

TECHNICAL APPENDIX

SES-14 AT 47.5° W.L.

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

This technical appendix is submitted in support of the petition of SES DTH do Brasil Ltda.

(“SES”) for U.S. market access for the SES-14 spacecraft to be located at 47.5° W.L.

SES-14 is currently under construction by Airbus Defence and Space, with payloads operating in portions of the C-band, Ku-band and Ka-band.

The spacecraft’s C-band transponders in the bands 3625-4200 MHz and 5850-6425 MHz will provide coverage of the visible Earth through a global beam and coverage of North and South America, Western Europe and Africa through a shaped beam (“EURAM” beam).

Five shaped beams operating in Ku-band will provide coverage of the U.S. East Coast (“USE” beam), the Atlantic (“Atlantic” beam), Brazil (“Brazil” beam), Southeastern Brazil (“BRSE” beam) and Venezuela, Peru, Ecuador, Colombia (“VPEC” beam) in the 11.95-12.20 GHz and 14.25-14.50 GHz frequencies. A series of spot beams (“HTS” beams) will provide coverage of South America, North America, the Atlantic Ocean, Western Europe and Western Africa in the 10.95-11.20 GHz, 11.45-11.70 GHz, 11.70-11.95 GHz, 12.20-12.45 GHz and 14.00-14.25 GHz frequencies.

To provide gateway functions for its Ku-band spot beams SES-14 will utilize Ku-band spectrum in 11.70-11.95 GHz, 13.75-14.00 GHz, 14.25-14.50 GHz and 17.30-17.80 GHz, via two fixed spot beams located over areas in the U.S. East Coast and Florida, and Ku-band spectrum in 17.30-18.05 GHz, via a fixed spot beam located over Western Europe.

The SES-14 spacecraft will also include the following payloads, for which SES is not seeking U.S. Market Access: (1) additional capability for the gateway functions for SES-14’s Ku-band

spot beams to be provided in Ku-band and Ka-band spectrum via five steerable spot beams located over areas in South America and Western Europe, and (2) a Ka-band beacon to be used by Earth stations located in South America to track SES-14.

2.0 Schedule S (§25.114(c))

The Schedule S database is included with this filing. In preparing the Schedule S, SES has relied on the March 2014 Schedule S instructions.¹

Considering the large number of connectivities for the forward and return links to the spot beams, the associated uplinks and downlinks are entered separately in Table S10, Space Station Transponders. SES is providing information regarding one representative user beam group in Section 5 below. In addition, because the bandwidths assigned to each beam range from 22 MHz to 225 MHz, and hence the maximum absolute EIRPs vary widely, SES is providing the maximum EIRP for the beam groups in 36 MHz equivalents in Schedule S, Table S7. The EIRP levels across 36 MHz of each user beam are similar.

In addition, consistent with Section 25.114(c)(4)(v), the minimum Saturation Flux Density value (SFD) for the command carrier is not provided since it is only a relevant parameter for the communication payload.

3.0 Telemetry and Telecommand (TT&C) frequencies and beams

The TT&C beam information and link budgets are included in the Schedule S. Table 1 below shows the satellite's TT&C frequencies, polarizations and associated antennas, and possible configurations. TT&C functions will be provided by earth stations located in Hortlandia, Brazil

¹ 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 petition.

and Betzdorf, Luxembourg. In practice, one command carrier will generally be used for nominal on station operations, and both telemetry carriers will be used. In an emergency, any of the configurations shown in Table 1 may be implemented.

Table 1: TT&C Carrier Frequencies

	Frequency, MHz	On Station Polarization	On Station Antenna	Transfer Orbit/Contingency Polarization	Transfer Orbit/Contingency Antenna
Command carriers (bandwidth: 800 kHz, 1.2 MHz capture range)					
TC1	14002	V	Horn	RHCP or LHCP	Omni
TC2	14498 ²	H	Horn	RHCP or LHCP	Omni
TC3	14002 ²	H	Horn	RHCP or LHCP	Omni
Telemetry (bandwidth: 200 kHz)/Beacon					
TM1	12198	H	Horn	RHCP or LHCP	Omni
TM2	10953	V	Horn	RHCP or LHCP	Omni

The beacons described above are also used to permit earth stations in Ku-band to track the satellite.

4.0 PFD limits (§25.208)

Tables 2, 3, 4, 5, 6, 7 and 8 demonstrate that the PFD values for SES-14's C-band and extended Ku-band payload will comply with §25.208(a) and (b), respectively.

Table 2: Maximum PFD values and margins relative to permissible limits of §25.208(a) for EURAM beam, CL polarization

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.0
Max. EIRP, dBW	42.5	42.5	42.5	42.5	42.5	42.5
Gain roll-off at elevation angle, dBi	-2.5	-2.5	-3.5	-1.5	-0.5	0.0
EIRP at elevation angle, dBW	40.0	40.0	39.0	41.0	42.0	42.5
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
EIRP density at elevation angle dBW/4kHz	0.5	0.5	-0.5	1.5	2.5	3.0
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.1
25.208(a) PFD limit (3650-4200 MHz), dBW/m2/4kHz	-152.0	-149.5	-147.0	-144.5	-142.0	-142.0
PFD, dBW/m2/4KHz	-162.8	-162.7	-163.6	-161.5	-160.4	-159.1
Margin, dB, relative to 25.208	10.8	13.2	16.6	17.0	18.4	17.1

Table 3: Maximum PFD values and margins relative to permissible limits of §25.208(a) for EURAM beam, CR polarization

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.0
Max. EIRP, dBW	42.5	42.5	42.5	42.5	42.5	42.5
Gain roll-off at elevation angle, dBi	-2.5	-2.5	-3.5	-1.5	-0.5	0.0
EIRP at elevation angle, dBW	40.0	40.0	39.0	41.0	42.0	42.5
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
EIRP density at elevation angle dBW/4kHz	0.5	0.5	-0.5	1.5	2.5	3.0
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.1
25.208(a) PFD limit (3650-4200 MHz), dBW/m2/4kHz	-152.0	-149.5	-147.0	-144.5	-142.0	-142.0
PFD, dBW/m2/4KHz	-162.8	-162.7	-163.6	-161.5	-160.4	-159.1
Margin, dB, relative to 25.208	10.8	13.2	16.6	17.0	18.4	17.1

Table 4: Maximum PFD values and margins relative to permissible limits of §25.208(a) for Global beam, CL polarization

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.0
Max. EIRP, dBW	38.3	38.3	38.3	38.3	38.3	38.3
Gain roll-off at elevation angle, dBi	-3.0	-3.0	-3.0	-2.5	-2.5	0.0
EIRP at elevation angle, dBW	35.3	35.3	35.3	35.8	35.8	38.3
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
EIRP density at elevation angle dBW/4kHz	-4.2	-4.2	-4.2	-3.7	-3.7	-1.2
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.1
25.208(a) PFD limit (3650-4200 MHz), dBW/m2/4kHz	-152.0	-149.5	-147.0	-144.5	-142.0	-142.0
PFD, dBW/m2/4KHz	-167.5	-167.4	-167.3	-166.7	-166.6	-163.3
Margin, dB, relative to 25.208	15.5	17.9	20.3	22.2	24.6	21.3

Table 5: Maximum PFD values and margins relative to permissible limits of §25.208(a) for Global beam, CR polarization

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.0
Max. EIRP, dBW	38.3	38.3	38.3	38.3	38.3	38.3
Gain roll-off at elevation angle, dBi	-3.0	-3.0	-3.0	-2.5	-2.5	0.0
EIRP at elevation angle, dBW	35.3	35.3	35.3	35.8	35.8	38.3
Carrier bandwidth, MHz	36.00	36.00	36.00	36.00	36.00	36.00
EIRP density at elevation angle dBW/4kHz	-4.2	-4.2	-4.2	-3.7	-3.7	-1.2
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.1
25.208(a) PFD limit (3650-4200 MHz), dBW/m2/4kHz	-152.0	-149.5	-147.0	-144.5	-142.0	-142.0
PFD, dBW/m2/4KHz	-167.5	-167.4	-167.3	-166.7	-166.6	-163.3
Margin, dB, relative to 25.208	15.5	17.9	20.3	22.2	24.6	21.3

Table 6: Maximum PFD values and margins relative to permissible limits of §25.208(b) for HTS beams, H polarization

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.00
Max. EIRP per 36 MHz, dBW	56.0	56.0	56.0	56.0	56.0	56.0
Output backoff, dB	3.0	3.0	3.0	3.0	3.0	3.0
Gain roll-off at elevation angle, dBi	-4.8	-3.8	-1.8	-0.8	0.0	0.0
EIRP at elevation angle, dBW	48.2	49.2	51.2	52.2	53.0	53.0
Carrier bandwidth, MHz	36	36	36	36	36	36
EIRP density at elevation angle dBW/4kHz	8.7	9.7	11.7	12.7	13.5	13.5
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.84
25.208 (b)(1) PFD limit, dBW/m2/4kHz	-150.0	-147.5	-145.0	-142.5	-140.0	-140.0
PFD, dBW/m2/4KHz	-154.6	-153.5	-151.4	-150.3	-149.4	-149.4
Margin, dB, relative to 25.208 (b)(1)	4.6	6.0	6.4	7.8	9.4	9.4

Table 7: Maximum PFD values and margins relative to permissible limits of §25.208(b) for HTS beams, V polarization

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.00
Max. EIRP per 36 MHz, dBW	54.7	54.7	54.7	54.7	54.7	54.7
Output backoff, dB	3.0	3.0	3.0	3.0	3.0	3.0
Gain roll-off at elevation angle, dBi	-8.5	-6.5	-4.5	-2.5	-0.5	0.0
EIRP at elevation angle, dBW	43.2	45.2	47.2	49.2	51.2	51.7
Carrier bandwidth, MHz	36	36	36	36	36	36
EIRP density at elevation angle dBW/4kHz	3.7	5.7	7.7	9.7	11.7	12.2
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.8
25.208 (b)(1) PFD limit, dBW/m2/4kHz	-150.0	-147.5	-145.0	-142.5	-140.0	-140.0
PFD, dBW/m2/4KHz	-159.6	-157.5	-155.4	-153.3	-151.2	-150.6
Margin, dB, relative to 25.208 (b)(1)	9.6	10.0	10.4	10.8	11.2	10.6

Table 8: Maximum PFD values and margins relative to permissible limits of §25.208(b) for TM2 beam, RHCP and LHCP polarizations

Elevation angle, deg	5.0	10.0	15.0	20.0	25.0	90.00
Max. EIRP per 36 MHz, dBW	24.5	24.5	24.5	24.5	24.5	24.5
Output backoff, dB	0.0	0.0	0.0	0.0	0.0	0.0
Gain roll-off at elevation angle, dBi	0.0	0.0	0.0	0.0	0.0	0.0
EIRP at elevation angle, dBW	24.5	24.5	24.5	24.5	24.5	24.5
Carrier bandwidth, MHz	0.2	0.2	0.2	0.2	0.2	0.2
EIRP density at elevation angle dBW/4kHz	7.5	7.5	7.5	7.5	7.5	7.5
Minimum spreading loss, dB/m2	-163.3	-163.2	-163.1	-162.9	-162.8	-162.84
25.208 (b)(1) PFD limit, dBW/m2/4kHz	-150.0	-147.5	-145.0	-142.5	-140.0	-140.0
PFD, dBW/m2/4KHz	-155.8	-155.6	-155.5	-155.4	-155.3	-155.3
Margin, dB, relative to 25.208 (b)(1)	5.8	8.1	10.5	12.9	15.3	15.3

No PFD limits for the 11700–12200 MHz band are specified in §25.208 or in No. 21.16 of the ITU Radio Regulations with respect to the operation of geostationary satellites. With respect to the 12.2–12.45 GHz band, there are PFDPFD limits in Section 4 of Annex 1 to Appendix 30 for protection of terrestrial services.² The analyses with respect to Annex 1 to Appendix 30 provided in Appendix 1 to Annex D of this document addresses the PFD limits in Section 4 and shows that SES-14 meets the levels set out in the Radio Regulations.

5.0 Satellite Antenna Gain Contours (§25.114(c)(4)(vi)(A) & (vii))

The Schedule S and accompanying gxt files provide the typical antenna gain contours for the SES-14 space station beams at 47.5° W.L.

Considering the large number of spot beams utilized in the Ku-band payload, the predicted antenna gain contours and associated performance characteristics are provided for one representative beam of each type, called beams UBDV, UBDH, UBUV and UBUH in Schedule S. In accordance with Section 25.114(c)(4)(vii)(B), Annex A to this document provides the latitude and longitude of each spot beam's maximum gain point.

Consistent with §25.114(c)(4)(vi)(A) of the Commission's rules, SES is not providing the gain characteristics for the global horn antennas (TMKHH, TMKHV, TMCHV, TCHH, TCHV) or the omni antennas (TMKOR, TMKOL, TCOL, TCOR) in a GIMS-readable format because the 8 dBi contours of these beams fall beyond the edge of the visible Earth.

² Section 25.114(d)(13) of the Commission's rules essentially applies Annex 1 to Appendices 30 and 30A of the ITU's Radio Regulations as the technical criteria applicable to DBS systems. It is worth noting that the PFD limits in Section 4 of Annex 1 to Appendix 30, once scaled to the same reference bandwidth, are the same as those applicable to non-geostationary satellite systems in the 12.2–12.7 GHz band in No. 21.16.

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

Annex B shows typical link budgets for the various payloads on the satellite, including emission designators.

7.0 Maximum Theoretical Operation Levels

SES-14 will be operated consistent with coordination agreements with adjacent GSO satellites.

In any case, in the 10.95-11.7, 11.7-12.2 GHz and 12.2-12.45 GHz bands, the downlink EIRP density of the SES-14 digital carriers will not exceed -18 dBW/Hz; and in the 13.75-14.5 GHz and 17.3-17.8 GHz bands, the input power density of the uplink digital carriers of earth stations operating with SES-14 will not exceed -42 dBW/Hz.

In the 3625-4200 MHz band the downlink EIRP density of the SES-14 digital carriers will not exceed -30 dBW/Hz; and in the 5850-6425 MHz band, the input power density of the uplink digital carriers of earth stations operating with SES-14 will not exceed -38.7 dBW/Hz.

8.0 Coordination Matters including Two Degree Spacing Analysis (§25.114(d)(7), §25.114(d)(13) and §25.140(b)(2))

Annex C provides analyses demonstrating the compatibility of SES-14 at 47.5° W.L. with neighboring spacecraft in the C-band and Ku-band.

With respect to §25.114(d)(13)(i), the operation of SES-14 in 17.3-18.05 GHz and 12.2-12.45 GHz will be under a Dutch ITU filing for which the information requested in Appendix 4 of the ITU Radio Regulations has already been submitted to, and published by, the ITU. The relevant publication is Special Sections AP30/E/610, AP30A/E/610, AP30-30A/E/612, AP30A/E/610 MOD-1 and AP30-30A/E/612 MOD-1, which can be found in the ITU's BR IFIC 2736 dated January 22, 2013, BR IFIC 2737 dated February 5, 2013 and BR IFIC 2780 dated October 14, 2014, respectively. Further, under this rule section, applicants must provide sufficient technical showing that the proposed system could operate satisfactorily if all

assignments in the BSS and feeder link Plans were implemented. SES is planning to use the 17.3-18.05 GHz and 12.2-12.45 GHz bands to provide FSS services, in a manner consistent with usage for BSS feeder links and BSS transmissions. Considering the application of two degree spacing in many other FSS bands in the United States, it would be reasonable to assume that such operations would be consistent with other Plan assignments within at least two degrees of orbital separation. A review of all Region 1 and 2 Appendix 30 and Appendix 30A Plan assignments within +/- 3 degrees shows the following:

Plan assignment	Category	Plan ID	Adm	Longitude
<u>B CE312</u>	B/Plan/List	30_2	B	-45.2
<u>B CE312</u>	B/Plan/List	30_2	B	-44.8
<u>B CE412</u>	B/Plan/List	30_2	B	-45.2
<u>B CE412</u>	B/Plan/List	30_2	B	-44.8
<u>B SU112</u>	B/Plan/List	30_2	B	-45.2
<u>B SU112</u>	B/Plan/List	30_2	B	-44.8
<u>B SU212</u>	B/Plan/List	30_2	B	-45.2
<u>B SU212</u>	B/Plan/List	30_2	B	-44.8

From this Table, there are no Plan assignments within two degrees of 47.5 W.L., and therefore SES-14 can be assumed to meet the requirements of this provision and to be able to operate satisfactorily should all Plan assignments be implemented.

With respect to §25.114(d)(13)(i), Annex D provides an analysis demonstrating compatibility of SES-14 at 47.5° W.L. with the provisions of Annex 1 to Appendix 30 and Annex 1 to Appendix 30A of the Radio Regulations.

In order to ensure compatibility with the Plans and Lists, SES plans to operate its uplinks and downlinks in these frequency bands in a manner similar to that of BSS feeder links and BSS transmissions. Specifically, SES plans to operate with a minimum uplink earth station size of 9 meters and an input power density of -66.5 dBW/Hz. With these assumptions, the analysis in Annex D shows that no U.S.-licensed DBS systems are affected and that the following three networks with service areas including the United States are affected:

- 1) Russia/Intersputnik's INTERSPUTNIK-47.5W-B network at 47.5°W.
- 2) The UK's UKBSS-50W network at 50°W;
- 3) The Netherlands' NSS-BSS 40.5W network at 40.5°W

Russia's network has recently expired, so there is no longer an interference potential into this network.

The UK's network was filed on behalf of Intelsat. SES and Intelsat have reached a coordination agreement for their respective networks.

Coordination of the Netherlands network at 40.5°W is a domestic issue, not an ITU one. The Netherlands' 40.5°W network was filed on behalf of SES, therefore coordination is an internal SES matter.

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

9.1 Spacecraft Hardware Design

1. *Spacecraft Hardware design.* SES has assessed and limited the amount of debris that will be released in a planned manner during normal operations of SES-14. During the satellite ascent, after separation from the launcher, no debris will be generated. As with all recent SES satellite launches, all deployments will be conducted using pyrotechnic devices designed to retain all physical debris. No debris is generated during normal on-station operations, and the spacecraft will be in a stable configuration.

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

damage would need to be mitigated in order for the spacecraft design to meet SES's required probability of success of the mission. SES has taken the following steps to limit the effects of such collisions: (1) critical spacecraft components are located inside the protective body of the spacecraft and properly shielded; and (2) all spacecraft subsystems have redundant components to ensure no single-point failures. The spacecraft will not use any subsystems for end-of-life disposal that are not used for normal operations.

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

The design of the SES-14 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. Burst tests are performed on all pressure vessels during qualification testing to demonstrate a margin of

safety against burst. Bipropellant mixing is prevented by the use of valves that prevent backwards flow in propellant and pressurization lines. All pressures, including those of the batteries, will be monitored by telemetry. At the end of operational life, after the satellite has reached its final disposal orbit, all on-board sources of stored energy will be depleted or secured, excess propellant remaining in the chemical propulsion tanks will be vented, excess pressurant remaining in the helium tanks will be vented, and the batteries will be discharged.

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.

SES-14 will be positioned at 47.5° W.L. In considering current and planned satellites that may have a station-keeping volume that overlaps the SES-14 satellite, SES has reviewed the FCC database 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 47.5° 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 SES-14 satellite, have been taken into account in the analysis. Based on these reviews, the satellites operating nominally at 47.5° W.L. are NSS-806 and ASTRA 1D, which are also controlled and operated by SES. There are no pending

applications before the Commission requesting authorization to use an orbital location within $\pm 0.15^\circ$ of 47.5° W.L. Furthermore, SES is not aware of any other system with an overlapping station-keeping volume with SES-14 that is either in orbit or progressing towards launch. Based on the preceding, it is concluded that physical coordination of the SES-14 satellite with another party is not required at the present time.

On-station operations require station-keeping within the ± 0.1 degree N-S and ± 0.05 degree E-W control box, thereby ensuring adequate collision avoidance distance from other satellites in geosynchronous orbit. SES-14 will be temporarily co-located with NSS-806 as traffic is transferred to SES-14. After traffic transfer is complete, the NSS-806 satellite will be relocated to another orbital location such that there will be no station-keeping volume overlap with SES-14.³ During the period of collocation, SES will use the proven inclination-eccentricity technique to ensure adequate separation between the 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 uses the Space Data Center (“SDC”) system from the Space Data Association to monitor the risk of close approach of its satellites with other objects. Any close encounters (separation of less than 10 km) are flagged and investigated in more detail. If required, avoidance maneuvers are performed to eliminate the possibility of collisions. During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. In addition, the SDC system is used to ensure no close encounter occurs

³ If SES proposes to use NSS-806 for service to the U.S. following relocation of the satellite, SES will seek modification of the satellite’s market access grant from the Commission.

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.

3. *Post-Mission Disposal.* Post-mission disposal of the satellite from operational orbit will be accomplished by carrying out maneuvers to a higher orbit. The upper stage engine remains part of the satellite, and there is no re-entry phase for either component. The fuel budget for elevating the satellite to a disposal orbit is included in the satellite design. SES plans to maneuver SES-14 to a disposal orbit with a minimum perigee of 257 km above the normal GSO operational orbit. This proposed disposal orbit altitude results from application of the IADC formula based on the following calculation:

$$\text{Total Solar Pressure Area "A"} = 78.0 \text{ m}^2$$

$$\text{"M"} = \text{Dry Mass of Satellite} = 3486 \text{ kg}$$

$$\text{"CR"} = \text{Solar Pressure Radiation Coefficient} = 1.00$$

Therefore the Minimum Disposal Orbit Perigee Altitude:

$$= 36,021 \text{ km} + 1000 \times \text{CR} \times \text{A} / \text{m}$$

$$= 36,021 \text{ km} + 1000 \times 1.00 \times 78.0 / 3486$$

$$= 36,043 \text{ km}$$

$$= 257 \text{ km above GSO (35,786 km)}$$

SES intends to reserve 15 kg of propellant in order to account for post-mission disposal of SES-14. SES has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

ANNEX A

Latitude and Longitude of Maximum Antenna Gain Point(s) in User Beam Group

Beam Number	Latitude (deg.N)	Longitude (deg.E)
1	-26.39	-61.41
2	-35.56	-70.89
3	-35.86	-58.79
4	-48.11	-69.1
5	-8.67	-65.93
6	-2.41	-59.86
7	4.2	-53.8
8	-18.64	-55.13
9	-11.98	-48.58
10	-5.02	-43.27
11	-9.8	-56.66
12	-2.39	-50.06
13	-27.47	-52.57
14	-20.78	-45.33
15	-14.86	-39.99
16	-6.91	-36.16
17	17.49	-87.12
18	17.37	-74.74
19	16.11	-63.79
20	9.89	-81.82
21	8.67	-70.27
22	7.28	-60.93

Beam Number	Latitude (deg.N)	Longitude (deg.E)
23	3.01	-75.93
24	0	-67.71
25	22.08	-98.67
26	31.92	-68.71
27	26.09	-83.02
28	22.49	-68.61
29	33.3	-80.01
30	43.71	-80.46
31	46.46	-69.3
32	48.64	-57.72
33	50.51	-45.66
34	49.2	-32.66
35	48.42	-18.35
36	44.03	-3.96
37	-5.17	-76.24
38	-14.47	-73.57
39	-23.69	-69.39
40	-16.65	-64.18
41	29.49	-9.4
42	18.4	-13.09
43	9.2	-11.1
44	8.55	1.53

ANNEX B

SES-14 Link Budgets

Table B-1
TT&C Link Budgets

Link Parameters	Units	Command			Telemetry	
		800KF9D	800KF9D	800KF9D	200KF9D	200KF9D
		TC1	TC2	TC3	TM1	TM2
Uplink Frequency	MHz	14002	14498	14002		
Downlink Frequency	MHz				12198	10953
Carrier Allocated Bandwidth	kHz	800.0	800	800	200	200
Uplink:						
Nominal Earth Station EIRP per carrier	dBW	76.0	76.0	76.0		
Earth Station Diameter	m	9.0	9.0	9.0		
Earth Station Gain	dB	59.5	59.8	59.5		
Uplink Input Power per Carrier	dBW	16.5	16.2	16.5		
	dBW/4					
Input power density	kHz	-6.5	-6.8	-6.5		
Free Space Loss	dB	206.4	206.8	206.4		
G/T Satellite towards E/S	dB/K	-17.5	-17.5	-17.5		
C/N Thermal Uplink	dB	21.6	21.3	21.6		
C/I XPOL, ACI, IM, ASI	dB	43.0	43.0	43.0		
C/(N+I) uplink	dB	21.6	21.3	21.6		
Downlink:						
Satellite e.i.r.p. per carrier	dBW				13.0	13.0
Maximum e.i.r.p. density	dBW/4kHz				-4.0	-4.0
Free Space Loss	dB				205.3	204.3
Earth Station Diameter	m				9.0	9.0
Earth Station Gain	dB				58.8	58.3
Noise Temperature	K				150.0	150.0
Earth Station G/T	dB/K				37.1	36.5
C/N Thermal Downlink	dB				20.4	20.8
C/I XPOL, ACI, IM, ASI	dB				20.9	20.3
C/(N+I) downlink	dB				17.6	17.5
Adjacent Satellite Interference:						
Uplink Inp. Pwr. Dens. @ 2 degrees	dBW/Hz	-50	-50	-50		
Downlink e.i.r.p. Dens @ 2 degrees	dBW/Hz				-26	-26
C/I up (single satellite)	dB	46.0	46.0	46.0		
C/I dn (single satellite)	dB				23.9	23.3
Aggregate C/I up	dB	43.0	43.0	43.0		
Aggregate C/I down	dB				20.9	20.3
Overall:						
C/(N+I) overall	dB	21.6	21.3	21.6	17.6	17.5
C/(N+I) required	dB	9.0	9.0	9.0	9.0	9.0
System Margin	dB	12.6	12.3	12.6	8.6	8.5

Table B-2
EURAM beam Link Budgets

Link Parameters	Units	1M44G7W	2M40G7W	9M0G7W	36M0G7W
Data rate	Mbps	1.92	2.67	7.42	58.07
Mod cod		QPSK -4/5	QPSK -2/3	QPSK 1/2	8PSK 2/3
Carrier bandwidth	MHz	1.44	2.40	9.00	36.00
Uplinks:					
Uplink Frequency	GHz	6.15	6.15	6.15	6.15
Uplink Transmit Power	dBW	10.00	12.04	11.06	21.49
Earth Station Diameter	m	2.40	1.80	6.30	6.00
Earth Station Gain	dBi	41.91	39.42	49.95	49.53
Earth Station Transmit EIRP/Carrier	dBW	51.91	51.46	60.98	71.00
Atmospheric Losses	dB	0.06	0.06	0.08	0.08
Free Space Loss	dB	199.62	199.62	199.87	199.87
Satellite G/T	dB/K	-5.52	-5.52	-4.79	-4.79
C/N Thermal Uplink	dB	14.52	11.85	16.10	20.10
C/I XPOL, CCI, ASI	dB	13.18	10.69	14.47	14.22
C/(N+I) uplink	dB	10.79	8.22	12.20	13.22
Downlinks:					
Downlink Frequency	GHz	3.92	3.92	3.92	3.92
Satellite EIRP per carrier	dBW	19.08	19.14	27.45	36.98
Atmospheric Losses	dB	0.07	0.07	0.04	0.04
Free Space Loss	dB	195.96	195.96	195.60	195.60
Earth Station Diameter	m	6.30	6.30	2.40	3.50
Earth Station Gain	dBi	46.05	46.05	38.01	41.29
System Noise Temperature	K	83.00	83.00	70.16	66.22
Earth Station G/T	dB/K	26.60	26.60	19.55	23.08
C/N Thermal Downlink	dB	17.45	15.29	11.20	18.24
C/I XPOL, ACI, CCI, IM, ASI	dB	13.12	11.14	5.36	17.16
C/(N+I) downlink	dB	13.94	11.96	4.54	14.66
Adjacent Satellite Interference:					
Uplink Input Power Density at 2 degrees	dBW/Hz	-47.00	-47.00	-47.00	-47.00
Downlink EIRP density at 2 degrees	dBW/Hz	-37.00	-37.00	-37.00	-37.00
C/I up (single satellite)	dB	15.80	13.12	16.89	16.73
C/I dn (single satellite)	dB	19.99	17.82	7.96	19.74
Aggregate C/I up	dB	12.79	10.11	13.88	13.72
Aggregate C/I down	dB	17.08	14.92	4.93	16.73
Overall:					
C/(N+I) overall	dB	8.24	5.90	3.69	10.87
C/(N+I) required	dB	5.74	4.05	1.15	7.87
Margin	dB	2.50	1.85	2.54	3.00

Table B-3
Global beam Link Budgets

Link Parameters	Units	1M80G7W	9M00G7W	36M0G7W
Data rate	Mbps	2.00	4.92	29.67
Mod cod		QPSK -2/3	QPSK 1/3	QPSK 1/2
Carrier bandwidth	MHz	1.80	9.00	36.00
Uplinks:				
Uplink Frequency	GHz	6.28	6.28	6.28
Uplink Transmit Power	dBW	10.00	10.63	21.07
Earth Station Diameter	m	2.40	6.30	6.00
Earth Station Gain	dBi	42.10	50.13	49.71
Earth Station Transmit EIRP/Carrier	dBW	52.10	60.74	70.76
Atmospheric Losses	dB	0.06	0.08	0.08
Free Space Loss	dB	199.80	200.05	200.05
Satellite G/T	dB/K	-6.86	-7.55	-7.55
C/N Thermal Uplink	dB	12.21	12.91	16.91
C/I XPOL, CCI, ASI	dB	12.46	14.24	17.74
C/(N+I) uplink	dB	9.32	10.51	14.29
Downlinks:				
Downlink Frequency	GHz	4.06	4.06	4.06
Satellite EIRP per carrier	dBW	17.32	25.45	34.98
Atmospheric Losses	dB	0.07	0.07	0.07
Free Space Loss	dB	196.25	196.28	196.28
Earth Station Diameter	m	6.30	2.40	2.40
Earth Station Gain	dBi	46.33	38.30	38.30
System Noise Temperature	K	83.03	71.74	67.79
Earth Station G/T	dB/K	26.88	19.74	19.99
C/N Thermal Downlink	dB	14.71	8.68	12.44
C/I XPOL, ACI, CCI, IM, ASI	dB	12.51	3.08	6.76
C/(N+I) downlink	dB	11.66	2.13	5.72
Adjacent Satellite Interference:				
Uplink Input Power Density at 2 degrees	dBW/Hz	-47.00	-47.00	-47.00
Downlink EIRP density at 2 degrees	dBW/Hz	-37.00	-37.00	-37.00
C/I up (single satellite)	dB	15.01	16.65	20.63
C/I dn (single satellite)	dB	17.54	5.57	8.96
Aggregate C/I up	dB	12.00	13.64	17.62
Aggregate C/I down	dB	14.63	2.50	6.01
Overall:				
C/(N+I) overall	dB	6.85	1.45	5.16
C/(N+I) required	dB	4.05	-1.03	2.25
Margin	dB	2.80	2.48	2.90

Table B-4
USE beam Link Budgets

Link Parameters	Units	2M40G7W	2M40G7W	1M80G7W	9M00G7W	35M4G7W
Data rate	Mbps	2.00	2.00	2.00	8.91	6.04
Mod cod		QPSK 1/2	QPSK 1/2	QPSK 2/3	QPSK 3/5	BPSK 1/5
Carrier bandwidth	MHz	2.40	2.40	1.80	9.00	35.40
Uplinks:						
Uplink Frequency	GHz	14.30	14.30	14.30	14.30	14.30
Uplink Transmit Power	dBW	11.58	3.98	-0.01	-0.10	6.35
Earth Station Diameter	M	0.55	1.20	2.40	9.00	9.00
Earth Station Gain	dBi	36.45	43.22	49.24	60.72	60.72
Earth Station Transmit EIRP/Carrier	dBW	48.03	47.20	49.23	60.63	67.07
Atmospheric Losses	dB	0.24	0.24	0.24	0.15	0.15
Free Space Loss	dB	207.54	207.54	207.54	207.18	207.18
Satellite G/T	dB/K	1.97	1.97	1.97	6.11	6.11
C/N Thermal Uplink	dB	7.81	6.98	10.26	19.26	19.76
C/I XPOL, CCI, ASI	dB	10.11	9.31	12.42	16.88	17.34
C/(N+I) uplink	dB	5.80	4.98	8.20	14.90	15.37
Downlinks:						
Downlink Frequency	GHz	12.00	12.00	12.00	12.00	12.00
Satellite EIRP per carrier	dBW	31.65	30.83	32.84	35.94	43.67
Atmospheric Losses	dB	0.11	0.11	0.11	0.16	0.16
Free Space Loss	dB	205.66	205.66	205.66	205.80	205.80
Earth Station Diameter	M	9.00	9.00	9.00	1.20	0.55
Earth Station Gain	dBi	59.20	59.20	59.20	41.70	34.92
System Noise Temperature	K	143.27	143.27	143.27	106.96	146.58
Earth Station G/T	dB/K	35.83	35.83	35.83	21.14	12.26
C/N Thermal Downlink	dB	27.30	26.48	29.73	10.98	3.88
C/I XPOL, ACI, CCI, IM, ASI	dB	15.23	14.54	17.12	10.20	-2.50
C/(N+I) downlink	dB	20.48	20.02	21.60	7.89	-3.31
Adjacent Satellite Interference:						
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.00	-50.00	-50.00	-50.00	-50.00
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00	-26.00	-26.00	-26.00
C/I up (single satellite)	dB	12.52	11.69	14.97	19.46	19.96
C/I dn (single satellite)	dB	32.66	31.83	35.09	13.50	-0.13
Aggregate C/I up	dB	9.51	8.68	11.96	16.45	16.95
Aggregate C/I down	dB	29.63	28.81	32.06	10.47	-3.16
Overall:						
C/(N+I) overall	dB	5.30	4.50	7.64	6.83	-3.46
C/(N+I) required	dB	2.00	2.00	4.05	2.55	-6.10
Margin	dB	3.30	2.50	3.60	4.28	2.64

Table B-5
Brazil beam Link Budgets

Link Parameters	Units	2M40G7W	2M40G7W	1M80G7W	9M0G7W	36M0G7W	36M0G7W
Data rate	Mbps	2.00	2.00	2.00	9.92	52.18	19.22
Mod cod		QPSK 1/2	QPSK 1/2	QPSK 2/3	QPSK 2/3	8PSK 3/5	QPSK 1/3
Carrier bandwidth	MHz	2.40	2.40	1.80	9.00	36.00	36.00
Uplinks:							
Uplink Frequency	GHz	14.48	14.48	14.48	14.48	14.48	14.48
Uplink Transmit Power	dBW	11.58	3.98	0.81	1.25	11.56	11.56
Earth Station Diameter	m	0.55	1.20	2.40	9.00	9.00	9.00
Earth Station Gain	dBi	36.56	43.33	49.35	60.83	60.49	60.49
Earth Station Transmit EIRP/Carrier	dBW	48.14	47.31	50.16	62.08	72.03	72.03
Atmospheric Losses	dB	0.13	0.13	0.13	0.12	0.12	0.12
Free Space Loss	dB	206.75	206.75	206.75	206.88	206.88	206.88
Satellite G/T	dB/K	2.05	2.05	2.05	4.23	4.30	4.30
C/N Thermal Uplink	dB	8.89	8.06	12.16	19.16	23.16	23.16
C/I XPOL, CCI, ASI	dB	10.31	9.52	13.37	18.23	21.64	21.64
C/(N+I) uplink	dB	6.53	5.72	9.71	15.66	19.33	19.33
Downlinks:							
Downlink Frequency	GHz	12.18	12.18	12.18	12.18	12.18	12.18
Satellite EIRP per carrier	dBW	34.33	33.52	34.36	37.95	48.00	50.00
Atmospheric Losses	dB	0.09	0.09	0.09	0.11	0.09	0.09
Free Space Loss	dB	205.38	205.38	205.38	205.30	205.25	205.26
Earth Station Diameter	m	9.00	9.00	9.00	1.20	0.90	0.45
Earth Station Gain	dBi	59.33	59.33	59.33	41.83	39.33	33.31
System Noise Temperature	K	118.66	118.66	118.66	104.75	96.47	96.36
Earth Station G/T	dB/K	37.05	37.05	37.05	21.36	19.49	13.47
C/N Thermal Downlink	dB	31.51	30.69	32.78	13.75	15.97	11.95
C/I XPOL, ACI, CCI, IM, ASI	dB	16.27	15.66	17.30	12.34	14.55	2.81
C/(N+I) downlink	dB	21.65	21.33	22.10	10.56	12.19	2.31
Adjacent Satellite Interference:							
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.00	-50.00	-50.00	-50.00	-50.00	-50.00
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00	-26.00	-26.00	-26.00	-26.00
C/I up (single satellite)	dB	12.73	11.90	16.00	20.95	25.75	25.75
C/I dn (single satellite)	dB	35.98	35.17	37.25	16.46	16.92	5.05
Aggregate C/I up	dB	9.72	8.89	12.99	17.93	22.74	22.74
Aggregate C/I down	dB	32.97	32.16	34.24	13.44	13.89	2.03
Overall:							
C/(N+I) overall	dB	6.08	5.29	9.00	8.94	11.42	2.23
C/(N+I) required	dB	2.00	2.00	4.05	3.21	6.90	-0.73
Margin	dB	4.08	3.29	4.95	5.72	4.52	2.96

Table B-6
BRSE beam Link Budgets

Link Parameters	Units	2M40G7W	2M40G7W	1M80G7W	9M40G7W	35M4G7W
Data rate	Mbps	2.00	2.00	2.00	9.92	29.17
Mod cod		QPSK 1/2	QPSK 1/2	QPSK 2/3	QPSK 2/3	QPSK 1/2
Carrier bandwidth	MHz	2.40	2.40	1.80	9.00	35.40
Uplinks:						
Uplink Frequency	GHz	14.30	14.30	14.30	14.30	14.30
Uplink Transmit Power	dBW	11.58	3.98	0.95	0.78	10.03
Earth Station Diameter	M	0.55	1.20	2.40	9.00	9.00
Earth Station Gain	dBi	36.45	43.22	49.24	60.72	60.72
Earth Station Transmit EIRP/Carrier	dBW	48.03	47.20	50.19	61.51	70.75
Atmospheric Losses	dB	0.15	0.15	0.15	0.11	0.11
Free Space Loss	dB	206.63	206.63	206.63	206.77	206.77
Satellite G/T	dB/K	2.00	2.00	2.00	4.79	4.79
C/N Thermal Uplink	dB	8.84	8.02	12.26	19.26	22.56
C/I XPOL, CCI, ASI	dB	10.19	9.40	13.38	17.72	20.56
C/(N+I) uplink	dB	6.46	5.64	9.77	15.41	18.44
Downlinks:						
Downlink Frequency	GHz	12.00	12.00	12.00	12.00	12.00
Satellite EIRP per carrier	dBW	31.24	30.42	31.39	36.96	44.62
Atmospheric Losses	dB	0.08	0.08	0.08	0.11	0.11
Free Space Loss	dB	205.25	205.25	205.25	205.10	205.10
Earth Station Diameter	M	9.00	9.00	9.00	1.20	0.90
Earth Station Gain	dBi	59.20	59.20	59.20	41.70	39.20
System Noise Temperature	K	118.55	118.55	118.55	104.19	104.19
Earth Station G/T	dB/K	36.95	36.95	36.95	21.26	18.76
C/N Thermal Downlink	dB	28.45	27.63	29.85	12.85	12.08
C/I XPOL, ACI, CCI, IM, ASI	dB	16.08	15.42	17.14	11.65	8.79
C/(N+I) downlink	dB	20.93	20.52	21.55	9.68	8.21
Adjacent Satellite Interference:						
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.00	-50.00	-50.00	-50.00	-50.00
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00	-26.00	-26.00	-26.00
C/I up (single satellite)	dB	12.60	11.78	16.02	20.38	23.68
C/I dn (single satellite)	dB	32.76	31.94	34.16	15.42	13.12
Aggregate C/I up	dB	9.59	8.77	13.01	17.37	20.67
Aggregate C/I down	dB	29.75	28.93	31.15	12.41	10.11
Overall:						
C/(N+I) overall	dB	5.98	5.18	9.01	8.27	6.81
C/(N+I) required	dB	2.00	2.00	4.05	3.21	1.15
Margin	dB	3.98	3.18	4.96	5.05	5.66

Table B-7
VPEC beam Link Budgets

Link Parameters	Units	2M4G7W	2M4G7W	1M8G7W	9M4G7W	35M4G7W
Data rate	Mbps	2.00	2.00	2.57	8.91	7.79
Mod cod		QPSK 1/2	QPSK 1/2	QPSK 6/7	QPSK 3/5	BPSK 4/15
Carrier bandwidth	MHz	2.40	2.40	1.80	9.00	35.40
Uplinks:						
Uplink Frequency	GHz	14.38	14.38	14.38	14.38	14.38
Uplink Transmit Power	dBW	11.58	3.98	5.05	-0.34	6.11
Earth Station Diameter	m	0.55	1.20	2.40	9.00	9.00
Earth Station Gain	dBi	36.50	43.27	49.29	60.77	60.77
Earth Station Transmit EIRP/Carrier	dBW	48.08	47.25	54.34	60.43	66.88
Atmospheric Losses	dB	0.17	0.17	0.14	0.18	0.18
Free Space Loss	dB	206.77	206.77	206.77	206.88	206.88
Satellite G/T	dB/K	4.04	4.04	1.99	5.99	5.99
C/N Thermal Uplink	dB	10.77	9.94	16.27	19.21	19.71
C/I XPOL, CCI, ASI	dB	10.22	9.42	16.95	16.67	17.13
C/(N+I) uplink	dB	7.47	6.66	13.59	14.75	15.22
Downlinks:						
Downlink Frequency	GHz	12.08	12.08	12.08	12.08	12.08
Satellite EIRP per carrier	dBW	33.36	33.53	32.08	34.94	45.69
Atmospheric Losses	dB	0.13	0.13	0.13	0.19	0.12
Free Space Loss	dB	205.37	205.37	205.37	205.48	205.26
Earth Station Diameter	m	9.00	9.00	9.00	1.20	0.55
Earth Station Gain	dBi	59.26	59.26	59.26	41.76	34.98
System Noise Temperature	K	118.34	118.34	118.34	108.84	105.27
Earth Station G/T	dB/K	37.06	37.06	37.06	21.12	14.50
C/N Thermal Downlink	dB	30.51	30.68	30.47	10.25	8.72
C/I XPOL, ACI, CCI, IM, ASI	dB	17.01	17.13	16.78	9.84	0.36
C/(N+I) downlink	dB	21.63	21.70	21.61	7.32	-0.04
Adjacent Satellite Interference:						
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.00	-50.00	-50.00	-50.00	-50.00
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00	-26.00	-26.00	-26.00
C/I up (single satellite)	dB	12.63	11.80	20.18	19.24	19.74
C/I dn (single satellite)	dB	34.85	35.02	34.81	13.04	2.86
Aggregate C/I up	dB	9.62	8.79	17.17	16.23	16.73
Aggregate C/I down	dB	31.82	31.99	31.78	10.00	-0.17
Overall:						
C/(N+I) overall	dB	6.99	6.27	11.83	6.35	-0.35
C/(N+I) required	dB	2.00	2.00	6.64	2.55	-4.90
Margin	dB	4.99	4.27	5.19	3.80	4.55

Table B-8
Atlantic beam Link Budgets

Link Parameters	Units	36M00G7W	2M40G7W
Data rate	Mbps	14.72	1.33
Mod cod		QPSK 1/4	BPSK 2/3
Carrier bandwidth	MHz	36.00	2.40
Uplinks:			
Uplink Frequency	GHz	14.44	14.13
Uplink Transmit Power	dBW	9.66	9.01
Earth Station Diameter	m	9.00	0.95
Earth Station Gain	dBi	60.46	40.74
Earth Station Transmit EIRP/Carrier	dBW	70.11	49.76
Atmospheric Losses	dB	0.33	0.13
Free Space Loss	dB	207.71	206.97
Satellite G/T	dB/K	12.29	-3.41
C/N Thermal Uplink	dB	28.18	4.83
C/I XPOL, ACI, IM, ASI	dB	20.38	11.85
C/(N+I) uplink	dB	19.52	4.04
Downlinks:			
Downlink Frequency	GHz	11.63	11.58
Satellite EIRP per carrier	dBW	41.49	34.91
Atmospheric Losses	dB	0.63	0.25
Free Space Loss	dB	206.04	205.79
Earth Station Diameter	m	0.95	9.00
Earth Station Gain	dBi	39.40	58.54
System Noise Temperature	K	162.42	125.40
Earth Station G/T	dB/K	17.30	36.95
C/N Thermal Downlink	dB	5.95	31.40
C/I XPOL, ACI, IM, ASI	dB	3.31	19.13
C/(N+I) downlink	dB	1.42	24.06
Adjacent Satellite Interference:			
Uplink Input Power Density at 2 degrees	dBW/Hz	-49.98	-50.13
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	23.77	14.48
C/I dn (single satellite)	dB	5.59	33.47
Aggregate C/I up	dB	20.76	11.46
Aggregate C/I down	dB	2.57	30.50
Overall:			
C/(N+I) overall	dB	1.36	3.90
C/(N+I) required	dB	-2.40	1.34
Margin	dB	2.76	2.56

Table B-9
HTS beams Forward Link Budgets

Link Parameters	Units	54M0G7W	54M0G7W
Data rate	Mbps	10.06	40.78
Mod cod		BPSK 1/5	QPSK 1/2
Carrier bandwidth	MHz	54.00	54.00
Uplinks:			
Uplink Frequency	GHz	13.88	17.62
Uplink Transmit Power	dBW	3.87	-0.52
Earth Station Diameter	m	9.00	9.00
Earth Station Gain	dBi	60.12	62.19
Earth Station Transmit EIRP/Carrier	dBW	63.98	61.65
Atmospheric Losses	dB	0.14	0.26
Free Space Loss	dB	206.92	209.00
Satellite G/T	dB/K	12.13	14.74
C/N Thermal Uplink	dB	20.73	18.83
C/I XPOL, ACI, IM, ASI	dB	12.29	9.91
C/(N+I) uplink	dB	11.71	9.38
Downlinks:			
Downlink Frequency	GHz	11.07	12.27
Satellite EIRP per carrier	dBW	46.96	47.05
Atmospheric Losses	dB	0.09	0.11
Free Space Loss	dB	204.89	205.78
Earth Station Diameter	m	0.65	1.00
Earth Station Gain	dBi	35.33	39.96
System Noise Temperature	K	148.46	123.81
Earth Station G/T	dB/K	12.51	18.55
C/N Thermal Downlink	dB	6.18	11.41
C/I XPOL, ACI, IM, ASI	dB	-1.23	9.29
C/(N+I) downlink	dB	-1.93	7.45
Adjacent Satellite Interference:			
Uplink Input Power Density at 2 degrees	dBW/Hz	-49.99	-49.99
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	15.03	12.59
C/I dn (single satellite)	dB	1.29	12.16
Aggregate C/I up	dB	12.01	9.57
Aggregate C/I down	dB	-1.59	9.52
Overall:			
C/(N+I) overall	dB	-2.14	5.15
C/(N+I) required	dB	-6.10	1.14
Margin	dB	3.96	4.01

Table B-10
HTS beams Return Link Budgets

Link Parameters	Units	2M40G7W	4M80G7W
Data rate	Mbps	2.00	4.00
Mod cod		QPSK 1/2	QPSK 1/2
Carrier bandwidth	MHz	2.40	4.80
Uplinks:			
Uplink Frequency	GHz	14.04	14.04
Uplink Transmit Power	dBW	7.40	6.67
Earth Station Diameter	m	0.65	1.00
Earth Station Gain	dBi	37.39	41.13
Earth Station Transmit EIRP/Carrier	dBW	44.80	47.81
Atmospheric Losses	dB	0.13	0.13
Free Space Loss	dB	206.92	206.92
Satellite G/T	dB/K	9.29	9.29
C/N Thermal Uplink	dB	12.62	12.62
C/I XPOL, ACI, IM, ASI	dB	7.18	7.18
C/(N+I) uplink	dB	6.09	6.09
Downlinks:			
Downlink Frequency	GHz	11.74	11.74
Satellite EIRP per carrier	dBW	34.08	37.09
Atmospheric Losses	dB	0.11	0.11
Free Space Loss	dB	205.47	205.47
Earth Station Diameter	m	9.00	9.00
Earth Station Gain	dBi	58.66	58.66
System Noise Temperature	K	122.22	122.22
Earth Station G/T	dB/K	37.04	37.04
C/N Thermal Downlink	dB	31.12	31.12
C/I XPOL, ACI, IM, ASI	dB	20.77	20.77
C/(N+I) downlink	dB	23.99	23.99
Adjacent Satellite Interference:			
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.13	-50.13
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	9.52	9.52
C/I dn (single satellite)	dB	33.37	33.37
Aggregate C/I up	dB	6.50	6.50
Aggregate C/I down	dB	30.37	30.37
Overall:			
C/(N+I) overall	dB	5.93	5.93
C/(N+I) required	dB	2.00	2.00
Margin	dB	3.93	3.93

ANNEX C

Interference Analysis

1- SES-14 TT&C:

Managing interference potential from TT&C carriers is done on a case-by-case basis and relies on frequency diversity, polarization diversity and other tools to avoid interference.

For the Ku-band, to ensure that SES-14's Ku-band TT&C operations do not cause harmful interference into the adjacent satellite networks, coordination of the TT&C channels will be completed with Intelsat, which operates the Intelsat 14 satellite at 45° W.L. and the Intelsat 1R and Intelsat 29e satellites at 50° W.L. This approach is consistent with industry practice, in which TT&C operations are typically addressed with adjacent satellite licensees on a case-by-case basis considering the actual characteristics of the respective networks.

2- SES-14 Communications Payload:

a) C-band and Ku-band Two Degree Spacing Analysis for 47.5° W.L.:

Currently there are no operational GSO C-band and Ku-band satellites that use the 3625-4200 MHz band, the 10.95-11.2 GHz band, the 11.45-11.7 GHz band or the 11.7-12.2 GHz band within two degrees of the 47.5° W.L. location, nor are there any pending applications before the Commission for use of these bands by a GSO satellite within two degrees.

It was assumed that a hypothetical satellite having the same operational characteristics as SES-14 was located at the orbital locations 45.5°W.L. and 49.5°W.L. For the satellite located at 45.5°W.L. it was assumed that the adjacent satellites were SES-14 located at 47.5°W and a hypothetical satellite having the same operational characteristics as SES-14 located at 43.5°W. For the satellite located at 49.5°W.L. it was assumed that the adjacent satellites were SES-14 located at 47.5°W and a hypothetical satellite having the same operational characteristics as SES-14 located at 51.5°W.

Given the large number of beams implemented on SES-14 calculations were performed considering the following subset of representative beams: C-band EURAM beam, Ku-band USE beam, Ku-band Atlantic beam and Ku-band HTS beam.

The results of the analysis are given in Appendix 1 and 2 and demonstrate that the proposed operations are compatible with a two degree environment.

APPENDIX 1 to ANNEX C

ADJACENT SATELLITE (45.5°W.L.) LINK BUDGETS

C-band (EURAM)

Link Parameters	Units	1M44G7W	2M40G7W	9M0G7W	36M0G7W
Data rate	Mbps	1.92	2.67	7.42	58.07
Mod cod		QPSK -4/5	QPSK -2/3	QPSK 1/2	8PSK 2/3
Carrier bandwidth	MHz	1.44	2.40	9.00	36.00
Uplinks:					
Uplink Frequency	GHz	6.15	6.15	6.15	6.15
Uplink Transmit Power	dBW	10.00	12.04	11.06	21.49
Earth Station Diameter	m	2.40	1.80	6.30	6.00
Earth Station Gain	dBi	41.91	39.42	49.95	49.53
Earth Station Transmit EIRP/Carrier	dBW	51.91	51.46	60.98	71.00
Atmospheric Losses	dB	0.06	0.06	0.08	0.08
Free Space Loss	dB	199.62	199.62	199.87	199.87
Satellite G/T	dB/K	-5.52	-5.52	-4.79	-4.79
C/N Thermal Uplink	dB	14.52	11.85	16.10	20.10
C/I XPOL, CCI, ASI	dB	13.18	10.69	14.47	14.22
C/(N+I) uplink	dB	10.79	8.22	12.20	13.22
Downlinks:					
Downlink Frequency	GHz	3.92	3.92	3.92	3.92
Satellite EIRP per carrier	dBW	19.08	19.14	27.45	36.98
Atmospheric Losses	dB	0.07	0.07	0.04	0.04
Free Space Loss	dB	195.96	195.96	195.60	195.60
Earth Station Diameter	m	6.30	6.30	2.40	3.50
Earth Station Gain	dBi	46.05	46.05	38.01	41.29
System Noise Temperature	K	83.00	83.00	70.16	66.22
Earth Station G/T	dB/K	26.60	26.60	19.55	23.08
C/N Thermal Downlink	dB	17.45	15.29	11.20	18.24
C/I XPOL, ACI, CCI, IM, ASI	dB	13.12	11.14	5.36	17.16
C/(N+I) downlink	dB	13.94	11.96	4.54	14.66
Adjacent Satellite Interference:					
Satellite 1 orbital location		43.5W	43.5W	43.5W	43.5W
Satellite 2 orbital location		47.5W	47.5W	47.5W	47.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-47.00	-47.00	-47.00	-47.00
Downlink EIRP density at 2 degrees	dBW/Hz	-37.00	-37.00	-37.00	-37.00
C/I up (single satellite)	dB	15.80	13.12	16.89	16.73
C/I dn (single satellite)	dB	19.99	17.82	7.96	19.74
Aggregate C/I up	dB	12.79	10.11	13.88	13.72
Aggregate C/I down	dB	17.08	14.92	4.93	16.73
Overall:					
C/(N+I) overall	dB	8.24	5.90	3.69	10.87
C/(N+I) required	dB	5.74	4.05	1.15	7.87
Margin	dB	2.50	1.85	2.54	3.00

Ku-band (USE)

Link Parameters	Units	2M40G7W	2M40G7W	1M80G7W	9M00G7W	35M4G7W
Data rate	Mbps	2.00	2.00	2.00	8.91	6.04
Mod cod		QPSK 1/2	QPSK 1/2	QPSK 2/3	QPSK 3/5	BPSK 1/5
Carrier bandwidth	MHz	2.40	2.40	1.80	9.00	35.40
Uplinks:						
Uplink Frequency	GHz	14.30	14.30	14.30	14.30	14.30
Uplink Transmit Power	dBW	11.58	3.98	-0.01	-0.10	6.35
Earth Station Diameter	m	0.55	1.20	2.40	9.00	9.00
Earth Station Gain	dBi	36.45	43.22	49.24	60.72	60.72
Earth Station Transmit EIRP/Carrier	dBW	48.03	47.20	49.23	60.63	67.07
Atmospheric Losses	dB	0.24	0.24	0.24	0.15	0.15
Free Space Loss	dB	207.54	207.54	207.54	207.18	207.18
Satellite G/T	dB/K	1.97	1.97	1.97	6.11	6.11
C/N Thermal Uplink	dB	7.81	6.98	10.26	19.26	19.76
C/I XPOL, CCI, ASI	dB	10.11	9.31	12.42	16.88	17.34
C/(N+I) uplink	dB	5.80	4.98	8.20	14.90	15.37
Downlinks:						
Downlink Frequency	GHz	12.00	12.00	12.00	12.00	12.00
Satellite EIRP per carrier	dBW	31.65	30.83	32.84	35.94	43.67
Atmospheric Losses	dB	0.11	0.11	0.11	0.16	0.16
Free Space Loss	dB	205.66	205.66	205.66	205.80	205.80
Earth Station Diameter	m	9.00	9.00	9.00	1.20	0.55
Earth Station Gain	dBi	59.20	59.20	59.20	41.70	34.92
System Noise Temperature	K	143.27	143.27	143.27	106.96	146.58
Earth Station G/T	dB/K	35.83	35.83	35.83	21.14	12.26
C/N Thermal Downlink	dB	27.30	26.48	29.73	10.98	3.88
C/I XPOL, ACI, CCI, IM, ASI	dB	15.23	14.54	17.12	10.20	-2.50
C/(N+I) downlink	dB	20.48	20.02	21.60	7.89	-3.31
Adjacent Satellite Interference:						
Satellite 1 orbital location		43.5W	43.5W	43.5W	43.5W	43.5W
Satellite 2 orbital location		47.5W	47.5W	47.5W	47.5W	47.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.00	-50.00	-50.00	-50.00	-50.00
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00	-26.00	-26.00	-26.00
C/I up (single satellite)	dB	12.52	11.69	14.97	19.46	19.96
C/I dn (single satellite)	dB	32.66	31.83	35.09	13.50	-0.13
Aggregate C/I up	dB	9.51	8.68	11.96	16.45	16.95
Aggregate C/I down	dB	29.63	28.81	32.06	10.47	-3.16
Overall:						
C/(N+I) overall	dB	5.30	4.50	7.64	6.83	-3.46
C/(N+I) required	dB	2.00	2.00	4.05	2.55	-6.10
Margin	dB	3.30	2.50	3.60	4.28	2.64

Ku-band (Atlantic)

Link Parameters	Units	36M00G7W	2M40G7W
Data rate	Mbps	14.72	1.33
Mod cod		QPSK 1/4	BPSK 2/3
Carrier bandwidth	MHz	36.00	2.40
Uplinks:			
Uplink Frequency	GHz	14.44	14.13
Uplink Transmit Power	dBW	9.66	9.01
Earth Station Diameter	m	9.00	0.95
Earth Station Gain	dBi	60.46	40.74
Earth Station Transmit EIRP/Carrier	dBW	70.11	49.76
Atmospheric Losses	dB	0.33	0.13
Free Space Loss	dB	207.71	206.97
Satellite G/T	dB/K	12.29	-3.41
C/N Thermal Uplink	dB	28.18	4.83
C/I XPOL, ACI, IM, ASI	dB	20.38	11.85
C/(N+I) uplink	dB	19.52	4.04
Downlinks:			
Downlink Frequency	GHz	11.63	11.58
Satellite EIRP per carrier	dBW	41.49	34.91
Atmospheric Losses	dB	0.63	0.25
Free Space Loss	dB	206.04	205.79
Earth Station Diameter	m	0.95	9.00
Earth Station Gain	dBi	39.40	58.54
System Noise Temperature	K	162.42	125.40
Earth Station G/T	dB/K	17.30	36.95
C/N Thermal Downlink	dB	5.95	31.40
C/I XPOL, ACI, IM, ASI	dB	3.31	19.13
C/(N+I) downlink	dB	1.42	24.06
Adjacent Satellite Interference:			
Satellite 1 orbital location		43.5W	43.5W
Satellite 2 orbital location		47.5W	47.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-49.98	-50.13
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	23.77	14.48
C/I dn (single satellite)	dB	5.59	33.47
Aggregate C/I up	dB	20.76	11.46
Aggregate C/I down	dB	2.57	30.50
Overall:			
C/(N+I) overall	dB	1.36	3.90
C/(N+I) required	dB	-2.40	1.34
Margin	dB	2.76	2.56

Ku-band (HTS Forward)

Link Parameters	Units	54M0G7W	54M0G7W
Data rate	Mbps	10.06	40.78
Mod cod		BPSK 1/5	QPSK 1/2
Carrier bandwidth	MHz	54.00	54.00
Uplinks:			
Uplink Frequency	GHz	13.88	17.62
Uplink Transmit Power	dBW	3.87	-0.52
Earth Station Diameter	m	9.00	9.00
Earth Station Gain	dBi	60.12	62.19
Earth Station Transmit EIRP/Carrier	dBW	63.98	61.65
Atmospheric Losses	dB	0.14	0.26
Free Space Loss	dB	206.92	209.00
Satellite G/T	dB/K	12.13	14.74
C/N Thermal Uplink	dB	20.73	18.83
C/I XPOL, ACI, IM, ASI	dB	12.29	9.91
C/(N+I) uplink	dB	11.71	9.38
Downlinks:			
Downlink Frequency	GHz	11.07	12.27
Satellite EIRP per carrier	dBW	46.96	47.05
Atmospheric Losses	dB	0.09	0.11
Free Space Loss	dB	204.89	205.78
Earth Station Diameter	m	0.65	1.00
Earth Station Gain	dBi	35.33	39.96
System Noise Temperature	K	148.46	123.81
Earth Station G/T	dB/K	12.51	18.55
C/N Thermal Downlink	dB	6.18	11.41
C/I XPOL, ACI, IM, ASI	dB	-1.23	9.29
C/(N+I) downlink	dB	-1.93	7.45
Adjacent Satellite Interference:			
Satellite 1 orbital location		43.5W	43.5W
Satellite 2 orbital location		47.5W	47.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-49.99	-49.99
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	15.03	12.59
C/I dn (single satellite)	dB	1.29	12.16
Aggregate C/I up	dB	12.01	9.57
Aggregate C/I down	dB	-1.59	9.52
Overall:			
C/(N+I) overall	dB	-2.14	5.15
C/(N+I) required	dB	-6.10	1.14
Margin	dB	3.96	4.01

Ku-band (HTS Return)

Link Parameters	Units	2M40G7W	4M80G7W
Data rate	Mbps	2.00	4.00
Mod cod		QPSK 1/2	QPSK 1/2
Carrier bandwidth	MHz	2.40	4.80
Uplinks:			
Uplink Frequency	GHz	14.04	14.04
Uplink Transmit Power	dBW	7.40	6.67
Earth Station Diameter	m	0.65	1.00
Earth Station Gain	dBi	37.39	41.13
Earth Station Transmit EIRP/Carrier	dBW	44.80	47.81
Atmospheric Losses	dB	0.13	0.13
Free Space Loss	dB	206.92	206.92
Satellite G/T	dB/K	9.29	9.29
C/N Thermal Uplink	dB	12.62	12.62
C/I XPOL, ACI, IM, ASI	dB	7.18	7.18
C/(N+I) uplink	dB	6.09	6.09
Downlinks:			
Downlink Frequency	GHz	11.74	11.74
Satellite EIRP per carrier	dBW	34.08	37.09
Atmospheric Losses	dB	0.11	0.11
Free Space Loss	dB	205.47	205.47
Earth Station Diameter	m	9.00	9.00
Earth Station Gain	dBi	58.66	58.66
System Noise Temperature	K	122.22	122.22
Earth Station G/T	dB/K	37.04	37.04
C/N Thermal Downlink	dB	31.12	31.12
C/I XPOL, ACI, IM, ASI	dB	20.77	20.77
C/(N+I) downlink	dB	23.99	23.99
Adjacent Satellite Interference:			
Satellite 1 orbital location		43.5W	43.5W
Satellite 2 orbital location		47.5W	47.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.13	-50.13
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	9.52	9.52
C/I dn (single satellite)	dB	33.37	33.37
Aggregate C/I up	dB	6.50	6.50
Aggregate C/I down	dB	30.37	30.37
Overall:			
C/(N+I) overall	dB	5.93	5.93
C/(N+I) required	dB	2.00	2.00
Margin	dB	3.93	3.93

APPENDIX 2 to ANNEX C

ADJACENT SATELLITE (49.5°W.L.) LINK BUDGETS

C-band (EURAM)

Link Parameters	Units	1M44G7W	2M40G7W	9M0G7W	36M0G7W
Data rate	Mbps	1.92	2.67	7.42	58.07
Mod cod		QPSK -4/5	QPSK -2/3	QPSK 1/2	8PSK 2/3
Carrier bandwidth	MHz	1.44	2.40	9.00	36.00
Uplinks:					
Uplink Frequency	GHz	6.15	6.15	6.15	6.15
Uplink Transmit Power	dBW	10.00	12.04	11.06	21.49
Earth Station Diameter	m	2.40	1.80	6.30	6.00
Earth Station Gain	dBi	41.91	39.42	49.95	49.53
Earth Station Transmit EIRP/Carrier	dBW	51.91	51.46	60.98	71.00
Atmospheric Losses	dB	0.06	0.06	0.08	0.08
Free Space Loss	dB	199.62	199.62	199.87	199.87
Satellite G/T	dB/K	-5.52	-5.52	-4.79	-4.79
C/N Thermal Uplink	dB	14.52	11.85	16.10	20.10
C/I XPOL, CCI, ASI	dB	13.18	10.69	14.47	14.22
C/(N+I) uplink	dB	10.79	8.22	12.20	13.22
Downlinks:					
Downlink Frequency	GHz	3.92	3.92	3.92	3.92
Satellite EIRP per carrier	dBW	19.08	19.14	27.45	36.98
Atmospheric Losses	dB	0.07	0.07	0.04	0.04
Free Space Loss	dB	195.96	195.96	195.60	195.60
Earth Station Diameter	m	6.30	6.30	2.40	3.50
Earth Station Gain	dBi	46.05	46.05	38.01	41.29
System Noise Temperature	K	83.00	83.00	70.16	66.22
Earth Station G/T	dB/K	26.60	26.60	19.55	23.08
C/N Thermal Downlink	dB	17.45	15.29	11.20	18.24
C/I XPOL, ACI, CCI, IM, ASI	dB	13.12	11.14	5.36	17.16
C/(N+I) downlink	dB	13.94	11.96	4.54	14.66
Adjacent Satellite Interference:					
Satellite 1 orbital location		47.5W	47.5W	47.5W	47.5W
Satellite 2 orbital location		51.5W	51.5W	51.5W	51.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-47.00	-47.00	-47.00	-47.00
Downlink EIRP density at 2 degrees	dBW/Hz	-37.00	-37.00	-37.00	-37.00
C/I up (single satellite)	dB	15.80	13.12	16.89	16.73
C/I dn (single satellite)	dB	19.99	17.82	7.96	19.74
Aggregate C/I up	dB	12.79	10.11	13.88	13.72
Aggregate C/I down	dB	17.08	14.92	4.93	16.73
Overall:					
C/(N+I) overall	dB	8.24	5.90	3.69	10.87
C/(N+I) required	dB	5.74	4.05	1.15	7.87
Margin	dB	2.50	1.85	2.54	3.00

Ku-band (USE)

Link Parameters	Units	2M40G7W	2M40G7W	1M80G7W	9M00G7W	35M4G7W
Data rate	Mbps	2.00	2.00	2.00	8.91	6.04
Mod cod		QPSK 1/2	QPSK 1/2	QPSK 2/3	QPSK 3/5	BPSK 1/5
Carrier bandwidth	MHz	2.40	2.40	1.80	9.00	35.40
Uplinks:						
Uplink Frequency	GHz	14.30	14.30	14.30	14.30	14.30
Uplink Transmit Power	dBW	11.58	3.98	-0.01	-0.10	6.35
Earth Station Diameter	m	0.55	1.20	2.40	9.00	9.00
Earth Station Gain	dBi	36.45	43.22	49.24	60.72	60.72
Earth Station Transmit EIRP/Carrier	dBW	48.03	47.20	49.23	60.63	67.07
Atmospheric Losses	dB	0.24	0.24	0.24	0.15	0.15
Free Space Loss	dB	207.54	207.54	207.54	207.18	207.18
Satellite G/T	dB/K	1.97	1.97	1.97	6.11	6.11
C/N Thermal Uplink	dB	7.81	6.98	10.26	19.26	19.76
C/I XPOL, CCI, ASI	dB	10.11	9.31	12.42	16.88	17.34
C/(N+I) uplink	dB	5.80	4.98	8.20	14.90	15.37
Downlinks:						
Downlink Frequency	GHz	12.00	12.00	12.00	12.00	12.00
Satellite EIRP per carrier	dBW	31.65	30.83	32.84	35.94	43.67
Atmospheric Losses	dB	0.11	0.11	0.11	0.16	0.16
Free Space Loss	dB	205.66	205.66	205.66	205.80	205.80
Earth Station Diameter	m	9.00	9.00	9.00	1.20	0.55
Earth Station Gain	dBi	59.20	59.20	59.20	41.70	34.92
System Noise Temperature	K	143.27	143.27	143.27	106.96	146.58
Earth Station G/T	dB/K	35.83	35.83	35.83	21.14	12.26
C/N Thermal Downlink	dB	27.30	26.48	29.73	10.98	3.88
C/I XPOL, ACI, CCI, IM, ASI	dB	15.23	14.54	17.12	10.20	-2.50
C/(N+I) downlink	dB	20.48	20.02	21.60	7.89	-3.31
Adjacent Satellite Interference:						
Satellite 1 orbital location		47.5W	47.5W	47.5W	47.5W	47.5W
Satellite 2 orbital location		51.5W	51.5W	51.5W	51.5W	51.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.00	-50.00	-50.00	-50.00	-50.00
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00	-26.00	-26.00	-26.00
C/I up (single satellite)	dB	12.52	11.69	14.97	19.46	19.96
C/I dn (single satellite)	dB	32.66	31.83	35.09	13.50	-0.13
Aggregate C/I up	dB	9.51	8.68	11.96	16.45	16.95
Aggregate C/I down	dB	29.63	28.81	32.06	10.47	-3.16
Overall:						
C/(N+I) overall	dB	5.30	4.50	7.64	6.83	-3.46
C/(N+I) required	dB	2.00	2.00	4.05	2.55	-6.10
Margin	dB	3.30	2.50	3.60	4.28	2.64

Ku-band (Atlantic)

Link Parameters	Units	36M00G7W	2M40G7W
Data rate	Mbps	14.72	1.33
Mod cod		QPSK 1/4	BPSK 2/3
Carrier bandwidth	MHz	36.00	2.40
Uplinks:			
Uplink Frequency	GHz	14.44	14.13
Uplink Transmit Power	dBW	9.66	9.01
Earth Station Diameter	m	9.00	0.95
Earth Station Gain	dBi	60.46	40.74
Earth Station Transmit EIRP/Carrier	dBW	70.11	49.76
Atmospheric Losses	dB	0.33	0.13
Free Space Loss	dB	207.71	206.97
Satellite G/T	dB/K	12.29	-3.41
C/N Thermal Uplink	dB	28.18	4.83
C/I XPOL, ACI, IM, ASI	dB	20.38	11.85
C/(N+I) uplink	dB	19.52	4.04
Downlinks:			
Downlink Frequency	GHz	11.63	11.58
Satellite EIRP per carrier	dBW	41.49	34.91
Atmospheric Losses	dB	0.63	0.25
Free Space Loss	dB	206.04	205.79
Earth Station Diameter	m	0.95	9.00
Earth Station Gain	dBi	39.40	58.54
System Noise Temperature	K	162.42	125.40
Earth Station G/T	dB/K	17.30	36.95
C/N Thermal Downlink	dB	5.95	31.40
C/I XPOL, ACI, IM, ASI	dB	3.31	19.13
C/(N+I) downlink	dB	1.42	24.06
Adjacent Satellite Interference:			
Satellite 1 orbital location		47.5W	47.5W
Satellite 2 orbital location		51.5W	51.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-49.98	-50.13
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	23.77	14.48
C/I dn (single satellite)	dB	5.59	33.47
Aggregate C/I up	dB	20.76	11.46
Aggregate C/I down	dB	2.57	30.50
Overall:			
C/(N+I) overall	dB	1.36	3.90
C/(N+I) required	dB	-2.40	1.34
Margin	dB	2.76	2.56

Ku-band (HTS Forward)

Link Parameters	Units	54M0G7W	54M0G7W
Data rate	Mbps	10.06	40.78
Mod cod		BPSK 1/5	QPSK 1/2
Carrier bandwidth	MHz	54.00	54.00
Uplinks:			
Uplink Frequency	GHz	13.88	17.62
Uplink Transmit Power	dBW	3.87	-0.52
Earth Station Diameter	m	9.00	9.00
Earth Station Gain	dBi	60.12	62.19
Earth Station Transmit EIRP/Carrier	dBW	63.98	61.65
Atmospheric Losses	dB	0.14	0.26
Free Space Loss	dB	206.92	209.00
Satellite G/T	dB/K	12.13	14.74
C/N Thermal Uplink	dB	20.73	18.83
C/I XPOL, ACI, IM, ASI	dB	12.29	9.91
C/(N+I) uplink	dB	11.71	9.38
Downlinks:			
Downlink Frequency	GHz	11.07	12.27
Satellite EIRP per carrier	dBW	46.96	47.05
Atmospheric Losses	dB	0.09	0.11
Free Space Loss	dB	204.89	205.78
Earth Station Diameter	m	0.65	1.00
Earth Station Gain	dBi	35.33	39.96
System Noise Temperature	K	148.46	123.81
Earth Station G/T	dB/K	12.51	18.55
C/N Thermal Downlink	dB	6.18	11.41
C/I XPOL, ACI, IM, ASI	dB	-1.23	9.29
C/(N+I) downlink	dB	-1.93	7.45
Adjacent Satellite Interference:			
Satellite 1 orbital location		47.5W	47.5W
Satellite 2 orbital location		51.5W	51.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-49.99	-49.99
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	15.03	12.59
C/I dn (single satellite)	dB	1.29	12.16
Aggregate C/I up	dB	12.01	9.57
Aggregate C/I down	dB	-1.59	9.52
Overall:			
C/(N+I) overall	dB	-2.14	5.15
C/(N+I) required	dB	-6.10	1.14
Margin	dB	3.96	4.01

Ku-band (HTS Return)

Link Parameters	Units	2M40G7W	4M80G7W
Data rate	Mbps	2.00	4.00
Mod cod		QPSK 1/2	QPSK 1/2
Carrier bandwidth	MHz	2.40	4.80
Uplinks:			
Uplink Frequency	GHz	14.04	14.04
Uplink Transmit Power	dBW	7.40	6.67
Earth Station Diameter	m	0.65	1.00
Earth Station Gain	dBi	37.39	41.13
Earth Station Transmit EIRP/Carrier	dBW	44.80	47.81
Atmospheric Losses	dB	0.13	0.13
Free Space Loss	dB	206.92	206.92
Satellite G/T	dB/K	9.29	9.29
C/N Thermal Uplink	dB	12.62	12.62
C/I XPOL, ACI, IM, ASI	dB	7.18	7.18
C/(N+I) uplink	dB	6.09	6.09
Downlinks:			
Downlink Frequency	GHz	11.74	11.74
Satellite EIRP per carrier	dBW	34.08	37.09
Atmospheric Losses	dB	0.11	0.11
Free Space Loss	dB	205.47	205.47
Earth Station Diameter	m	9.00	9.00
Earth Station Gain	dBi	58.66	58.66
System Noise Temperature	K	122.22	122.22
Earth Station G/T	dB/K	37.04	37.04
C/N Thermal Downlink	dB	31.12	31.12
C/I XPOL, ACI, IM, ASI	dB	20.77	20.77
C/(N+I) downlink	dB	23.99	23.99
Adjacent Satellite Interference:			
Satellite 1 orbital location		47.5W	47.5W
Satellite 2 orbital location		51.5W	51.5W
Uplink Input Power Density at 2 degrees	dBW/Hz	-50.13	-50.13
Downlink EIRP density at 2 degrees	dBW/Hz	-26.00	-26.00
C/I up (single satellite)	dB	9.52	9.52
C/I dn (single satellite)	dB	33.37	33.37
Aggregate C/I up	dB	6.50	6.50
Aggregate C/I down	dB	30.37	30.37
Overall:			
C/(N+I) overall	dB	5.93	5.93
C/(N+I) required	dB	2.00	2.00
Margin	dB	3.93	3.93

ANNEX D

Compatibility analysis with Appendix 30 and Appendix 30A

APPENDIX 1 to ANNEX D

Analysis of ANNEX 1 of Appendix 30

1 Limits for the interference into frequency assignments in conformity with the Regions 1 and 3 Plan or with the Regions 1 and 3 List or into new or modified assignments in the Regions 1 and 3 List

An administration in Region 1 or 3 is considered as not being affected if the effect of the proposed new or modified assignments in the List is that the equivalent downlink protection margin corresponding to a test point of its assignment in the Regions 1 and 3 Plan or List, or for which the procedure of Article 4 has been initiated, including cumulative effect of any previous modification to the List or any previous agreement, does not fall more than 0.45 dB below 0 dB or, if already negative, more than 0.45 dB.

The SES-14 satellite network has frequency assignments in both the Regions 1 and 3 List and the Region 2 Plan. In accordance with the requirements of Appendices 30 and 30A of the ITU Radio Regulations, the satellite therefore is required to operate using two separate ITU filings:

- 1) The Regions 1 and 3 NSS-BSS 47.5W ITU filing for the satellite's beams located within Region 1.
- 2) The Region 2 NSS-BSS 47.5W ITU filing for the satellite's beams located within Region 2.

This section addresses that portion of the SES-14 satellite that has downlink beams located within Region 1.

The Regions 1 and 3 NSS-BSS 47.5W ITU filing completely envelopes the downlink transmission parameters that will be used by the SES-14 satellite. As part of the processing and examination of the NSS-BSS 47.5W network, the ITU performed an MSPACE analysis using this network against the networks in the existing Regions 1 and 3 List. For simplicity, we can reference the ITU's MSPACE results that were published as part of the NSS-BSS 47.5W publication.

The ITU's MSPACE analysis shows that only two adjacent networks are affected:

- 1) The Netherlands' NSS-BSS 40.5W network at 40.5°W; and,
- 2) Russia/Intersputnik's INTERSPUTNIK-47.5W-B network at 47.5°W.

Each of these networks is discussed below.

Russia's network has recently expired, so there is no longer an interference potential into this network.

Coordination of the Netherlands network at 40.5°W is a domestic issue, not an ITU one. The Netherlands' 40.5°W network was filed on behalf of SES, therefore coordination is an internal SES matter.

2 Limits to the change in the overall equivalent protection margin for frequency assignments in conformity with the Region 2 plan

With respect to § 4.2.3 c) of Article 4, an administration in Region 2 is considered as being affected if the overall equivalent protection margin corresponding to a test point of its entry in the Region 2 Plan, including the cumulative effect of any previous modification to that Plan or any previous agreement, falls more than 0.25 dB below 0 dB, or, if already negative, more than 0.25 dB below the value resulting from:

- the Region 2 Plan as established by the 1983 Conference; or*
- a modification of the assignment in accordance with this Appendix; or*
- a new entry in the Region 2 Plan under Article 4; or*
- any agreement reached in accordance with this Appendix. (WRC-03)*

This section addresses the portion of the SES-14 satellite network that has frequency assignments in the Region 2 Plan.

Using the transmission parameters of the SES-14 satellite network, an MSPACE analysis was performed utilizing the Region 2 BSS Plan as contained in IFIC 2737, the IFIC in which the NSS-BSS 47.5W network was published.

The MSPACE analysis shows that three adjacent networks are affected:

- 4) Russia/Intersputnik's INTERSPUTNIK-47.5W-B network at 47.5°W.
- 5) The UK's UKBSS-50W network at 50°W; and,
- 6) France's SPMFRAN3 Plan network at 53.2°W.

Each of these networks is discussed below.

Russia's network has recently expired, so there is no longer an interference potential into this network.

The UK's network was filed on behalf of Intelsat. SES and Intelsat have reached a coordination agreement for their respective networks.

SES, through the Netherlands, will coordinate with France. Coordination should be achievable given the size of the orbital separation. Note that France's Plan network has not been brought into use.

3 Limits to the change in the power flux-density to protect the broadcasting-satellite service in Regions 1 and 2 in the band 12.2-12.5 GHz and in Region 3 in the band 12.5-12.7 GHz

With respect to § 4.1.1 c) of Article 4, an administration in Region 2 is considered as being affected if the proposed new or modified assignment in the Regions 1 and 3 List would result in exceeding the following power flux-density values, at any test point in the service area of its overlapping frequency assignments:

$$\begin{array}{ll}
 -147 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 0^\circ \leq \theta < 0.23^\circ \\
 -135.7 + 17.74 \log \theta \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 0.23^\circ \leq \theta < 1.8^\circ \\
 -134.0 + 0.89 \theta^2 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 1.8^\circ \leq \theta < 5.0^\circ \\
 -129.2 + 25 \log \theta \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 5.0^\circ \leq \theta < 10.57^\circ \\
 -103.6 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 10.57^\circ \leq \theta
 \end{array}$$

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies.

With respect to § 4.2.3 a), 4.2.3 b) or 4.2.3 f) of Article 4, as appropriate, an administration in Region 1 or 3 is considered as being affected if the proposed modification to the Region 2 Plan would result in exceeding the following power flux-density values, at any test point in the service area of its overlapping frequency assignments:

$$\begin{array}{ll}
 -147 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 0^\circ \leq \theta < 0.23^\circ \\
 -135.7 + 17.74 \log \theta \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 0.23^\circ \leq \theta < 2.0^\circ \\
 -136.7 + 1.66 \theta^2 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 2.0^\circ \leq \theta < 3.59^\circ \\
 -129.2 + 25 \log \theta \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 3.59^\circ \leq \theta < 10.57^\circ \\
 -103.6 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))} & \text{for } 10.57^\circ \leq \theta
 \end{array}$$

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies. (WRC-03)

The GIMS PFD tool was used to assess compliance with this Section using the downlink transmission parameters of the SES-14 satellite's beams.

The Regions 1 and 3 portion of the SES-14 satellite was found to exceed the PFD coordination trigger levels into the co-located Region 2 INTERSPUTNIK-47.5W-B network. Similarly, the Region 2 portion of the SES-14 satellite was found to exceed the PFD coordination trigger levels into the co-located Regions 1 and 3 INTERSPUTNIK-47.5W-B network. No other networks were affected.

The two 47.5°W Intersputnik networks have since expired. Accordingly, the preceding demonstrates that no existing adjacent networks are affected and therefore the SES-14 satellite is compliant with this Section.

4 Limits to the power flux-density to protect the terrestrial services of other administrations

With respect to § 4.2.3 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the consequence of the proposed modification to an existing assignment in the Region 2 Plan is to increase the power flux-density arriving on any part of the territory of that administration by more than 0.25 dB over that resulting from that frequency assignment in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference. The same administration is considered as not being affected if the value of the power flux-density anywhere in its territory does not exceed the limits expressed below.

With respect to § 4.1.1 d) or § 4.2.3 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the proposed new assignment in the Regions 1 and 3 List, or if the proposed new frequency assignment in the Region 2 Plan, would result in exceeding a power flux-density, for any angle of arrival, at any point on its territory, of:

$$\begin{array}{ll}
 -148 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))} & \text{for } \theta \leq 5^\circ \\
 -148 + 0.5 (\theta - 5) \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))} & \text{for } 5^\circ < \theta \leq 25^\circ \\
 -138 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))} & \text{for } 25^\circ < \theta \leq 90^\circ
 \end{array}$$

where θ represents the angle of arrival. (WRC-03)

The GIMS PFD tool was used to assess compliance with this Section. Using the downlink transmission parameters of the SES-14 satellite, the GIMS PFD tool showed that no administrations are affected. Therefore the SES-14 satellite network is compliant with this Section and for all three ITU Regions.

5 (Not used.)

6 **Limits to the change in the power flux-density of assignments in the Regions 1 and 3 Plan or List to protect the fixed-satellite service (space-to-earth) in the band 11.7-12.2 GHz in Region 2 or in the band 12.2-12.5 GHz in Region 3, and of assignments in the Region 2 plan to protect the fixed-satellite service (space-to-earth) in the band 12.5-12.7 GHz in Region 1 and in the band 12.2-12.7 GHz in Region 3**

With respect to § 4.2.3 e), an administration is considered as being affected if the proposed modification to the Region 2 Plan would result in an increase in the power flux-density over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 1 or 3 of 0.25 dB or more above that resulting from the frequency assignments in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference.

With respect to § 4.1.1 e) or 4.2.3 e) of Article 4, an administration is considered as not being affected if the proposed new or modified assignment in the Regions 1 and 3 List, or if a proposed modification to the Region 2 Plan, gives a power flux-density anywhere over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 1, 2 or 3 of less than:

$-186.5 \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$	<i>for $0^\circ \leq \theta < 0.054^\circ$</i>
$-164.0 + 17.74 \log \theta \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$	<i>for $0.054^\circ \leq \theta < 2.0^\circ$</i>
$-165.0 + 1.66 \theta^2 \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$	<i>for $2.0^\circ \leq \theta < 3.59^\circ$</i>
$-157.5 + 25 \log \theta \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$	<i>for $3.59^\circ \leq \theta < 10.57^\circ$</i>
$-131.9 \text{ dB(W/(m}^2 \cdot 40 \text{ kHz))}$	<i>for $10.57^\circ \leq \theta$</i>

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies.

The ITU's GIBC software tool was used to assess compliance with this Section. Using the transmission parameters of the SES-14 satellite, the software reported no administrations as being affected. Therefore the SES-14 satellite network is compliant with this Section.

7 Limits to the change in equivalent noise temperature to protect the fixed-satellite service (earth-to-space) in Region 1 from modifications to the Region 2 plan in the band 12.5-12.7 GHz

With respect to § 4.2.3 e) of Article 4, an administration of Region 1 is considered as being affected if the proposed modification to the Region 2 Plan would result in:

- the value of $\Delta T/T$ resulting from the proposed modification is greater than the value of $\Delta T/T$ resulting from the assignment in the Region 2 Plan as of the date of entry into force of the Final Acts of the 1985 Conference; and*
- the value of $\Delta T/T$ resulting from the proposed modification exceeds 6%, using the method of Appendix 8 (Case II). (WRC-03)*

From a review of the available ITU space network databases there are no assignments registered in the Earth-to-space direction in the frequency band 12.5-12.7 GHz. Therefore no Region 1 space stations can be affected and hence the SES-14 satellite network is compliant with this Section.

APPENDIX 2 TO ANNEX D

Analysis of ANNEX 1 of Appendix 30A

1 (SUP - WRC-2000)

2 (SUP - WRC-2000)

3 Limits to the change in the overall equivalent protection margin with respect to frequency assignments in conformity with the Region 2 feeder-link plan (WRC-2000)

With respect to the modification to the Region 2 feeder-link Plan and when it is necessary under this Appendix to seek the agreement of any other administration of Region 2, except in cases covered by Resolution 42 (Rev.WRC-03), an administration is considered as being affected if the overall equivalent protection margin corresponding to a test point of its entry in that Plan, including the cumulative effect of any previous modification to that Plan or any previous agreement, falls more than 0.25 dB below 0 dB, or, if already negative, more than 0.25 dB below the value resulting from:

- the feeder-link Plan as established by the 1983 Conference; or*
- a modification of the assignment in accordance with this Appendix; or*
- a new entry in the feeder-link Plan under Article 4; or*
- any agreement reached in accordance with this Appendix except for Resolution 42 (Rev.WRC-03). (WRC-03)*

This section addresses the portion of the SES-14 satellite that has frequency assignments in the Region 2 Plan.

Using the transmission parameters of the SES-14 satellite network, an MSPACE analysis was performed utilizing the Region 2 BSS Plan as contained in IFIC 2737, the IFIC in which the NSS-BSS 47.5W network was published.

The MSPACE analysis shows that three adjacent networks are affected:

- 1) Russia/Intersputnik's INTERSPUTNIK-47.5W-B network at 47.5°W.
- 2) The UK's UKBSS-50W network at 50°W; and,
- 3) France's SPMFRAN3 Plan network at 53.2°W.

Each of these networks is discussed below.

Russia's network has recently expired, so there is no longer an interference potential into this network.

The UK's network was filed on behalf of Intelsat. SES and Intelsat have reached a coordination agreement for their respective networks.

SES, through the Netherlands, will coordinate with France. Coordination should be achievable given the size of the orbital separation. Note that France's Plan network has not been brought into use.

4 Limits to the interference into frequency assignments in conformity with the Regions 1 and 3 feeder-link Plan or with the Regions 1 and 3 feeder-link List or proposed new or modified assignments in the Regions 1 and 3 feeder-link list (WRC-03)

An administration is not considered as being affected if, under assumed free-space propagation conditions, the effect of the proposed new or modified assignments in the feeder-link List is that the feeder-link equivalent protection margin corresponding to a test point of its assignment in the feeder-link Plan or the feeder-link List or for which the procedure of Article 4 has been initiated, including the cumulative effect of any previous modification to the feeder-link List or any previous agreement, does not fall more than 0.45 dB below 0 dB, or, if already negative, more than 0.45 dB.

This section addresses the portion of the SES-14 satellite that has uplink frequency assignments in the Regions 1 and 3 List.

The Regions 1 and 3 NSS-BSS 47.5W ITU filing completely envelopes the uplink transmission parameters that will be used by the SES-14 satellite. As part of the processing and examination of the NSS-BSS 47.5W network, the ITU performed an MSPACE analysis using this network against the networks in the existing Regions 1 and 3 List. For simplicity, we can reference the ITU's MSPACE results that were published as part of the NSS-BSS 47.5W publication.

The ITU's MSPACE analysis shows that only two adjacent networks are affected:

- 1) The Netherlands' NSS-BSS 40.5W network at 40.5°W; and,
- 2) Russia/Intersputnik's INTERSPUTNIK-47.5W-B network at 47.5°W.

Each of these networks is discussed below.

Russia's network has recently expired, so there is no longer an interference potential into this network.

Coordination of the Netherlands network at 40.5°W is a domestic issue, not an ITU one. The Netherlands' 40.5°W network was filed on behalf of SES, therefore coordination is an internal SES matter.

5 Limits applicable to protect a frequency assignment in the bands 17.3-18.1 GHz (Regions 1 and 3) and 17.3-17.8 GHz (Region 2) to a receiving space station in the fixed-satellite service (earth-to-space)

An administration in Region 1 or 3 is considered as being affected by a proposed modification in Region 2, with respect to § 4.2.2 a) or 4.2.2 b) of Article 4, or an administration in Region 2 is considered as being affected by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List, with respect to § 4.1.1 c) of Article 4, when the power flux-density arriving at the receiving space station of a broadcasting-satellite feeder-link would cause an increase in the noise temperature of the feeder-link space station which exceeds the threshold value of $\Delta T/T$ corresponding to 6%, where $\Delta T/T$ is calculated in accordance with the method given in Appendix 8, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the necessary bandwidth of the feeder-link carriers. (WRC-03)

Using the parameters of the SES-14 satellite network, the only two networks found to be affected were the Region 2 INTERSPUTNIK-47.5W-B network and the Regions 1 and 3 INTERSPUTNIK-47.5W-B network. Both of these networks have since expired and therefore the SES-14 satellite network is compliant with this Section.

6 Limits applicable to protect a frequency assignment in the band 17.8- 18.1 GHz (Region 2) to a receiving feeder-link space station in the fixed-satellite service (Earth-to-space) (WRC-03)

With respect to § 4.1.1 d) of Article 4, an administration is considered affected by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List when the power flux-density arriving at the receiving space station of a broadcasting-satellite feeder-link in Region 2 of that administration would cause an increase in the noise temperature of the receiving feeder-link space station which exceeds the threshold value of $\Delta T/T$ corresponding to 6%, where $\Delta T/T$ is calculated in accordance with the method given in Appendix 8, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the necessary bandwidth of the feeder-link carriers. (WRC-03)

This section does not apply to the Region 2 frequency assignments of the SES-14 satellite network.

With respect to the Regions 1 and 3 frequency assignments of the SES-14 satellite network, the analysis shows that no adjacent networks are affected. Therefore the SES-14 satellite network is compliant with this Section.

DECLARATION

I, Philippe Secher, 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/ Philippe Secher

Philippe Secher
Senior Manager, Spectrum Management &
Development
SES Americom, Inc.

Dated: September 18, 2016