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

In the Matter of	)	
	)	
Gogo LLC	)	File No. SES-MOD-_____
	)	Call Sign E120106
Modification to Blanket License for	)	
Operation of Ku-Band Transmit/Receive	)	
Earth Stations Aboard Aircraft	)	

MODIFICATION

Gogo LLC ("Gogo") hereby requests a modification of its blanket license to operate Ku-band transmit/receive earth stations aboard aircraft ("ESAAs") on domestic and international flights.[1] Gogo requests that the Commission modify the Gogo ESAA License by adding the following spacecraft as authorized points of communication: Intelsat 20; Intelsat 29e; Intelsat 33e; Intelsat 907; AMC-3; AMC-21; and ASTRA 4A.

A narrative description of the relevant changes is provided here, and Gogo is attaching an FCC Form 312 and Schedule B that identify the new points of communication and provide technical parameters for the ESAA operations. Supplemental technical information and copies of relevant coordination letters are attached as well. Pursuant to Section 25.117(c) of the Commission's rules, Gogo is providing herein information that is changing as a result of the

[1] *See* Call Sign E120106, File No. SES-MFS-20151022-00735, granted June 30, 2016 (the "Gogo ESAA License"). A *pro forma* assignment of the Gogo ESAA license to Gogo's affiliate AC BidCo LLC ("AC BidCo") has been approved by the Commission but has not yet been consummated. *See* File No. SES-ASG-20160714-00659, granted July 19, 2016. Gogo requests that upon consummation of the assignment, the Commission continue to process this modification application but replace Gogo with AC BidCo as the applicant.

modification. Gogo certifies that the remaining information provided in support of the Gogo ESAA License has not changed.[2]

I. ADDITIONAL SATELLITES

Gogo requests modification of its license to add the Intelsat 20; Intelsat 29e; Intelsat 33e; Intelsat 907; AMC-3; AMC-21; and ASTRA 4A satellites as points of communication for the Gogo ESAA network pursuant to the provisions of Section 25.227(a)(2) and (b)(2). As discussed below, each of the requested satellites is eligible for authority for use with the Gogo ESAA network. Updated tables listing the satellites to be used and the associated ground stations are provided in Annex 2 hereto.

Intelsat 20: Intelsat 20 is a U.S.-licensed satellite positioned at the 68.5° E.L. orbital location,[3] and complete technical information regarding the satellite is therefore already on file with the Commission.[4] Gogo seeks authority to use Intelsat 20 capacity for ESAA operations on a primary basis in conventional Ku-band uplink spectrum, 14-14.5 GHz, and on an unprotected basis in the 10.95-11.2 GHz and 11.45-11.7 GHz downlink spectrum, consistent with the Commission's orders in the ESAA proceeding[5] and with the terms of the satellite

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[2] For the Commission's convenience, Gogo has attached as Annex 1 hereto a table listing the information required pursuant to Section 25.227 of the Commission's rules and providing a cross-reference to the necessary information.

[3] *See Intelsat License LLC*, Call Sign S2847, File No. SAT-LOA-20111024-00208, grant-stamped July 26, 2012.

[4] Gogo has already commenced ESAA operations with Intelsat 20 pursuant to a grant of Special Temporary Authority. *See Gogo LLC*, File No. SES-STA-20160624-00610, granted June 30, 2016.

[5] *Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14-14.5 GHz Frequency Bands*, Notice of Proposed Rulemaking and Report and Order, IB Docket Nos. 12-376 & 05-20, 27 FCC Rcd 16510 (2012) ("ESAA Order"); Second Report and Order and Order on

license. Gogo also seeks authority to use Intelsat 20 capacity for ESAA operations on a nonconforming basis in the 12.5-12.75 GHz downlink spectrum.

Intelsat 20 will provide coverage of the Middle East. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of Intelsat 20 is included in Annex 3.

Intelsat 29e: Intelsat 29e is a U.S.-licensed satellite positioned at the 50° W.L. orbital location,[6] and complete technical information regarding the satellite is therefore already on file with the Commission. Gogo seeks authority to use Intelsat 29e capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum and the 11.7-12.2 GHz downlink spectrum and on an unprotected basis in the 10.95-11.7 GHz downlink spectrum, consistent with the ESAA Decisions and with the terms of the satellite license.

Intelsat 29e will provide coverage of the United States. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of Intelsat 29e is included in Annex 3.

Intelsat 33e: Intelsat 33e is a U.S.-licensed satellite positioned at the 60° E.L. orbital location,[7] and complete technical information regarding the satellite is therefore already on file with the Commission. Gogo seeks authority to use Intelsat 33e capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum and the 11.7-12.2 GHz downlink spectrum and on an unprotected basis in the 10.95-11.2 GHz and 11.45-11.7 GHz

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Reconsideration, IB Docket No. 12-376, 29 FCC Rcd 4226 (2014) ("ESAA Second Order," and with the ESAA Order, the "ESAA Decisions").

[6] *See Intelsat License LLC*, Call Sign S2913, File No. SAT-LOA-20130722-00097, grant-stamped May 21, 2015.

[7] *See Intelsat License LLC*, Call Sign S2939, File No. SAT-LOA-20150327-00016, grant-stamped Feb. 25, 2016.

downlink spectrum, consistent with the ESAA Decisions and with the terms of the satellite license. Gogo also seeks authority to use Intelsat 33e capacity for ESAA operations on a nonconforming basis in the 12.5-12.6 GHz downlink spectrum.

Intelsat 33e will provide coverage of Africa, Asia, and Europe. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of Intelsat 33e is included in Annex 3.

Intelsat 907: Intelsat 907 is a U.S.-licensed satellite positioned at the 27.5° W.L. orbital location,[8] and complete technical information regarding the satellite is therefore already on file with the Commission. Gogo seeks authority to use Intelsat 907 capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum and on an unprotected basis in the 10.95-11.2 GHz and 11.45-11.7 GHz downlink spectrum, consistent with the ESAA Decisions and with the terms of the satellite license.

Intelsat 907 will provide coverage of the East Pacific. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of Intelsat 907 is included in Annex 3.

AMC-3: AMC-3 is a U.S.-licensed satellite positioned at the 67° W.L. orbital location,[9] and complete technical information regarding the satellite is therefore already on file with the Commission. Gogo seeks authority to use AMC-3 capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum and in the 11.7-12.2 GHz downlink spectrum, consistent with the Commission's ESAA Decisions and with the terms of the satellite license.

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[8] *See Intelsat License LLC*, Call Sign S2411, File Nos. SAT-LOA-20000119-00025 & SAT-MOD-20020918-00183, Memorandum Opinion Order and Authorization, 15 FCC Rcd 15460 (2000).

[9] *See SES Americom, Inc.*, Call Sign S2162, File No. SAT-MOD-20111220-00243, grant-stamped June 28, 2012.

AMC-3 will provide coverage of Mexico. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of AMC-3 is included in Annex 3.

AMC-21: AMC-21 is a Gibraltar-licensed satellite positioned at the 124.9° W.L. orbital location. The Commission placed AMC-21 on the Permitted Space Station List for operations at this location in the conventional Ku-band,[10] and complete technical information regarding the satellite is therefore already on file with the Commission. Gogo seeks authority to use AMC-21 capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum and the 11.7-12.2 GHz downlink spectrum, consistent with the Commission's ESAA Decisions and the satellite's authorization.

AMC-21 will provide coverage of the United States. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of AMC-21 is included in Annex 3.

ASTRA 4A: ASTRA 4A is licensed by Sweden and positioned at the 4.8° E.L. orbital location. ASTRA 4A is not on the Permitted Space Station List, but its licensing administration, Sweden, is a member of the World Trade Organization ("WTO"). Accordingly, under the Commission's *DISCO II* market access framework, there is a presumption that allowing the satellite to communicate with U.S.-licensed earth stations for services covered by the WTO Basic Telecommunications Agreement will serve the public interest.[11]

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[10] *See SES Satellites (Gibraltar) Limited*, Call Sign S2676, File Nos. SAT-ASG-20080609-00120 & SAT-PPL-20080929-00203, grant-stamped Aug. 6, 2008.

[11] *See Amendment of the Commission's Policies to Allow Non-U.S. Licensed Space Stations providing Domestic and International Service in the United States,* Report & Order, 12 FCC Rcd 24094, 24112, ¶ 39 (1997) ("*DISCO II*").

Gogo seeks authority to use ASTRA 4A capacity for ESAA operations on a primary basis in the 14-14.25 GHz uplink spectrum and in the 11.7-12.2 GHz downlink spectrum, consistent with the Commission's ESAA Decisions. Gogo also seeks authority to use ASTRA 4A capacity for ESAA operations on a nonconforming basis in the 12.2-12.75 GHz downlink spectrum.

ASTRA 4A will provide coverage of Europe. A letter confirming that operation of the Gogo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of ASTRA 4A is included in Annex 3. In addition, Annex 4 contains technical materials regarding the proposed Gogo operations with ASTRA 4A, including a coverage map, link budgets, and an orbital debris mitigation statement.

II. COORDINATION AND SPECTRUM SHARING MATTERS

Attached as Annex 3 pursuant to Section 25.227(b)(2) of the Commission's rules are copies of letters confirming that Gogo's proposed ESAA operations are consistent with the coordination agreements between the satellites discussed above and operators of adjacent spacecraft. Furthermore, Gogo's operations with the additional satellites will conform to the terms of the agreements between Gogo and the National Aeronautics and Space Administration and the National Science Foundation, as required by the Gogo ESAA License.[12]

III. WAIVER REQUESTS

Gogo seeks limited waivers of the Commission's rules in connection with its request to add satellites as authorized points of communication for the Gogo ESAA network. Specifically, Gogo seeks a waiver of the Table of Allocations for its proposed operations in the 12.2-12.75 GHz spectrum and a waiver of orbital debris mitigation requirements for ASTRA 4A,

[12] Gogo ESAA License, Special and General Provisions, Condition 90057.

which cannot fully vent propellants and/or relieve pressure vessels at end of life. Grant of these 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.[13]

Section 2.106: Gogo requests waiver of the Table of Allocations in Section 2.106 of the Commission's rules to permit use of downlink spectrum in the 12.2-12.75 GHz band range for ESAA operations. Gogo proposes to use capacity in part or all of this spectrum range on the following spacecraft: Intelsat 20; Intelsat 33e; and ASTRA 4A.

Prior to adoption of the ESAA decisions, the Commission granted waivers for downlink operations in the 11.7-12.2 GHz conventional Ku-band downlink spectrum "based upon either a showing that the proposed AMSS downlink transmissions will not exceed the 10 dBW/4 kHz limit for routine processing in Section 25.134(g)(2) of the Commission's rules or proof that adjacent satellite operators have consented to the operations."[14] ESAA operators were also permitted to use extended Ku-band frequencies for ESAA downlinks pursuant to the same rationale.[15] The Commission has recognized that "terminals on U.S.-registered aircraft may

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

[14] *See, e.g., Panasonic Avionics Corporation, Application for Authority to Operate Up to 50 Technically Identical Aeronautical Mobile-Satellite Service Aircraft Earth Stations in the 14.0-14.4 GHz and 11.7-12.2 GHz Frequency Bands,* Order and Authorization, 26 FCC Rcd 12557 (IB and OET 2011) at ¶ 11.

[15] *See* Row 44 Inc., File No. SES-MFS-20100715-00903, Call Sign E080100, Attachment at 3 (requesting expansion of the waiver of Section 2.106 that Row 44 was granted for conventional Ku-band downlinks to cover the proposed use of the 11.45-11.7 GHz band), granted Dec. 23, 2010.

need to access foreign satellites while traveling outside of the United States (*e.g.*, over international waters), and therefore may need to downlink in the extended Ku-band in certain circumstances."[16]

The Commission's ESAA Decisions modified the Table of Allocations to permit ESAA operations in the conventional Ku-band, as well as in the 10.95-11.2 GHz and 11.45-11.7 GHz segments of the extended Ku-band. The Commission acknowledged that ESAA operators may also wish to use other downlink spectrum, particularly for reception of transmissions from space stations with little or no U.S. coverage.[17] Although the Commission had not requested comment on changing the allocation status of this downlink spectrum, it specifically contemplated that access to such spectrum could be granted "on a case-by-case basis under Part 25 licensing rules."[18] For example, the Commission has authorized Gogo and other ESAA providers to receive signals in the 12.2-12.75 GHz band.[19]

Consistent with these past rulings, Gogo requests a waiver of the Table of Allocations to permit its terminals to receive transmissions from the ASTRA 4A spacecraft in the 12.2-12.75 GHz band; from the Intelsat 33e spacecraft in the 12.5-12.6 GHz band; and from the Intelsat 20 spacecraft in the 12.5-12.75 GHz band. None of these spacecraft is proposed to be used in U.S. airspace. As noted above, the satellite operators that will provide capacity to Gogo have coordinated the ESAA operations with satellites within six degrees. Authorizing Gogo to

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16 *Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 05-20, Notice of Proposed Rulemaking, 20 FCC Rcd 2906 (2005) at ¶ 18 (footnote omitted).

17 *See ESAA Order* at n.43.

18 *Id.*

19 *See, e.g.*, Gogo Blanket License, Section B (authorizing use of the 12.2-12.75 GHz band); *Panasonic Avionics Corporation*, File No. SES-MFS-20150609-00349, Call Sign E100089, granted June 30, 2016 (the "Panasonic ESAA Grant"), Section B (authorizing use of the 10.7-12.75 GHz band).

receive signals from these satellites will not alter the technical characteristics of the satellites' operations in any way, and therefore will not create harmful interference to other authorized users of the spectrum. Furthermore, Gogo will not claim interference protection from such authorized users. Under these circumstances, grant of a Section 2.106 waiver is justified to permit use of the 12.2-12.75 GHz band for downlinks as part of the Gogo ESAA network.

Section 25.283(c): Section 25.283(c) specifies requirements relating to venting stored energy sources at the spacecraft's end of life. Specifically, the rule provides that upon completion of a satellite's mission, "a space station licensee shall ensure, unless prevented by technical failures beyond its control, that all stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures."[20] Gogo requests any necessary waiver of this requirement in connection with its request to communicate with the ASTRA 4A satellite, an in-orbit spacecraft that was not designed to allow complete venting at end of life.

ASTRA 4A is a Lockheed Martin A2100 model spacecraft. As described in more detail in the attached Orbital Debris Mitigation Statement, the oxidizer tanks on the ASTRA 4A spacecraft were sealed following completion of the launch phase and will therefore retain residual pressure when the spacecraft is retired. Given the spacecraft design, it is physically impossible 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

[20] 47 C.F.R. § 25.283(c).

late stage of construction would pose an undue hardship.[21] In the case of ASTRA 4A, which is currently in-orbit, 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 is a Lockheed Martin A2100 design like ASTRA 4A, the Commission waived Section 25.283(c) 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."[22]

The same practical obstacle is present here. Because ASTRA 4A is already in orbit, it cannot be modified to enable full venting of residual pressure. Given this reality, a waiver is clearly warranted.

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[21] *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).

[22] 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").

IV. CONCLUSION

Gogo respectfully requests that the Commission modify the Gogo ESAA License to reflect the changes described herein.

Respectfully submitted,

GOGO LLC

By: */s/ William J. Gordon*

Of Counsel
Karis A. Hastings
SatCom Law LLC
1317 F Street, N.W., Suite 400
Washington, D.C. 20004
Tel: (202) 599-0975

William J. Gordon
VP, Regulatory Affairs
Gogo LLC
111 North Canal Street
Chicago, IL 60606
Tel: (202) 870-7220

Dated: August 24, 2016

ANNEX 1: Table of Information Required by Section 25.227

Section 25.227 Requirement	Citation to Information Provided
25.227(a)(1)(ii) & 25.227(a)(1)(iii)	As Gogo has demonstrated, both ESAA antennas will maintain a pointing error of less than or equal to 0.2° between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna and will automatically cease transmission within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESAA antenna exceeds 0.5°, and transmission shall not resume until such angle is less than or equal to 0.2°. *See* File No. SES-AMD-20120731-00709, Technical Appendix, Section 2.2.4; File No. SES-MFS-20140801-00625, Technical Annex, Section 1.3.
25.227(a)(4) & 25.227(b)(5)	N/A: no use of a contention protocol is proposed.
25.227(a)(5) & 25.227(b)(6)	The 24/7 point of contact information remains the same. The phone number is +1 866-943-4662 and the e-mail address is noc@gogoair.com. The street address is: Gogo Network Operations Center, 111 North Canal Street, Chicago, IL, 60606, as specified in Form 312 Schedule B, Items E2-E9.
25.227(a)(15)	Gogo certifications are in Annex 5 attached.
25.227(b)(2)(i), (ii) & (iii)	Target satellite operator certifications are in Annex 3 attached.
25.227(b)(2)(iv)	Gogo has previously demonstrated that its system will comply with coordination agreements and requirements to cease emissions.[1]
25.227(b)(4)	The ESAA network will operate in U.S. airspace, foreign airspace, and in the airspace over international waters. Coverage areas for the specific satellites to be used in the ESAA network are described in the table found in Annex 2 attached. Contours for the Intelsat 20; Intelsat 29e; Intelsat 33e; Intelsat 907; AMC-3; and AMC-21 satellites are already on file with the Commission. A coverage map for ASTRA 4A is included in Annex 4.
25.227(b)(7)	Gogo certifications are in Annex 5 attached.
25.227(b)(8)	No change to previously filed Radiation Hazard analyses.
25.227(c)	Gogo's coordination agreement with NASA was filed February 1, 2013 in File Nos. SES-LIC-20120619-00574 *et al*.
25.227(d)	Gogo's coordination agreement with NSF was included as Amendment Exhibit B in File No. SES-AMD-20120731-00709.

[1] Gogo's initial showing with respect to these requirements referred to the iDirect satellite modem used as part of the antenna control system. In the future, Gogo may incorporate modems from other manufacturers, but the antenna system will continue to function in the same way to ensure compliance with applicable coordination agreements and shut-off requirements.

ANNEX 2:

Updated Spacecraft and Teleport Tables

Satellite	Location	Beam Coverage Area	Tx (GHz)	Rx (GHz)	Use in US airspace?	Satellite Operator
AMC-1	129.15W	North America	14-14.5	11.7-12.2	Yes	SES
AMC-3[1]	67W	Mexico	14-14.5	11.7-12.2	Yes	
AMC-21	124.9W	United States	14-14.5	11.7-12.2	Yes	
ASTRA 4A	4.8E	Europe	14-14.25	11.7-12.2; 12.2-12.75	No	
SES-1	101W	North America	14-14.5	11.7–12.2	Yes	
SES-4	22W	Europe	14-14.5	12.5-12.75	No	
SES-6	40.5W	East Atlantic Ocean	14-14.5	10.95-11.2; 11.45-11.7	No	
		West Atlantic Ocean	14-14.5	10.95-11.2; 11.45-11.7	Yes	
Galaxy 17	91W	North America	14-14.5	11.7-12.2	Yes	Intelsat
IS-14	45W	North and South America excludes Brazil	14-14.5	11.7–12.2	Yes	
IS-18	180E	South Pacific	14-14.5	12.25-12.75	No	
IS-19	166E	Northeast Pacific	14-14.5	12.25-12.75	Yes	
		Northwest Pacific	14-14.5	12.25-12.75	No	
		Australia				
		Southwest Pacific				
IS-20	68.5E	Middle East	14-14.5	10.95-11.2; 11.45-11.7; 12.5-12.75	No	
IS-21	58W	Brazil	14-14.5	11.7–12.2	No	
		South Atlantic Ocean	14-14.5	11.45–11.7	No	
IS-22	72.1E	Mobility from Mideast to Japan and to Australia	14-14.5	12.25–12.5	No	
IS-29e	50W	United States	14-14.5	10.95-11.7; 11.7-12.2	Yes	
IS-33e	60E	Africa, Asia, and Europe	14-14.5	10.95-11.2; 11.45-11.7; 11.7-12.2; 12.5-12.6	No	
IS-904	60E	Spot 1 - Western Russia	14-14.5	10.95–11.2; 11.45-11.7	No	
IS-907	27.5W	East Pacific	14-14.5	10.95–11.2; 11.45-11.7	Yes	

[1] This satellite is only used for communications with the ThinKom antenna system.

Satellite	Location	Beam Coverage Area	Tx (GHz)	Rx (GHz)	Use in US airspace?	Satellite Operator
Eutelsat 115WB (Satmex 7)	114.9W	North America	14-14.5	11.7-12.2	Yes	Eutelsat
Eutelsat 117WA (Satmex 8)	116.8W	Central and South America	14-14.5	11.7-12.2	Yes	
E172A[2]	172E	North Pacific and Northeastern Russia	14-14.5	10.95-11.2; 11.45-11.7; 12.2-12.75	No	
T-11N	37.5W	Africa	14-14.5	10.95-11.2; 11.45-11.7; 12.5-12.75	No	Telesat
		Atlantic	14-14.5	11.45-11.7	No	
T-18	138E	Asia	14-14.5	12.2–12.75	No	
JCSAT-2B	154E	South Pacific	14-14.5	11.45-11.7; 12.25-12.75	Yes	JSAT
JCSAT-5A[2]	132E	Japan	14-14.5	12.25-12.75	No	
Yamal 300K	183E (177W)	North Pacific Ocean	14-14.5	10.95-11.2; 11.45-11.7; 12.5-12.75	Yes	Gazprom Space Systems
Yamal 401	90E	Russia	14-14.5	10.95-11.2; 11.45-11.7; 12.5-12.75	No	
Asiasat 7	105.5E	China	14-14.5	12.25-12.75	No	AsiaSat

[2] These satellites are only used for communications with the Aerosat antenna system.

Satellite	Teleport Location	FCC Call Sign
AMC-1	Woodbine, MD	E900448
AMC-3	Perris, CA	E940448
AMC-21	Woodbine, MD	E900448
ASTRA 4A	Betzdorf, Luxembourg	N/A
SES-1	Woodbine, MD	E920698
SES-4	Bristow, VA	E020071
	Bristow, VA	E000696
SES-6	Betzdorf, Luxembourg	N/A
Galaxy 17	Atlanta, GA ATL-K26	E990214
IS-14	ATL teleport ATL-C06	E940333
	ATL teleport ATL-K15	E090093
IS-18	Napa teleport NAP-K22	E990224
IS-19	Perth, Australia	N/A
	Napa teleport NAP-K31	E980460
	Napa teleport NAP-C30	E980467
IS-20	Fuchsstadt, Germany	N/A
IS-21	Rio de Janeiro, Brazil	N/A
	Mobility: MTN teleport MTN-K02	E030051
IS-22	Kumsan, Korea	N/A
IS-29e	Hagerstown, MD	E030103
IS-33e	Fuchsstadt, Germany	N/A
	Moscow, Russia	N/A
IS-904	Moscow, Russia	N/A
IS-907	Hagerstown, MD	E030103
Eutelsat 115WB (Satmex 7)	Brewster, WA	E120043
Eutelsat 117WA (Satmex 8)	Brewster, WA	E060416
E172a	Khabarovsk, Russia	N/A
T-11N	Aflenz, Austria	N/A
T-18	China (City TBD)	N/A
JCSAT-2B	Kapolei, HI	E010236
JCSAT-5A	Yokohama, Japan	N/A
Yamal 300K	Brewster, WA BRW-05C	E120043
Yamal 401	Moscow, Russia	N/A
Asiasat 7	Beijing, China	N/A

ANNEX 3:

Satellite Company Letters

INTELSAT
Envision. Connect. Transform.

May 16, 2016

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

Re: Engineering Certification of Intelsat for IS-20 Satellite

To Whom It May Concern:

This letter confirms that Intelsat is aware that Gogo LLC ("Gogo") is planning to seek a modification to its blanket authorization (the "Modification Application") from the Federal Communications Commission ("FCC") to operate two types of Ku band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E120106. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the IS-20 satellite at 68.5° EL. under the current ESAA rules including Section 25.227.

Based upon the representations made to Intelsat by Gogo concerning the contents of its Modification Application:

- INTELSAT acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to IS-20 that may be unacceptable.
- Intelsat certifies that the proposed use of the ESAA transmit/receive terminals at the power density levels specified by Gogo are consistent with existing coordination agreements to which INTELSAT is a party with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-20.
- If the FCC authorizes the operations proposed by Gogo, Intelsat will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to IS-20.

Sincerely,

Armand Kadrichu
Senior Technical Advisor, Spectrum Strategy
INTELSAT
7900 Tysons One Place, McLean, VA 22102-5972
T +1 703-559-7525 M +1 202-445-4377
armand.kadrichu@intelsat.com

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May 16, 2016

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

Re: Engineering Certification of Intelsat for IS-29e Satellite

To Whom It May Concern:

This letter confirms that Intelsat is aware that Gogo LLC ("Gogo") is planning to seek a modification to its blanket authorization (the "Modification Application") from the Federal Communications Commission ("FCC") to operate two types of Ku band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E120106. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the IS-29e satellite at 50° WL. under the current ESAA rules including Section 25.227.

Based upon the representations made to Intelsat by Gogo concerning the contents of its Modification Application:

- INTELSAT acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to IS-29e that may be unacceptable.
- Intelsat certifies that the proposed use of the ESAA transmit/receive terminals at the power density levels specified by Gogo are consistent with existing coordination agreements to which INTELSAT is a party with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-29e.
- If the FCC authorizes the operations proposed by Gogo, Intelsat will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to IS-29e.

Sincerely,

Armand Kadrichu
Senior Technical Advisor, Spectrum Strategy
INTELSAT
7900 Tysons One Place, McLean, VA 22102-5972
T +1 703-559-7525 M +1 202-445-4377
armand.kadrichu@intelsat.com

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Envision. Connect. Transform.

May 16, 2016

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

Re: Engineering Certification of Intelsat for IS-33e Satellite

To Whom It May Concern:

This letter confirms that Intelsat is aware that Gogo LLC ("Gogo") is planning to seek a modification to its blanket authorization (the "Modification Application") from the Federal Communications Commission ("FCC") to operate two types of Ku band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E120106. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the IS-33e satellite at 60° EL. under the current ESAA rules including Section 25.227.

Based upon the representations made to Intelsat by Gogo concerning the contents of its Modification Application:

- INTELSAT acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to IS-33e that may be unacceptable.
- Intelsat certifies that the proposed use of the ESAA transmit/receive terminals at the power density levels specified by Gogo are consistent with existing coordination agreements to which INTELSAT is a party with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-33e.
- If the FCC authorizes the operations proposed by Gogo, Intelsat will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to IS-33e.

Sincerely,

Armand Kadrichu
Senior Technical Advisor, Spectrum Strategy
INTELSAT
7900 Tysons One Place, McLean, VA 22102-5972
T +1 703-559-7525 M +1 202-445-4377
armand.kadrichu@intelsat.com

INTELSAT
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May 16, 2016

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

Re: Engineering Certification of Intelsat for IS-907 Satellite

To Whom It May Concern:

This letter confirms that Intelsat is aware that Gogo LLC ("Gogo") is planning to seek a modification to its blanket authorization (the "Modification Application") from the Federal Communications Commission ("FCC") to operate two types of Ku band transmit/receive earth stations aboard aircraft ("ESAAs"), Call Sign E120106. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the IS-907 satellite at 27.5° WL. under the current ESAA rules including Section 25.227.

Based upon the representations made to Intelsat by Gogo concerning the contents of its Modification Application:

- INTELSAT acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to IS-907 that may be unacceptable.
- Intelsat certifies that the proposed use of the ESAA transmit/receive terminals at the power density levels specified by Gogo are consistent with existing coordination agreements to which INTELSAT is a party with all adjacent satellite operators within +/- 6 degrees of orbital separation from IS-907.
- If the FCC authorizes the operations proposed by Gogo, Intelsat will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to IS-907.

Sincerely,

Armand Kadrichu
Senior Technical Advisor, Spectrum Strategy
INTELSAT
7900 Tysons One Place, McLean, VA 22102-5972
T +1 703-559-7525 M +1 202-445-4377
armand.kadrichu@intelsat.com

SES

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554
United States

4 August 2016

Subject: **Engineering Certification of SES for the AMC-3 satellite**

To whom it may concern,

This letter confirms that SES is aware that Gogo LLC ("Gogo"), licensed by the Federal Communications Commission ("FCC") as Gogo LLC, is planning to file an application seeking a modification to its blanket authorization (the "Modification Application") to operate Ku-band Earth Stations Aboard Aircraft ("ESAA") transmit/receive terminals (Call Sign E120106) pursuant to ITU RR 5.504A and Section 25.227 of the Commission's rules, on domestic and international flights. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the AMC-3 satellite at 67°W.L., under the current ESAA rules, including Section 25.227.

Based upon the representations made to SES by Gogo concerning how it will operate on AMC-3 according to its letter dated 2 August 2016:

- SES acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to AMC-3 that may be unacceptable.
- SES certifies that it has completed coordination as required under the FCC's rules and that the power density levels specified by Gogo are consistent with existing coordination agreements to which SES is a party with all adjacent satellite operators within +/- 6 degrees of orbital separation from AMC-3.
- If the FCC authorizes the operations proposed by Gogo, SES will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to AMC-3.

Yours Sincerely,

Aug. 4 2016

Kimberly M. Baum
Vice President
Spectrum Development & Management Americas

Date

Kimberly M. Baum
Vice President Spectrum Management & Development, Americas

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

10 August 2016

Subject: Engineering Certification of SES for the AMC-21 Satellite

To whom it may concern,

This letter confirms that SES is aware that Gogo LLC ("Gogo") is planning to file an application seeking a modification to its blanket authorization (the "Modification Application") from the FCC to operate Ku-band Earth Stations Aboard Aircraft ("ESAA") transmit/receive terminals (Call Sign E120106) pursuant to ITU RR 5.504A and Section 25.227 of the Commission's rules, on domestic and international flights. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the AMC-21 satellite at 124.9° W.L., under the current ESAA rules, including Section 25.227.

Based upon the representations made to SES by Gogo concerning how it will operate on AMC-21 according to its letter dated August 8, 2016 for ThinKom 2Ku antennas and August 10, 2016 for Aerosat HR6400 antennas:

- SES acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to AMC-21 that may be unacceptable.
- SES certifies that it has completed coordination as required under the FCC's rules and that the power density levels specified by Gogo are consistent with any existing coordination agreements to which SES is a party with adjacent satellite operators within +/- 6 degrees of orbital separation from AMC-21.
- If the FCC authorizes the operations proposed by Gogo, SES will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to AMC-21.

Yours Sincerely,

Kimberly M. Baum

SES Americom, Inc.
1129 20th St NW #1000
Washington, DC 20036
USA

Tel. +1 609 987 4000
Fax +1 609 987 4517
kimberly.baum@ses.com
www.ses.com

Patrick van Niftrik
Vice President Spectrum Management & Development, EMEA

Federal Communications Commission
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554
United States

29 July 2016

Subject: **Engineering Certification of SES for the ASTRA-4A satellite**

To whom it may concern,

This letter confirms that SES is aware that Gogo LLC ("Gogo"), licensed by the Federal Communications Commission ("FCC") as Gogo LLC, is planning to file an application seeking a modification to its blanket authorization (the "Modification Application") to operate two types of Ku-band Earth Stations Aboard Aircraft ("ESAA") transmit/receive terminals (Call Sign E120106) pursuant to ITU RR 5.504A and Section 25.227 of the Commission's rules, on domestic and international flights. Among other changes, the Modification Application will seek authority for Gogo's ESAA terminals to communicate with the ASTRA-4A satellite at 4.8°E.L., under the current ESAA rules, including Section 25.227.

Based upon the representations made to SES by Gogo concerning how it will operate on ASTRA-4A according to its letters dated 28 July 2016:

- SES acknowledges that the proposed operation of the Gogo ESAA terminals has the potential to create harmful interference to satellite networks adjacent to ASTRA-4A that may be unacceptable.
- SES certifies that it has completed coordination as required under the FCC's rules and that the power density levels specified by Gogo are consistent with existing coordination agreements to which SES is a party with all adjacent satellite operators within +/- 6 degrees of orbital separation from ASTRA-4A.
- If the FCC authorizes the operations proposed by Gogo, SES will include the power density levels specified by Gogo in all future satellite network coordination with other operators of satellites adjacent to ASTRA-4A.

Yours Sincerely,

Patrick van Niftrik

SES ASTRA S.A.
Château de Betzdorf
L-6815 Betzdorf
Luxembourg

Tel. +352 710 725 1
Fax +352 710 725 227
Enter sender e-mail
www.ses.com

Company Register No. B 22 589
Identification No. LU12859882

1/1

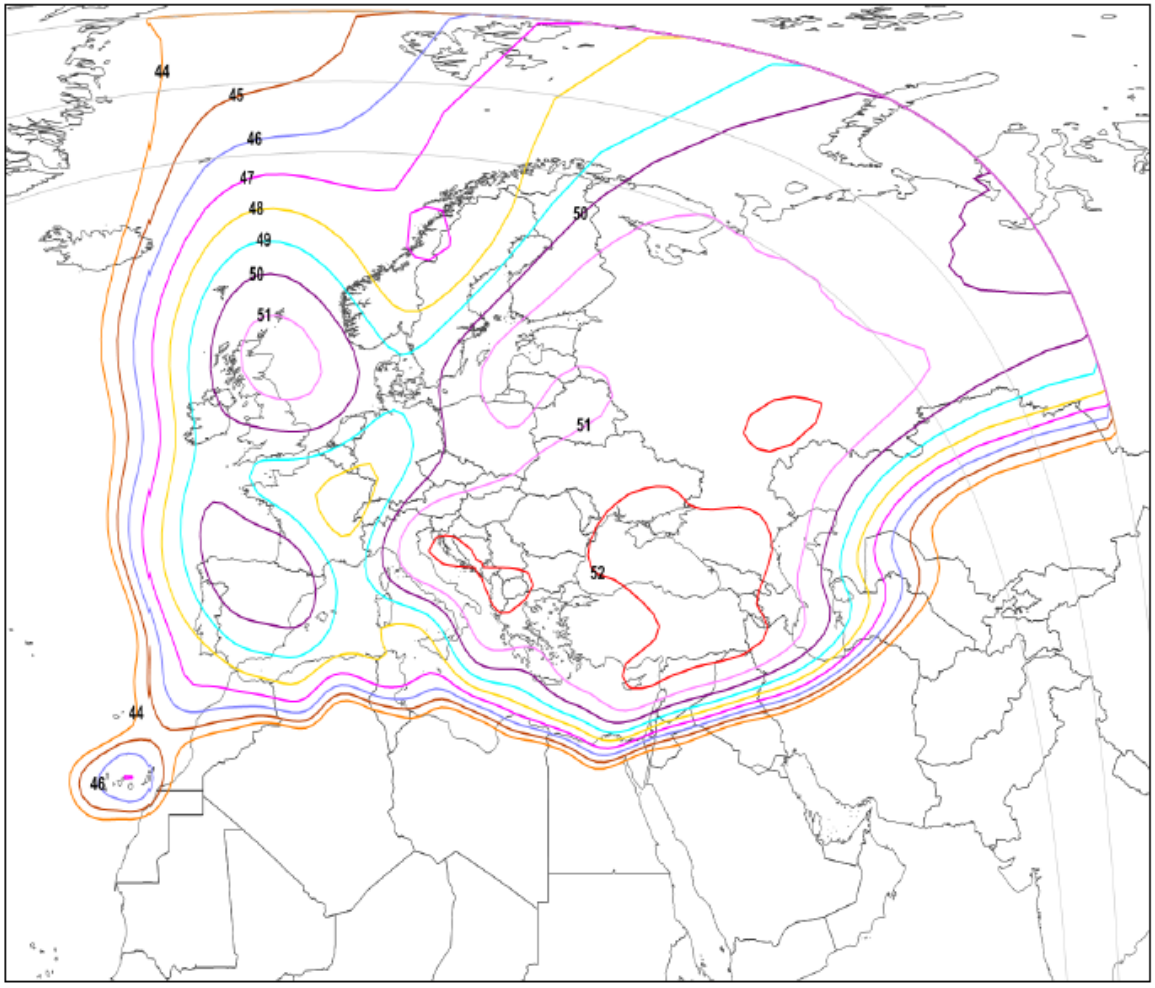
ANNEX 4:

ASTRA 4A Coverage Map, Link Budgets, and Orbital Debris Mitigation Statement

ASTRA 4A Coverage Map

Ku band: ECEE (EU) beam EIRP

SES



Contours Shown

EIRP [dBW]

52.7 Beam peak

52
51
50
49
48
47
46
45
44

Notes

The adjacent plot shows the measured performance of a typical satellite transponder. Performance differences should be expected between individual transponders.

Elevation Angles are shown at 0, 5 and 10 Degrees.

AeroSat Antenna

Forward Link Budget

Hub	Betzdorf, Luxembourg	
Required Eb/No	.9	dB
Modulation	4-PSK	
Info Rate	22.74	Mbps
FEC Rate	0.41	
Carrier Rolloff	1.2	
Satellite SFD @ 0 dB/K	-91.7	dBW/m^2
Transponder Atten	11.0	dB
Transponder ID	4.224/4.224	

Hub Transmit

Frequency	17.77	GHz
Satellite G/T	6.1	dB/^{o}K
Antenna Diameter	9.0	m
Carrier EIRP	75.33	dBW
Ant. Input PFD	-25.67	dBW/4kHz
Path Loss	209	dB
Atm/Point/Pol Loss	0.5	dB

Aircraft Receive Terminal

Frequency	12.52	GHz
Satellite EIRP	52.8	dBW
Downlink PFD@ Beam Center	13.41	dBW/4kHz
Receive Gain	29	dBi
Terminal G/T	11.7	dB/^{o}K
Path Loss	206	dB
Other Losses	0.7	dB

Transponder

Total OPBO	1	dB
Carrier OPBO	1	dB
C/No Thermal Up	100.5	dB-Hz
C/No Thermal Dn	77	dB-Hz
C/Io Total	86.3	dB-Hz
C/No+Io	76.6	dB-Hz
Add'l Link Margin	1.0	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	33	MHz

Return Link Budget

Terminal	Ku	
Required Eb/No	3.5	dB
Modulation	2-PSK	
Info Rate	1.03	KMps
FEC Rate	.5	
Carrier Spacing	1.3	
Carrier Spreading	0.0	
Satellite SFD @ 0 dB/K	-79	dBW/m^2
Transponder Atten	13	dB
Transponder ID	4.306/4.306	

Aircraft Transmit Terminal

Frequency	14.2	GHz
Satellite G/T	2.3	dB/^{o}K
Antenna Diameter	0.74	m
Carrier EIRP	42.7	dBW
Ant Input PFD	-13.3	dBW/4kHz
Path Loss	207.0	dB
Atm/Point/Pol Loss	0.7	dB

Hub Receive

Frequency	12.7	GHz
Satellite EIRP	50	dBW
Downlink PFD@ Beam Center	-12.7	dBW/4kHz
Hub G/T	38.4	dB/^{o}K
Path Loss	206.2	dB
Other Losses	0.8	dB

Transponder

Total OPBO	4.4	dB
Carrier OPBO	38.8	dB
C/No Thermal Up	66.0	dB-Hz
C/No Thermal Dn	71.3	dB-Hz
C/Io Total	83.3	dB-Hz
C/No+Io	64..8	dB-Hz
Add"l Link Margin	1.2	dB
% BW per cxr	3.7	%
% Power per cxr	0.04	%
Xpdr BW Alloc	2.67	MHz

ThinKom Antenna

Forward Link Budget

Hub	Betzdorf, Luxembourg	
Required Eb/No	1.7	dB
Modulation	4-PSK	
Info Rate	22.74	Mbps
FEC Rate	0.41	
Carrier Rolloff	1.2	
Satellite SFD @ 0 dB/K	-91.7	dBW/m²
Transponder Atten	11.0	dB
Transponder ID	4.224/4.224	

Hub Transmit

Frequency	17.76	GHz
Satellite G/T	6.1	dB/°K
Antenna Diameter	9.0	m
Carrier EIRP	75.33	dBW
Ant. Input PFD	-25.67	dBW/4kHz
Path Loss	209	dB
Atm/Point/Pol Loss	0.2	dB

Aircraft Receive Terminal

Frequency	12.52	GHz
Satellite EIRP	51	dBW
Downlink PFD@ Beam Center	13.41	dBW/4kHz
Receive Gain	33	dBi
Terminal G/T	6.1	dB/°K
Path Loss	206	dB
Other Losses	0.7	dB

Transponder

Total OPBO	1	dB
Carrier OPBO	1	dB
C/No Thermal Up	100.5	dB-Hz
C/No Thermal Dn	77	dB-Hz
C/Io Total	86.3	dB-Hz
C/No+Io	76.9	dB-Hz
Add'l Link Margin	.6	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	33	MHz

Return Link Budget

Terminal	2Ku	
Required Eb/No	3.5	dB
Modulation	2-PSK	
Info Rate	1.03	KMps
FEC Rate	.5	
Carrier Spacing	1.3	
Carrier Spreading	2.0	
Satellite SFD @ 0 dB/K	-80.8	dBW/m²
Transponder Atten	4.0	dB
Transponder ID	4.306/4.306	

Aircraft Transmit Terminal

Frequency	14.2	GHz
Satellite G/T	4.1	dB/°K
Antenna Diameter	0.74	m
Carrier EIRP	41.7	dBW
Ant Input PFD	-13.3	dBW/4kHz
Path Loss	207.6	dB
Atm/Point/Pol Loss	0.4	dB

Hub Receive

Frequency	12.7	GHz
Satellite EIRP	50	dBW
Downlink PFD@ Beam Center	-12.7	dBW/4kHz
Hub G/T	38.4	dB/°K
Path Loss	206.2	dB
Other Losses	0.8	dB

Transponder

Total OPBO	4.4	dB
Carrier OPBO	38.8	dB
C/No Thermal Up	66	dB-Hz
C/No Thermal Dn	71.3	dB-Hz
C/Io Total	85.6	dB-Hz
C/No+Io	64..8	dB-Hz
Add"l Link Margin	1.2	dB
% BW per cxr	3.7	%
% Power per cxr	0.04	%
Xpdr BW Alloc	2.67	MHz

ASTRA 4A Orbital Debris Mitigation Statement

This document contains the information required under Section 25.114(d)(14) of the Federal Communications Commission's Rules for the ASTRA 4A satellite operating at 4.8° E.L.

Spacecraft Hardware Design: SES has assessed and limited the amount of debris released in a planned manner during normal operations of ASTRA 4A. No debris is generated during normal on-station operations, and the spacecraft will be in a stable configuration. On-station operations require station keeping within the +/- 0.05 degree E-W and N-S control box, thereby ensuring adequate collision avoidance distance from other satellites in geosynchronous orbit. In the event that co-location within the same stationkeeping volume of this and another satellite is required, use of the proven Inclination-Eccentricity (I-E) separation method can be employed. This strategy is presently in use by SES to ensure proper operation and safety of multiple satellites within one orbital box.

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. 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 the required probability of success of the mission. The design of the spacecraft locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris. Steps have been taken to limit the effects of any collisions through shielding, the placement of components, and the use of redundant systems.

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, 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 ASTRA 4A 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, on-board sources of stored energy will be depleted or secured, and the batteries will be discharged. However, at the end of ASTRA 4A'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:

Item	Total Volume [l]	Pressure [bar]	Temp. [deg C]	Total Mass [kg]
Oxidizer (in two interconnected tanks)	657	19	21.5	12

The oxidizer tanks are well shielded, and the residual pressure in the tanks will be well below their maximum rating. The oxidizer in the tanks is MON-3 (N_2O_4 with 3% NO_2). In addition to the oxidizer, the tanks include helium pressurant, which has a residual mass of approximately 1.9 kg. Given the tank temperature, the majority of the residual oxidizer (over 8 liters) is in a liquid form. Accordingly, the pressure results above reflect the combined pressure of the helium gas and the vapor pressure from the oxidizer that is in gas form, using a tank volume of approximately 649 liters (657 liters less the 8 liters occupied by the liquid oxidizer).

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, 4.8° E.L. or assigned in the vicinity of that location.

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

At 4.8° E.L., ASTRA 4A operates at an offset from SES's SES-5 satellite operating at the nominal 5.0° E.L. During regular operation there are no other satellites assigned to or reasonably

expected to be located at 4.8° E.L. or to nearby orbital locations such that there would be an overlap with the stationkeeping volume of ASTRA 4A at 4.8° E.L.

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 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.

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.

Post-mission disposal of the satellite from operational orbit will be accomplished by carrying out maneuvers to a higher orbit. The fuel budget for this operation is included in the satellite design. SES plans to maneuver ASTRA 4A to a disposal orbit with a minimum perigee of 258 km above the normal operational altitude. This proposed disposal orbit altitude is based on the following calculation pursuant to § 25.283 of the Commission's Rules.

Area of the satellite (average aspect area): 54 m^2
Mass of the spacecraft: 2261.4 kg
CR (solar radiation pressure coefficient): 0.98

Therefore the Minimum Disposal Orbit Perigee Altitude, as calculated under the IADC formula is:

36,021 km + (1000 x CR x A/m) = 36,044 km, or 258 km above the GSO arc (35,786 km)

SES intends to reserve 5.3 kg of fuel in order to account for post-mission disposal of ASTRA 4A. SES has assessed fuel gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

ANNEX 5:

Gogo Certifications

Gogo LLC ("Gogo"), in support of the foregoing application to modify the Gogo ESAA License, hereby certifies as follows:

1. Gogo's target space station operators have confirmed that Gogo's proposed ESAA operations over international waters are within coordinated parameters for adjacent satellites up to 6 degrees away on the geostationary arc.
2. Gogo will comply with the requirements contained in paragraphs (a)(6), (a)(9), (a)(10), and (a)(11) of Section 25.227 of the Commission's rules, 47 C.F.R. § 25.227.

By: /s/ Timothy Joyce
Timothy Joyce
VP of RF Engineering
Gogo LLC

August 24, 2016