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

In the Matter of	)	
	)	
SES AMERICOM, INC.	)	File No. SAT-MOD-_____
	)	Call Sign S2155
Application for Modification of AMC-7	)	
Fixed-Satellite Space Station License	)	

APPLICATION OF SES AMERICOM, INC.

SES Americom, Inc. ("SES") respectfully requests a modification of its license for the AMC-7 C-band fixed-satellite space station to reassign the spacecraft to 135° W.L. At 135° W.L., AMC-7 will be co-located with SES's AMC-10 satellite. SES requests authority to perform Telemetry, Tracking and Command ("TT&C") in order to relocate AMC-7 from 137º W.L. to 135° W.L., and authority to operate both the TT&C and C-band communications payloads on AMC-7 after it has arrived. Grant of the requested authority will serve the public interest by facilitating the use of AMC-7 to provide back-up capacity for AMC-10 and other SES C-band satellites in this portion of the orbital arc. In addition to seeking reassignment of AMC-7, SES also requests extension of the AMC-7 license term to October 25, 2018.

A completed FCC Form 312 is attached, and SES is providing here technical information relating to the proposed modification to the AMC-7 license in Schedule S and in narrative form pursuant to Section 25.114 of the Commission's Rules.[1]

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[1] In completing the Schedule S, SES has relied on the most recent Schedule S instructions that take into account the changes to Section 25.114 adopted in the Part 25 reform proceeding. Consistent with those instructions, in cases where the Schedule S software requests information that space station applicants are no longer required to provide, SES has omitted data elements, or where necessary to permit validation of the Schedule S file, has entered a "1" as a placeholder. SES specifies that these "1" data entries are outside the scope of the certifications herein regarding accuracy of the information provided with this modification.

MODIFICATION

AMC-7 is C-band satellite that is licensed by the Commission to operate at 137° W.L., with a license term that expires October 25, 2015. SES operates the AMC-10 spacecraft at 135° W.L. SES seeks reassignment of AMC-7 to permit it to be collocated with AMC-10 in order to facilitate use of AMC-7 to provide back-up capacity as necessary. No customers of AMC-7 will be adversely affected, as they will be transferred to other satellites prior to the proposed relocation.

Relocation Authority. Grant of the requested authority to relocate and operate AMC-7 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 satellites in their fleet to reflect business and customer considerations where no public interest factors are adversely affected."[2] 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.[3]

Here, the proposed change will allow SES to make efficient use of AMC-7 in order to facilitate the provision of back-up capacity for AMC-10 and other satellites in this segment of the orbital arc. As noted above, current AMC-7 customers will be transferred to

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[2] *SES Americom, Inc.*, Order and Authorization, 21 FCC Rcd 3430, 3433, ¶ 8 (IB 2006), *citing Amendment of the Commission's Space Station Licensing Rules and Policies*, Second Report and Order, 18 FCC Rcd 12507, 12509, ¶ 7 (2003).

[3] *AMSC Subsidiary Corp.*, Order and Authorization, DA 98-493, 13 FCC Rcd 12316, 12318, ¶ 8 (IB 1998) (footnote omitted).

other spacecraft, so the proposed relocation will not have any impact on existing services.[4] SES will coordinate internally to ensure compatibility of C-band operations between AMC-7 and AMC-10, as necessary.

Reassignment of AMC-7 to 135º W.L. will not adversely affect other operators. SES will operate only the TT&C frequencies of AMC-7 during the drift and will follow standard industry practices for coordination of such TT&C transmissions. The Technical Appendix demonstrates that the AMC-7 network is compliant with Commission rules for operation in a two-degree spacing environment and is compatible with co-frequency satellites adjacent to the 135º W.L. orbital location.

As explained in the Technical Appendix, SES plans to operate both AMC-7 and AMC-10 within the same 135° W.L. +/- 0.05 degrees east-west station keeping box. The proposed stationkeeping volume for AMC-7 and AMC-10 will not overlap with the stationkeeping volume of any other spacecraft.[5]

License Extension: SES requests a 3-year extension of the AMC-7 license term to October 25, 2018. SES has calculated that there is sufficient fuel onboard the AMC-7 spacecraft for the spacecraft to continue providing reliable service during the proposed extended license term and to deorbit the spacecraft to a disposal altitude of 150 km above geostationary orbit (see below).[6] In making these calculations, SES has assumed that standard stationkeeping

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4 SES does not have plans to deploy a replacement satellite to 137° W.L. and understands that following the departure of AMC-7, the Commission will make that location available for reassignment.

5 *See* Technical Appendix at Section 8.

6 SES developed the nominal lifetime prediction by estimating future fuel consumption, including for the planned deorbiting maneuvers, and taking into account fuel usage predictions based on data from previous maneuvers. SES's calculations use lifetime models that incorporate

maneuvers will be performed to maintain AMC-7 within its existing east-west and north-south stationkeeping tolerances.[7] Furthermore, although SES does not currently contemplate relocating AMC-7 to another orbital location, SES has made allowance in its fuel life calculations for the possibility of a single relocation during the requested extension term of the AMC-7 license.[8]

The satellite's overall health is good, with all satellite subsystems functioning nominally. There is no single point of failure in the satellite's design; and there is no problem with the satellite's TT&C links, including the back-up TT&C links. As a result, extending the license term for AMC-7 will serve the public interest by allowing SES to continue to use the spacecraft to provide service to customers, promoting the efficient use of satellite and orbital resources.

SES proposes to relocate AMC-7 at its end of life to a disposal orbit with a minimum perigee altitude of at least 150 km above the geostationary arc. Because AMC-7 was launched before March 18, 2002, the spacecraft is not subject to the minimum perigee requirements of Section 25.283(a).[9] The Commission has previously authorized the use of a

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uncertainty in a number of variables including initial tank loading, fuel usage efficiency and the oxidizer to fuel ratio.

[7] The calculations do not assume that the spacecraft will be placed into inclined orbit during the requested extension term. If AMC-7 is placed into inclined orbit during this time, the lifetime of the satellite will be extended.

[8] Depending on whether there are any relocations during this time, and the distance and speed of any such relocations, the expected lifetime of the satellite may be longer or shorter than estimated. In any case, SES will de-orbit the spacecraft to at least 150 km above the geostationary arc (as discussed below), regardless of the remaining term of the AMC-7 license.

[9] *See* 47 C.F.R. § 25.283(d).

150-km deorbit altitude for spacecraft launched prior to March 18, 2002.[10] 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. Thus, SES's plans for deorbit of AMC-7 are consistent with Commission precedent and will facilitate placement of AMC-7 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.[11]

Sections 25.114(d)(14) and 25.283(c): Sections 25.114(d)(14)(ii) and 25.283(c) address requirements relating to venting stored energy sources at the spacecraft's end of life.[12] AMC-7 is a Lockheed Martin A2100 model spacecraft. As described in more detail in the attached Technical Appendix, the oxidizer tanks on the spacecraft were sealed following

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[10] *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.

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

[12] Section 25.283(c) contains the substantive venting requirement, and Section 25.114(d)(14)(ii) requires applicants to submit information that addresses "whether stored energy will be removed at the spacecraft's end of life." 47 C.F.R. § 25.114(d)(14)(ii).

completion of the launch phase and will therefore retain residual pressure when the spacecraft is retired. Given the spacecraft design, it is physically impossible for SES to vent the oxidizer tanks in order to comply with Section 25.283(c).

Under Commission precedent, grant of a waiver is warranted. In a number of cases involving various spacecraft models with similar limitations, the Commission has waived Section 25.283(c) to permit launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the space station design at a late stage of construction would pose an undue hardship.[13] In the case of AMC-7, which was launched and operational before the venting requirements were adopted, there is no question of bringing the satellite into compliance with the rule. The Commission has expressly recognized this, finding a waiver of Section 25.283(c) to be justified for in-orbit spacecraft that cannot satisfy the rule's requirements. For example, in a decision involving the AMC-2 satellite, which like AMC-7 was launched before Section 25.283(c) was adopted, the Commission waived the rule on its own motion, observing that venting the spacecraft's sealed oxidizer tanks "would require direct retrieval of the satellite, which is not currently possible."[14]

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[13] *See, e.g., EchoStar Satellite Operating Corp.,* File No. SAT-LOA-20071221-00183, Call Sign S2746, grant-stamped Mar. 12, 2008, Attachment at ¶ 4 (granting a partial waiver of Section 25.283(c) for AMC-14, a Lockheed Martin A2100 model spacecraft, on grounds that requiring modification of satellite would present an undue hardship); *DIRECTV Enterprises LLC*, File No. SAT-LOA-20090807-00086, Call Sign S2797, grant-stamped Dec. 15, 2009, Attachment at ¶ 4 (same for DIRECTV 12, a Boeing 702 model spacecraft); *PanAmSat Licensee Corp*., File Nos. SAT-MOD-20070207-00027, SAT-AMD-20070716-00102, Call Sign S2237, grant-stamped Oct. 4, 2007, Attachment at ¶ 7 (same for Intelsat 11, an Orbital Sciences Star model spacecraft).

[14] File No. SAT-MOD-20101215-00261, Call Sign S2134, grant-stamped Mar. 8, 2011, Attachment at ¶ 4. *See also XM Radio Inc.,* File No. SAT-MOD-20100722-00165, Call Sign S2616, grant-stamped Oct. 14, 2010, Attachment at ¶ 2 (waiving Section 25.283(c) for XM-4, a Boeing 702 model spacecraft, because "modification of the spacecraft would present an undue hardship, since XM-4 is an in-orbit space station and venting XM-4's helium and xenon tanks would require direct retrieval of the satellite, which is not currently possible").

The same practical obstacle is present here. Because AMC-7 is already in orbit, SES can do nothing to enable full venting of residual pressure in the oxidizer tanks. Given this reality, a waiver is clearly warranted.

CONCLUSION

For the foregoing reasons, SES seeks a modification of the AMC-7 license to reassign the spacecraft to 135° W.L. and to extend the satellite's license term through October 25, 2018.

Respectfully submitted,

SES AMERICOM, INC.

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Attachment A
Technical Information to Supplement Schedule S

1 SCOPE

This Attachment contains information required by §25.114(d) and other sections of the FCC Part 25 rules that cannot be entered into the Schedule S submission.

2 GENERAL DESCRIPTION

The AMC-7 satellite is a C-band satellite that will operate collocated with the AMC-10 satellite at the 135° W.L. orbital location. AMC-7 will serve as a back-up for AMC-10 and other SES satellites in this section of the orbital arc.

The AMC-7 satellite has two C-band beams: an Alaskan beam and a beam covering all fifty USA States (the "USA" beam). At the 135° W.L. orbital location, only the USA beam will be employed and therefore only the USA beam (uplink and downlink direction) is described herein.

The satellite employs twenty-four 36 MHz transponders operating in both linear polarizations. At the 135° W.L. orbital location, the satellite will be operated with the same polarization as AMC-10, which is odd channels in the uplink direction are horizontally polarized, and odd channels in the downlink direction are vertically polarized. The satellite is designed to meet all the requirements of §25.210(a) as well as §25.210(f).

3 PREDICTED SPACE STATION ANTENNA GAIN CONTOURS

The AMC-7 satellite's antenna gain contours for all receive and transmit beams, as required by §25.114(c)(4)(vi)(A), are provided in GXT format and embedded in the associated Schedule S submission. The gain contours of the horn antennas, which are used for normal on-station telecommand as well as telemetry in anomaly situations, vary by less than 8 dB across the surface of the Earth and therefore the contours have not been included in the Schedule S submission. Similarly, the gain contours of the near-omnidirectional antennas used for

emergency TT&C also vary by less than 8 dB across the surface of the Earth and thus also have not been included in the Schedule S submission.

4 SERVICES TO BE PROVIDED

The AMC-7 satellite will provide a variety of FSS and DTH services including a range of narrow- and wide-band digital services. Analog TV (TV/FM) carriers may also be transmitted in a limited number of transponders. Representative link budgets, which include details of the transmission characteristics, performance objectives and earth station characteristics, are provided in the associated Schedule S submission.

5 MAXIMUM OPERATION LEVELS

The AMC-7 satellite will be operated such that downlink transmissions of digital carriers will not exceed an EIRP density of -30 dBW/Hz (6 dBW/4kHz). Downlink transmissions of analog TV carriers (2 MHz energy dispersal bandwidth) will not exceed an EIRP density of -23.4 dBW/Hz (12.6 dBW/4 kHz) in order to comply with power flux-density limits.

No authorized uplink earth station operating with AMC-7, whether transmitting a digital or analog carrier, will exceed an uplink input power density of -38.7 dBW/Hz.

6 ARRANGEMENT FOR TT&C

Table 6-1 summarizes the salient details of the TT&C for on-station and emergency operations. Additional TT&C information is provided in the associated Schedule S submission.

Table 6-1. TT&C on-station frequencies, polarizations and beams

Carrier Type	Frequency (MHz)	Polarization Type	Beam
Command 1	6423.5	V	Global horn
Command 2	6423.5	H or V	Omni
Telemetry 1	3700.5	H or V	Comms
Telemetry 2	4199.5	H or V	Comms
Telemetry 3	3700.5	V	Global horn
Telemetry 4	4199.5	V	Global horn
Telemetry 5	3700.5	H	Omni
Telemetry 6	4199.5	H	Omni

7 INTERFERENCE AND PFD ANALYSES

The interference and power flux-density ("PFD") analyses are contained in Annex A of this Attachment.

8 ORBITAL DEBRIS MITIGATION PLAN

8.1 Spacecraft Hardware Design

SES has assessed and limited the amount of debris released in a planned manner during normal operations of AMC-7 at 135° W.L. No debris is generated during normal on-station operations and the spacecraft will be in a stable configuration.

SES has also assessed and limited the probability of the space station becoming a source of orbital debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. The design of the AMC-7 satellite locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris. SES requires that spacecraft manufacturers assess the probability of micrometeorite damage that can cause any loss of functionality. This probability is then factored into the ultimate spacecraft probability of success. Any significant probability of damage would need to be mitigated in order for the spacecraft design to meet SES's required probability of success of the mission. SES

has taken steps to limit the effects of any collisions through shielding, the placement of components, and the use of redundant systems.

8.2 Minimizing Accidental Explosions

The AMC-7 satellite was designed and manufactured by Lockheed Martin and was launched in 2000.

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

The design of the AMC-7 spacecraft is such that the risk of explosion is minimized both during and after mission operations. In designing and building the spacecraft, the manufacturer took steps to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. All propulsion subsystem pressure vessels, which have high margins of safety at launch, have even higher margins in orbit, since use of propellants and pressurants during launch decreases the propulsion system pressure. Burst tests are performed on all pressure vessels during qualification testing to demonstrate a margin of safety against burst. Bipropellant mixing is prevented by the use of valves that prevent backwards flow in propellant and pressurization lines. All pressures, including those of the batteries, are monitored by telemetry.

At the end of operational life, after the satellite has reached its final disposal orbit, onboard sources of stored energy will be depleted or secured, and the batteries will be discharged. However, at the end of AMC-7's operational life, there will be oxidizer remaining in the tanks that cannot be vented. Following insertion of the spacecraft into orbit, the spacecraft manufacturer permanently sealed the oxidizer tanks by firing pyrotechnic valves. This is a design feature of the Lockheed A2100 series spacecraft that cannot now be changed or remedied. Information regarding the residual oxidizer in the tanks is as follows:

Tank	Volume [l]	Pressure [bar]	Temp. [deg C]	Oxidizer mass [kg]
Ox 1	229.8	17.9	21	7.385
Ox 2	229.8	17.9	21	7.385

The oxidizer tanks are well shielded, and the residual pressure in the tanks will be well below their maximum rating.

In the narrative portion of this application, SES requests any necessary waiver of Sections 25.114(d)(14)(ii) and 25.283(c) in connection with the residual oxidizer that will remain in these tanks at the end of the satellite's life.

8.3 Safe Flight Profiles

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

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

In considering current and planned satellites that may have a station-keeping volume that overlaps the AMC-7 satellite, SES has reviewed the FCC databases for FCC licensed satellite

networks and those that are currently under consideration by the FCC. In addition, networks for which a request for coordination has been published by the ITU within ±0.15 degrees of 135° W.L. have also been reviewed. Only those networks that either operate, or are planned to operate, and have an overlapping station-keeping volume with the AMC-7 satellite, have been taken into account in the analysis.

Based on these reviews, there are two satellites operating nominally at 135° W.L.: the AMC-10 satellite operated by SES and the GOES 15 satellite operated by NOAA. There are no pending applications before the Commission requesting authorization to use an orbital location within ±0.15° of 135° W.L., and within this sub-arc, there are no known operational or known satellites progressing towards launch.

On-station operations require station-keeping within the +/- 0.05 degree N-S and E-W control box, thereby ensuring adequate collision avoidance distance from other satellites in geosynchronous orbit. AMC-7 will be collocated with AMC-10. During the period of collocation, SES will use the proven Inclination-Eccentricity (IE) technique to ensure adequate separation between its satellites. This strategy is presently in use by SES at several orbital locations to ensure proper operation and safety of multiple satellites within one orbital box.

SES Americom uses the Space Data Center ("SDC") system from the Space Data Association to monitor the risk of close approach of its satellites with other objects. Any close encounters (separation of less than 10 km) are flagged and investigated in more detail. If required, avoidance maneuvers are performed to eliminate the possibility of collisions. SES uses this information to avoid collision with the GOES 15 satellite and any other satellite that might venture into the vicinity of SES's operations.

During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. In addition, the SDC system is used to ensure no close encounter occurs during the move. When de-orbit of a spacecraft is required, the initial phase is treated as a satellite move, and the same precautions are used to ensure collision avoidance.

8.4 Post Mission Disposal Plan

Post-mission disposal of the satellite from operational orbit will be accomplished by carrying out maneuvers to raise the satellite to a higher orbit. The upper stage engine remains part of the satellite, and there is no re-entry phase for either component. The fuel budget for elevating the satellite to a disposal orbit is included in the satellite design.

SES plans to maneuver AMC-7 to a disposal orbit with a minimum perigee at least 150 km above its operational geostationary orbit. SES intends to reserve 11 kg of fuel in order to account for post-mission disposal of AMC-7. SES has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

AMC-7 is not subject to the minimum perigee requirement of Section 25.283(a) of the Commission's Rules because the satellite was launched prior to March 18, 2002. However, for the Commission's information, the disposal orbit altitude resulting from the IADC formula would be 262 km based on the following calculation:

Area of the satellite (average aspect area): 17.8 m^2

Mass of the spacecraft: 935 kg

CR (solar radiation pressure coefficient): 1.42

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

36,021 km + (1000 x CR x A/m) = 36,048 km or 262 km above the GSO (35,786 km).

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this application and that it is complete and accurate to the best of my knowledge and belief.

/s/

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ANNEX A

INTERFERENCE AND PFD ANALYSES

1.0 Interference Analyses

This section demonstrates that the AMC-7 satellite network is two-degree compatible.

1.1 137° W.L. Orbital Location

SES seeks Commission-authorization to move the AMC-7 satellite from 137° W.L. to 135° W.L. Assuming the Commission authorizes the move, relocation of AMC-7 would leave the 137° W.L. orbital location vacant. In such instances, and for purposes of demonstrating two-degree compatibility, the Commission allows an applicant to assume a future two-degree separated satellite has the same characteristics as the applicant's satellite.

The associated Schedule S submission contains the link budgets for the AMC-7 satellite. The link budgets assume two adjacent interfering satellites, each located two degrees away from 135° W.L.; one to the east and one to the west. These two hypothetical satellites have been assumed to be transmitting at the same maximum uplink power density and downlink EIRP density levels as those being sought for the AMC-7 satellite network. The AMC-7 link budgets demonstrate that the links are sufficiently robust given the assumed interference levels and therefore also serve to demonstrate that the AMC-7 satellite network is compatible with a potential future satellite located at 137° W.L.

1.2 133° W.L. Orbital Location

Intelsat operates the C-band GALAXY-15 satellite at 133° W.L. This section demonstrates compatibility between the operations of the AMC-7 and GALAXY-15 satellite networks.

Table 1 provides a summary of the digital transmission parameters derived from the AMC-7 link budgets that are embedded in the associated Schedule S submission. Table 2 provides a

summary of the digital transmission parameters of the GALAXY-15 satellite network as contained in the GALAXY-15 application.[1]

Interference from the AMC-7 network into the GALAXY-15 network was calculated and vice versa. Tables 3 and 4 show the results of the interference calculations using the transmission parameters of the two networks' digital carriers. These tables provide the calculated downlink and uplink C/I. The interference calculations assume a 1 dB advantage for topocentric-to-geocentric conversion and that all wanted and interfering carriers are co-polarized. The C/I calculations were performed on a per Hz basis, and assume that all earth stations comply with Section 25.209.

With respect to the uplink, the input power density for AMC-7 will not exceed that allowed under Section 25.218(d) of the FCC's rules (equivalent to an input power density of -38.7 dBW/Hz). With respect to the downlink, the calculated C/I's are within the range of C/I's used in the link budgets for GALAXY-15 in Intelsat's FCC application. Specifically, Intelsat assumed an adjacent satellite downlink C/I, in Exhibit A-1 of its application, ranging from 9.4 to 22 dB. As a result, this analysis demonstrates the compatibility between the AMC-7 and GALAXY-15 satellite networks.

Table 1. AMC-7 Typical Digital Carrier Transmission Parameters

Carrier ID	Bandwidth (MHz)	Tx E/S Gain (dBi)	Uplink EIRP (dBW)	Uplink Input Power Density (dBW/Hz)	Downlink EIRP (dBW)	Rx E/S Gain (dBi)
1	0.0486	47.4	49.4	-44.1	12.1	38.1
2	1.688	42.0	57.0	-46.5	24.7	49.9
3	6.33	47.4	68.3	-46.4	31.0	41.9
4	18.2	53.7	75.0	-50.5	39.6	38.1
5	36	50.1	83.9	-40.9	40.1	41.9
6	36	50.1	75.0	-49.8	40.1	43.6

[1] *See* SAT-AMD-20031103-00320.

Table 2. GALAXY-15 Digital Carrier Transmission Parameters

Carrier ID	Bandwidth (MHz)	Tx E/S Gain (dBi)	Uplink EIRP (dBW)	Downlink EIRP (dBW)	Rx E/S Gain (dBi)
1	30.133	53.1	76.8	41.2	40.7
2	5.565	53.1	71.9	32.9	40.7
3	0.077	53.1	53.3	14.3	40.7
4	0.0512	53.1	52.4	13.4	43.4
5	1.24	53.1	66.2	27.2	43.4
6	1.229	53.1	62.0	23.0	40.7
7	0.307	44.6	47.7	12.7	49.8

Table 3. Uplink C/I (dB); AMC-7 interfering into GALAXY-15.

		Interfering Carriers					
	Carrier ID	1	2	3	4	5	6
Wanted Carriers	1	30.0	32.4	32.3	36.5	26.9	35.8
	2	25.1	27.5	27.4	31.6	22.0	30.9
	3	25.1	27.4	27.4	31.5	21.9	30.8
	4	26.0	28.3	28.2	32.4	22.8	31.7
	5	25.9	28.3	28.2	32.4	22.8	31.7
	6	21.8	24.1	24.0	28.2	18.6	27.5
	7	13.5	15.8	15.7	19.9	10.3	19.2

Table 4. Uplink C/I (dB); GALAXY-15 interfering into AMC-7.

		Interfering Carriers						
	Carrier ID	1	2	3	4	5	6	7
Wanted Carriers	1	29.6	34.5	34.5	33.7	33.7	37.9	37.7
	2	21.8	26.7	26.7	25.9	25.9	30.1	29.9
	3	27.4	32.3	32.3	31.4	31.5	35.6	35.4
	4	29.5	34.4	34.4	33.5	33.6	37.7	37.5
	5	35.4	40.3	40.4	39.5	39.5	43.7	43.5
	6	26.5	31.4	31.5	30.6	30.6	34.8	34.6

Table 5. Downlink C/I (dB); AMC-7 interfering into GALAXY-15.

		Interfering Carriers					
	Carrier ID	1	2	3	4	5	6
Wanted Carriers	1	20.6	23.4	22.9	18.9	21.4	21.3
	2	19.6	22.5	21.9	17.9	20.4	20.4
	3	19.6	22.5	21.9	17.9	20.4	20.4
	4	23.2	26.0	25.5	21.5	23.9	23.9
	5	23.2	26.0	25.4	21.5	23.9	23.9
	6	16.3	19.1	18.6	14.6	17.0	17.0
	7	21.1	24.0	23.4	19.4	21.9	21.9

Table 6. Downlink C/I (dB); GALAXY-15 interfering into AMC-7.

		Interfering Carriers						
	Carrier ID	1	2	3	4	5	6	7
Wanted Carriers	1	17.3	18.3	18.3	17.4	17.4	21.6	25.9
	2	26.2	27.2	27.2	26.3	26.4	30.5	34.8
	3	18.8	19.7	19.8	18.9	18.9	23.1	27.4
	4	19.0	20.0	20.0	19.1	19.2	23.3	27.6
	5	20.3	21.3	21.3	20.4	20.5	24.6	28.9
	6	22.0	23.0	23.0	22.1	22.2	26.3	30.6

The preceding did not consider interference from or into TV/FM carriers. TV/FM carriers can be very high-density carriers when the signal collapses to the energy dispersal bandwidth. As a result, operation of sensitive narrowband carriers is precluded within, and near, the center of the TV/FM carrier. Satellite operators avoid placement of their sensitive narrowband carriers near the energy dispersal bandwidth of a TV/FM carrier being transmitted by an adjacent satellite operator. C/I calculations between narrowband carriers and TV/FM carriers only serve to show their non-compatibility in a two-degree spacing environment (when assuming the worst-case situation where the narrowband carrier is located within the energy dispersal bandwidth of the TV/FM carrier). SES will coordinate any analog carriers on a case-by-case basis and therefore they are not addressed in this analysis.

2.0 PFD Analyses

SES will operate the AMC-7 satellite such that all C-band downlink transmissions will comply with the PFD limits of §25.208(a), as well as those of Article 21 of the ITU's Radio Regulations.

The maximum PFD levels caused by the AMC-7 satellite occur when a TV/FM carrier is transmitted and hence this carrier type is used to demonstrate compliance with the PFD limits of §25.208. In order to comply with the PFD limits, the downlink EIRP of an AMC-7 TV/FM carrier needs to be limited to 39.6 dBW, which causes an EIRP density of -23.4 dBW/Hz (2 MHz energy dispersal bandwidth). Using this high EIRP density, Table 7 shows the maximum PFD levels that can occur at various angles of arrival and demonstrates compliance with §25.208. Note that the maximum EIRP density that will be transmitted for digital carriers is -30 dBW/Hz (*i.e.*, 6.6 dB lower than the TV/FM carrier), hence all AMC-7 digital carriers also comply with the PFD limits of §25.208.

Table 7. Maximum AMC-7 PFD Levels.

Angle of Arrival	Applicable PFD Limit for Angle of Arrival (dBW/m^2/4 kHz)	Spreading Loss (dBW/m^2)	Gain Contour (dB)	Worst Case PFD Level at Angle of Arrival (dBW/m^2/4 kHz)	PFD Margin (dB)
0°	-152.0	-163.4	-1.5	-152.3	0.3
5°	-152.0	-163.3	-1.4	-152.1	0.1
10°	-149.5	-163.2	-1.1	-151.6	2.1
15°	-147.0	-163.0	-0.7	-151.1	4.1
20°	-144.5	-162.9	-0.4	-150.7	6.2
25°	-142.0	-162.8	-0.3	-150.5	8.5
33.3° (Peak)	-142.0	-162.7	0.0	-150.1	8.1

ANNEX B

ANTENNA GAIN CONTOUR DIAGRAMS (COMMS)

Figure 1.
Uplink Beam CUH
Horizontal Polarization

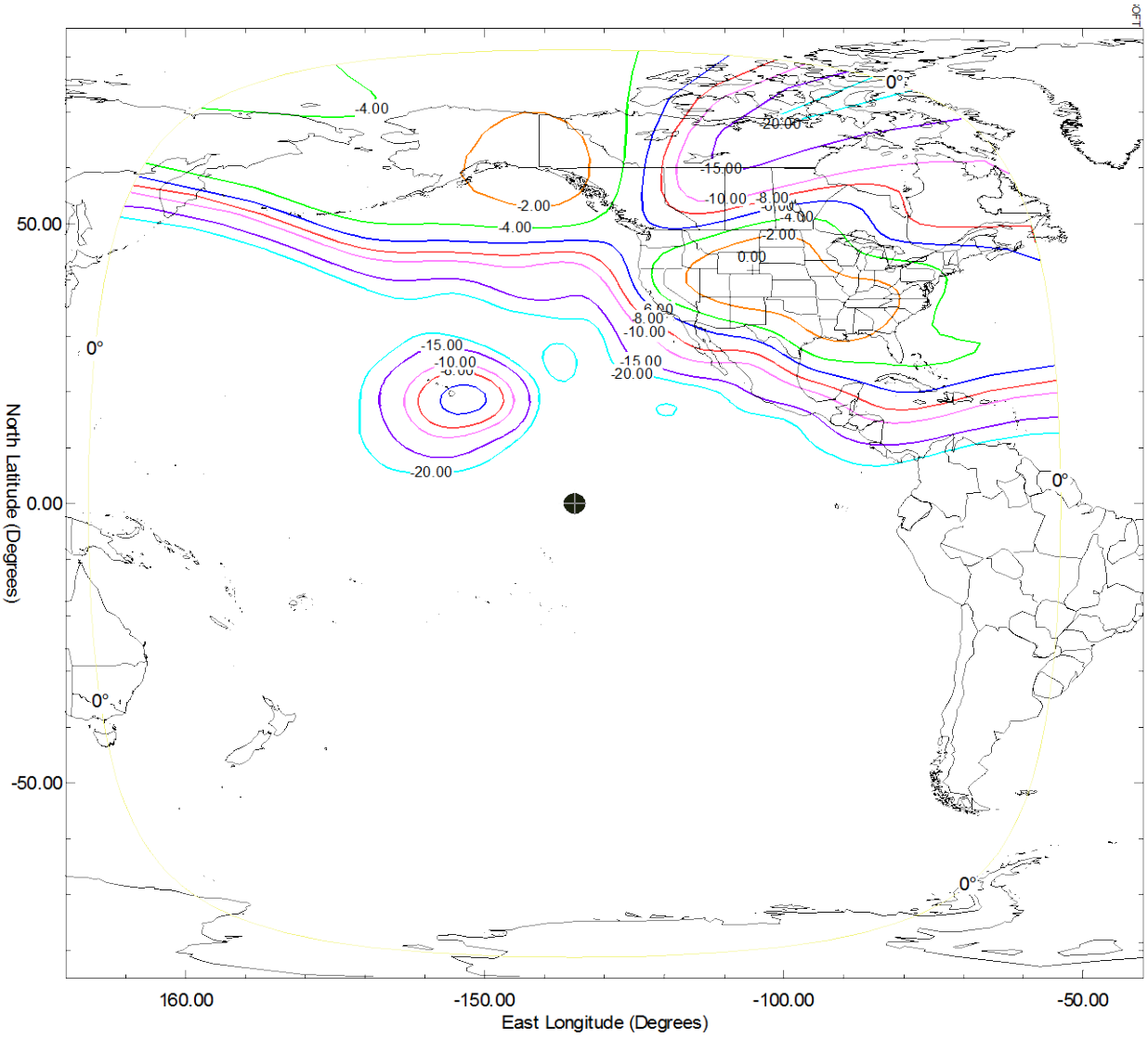

Figure 2.
Uplink Beam CUV
Vertical Polarization

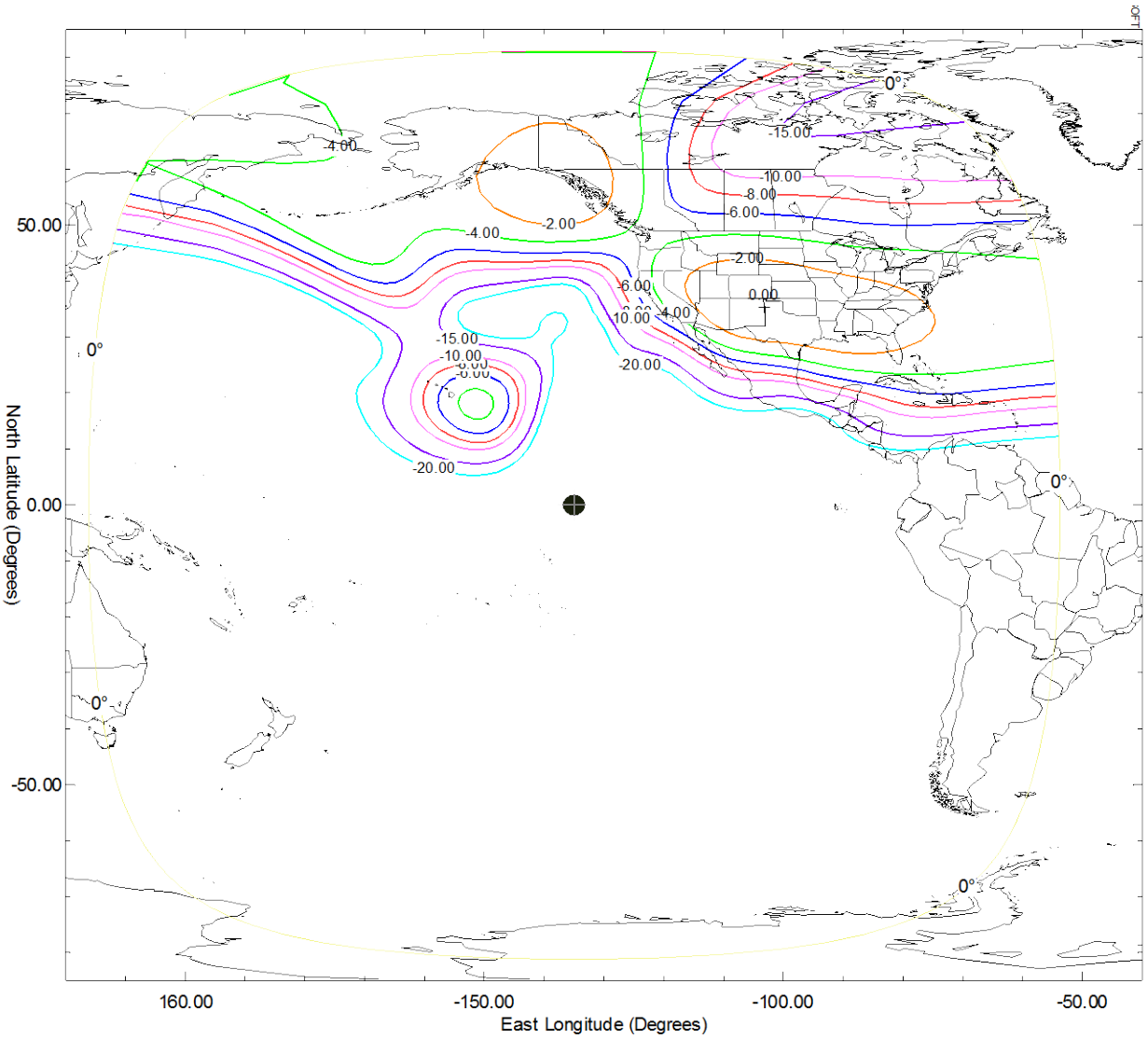

Figure 3.
Downlink Beam CDH
Horizontal Polarization

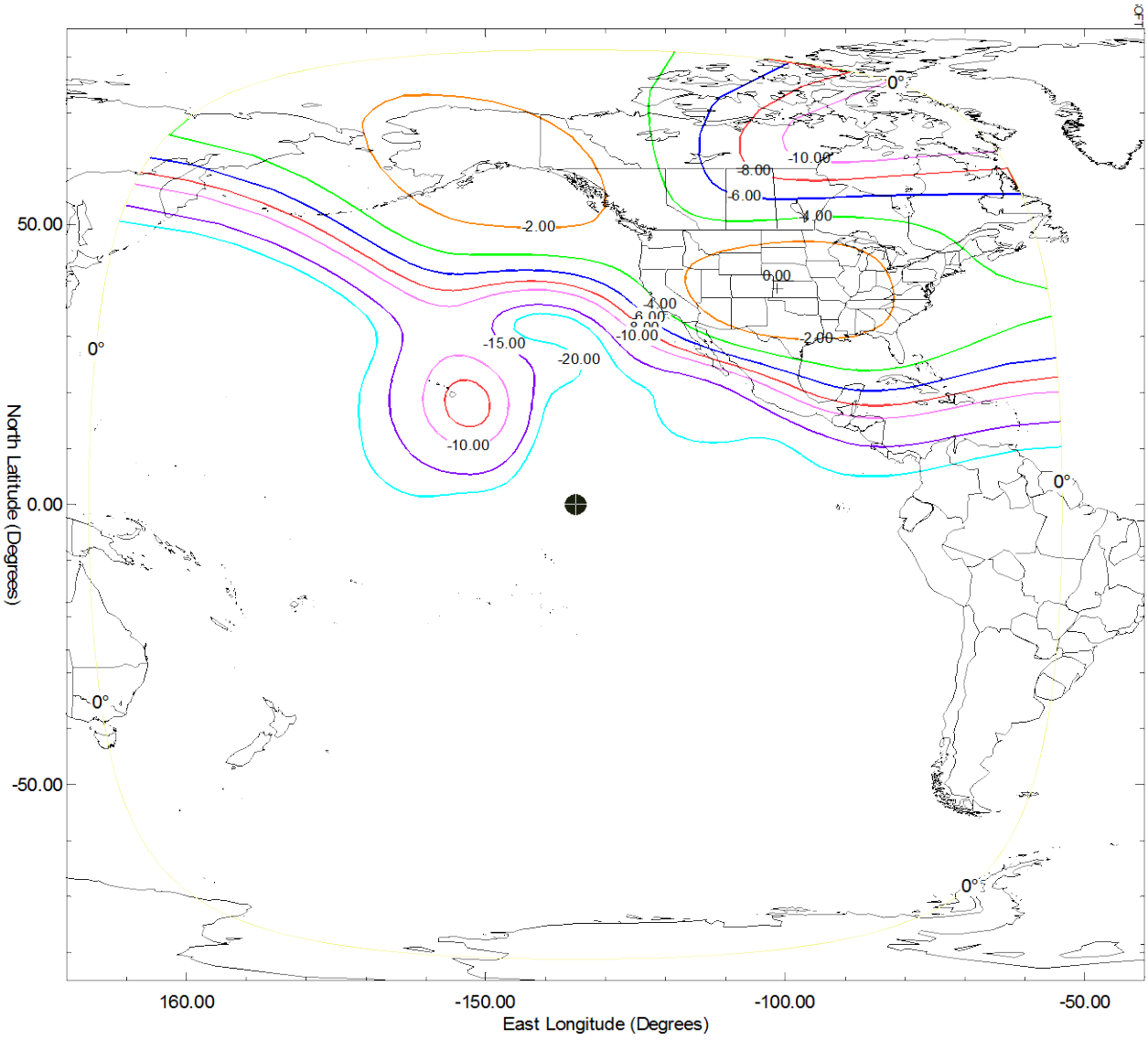

Figure 4.
Downlink Beam CDV
Vertical Polarization