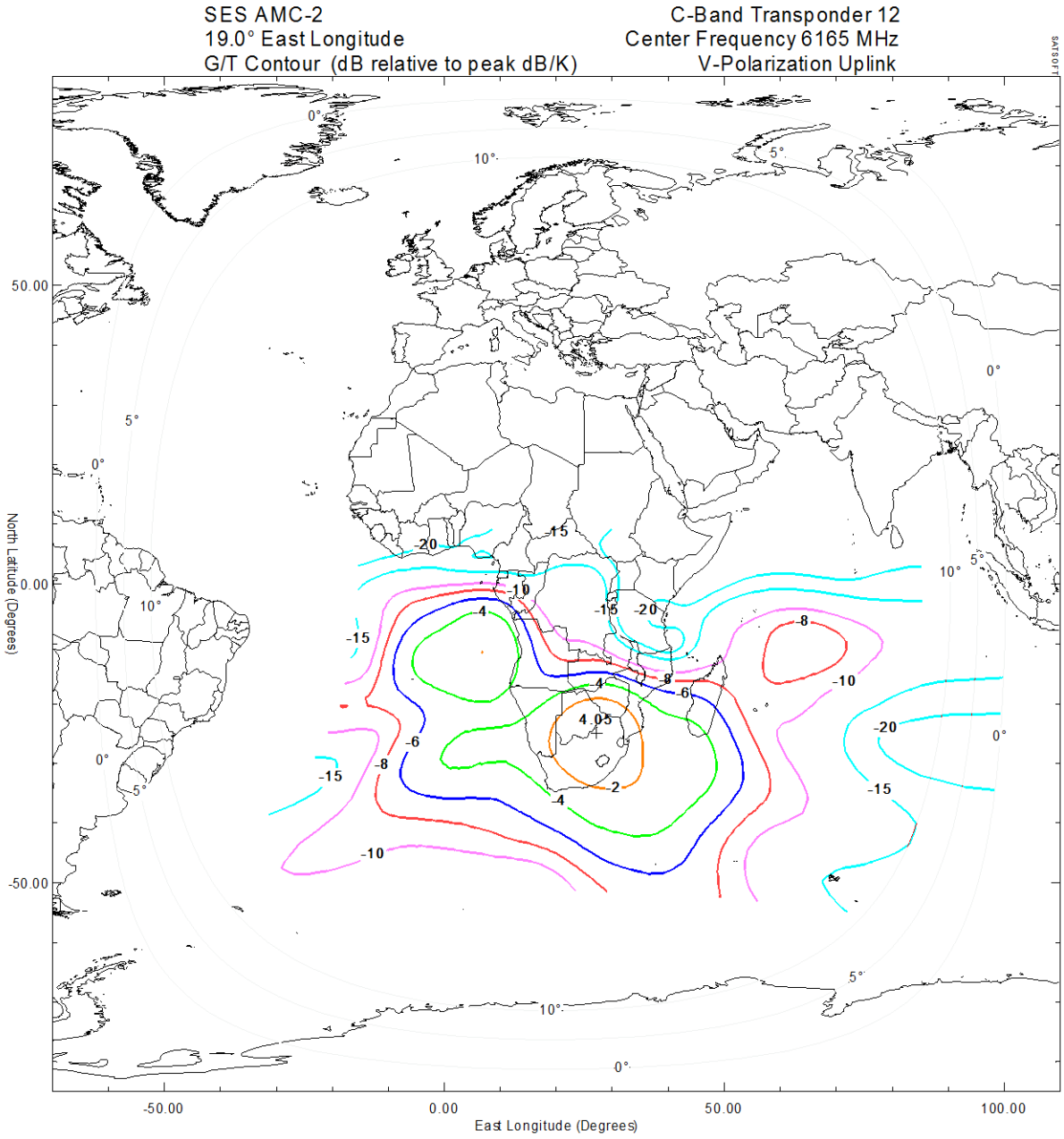

Figure 3.
Transmit beam CTV
C-band, V-pol, Antenna peak gain: 31.04 dB, peak EIRP: 42.10dBW

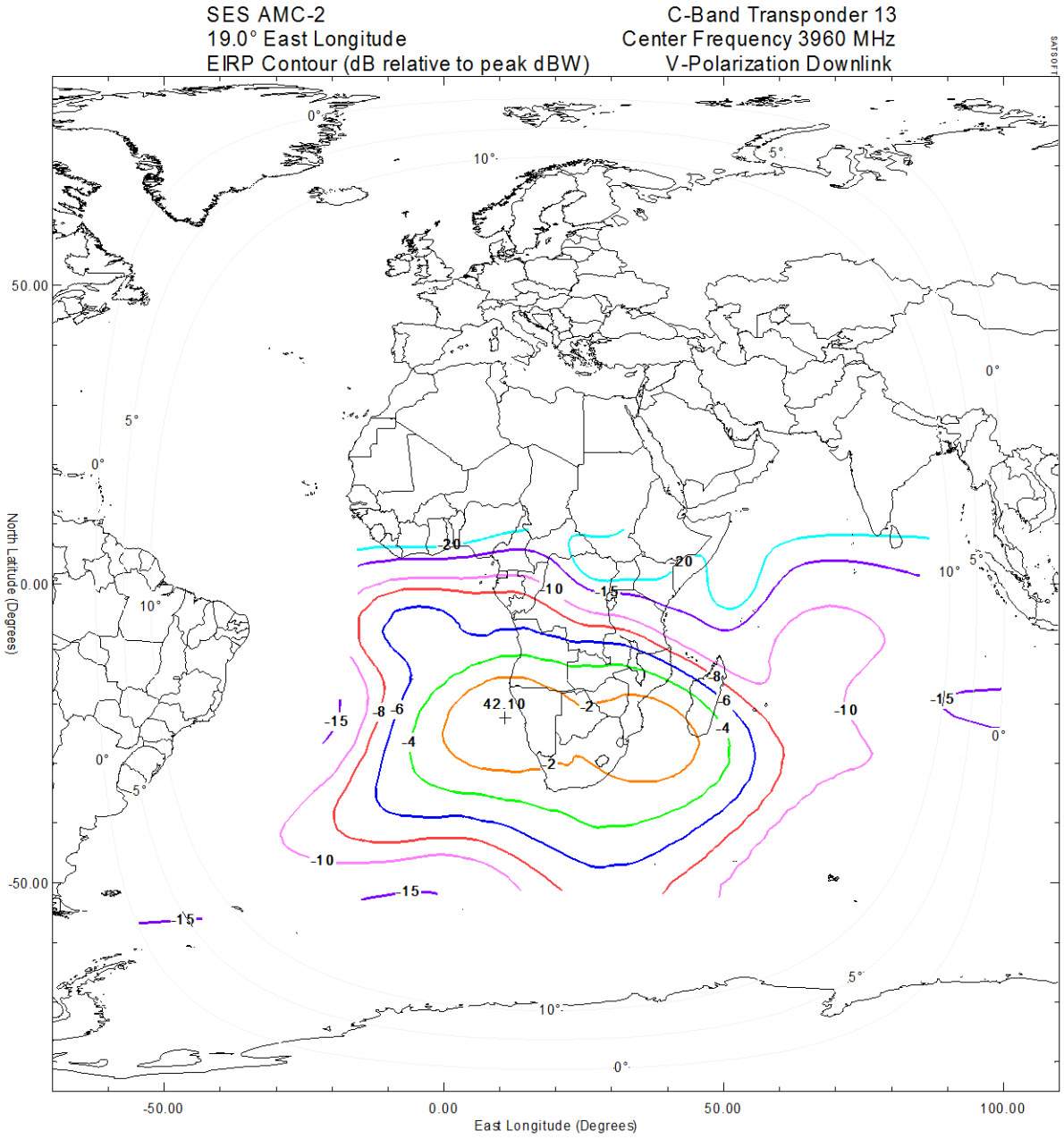

Figure 4.
Receive beam CRH
C-band, H-pol, Antenna peak gain: 32.89 dB, peak G/T: 5.82 dB/K

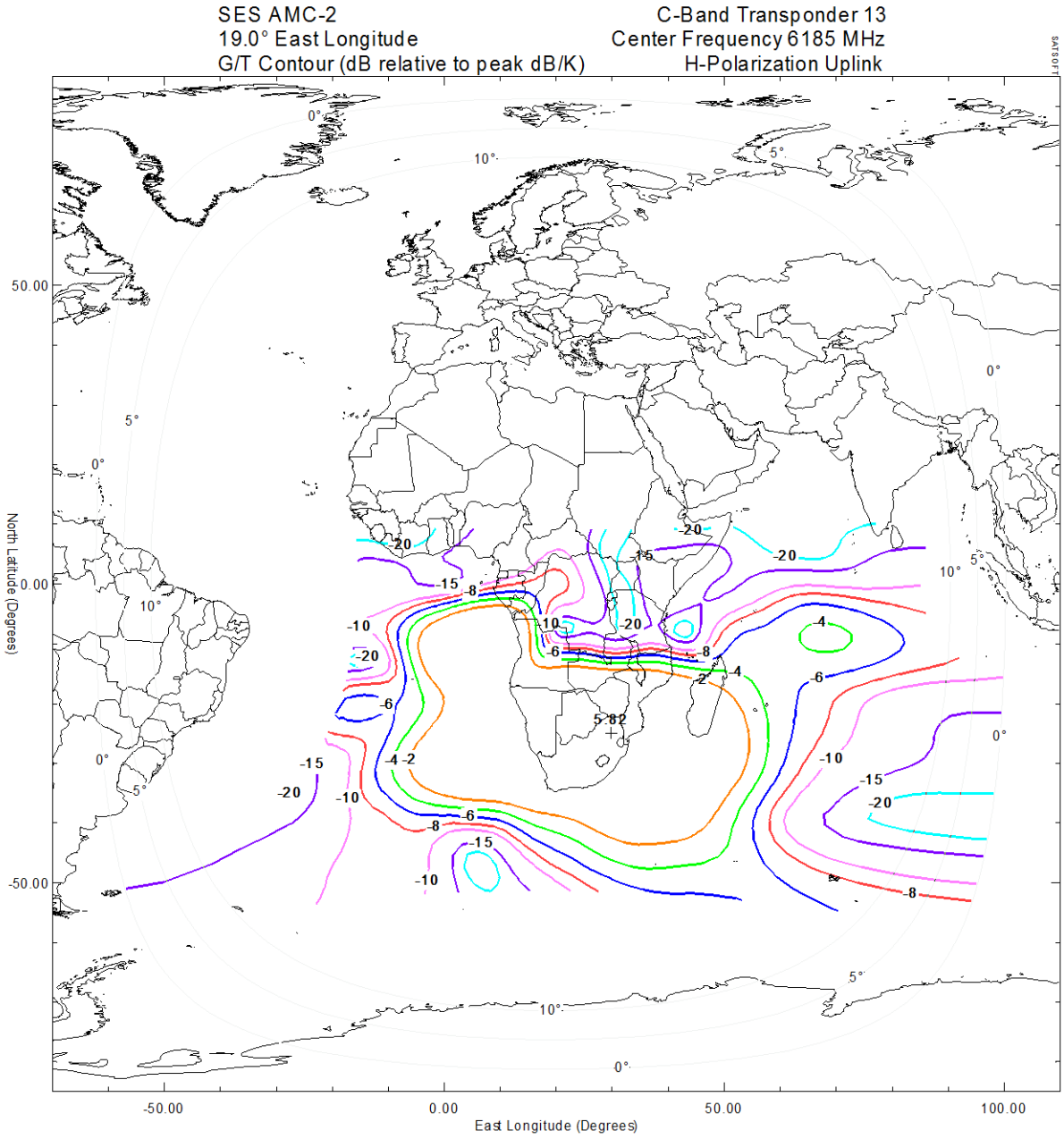

Figure 5.
Transmit beam KTH
Ku-band, H-pol, Antenna peak gain: 33.27 dB, peak EIRP: 49.68 dBW

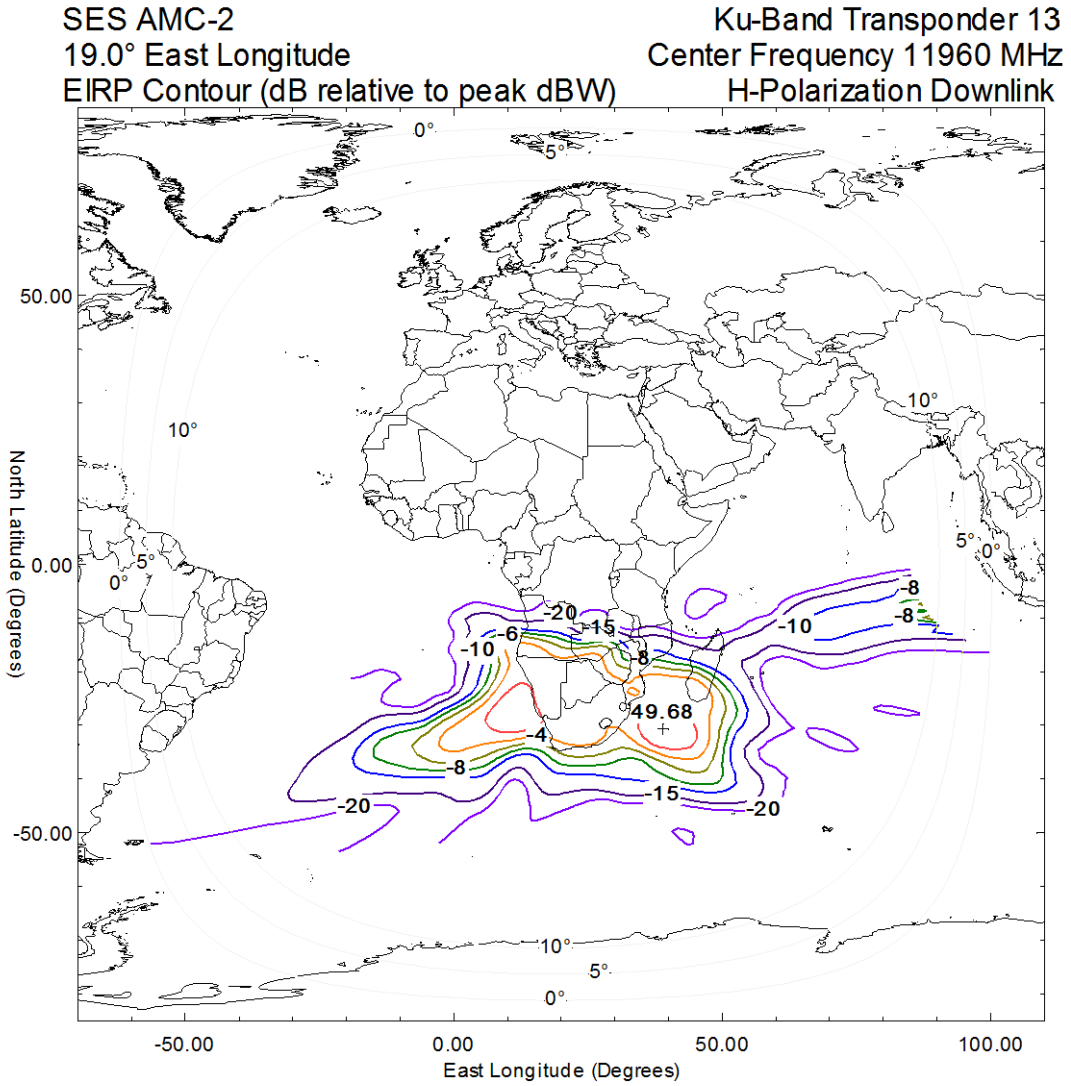

Figure 6.
Receive beam KRV
Ku-band, V-pol, Antenna peak gain: 30.86 dB, peak G/T: 3.46 dB/K

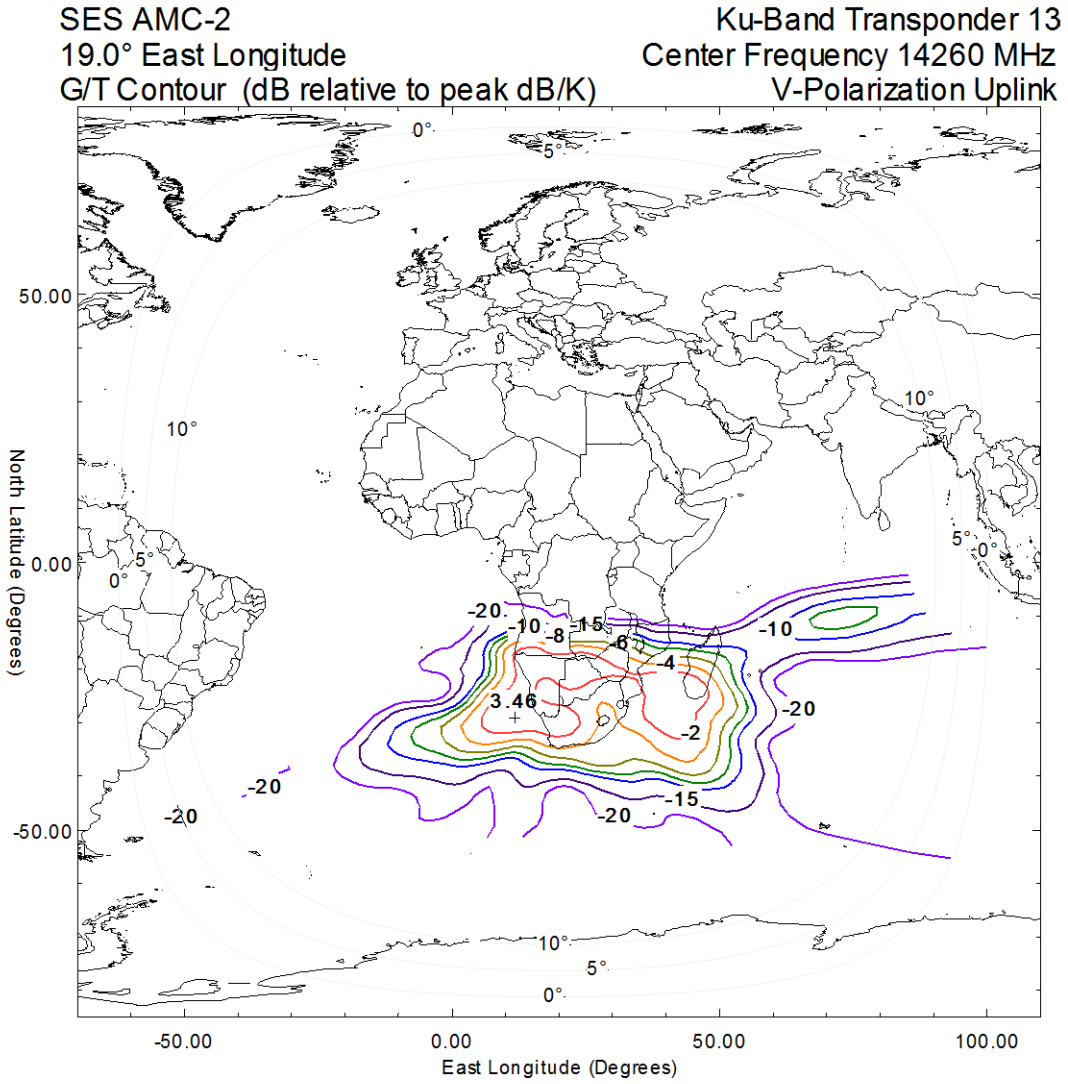

Figure 7.
Transmit beam KTV
Ku-band, V-pol, Antenna peak gain: 33.0 dB, peak EIRP: 49.2dBW

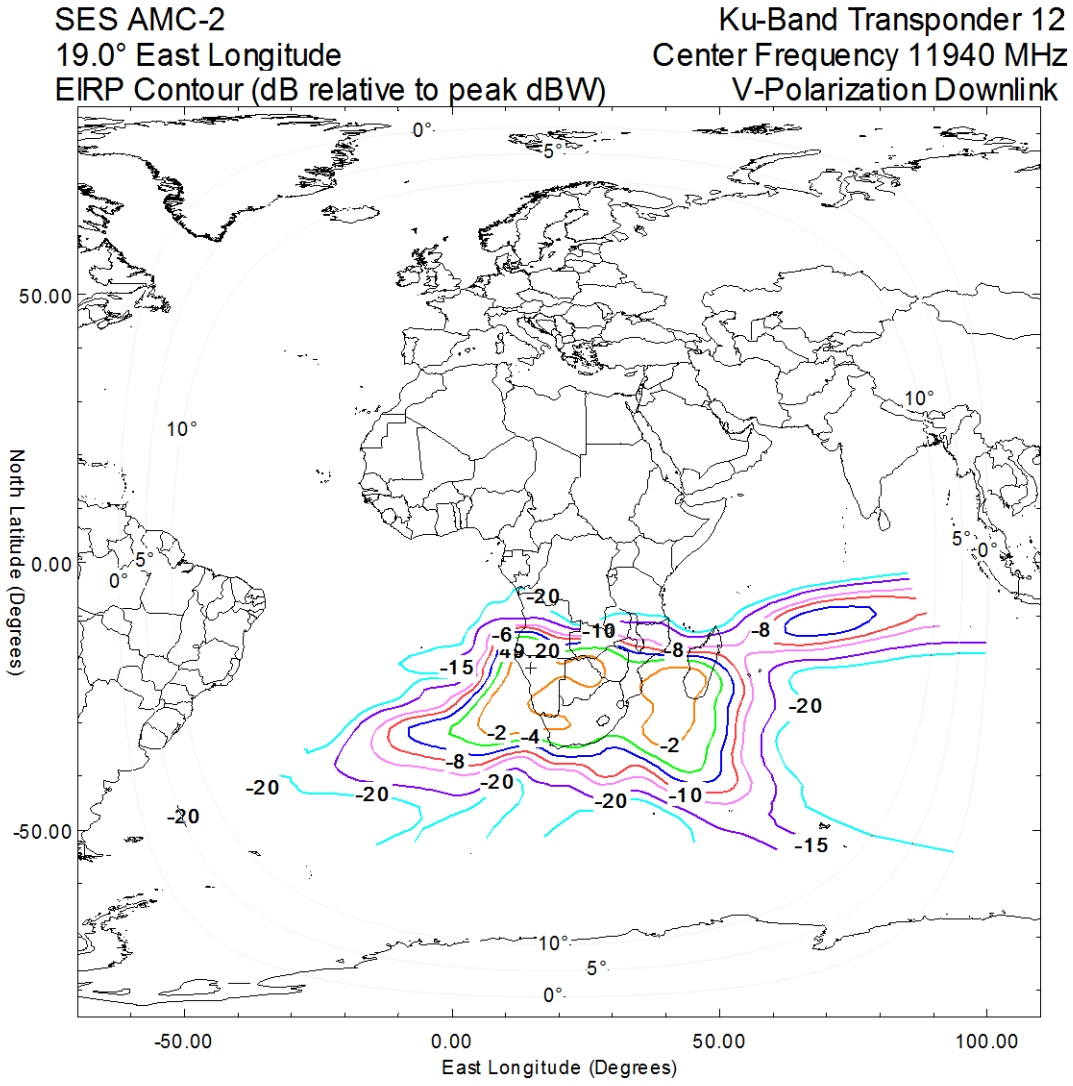

Figure 8.
Receive beam KRH
Ku-band, H-pol, Antenna peak gain: 33.63 dB, peak G/T: 5.93 dB/K

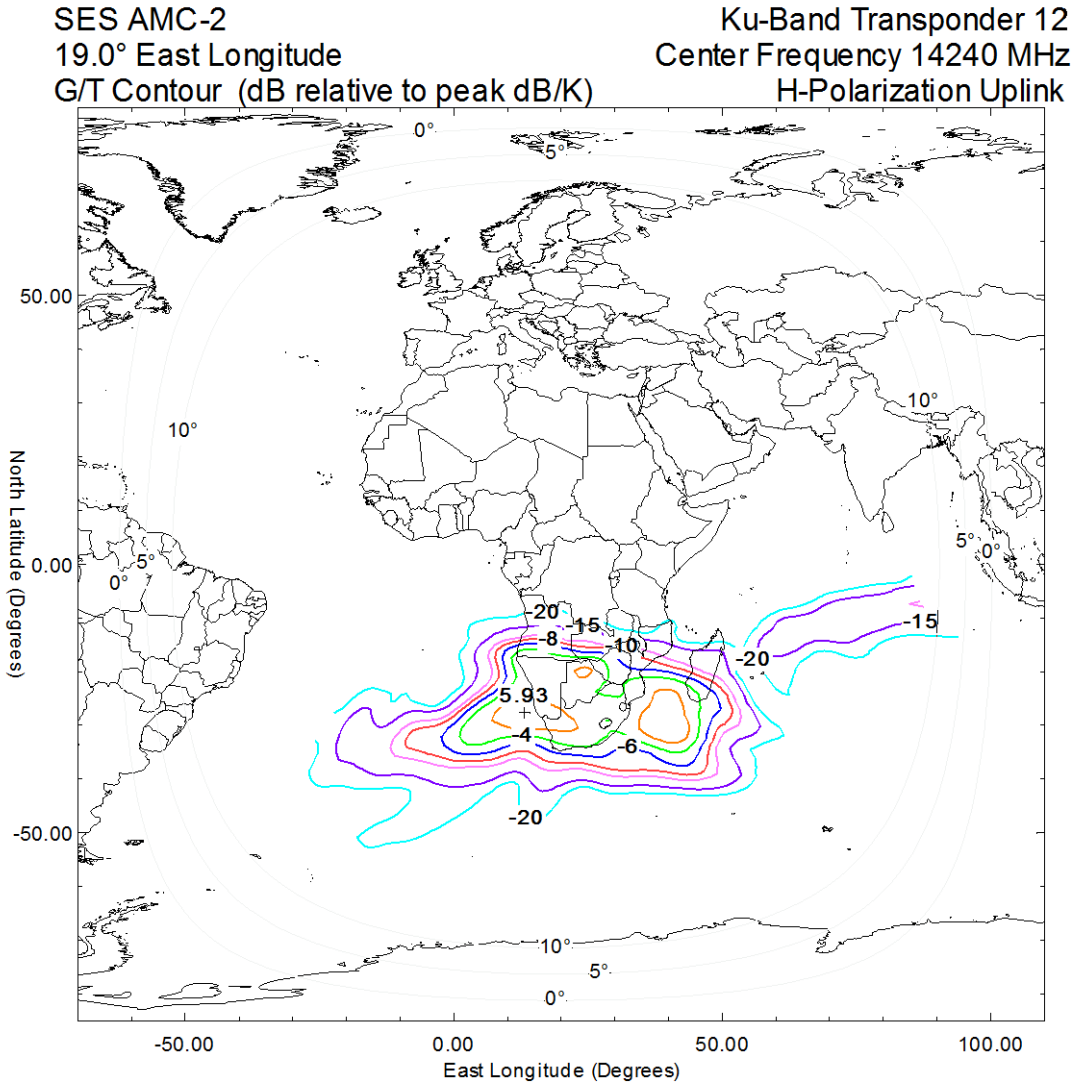

Fig 9. Global Horn Characteristics

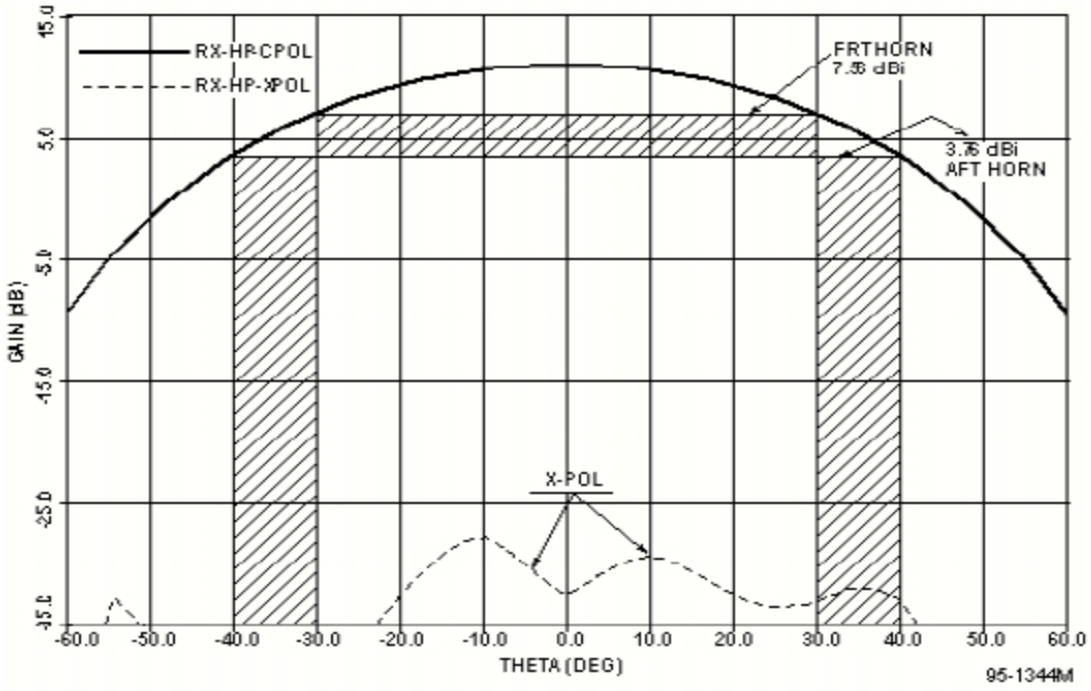

Figure 2.3-4. Measured Performance of Command Horn

ANNEX 2

INTERFERENCE ANALYSIS IN SUPPORT OF AMC-2 (KU-BAND)

Two-degree spacing analysis

The following analysis will demonstrate that the AMC-2 network is compatible with a co-coverage, co-frequency satellite, spaced 2º away. This analysis has been performed for digital signals in both networks. Analog TV/FM signals are coordinated on a case-by-case basis with nearby spacecraft, and are therefore not addressed in this analysis. Digital signals are more robust and operate typically down to much lower C/N ratios than analog signals. They are therefore more tolerant of interference, thereby improving the ability to coordinate at 2º orbit spacing. Sections 1 and 2 provide generic analyses, while Sections 3 and 4 provide analyses of specific operational satellites within 2° of 19.0° E.L.

1 General Ku-band 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 2.1º. The sidelobe envelope at 2.1º off boresight for an antenna that meets the 29-25 log (θ) reference pattern is 20.9dBi. 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: Uplink C/I for 2 degree geocentric spacing

Antenna size (m)	On-axis gain (dBi)	Off-axis gain	C/I (dB)
1.2	43.19	20.94	22.25
1.8	46.71	20.94	25.77
2.4	49.21	20.94	28.27
4.5	54.67	20.94	33.73
6	57.17	20.94	36.22

Assuming that the minimum *(i.e.*, threshold) C/N for a digital service is 8 dB, the effect of the C/I (22.25 dB) from the 1.2 meter earth station in Table 1 above would only degrade the C/N by 0.16 dB, equivalent to an increase of 3.76% in the victim system's noise temperature. This is less than the ITU coordination trigger criteria; *i.e.*, internationally, if a 6% increase in noise temperature is not exceeded, then coordination is not needed between the concerned networks.

2 General Ku-band 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-2. Similar to the uplink, the downlink C/I will be a function of the difference between the gain of the receiving earth stations at boresight and the gain at the off-axis angle, as well as any difference in EIRP between the two networks.

The topocentric angle for a geocentric separation of 2º is approximately 2.1º. The gain at 2.1º 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: Downlink C/I for 2 degree geocentric spacing with similar EIRPs

Antenna size (m)	On-axis gain (dBi)	Off-axis gain (dBi)	Off-axis discrimination (dB)	C/I (dB)
1.2	41.66	20.94	20.72	20.72
1.8	45.18	20.94	24.24	24.24
2.4	47.68	20.94	26.74	26.74
4.5	53.14	20.94	32.20	32.20
6	55.64	20.94	34.70	34.70

Table 3: Downlink C/I for 2 degree geocentric spacing with different EIRPs

Antenna size (m)	On-axis gain (dBi)	Off-axis gain (dBi)	Off-axis discrimination (dB)	C/I (dB)
1.2	41.66	20.94	20.72	18.72
1.8	45.18	20.94	24.24	22.24
2.4	47.68	20.94	26.74	24.74
4.5	53.14	20.94	32.20	30.20
6	55.64	20.94	34.70	32.70

Again, assuming that the minimum (*i.e.*, threshold) C/N for a digital service is 8 dB, the effect of the C/I (18.72 dB) into the 1.2 meter earth station in Table 3 above would only degrade the C/N by 0.35 dB, equivalent to an increase of 8.47% in the victim system's noise temperature. Although this does exceed the normal criteria of 6% by a small amount, the victim system's link degradation is still less than 0.5 dB, which is significantly less than the likely link margin.

3 Specific Ku-band interference analysis

Based on a review of the orbital arc around the planned AMC-2 orbital position of 19° E.L., there is one non-SES spacecraft operating in partly overlapping frequency bands with 2 degrees separation. SES currently operates ASTRA 1H, ASTRA 1KR, ASTRA 1L, ASTRA 1M and ASTRA 2C in the vicinity of the planned orbital location for AMC-2, and will internally manage operations to ensure that no harmful interference to these spacecraft results from the proposed relocation of AMC-2.

The AMOS-5 satellite is located at 17.0° E.L., 2 degrees away from the proposed location for AMC-2. The attached Tables 4 to 6 show examples of uplink C/I analysis for some typical carriers for the interference analysis of AMC-2 with respect to AMOS-5. The uplink carrier parameters for the adjacent satellite at 17° E.L. had to be assumed as details on typical carrier parameters and transponder performance could not be found in the public domain. For that reason, the AMC-2 carrier parameters were used for AMOS-5. Table 5 shows the carrier parameters assumed for the operations at 17° E.L.

As shown in Table 6, the C/I values are generally above 20 dB, demonstrating that the AMC-2 network is compatible with this co-coverage, co-frequency satellite, spaced 2º away.

Table 4: AMC-2 carrier parameters used in analysis as interfering carriers

SES carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
Bandwidth, MHz	36	27	6.95	5	1.6	0.1
UL flange power dens., dBW/Hz	-55	-55	-50.5	-50.5	-50.5	-50.5
UL ant. Dia, m	6.1	6.1	3.7	3.7	1.8	1.2
UL ant. Gain, dBi	57.3	57.3	53.0	53.0	46.7	43.2
UL EIRP, dBW	77.9	76.6	70.9	69.5	58.3	42.7
UL flange power, dBW	20.6	19.3	17.9	16.5	11.5	-0.5
UL EIRP density, dBW/Hz	2.3	2.3	2.5	2.5	-3.8	-7.3
Sidelobe gain, dBi	20.9	20.9	20.9	20.9	20.9	20.9
Off-ax. EIRP dens, dBW/Hz	-34.1	-34.1	-29.6	-29.6	-29.6	-29.6
G/T, dB/K	5.93	5.93	5.93	5.93	5.93	5.93
C/N (thermal), dB	29.8	29.8	30.0	30.0	23.7	20.2

Table 5: Uplink carrier parameters used in analysis at 17° E.L as wanted carriers

Adjacent Satellite carriers	25M0G7W	17M5G7W	Dig. TV(20.0)	Dig. TV(3.95)	TDMA	64Kbps	9.6Kbps
Bandwidth, MHz	25	17.5	14.9	3.4	36	0.1	0.0235
UL flange power dens., dBW/Hz	-58.4	-63.9	-56.1	-51.9	-54.4	-50.8	-50.5
UL ant. Dia, m	7	7	7	1.8	4.5	1.2	1.2
UL ant. Gain, dBi	58.5	58.5	58.5	46.7	54.7	43.2	43.2
UL EIRP, dBW	74.1	67.0	74.1	60.1	75.8	42.4	36.4
UL flange power, dBW	15.6	8.5	15.6	13.4	21.2	-0.8	-6.8
UL EIRP density, dBW/Hz	0.1	-5.4	2.4	-5.2	0.3	-7.6	-7.3
Sidelobe gain, dBi	20.9	20.9	20.9	20.9	20.9	20.9	20.9
Off-ax. EIRP dens, dBW/Hz	-37.5	-43.0	-35.2	-31.0	-33.5	-29.9	-29.6
G/T, dB/K	0	0	0	0	0	0	0
C/N (thermal), dB	21.7	16.2	24.0	16.4	21.9	14.0	14.3

Table 6: Uplink C/I estimates based on carrier parameters shown in Tables 4 and 5

Uplink C/I into SES carriers due to interference from adj. satellite

	SES carriers					
Adj. Sat carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
25M0G7W	39.8	39.8	39.9	39.9	33.7	30.1
17M5G7W	45.3	45.3	45.4	45.4	39.2	35.6
Dig. TV(20.0)	37.5	37.5	37.6	37.6	31.4	27.8
Dig. TV(3.95)	33.3	33.3	33.4	33.4	27.2	23.6
TDMA	35.8	35.8	35.9	35.9	29.7	26.1
64Kbps	32.2	32.2	32.3	32.3	26.1	22.5
9.6Kbps	31.9	31.9	32.0	32.0	25.8	22.2

Uplink C/I into adjacent sat carriers due to interference from SES carriers

	SES carriers					
Adj. Sat carriers	36M0G7W	27M0G7W	6M95G1W	5M00G1W	1M60G1W	100KG1W
25M0G7W	34.2	34.2	29.7	29.7	29.7	29.7
17M5G7W	28.7	28.7	24.2	24.2	24.2	24.2
Dig. TV(20.0)	36.5	36.5	32.0	32.0	32.0	32.0
Dig. TV(3.95)	28.9	28.9	24.4	24.4	24.4	24.4
TDMA	34.3	34.3	29.8	29.8	29.8	29.8
64Kbps	26.4	26.4	21.9	21.9	21.9	21.9
9.6Kbps	26.7	26.7	22.2	22.2	22.2	22.2

4 Operations in the band 11.7-12.2 GHz

AMC-2 will use Ku-band downlink spectrum at 11.7-12.2 GHz, which is a BSS band with respect to the planned ITU Region 1 coverage as set out in Annex 1 of Appendix 30 of the ITU Radio Regulations. The closest operational network in this band is AMOS-5 at 17° E.L., with a 2 degree orbital separation.

According to Annex 1 to Appendix 30 of the ITU Radio Regulations, in order for an administration not to be considered as being affected, the downlink EIRP per 27 MHz should not exceed the levels indicated in Table 8 below. This table also shows the networks and Plan assignments for which coordination is required for the DBL-G3-19.2E filing under which AMC-2 will operate in the 11.7-12.2 GHz band, pursuant to the Appendix 30 Part D publication for the filing.

Table 8: Maximum allowed EIRP/36MHz for AMC-2
Under Annex 1 to Appendix 30 of the ITU Radio Regulations without coordination

Nearby Plan & List assignments	France (EUT)	France (EUT)	Saudi Arabia	Qatar	Finland	Lithuania	Saudi Arabia (ARB)	Iran
Service Area	Europe	Visible Earth	Saudi Arabia	Qatar	Finland	Lithuania	MENA	Iran
Type of modulation	Analog	Digital	Digital	Digital	Digital	Digital	Digital	Digital
Wanted orbit location, degrees E.L.	13.0	13.0	17.0	20.0	22.8	23.2	26.0	26.0
Interfering orbit location, degrees E.L.	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Orbital separation, incl stakion-keeping tolerance, degrees	5.8	5.8	1.8	0.8	3.6	4.0	6.8	6.8
Appendix 30, An 1 Section 1 allowed pfd, dBW/m2/27 MHz (R1 BSS into R1 BSS)	-118.9	-110.1	-131.1	-137.4	-122.5	-119.8	-108.4	-108.4
Allowed pfd, dBW/m2/36 MHz	-117.7	-108.9	-129.9	-136.2	-121.2	-118.5	-107.1	-107.1
Allowed EIRP, dBW/36 MHz	45.8	54.6	33.6	27.3	42.3	45.0	56.4	56.4
AMC-2 EIRP over relevant service area, dBW/36 MHz	24.7	49.7	24.7	24.7	24.7	24.7	24.7	24.7

Operations of AMC-2 will conform to the existing coordination agreements that are in place for the DBL-G3-19.2E filing. The Administration of Luxembourg has completed the necessary coordinations and submitted the DBL-G3-19.2E filing to the ITU for inclusion in the Regions 1 and 3 BSS List pursuant to 4.1.12 of Appendix 30.

Table 9 below shows the allowed EIRP for the AMOS-5 satellite operating 2° away at 17° E.L., which operates under a filing submitted after DBL-G3-19.2E under Appendix 30. To ensure compatibility, AMOS-5 would have to operate at or below 32.5 dBW/36 MHz in order to be compatible with DBL-G3-19.2E. Therefore, if it seeks to operate above that level, AMOS-5 will have to seek agreement with respect to the AMC-2 operations at 19°E.L.

Table 9: Maximum allowed EIRP/36MHz for AMOS-5
Under Annex 1 to Appendix 30 of the ITU Radio Regulations without coordination

Nearby spacecraft	AMS-CK-17E
Wanted orbit location, degrees E.L.	19.0
Interfering orbit location, degrees E.L.	17.0
Orbital separation, incl stakion-keeping tolerance, degrees	1.9
Appendix 30, An 1 Section 1 allowed pfd, dBW/m2/27 MHz (R1 BSS into R1 BSS)	-130.8
Allowed pfd, dBW/m2/36 MHz	-129.5
Allowed EIRP, dBW/36 MHz	32.5

ANNEX 3

INTERFERENCE ANALYSIS IN SUPPORT OF AMC-2 (C-BAND)

Two-Degree Spacing Analysis for AMC-2

AMC-2 will not be providing C-band communications service at 19.0° E.L. However, the C-band will be used for TT&C. Based on a review of the orbital arc around the planned AMC-2 orbital position of 19.0°E.L., there are two satellites operating in C-band within two degrees of this location, ARABSAT-5C at 20° E.L and AMOS-5 at 17° E.L. The following analysis shows that the AMC-2 TT&C operations at 19.0°E.L. will be compatible with operations of these satellites.[8]

1 Downlink analyses

SES understands that there is no overlap between the ARABSAT-5C and AMC-2 telemetry frequencies. However, for purposes of Table 1, SES has calculated C/I levels assuming the two satellites' frequencies did overlap. The Table 1 results are conservative because the analysis does not take into account the fact that the ARABSAT-5C EIRP would roll-off significantly out-of-band or that the AMC-2 TT&C earth station likely has higher discrimination than protected by a standard antenna pattern mask. When these factors are considered, it is clear that the AMC-2 telemetry operations are compatible with those of ARABSAT-5C.

Table 1: Analysis of AMC-2 telemetry at 19° E.L. and ARABSAT-5C at 20° E.L.

AMC-2 Telemetry EIRP, dBW	10
AMC-2 Telemetry BW, kHz	300
AMC-2 earth station antenna size, m	11
AMC-2 earth station peak gain, dBi	51.4
AMC-2 earth station off-axis gain, dBi	29.7
Assumed Arabsat EIRP, dBW/36 MHz	39
Arabsat EIRP density, dBW/300 kHz	18.2
Arabsat earth station antenna size, m	3.8
Arabsat earth station peak gain, dBi	42.2
Orbital separation, degrees	0.9
Arabsat earth station off-axis gain, dBi	29.7
C/I for Arabsat	20.6
C/I for AMC-2	13.5

[8] SES is providing this interference analysis out of an abundance of caution. Consistent with industry practice, SES will individually coordinate its TT&C operations with adjacent satellite operators.

Based on publicly available information, there is potential frequency overlap between the AMC-2 telemetry frequencies and the AMOS-5 transponders. The analysis in Table 2 shows that AMC-2 telemetry carriers can operate compatibly with AMOS-5.

Table 2: Analysis of AMC-2 telemetry at 19°E.L. and AMOS-5 at 17° E.L.

AMC-2 Telemetry EIRP, dBW	10
AMC-2 Telemetry BW, kHz	300
AMC-2 earth station antenna size, m	11
AMC-2 earth station peak gain, dBi	51.4
AMC-2 earth station off-axis gain, dBi	21.3
Assumed Amos EIRP, dBW/36 MHz	37
Amos EIRP density, dBW/300 kHz	16.2
Amos earth station antenna size, m	3.8
Amos earth station peak gain, dBi	42.2
Orbital separation, degrees	1.9
Amos earth station off-axis gain, dBi	21.3
C/I for Amos	27.1
C/I for AMC-2	23.9

2 Uplink analyses

SES understands that ARABSAT-5C has a command carrier centered 1.3 MHz from the center frequency of the AMC-2 command carrier. Because typical command carriers and capture ranges are 1.2 MHz or less, the 1.3 MHz separation between the ARABSAT-5C and AMC-2 command carriers should ensure there is no frequency overlap. The analysis in Table 3 shows that the AMC-2 command carrier can operate compatibly with ARABSAT-5C in the event that there is frequency overlap.

Table 3: Analysis of AMC-2 telecommand at 19°E.L. and ARABSAT-5C at 20° E.L.

AMC-2 Command EIRP, dBW	75
AMC-2 Command BW, kHz	800
AMC-2 earth station antenna size, m	11
AMC-2 earth station peak gain, dBi	54.9
AMC-2 earth station off-axis gain, dBi	29.7
Assumed Arabsat Command EIRP, dBW/1.2 MHz	78
Arabsat earth station antenna size, m	9
Arabsat earth station peak gain, dBi	53.2
Orbital separation, degrees	0.9
Arabsat earth station off-axis gain, dBi	29.7
C/I for Arabsat	28.2
C/I for AMC-2	20.4

Based on publicly available information, there is the potential for frequency overlap between the AMC-2 command carrier and AMOS-5 transponders. The analysis in Table 4 shows that the AMC-2 command carrier can operate compatibly with AMOS-5.

Table 4: Analysis of AMC-2 telecommand at 19° E.L. and AMOS-5 at 17° E.L.

AMC-2 Command EIRP, dBW	75
AMC-2 Command BW, kHz	800
AMC-2 earth station antenna size, m	11
AMC-2 earth station peak gain, dBi	54.9
AMC-2 earth station off-axis gain, dBi	21.3
Amos Uplink EIRP, dBW/36 MHz	68
Amos earth station antenna size, m	4.5
Amos earth station peak gain, dBi	47.2
Orbital separation, degrees	1.9
Amos earth station off-axis gain, dBi	21.3
C/I for Amos	26.6
C/I for AMC-2	32.9

Engineering Declaration

DECLARATION OF DEBA ATHER

I, Deba Ather, 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/_Deba Ather

For SES Americom, Inc.

Dated: May 24, 2012