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

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

MODIFICATION

AC BidCo LLC ("AC BidCo") 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] AC BidCo requests that the Commission modify the AC BidCo ESAA License to include additional spacecraft as authorized points of communication. Specifically, AC BidCo requests that the Commission permit ESAA operations with:

(1) the Tonga-licensed Telstar 18 VANTAGE satellite at 138° E.L.;
(2) the Japan-licensed JCSAT-3A satellite at 128° E.L.;
(3) the China-licensed AsiaSat-9 satellite at 122° E. L.; and
(4) the China-licensed APSTAR 6C satellite at 134° E. L.

A narrative description of the relevant changes is provided here, and AC BidCo is attaching an FCC Form 312 that identifies the revised points of communication. Supplemental technical information and copies of relevant coordination letters are attached as well. Pursuant to Section 25.117(c) of the Commission's rules, AC BidCo is providing herein information that

[1] *See* Call Sign E120106, File No. SES-MFS-20180813-02152, granted Nov. 8, 2018 (the "AC BidCo ESAA License").

is changing as a result of the modification. AC BidCo certifies that the remaining information provided in support of the AC BidCo ESAA License has not changed.[2]

I. SATELLITES USED BY THE AC BIDCO ESAA NETWORK

AC BidCo requests modification of its license to specify the satellites described below as points of communication for the AC BidCo ESAA network pursuant to the provisions of Section 25.227(a)(2) and (b)(2). Each of the requested satellites is eligible for authority for use with the AC BidCo ESAA network. Updated tables listing the satellites to be used and the associated ground stations are provided in Annex 2 hereto. AC BidCo seeks authority for all the requested additional satellites to communicate with both the AeroSat antennas designated as AES1 on the AC BidCo ESAA License and the ThinKom model 2Ku antennas designated as AES2 on the license. AC BidCo does not propose to use any of these added satellites in U.S. airspace.

Telstar 18 VANTAGE: Telstar 18 VANTAGE ("T18V") is licensed by the Kingdom of Tonga and is positioned at 138° E.L. T18V is not on the Permitted Space Station List, but an application seeking authority for U.S. market access for the satellite is pending before the Commission that provides details regarding the satellite's operational characteristics.[3] As discussed in the HPT Application, the licensing administration for T18V, Tonga, is a WTO

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[2] For the Commission's convenience, AC BidCo 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. Annex 1 tracks the requirements as set forth in the Commission's current rules, as the changes to the ESAA regulatory regime adopted by the Commission in September are not yet in effect. *See Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed-Satellite Service*, Report and Order and Further Notice of Proposed Rulemaking, FCC 18-138 (rel. Sept. 27, 2018).

[3] *Hawaii Pacific Teleport, L.P.*, Call Sign E030115, File No. SES-MFS-20180921-02790 ("HPT Application").

member. 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.[4]

AC BidCo seeks authority to use T18V capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum and on an unprotected basis in the 11.45-11.7 GHz downlink spectrum, consistent with the Commission's orders in the ESAA proceeding.[5]

T18V will provide coverage of Australia, New Zealand, Indonesia, and Malaysia. A letter confirming that operation of the AC BidCo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of T18V is included in Annex 3. In addition, because AC BidCo is seeking authority to use frequencies and beams not addressed in the HPT Application, AC BidCo is supplying in Annex 4 technical materials regarding its proposed operations with T18V, including supplemental coverage maps and link budgets. AC BidCo incorporates by reference the orbital debris mitigation statement for T18V that was submitted with the HPT Application.[6]

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[4] *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*").

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

[6] HPT Application, Exhibit 2, Section A8.

JCSAT-3A: JCSAT-3A (also known as JCSAT-10) is licensed by Japan and is positioned at 128° E.L. JCSAT-3A is not on the Permitted Space Station List, but its licensing administration, Japan, is a member of the World Trade Organization ("WTO"). Accordingly, under the Commission's *DISCO II* market access framework referenced above, 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.

AC BidCo seeks authority to use JCSAT-3A capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum, consistent with the Commission's ESAA Decisions. AC BidCo seeks authority to use JCSAT-3A capacity for ESAA operations on a nonconforming basis in the 12.2-12.75 GHz downlink spectrum.

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

AsiaSat-9: AsiaSat-9 is licensed by China through the Hong Kong Office of the Communications Authority ("OFCA") and is positioned at 122° E.L. AsiaSat-9 is not on the Permitted Space Station List, but its licensing administration, China, is a WTO member. Accordingly, under the Commission's *DISCO II* market access framework referenced above, 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.

AC BidCo seeks authority to use AsiaSat-9 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 Commission's ESAA Decisions. AC BidCo also seeks authority to use AsiaSat-9 capacity for ESAA operations on a nonconforming basis in the 12.2-12.75 GHz downlink spectrum.

AsiaSat-9 will provide coverage of China. A letter confirming that operation of the AC BidCo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of AsiaSat-9 is included in Annex 3. In addition, Annex 4 contains technical materials regarding the proposed AC BidCo operations with AsiaSat-9, including coverage maps, link budgets, and an orbital debris mitigation statement.

<u>*APSTAR-6C*</u>: APSTAR-6C is licensed by China through OFCA and is positioned at 134° E.L. APSTAR-6C is not on the Permitted Space Station List, but its licensing administration, China, is a WTO member. Accordingly, under the Commission's *DISCO II* market access framework referenced above, 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.

AC BidCo seeks authority to use APSTAR-6C capacity for ESAA operations on a primary basis in the 14-14.5 GHz uplink spectrum, consistent with the Commission's ESAA Decisions. AC BidCo seeks authority to use APSTAR-6C capacity for ESAA operations on a nonconforming basis in the 12.25-12.75 GHz downlink spectrum.

APSTAR-6C will provide coverage of Asia. A letter confirming that operation of the AC BidCo ESAA terminals is consistent with coordination agreements with satellites operated within six degrees of APSTAR-6C is included in Annex 3. In addition, Annex 4 contains technical materials regarding the proposed AC BidCo operations with APSTAR-6C, including coverage maps, 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 AC BidCo's proposed ESAA operations are consistent with the coordination agreements between operators of the satellites discussed above and operators of adjacent spacecraft. Furthermore, AC BidCo's operations with the additional satellites will conform to the terms of the agreements between AC BidCo and the National Aeronautics and Space Administration and the National Science Foundation.

III. WAIVER REQUESTS

AC BidCo seeks limited waivers of the Commission's rules in connection with its request to update the satellites authorized as points of communication for the AC BidCo ESAA network. Specifically, AC BidCo requests: (1) a waiver of the U.S. Table of Allocations in Section 2.106 to permit ESAA operations in the 12.2-12.75 GHz spectrum; and (2) a waiver of the orbital debris mitigation requirements for JCSAT-3A and APSTAR 6C, 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.[7]

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

Section 2.106: AC BidCo 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. The Commission has expressly recognized that "terminals on U.S.-registered aircraft may 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."[8] To meet this need, AC BidCo and other ESAA providers have requested and received Commission authority to receive signals in the 12.2-12.75 GHz band.[9]

The same rationale supports grant of a waiver to permit AC BidCo to receive transmissions from the JCSAT-3A, AsiaSat-9, and APSTAR-6C satellites using spectrum in the 12.2-12.75 GHz range. In each case the proposed operations are consistent with coordination agreements with operators of adjacent satellites within six degrees. Authorizing AC BidCo to receive signals from these satellites will not alter the technical characteristics of the satellite's operations in any way, and therefore will not create harmful interference to other authorized users of the spectrum. Furthermore, AC BidCo 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 frequencies in the 12.2-12.75 GHz band for downlinks from JCSAT-3A, AsiaSat-9, and APSTAR-6C as part of the AC BidCo 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

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8 *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).

9 *See, e.g.*, AC BidCo ESAA License, Section B and conditions 900387 and 900421 (authorizing reception of transmissions in the 12.2-12.75 GHz band on a non-interference, non-protected basis); *Panasonic Avionics Corporation*, File No. SES-MFS-20180122-00052, Call Sign E100089, granted Aug. 1, 2018, Section B.

completion of a satellite's mission, "a space station licensee shall ensure, unless prevented by technical failures beyond its control, that stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, or other appropriate measures."[10] AC BidCo requests any necessary waiver of this requirement in connection with its request to communicate with the JCSAT-3A and APSTAR 6C satellites, in-orbit spacecraft that were not designed to allow complete venting at end of life.

JCSAT-3A is a Lockheed Martin A2100 model spacecraft. As described in more detail in the attached Orbital Debris Mitigation Statement, the oxidizer tanks on the JCSAT-3A 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).

APSTAR 6C is a DFH-4 model spacecraft. As described in more detail in the attached Orbital Debris Mitigation Statement, the helium tanks on the APSTAR 6C 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 helium tanks in order to comply with Section 25.283(c).

Under Commission precedent, grant of a waiver for these satellites is warranted. In a number of cases involving various spacecraft models with similar limitations, the Commission has waived Section 25.283(c) to permit launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the space station design at a late stage of construction would pose an undue hardship.[11] In the case of the JCSAT-

[10] 47 C.F.R. § 25.283(c).

[11] *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

3A and APSTAR 6C satellites, which are currently in-orbit, there is no question of bringing the satellites 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 JCSAT-3A, 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."[12] The Commission has reached a similar conclusion with respect to satellites with helium tanks that cannot be fully vented.[13]

The same practical obstacle is present here. Because JCSAT-3A and APSTAR 6C are already in orbit, they cannot be modified to enable full venting of residual pressure. Given this reality, a waiver is clearly warranted.

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).

[12] File No. SAT-MOD-20101215-00261, Call Sign S2134, grant-stamped Mar. 8, 2011, Attachment at ¶ 4.

[13] *See, e.g., 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

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

Respectfully submitted,

AC BIDCO LLC

By: *<u>/s/ Marguerite Elias</u>*

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Dated: March 4, 2019

ANNEX 1: Table of Information Required by Section 25.227

Section 25.227 Requirement	Citation to Information Provided
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: AC BidCo Network Operations Center, 111 North Canal Street, Chicago, IL, 60606, as specified in Form 312 Schedule B, Items E2-E9.
25.227(a)(15)	AC BidCo certifications are in Annex 5 attached.
25.227(b)(2)(i)	Off-axis EIRP density information regarding the AeroSat and ThinKom terminals licensed for use by AC BidCo was previously provided to the Commission.
25.227(b)(2)(ii)	Target satellite operator certifications are in Annex 3 attached.
25.227(b)(2)(iii) & (iv)	AC BidCo has previously demonstrated that its system will comply with coordination agreements and requirements to cease emissions.
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. Coverage maps for the additional satellites included in this application are in Annex 4 attached.
25.227(b)(7)	AC BidCo certifications are in Annex 5 attached.
25.227(b)(8)	No change to previously filed Radiation Hazard analyses.
25.227(c)	AC BidCo's coordination agreement with NASA was filed February 1, 2013 in File Nos. SES-LIC-20120619-00574 *et al*.
25.227(d)	AC BidCo's coordination agreement with NSF was included as Amendment Exhibit B in File No. SES-AMD-20120731-00709.

ANNEX 2:

Updated Spacecraft and Teleport Tables

Satellite	Location	Beam Coverage Area	Tx (GHz)	Rx (GHz)	Use in US airspace?	Satellite Operator
AMC-1[1]	130.9W	North America, Pacific Ocean	14-14.5	11.7-12.2	Yes	SES
AMC-4[2]	134.9W	North America, Pacific Ocean	14-14.5	11.45-11.7; 11.7-12.2	Yes	
AMC-6	83W	North America	14-14.5	11.45-11.7; 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-3	103W	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	
SES-10	67W	North and Central America, the Gulf of Mexico, and the Caribbean	14-14.5	10.95-11.2; 11.45-11.7; 11.7-12.2	Yes	
SES-14	47.5W	North America	14-14.5	10.95-11.2; 11.45-11.7; 11.7-12.2	Yes	
SES-15	129.15W	North America, Pacific Ocean	14-14.5	10.7-11.7 11.7-12.2	Yes	

[1] This satellite is only used for communications with the Aerosat antenna system, designated AES1.

[2] This satellite is only used for communications with the ThinKom 2Ku antenna system, designated AES2.

Satellite	Location	Beam Coverage Area	Tx (GHz)	Rx (GHz)	Use in US airspace?	Satellite Operator
Galaxy 17	91W	North America	14-14.5	11.7-12.2	Yes	Intelsat
Galaxy 28	89W	Brazil	14-14.5	11.7-12.2	No	
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-37e	18W	Europe	14-14.5	10.95-11.7; 12.5-12.75	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	
Horizons 3e	169E	Asia Pacific	14-14.5	10.95-11.7 12.2-12.75	Yes	

Satellite	Location	Beam Coverage Area	Tx (GHz)	Rx (GHz)	Use in US airspace?	Satellite Operator
Eutelsat 115WB	114.9W	North America	14-14.5	11.7-12.2	Yes	Eutelsat
Eutelsat 117WA	116.8W	Central and South America	14-14.5	11.7-12.2	Yes	
E172B[1]	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	
Telstar 12V	15W	Brazil	14-14.5	11.7-12.2	No	
Telstar 18/ Apstar 5	138E	Asia	14-14.5	12.2–12.75	No	
Telstar 18V	138E	Australia, New Zealand, Indonesia, and Malaysia	14-14.5	11.45-11.7	No	
JCSAT-2B	154E	South Pacific	14-14.5	11.45-11.7; 12.25-12.75	Yes	JSAT
JCSAT-3A	128E	Japan	14-14.5	12.2-12.75	No	
JCSAT-5A[1]	132E	Japan	14-14.5	12.25-12.75	No	
JCSAT-110A[2]	110E	Indian Ocean	14-14.5	12.2-12.75	No	
Yamal 300K	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
AsiaSat 9	122E	China	14-14.5	10.95-12.75	No	
ARSAT-2	81W	North America	14-14.5	11.7-12.2	Yes	Empresa Argentina de Soluciones Satelitales S.A.
Optus D2	152E	Australia	14-14.5	12.25-12.75	No	Optus
ABS-3A	3W	North and South America	14-14.25	10.95-11.2	Yes	ABS Global
APSTAR-6C	134E	Asia	14-14.5	12.25-12.75	No	APT Mobile Satcom Limited

[1] These satellites are only used for communications with the Aerosat antenna system, designated AES1.

[2] This satellite is only used for communications with the ThinKom 2Ku antenna system, designated AES2.

Satellite	Teleport Location	FCC Call Sign
AMC-1	Woodbine, MD	E900448
AMC-4	Brewster, WA	E120043
AMC-6	Perris, CA	E940448
AMC-21	Woodbine, MD	E900448
ASTRA 4A	Betzdorf, Luxembourg	N/A
SES-1	Woodbine, MD	E920698
SES-3	Woodbine, MD	E140059
SES-4	Bristow, VA	E020071
	Bristow, VA	E000696
SES-6	Betzdorf, Luxembourg	N/A
SES-10	Perris, CA	E940448
SES-14	Woodbine, MD Port St. Lucie, FL	E170197 E170198
SES-15	Woodbine, MD South Mountain, CA	E170138 E170139
Galaxy 17	Atlanta, GA ATL-K26	E990214
Galaxy 28	Rio de Janeiro, Brazil	N/A
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-37e	Hagerstown, MD	E040414
IS-904	Moscow, Russia	N/A
IS-907	Hagerstown, MD	E030103
Horizons 3e	Napa teleport NAP-C21	E950307

Satellite	Teleport Location	FCC Call Sign
Eutelsat 115WB	Brewster, WA	E120043
Eutelsat 117WA	Brewster, WA	E060416
E172B	Khabarovsk, Russia	N/A
T-11N	Aflenz, Austria	N/A
Telstar 12V	Rio de Janeiro, Brazil	N/A
Telstar 18/Apstar 5	China	N/A
Telstar 18V	Sydney, Australia	N/A
JCSAT-2B	Kapolei, HI	E010236
JCSAT-3A	Yokohama, Japan	N/A
JCSAT-5A	Yokohama, Japan	N/A
JCSAT-110A	Perth, Australia	N/A
Yamal 300K	Brewster, WA BRW-05C	E120043
Yamal 401	Moscow, Russia	N/A
AsiaSat-7	Beijing, China	N/A
AsiaSat-9	Beijing, China	N/A
ARSAT-2	Brewster, WA	E120043
Optus D2	Belrose, Australia	N/A
ABS-3A	Macae, Brazil	N/A
APSTAR 6C	Beijing, China	N/A

ANNEX 3:

Satellite Company Letters

160 Elgin Street, Suite 2100
Ottawa, ON, Canada K2P 2P7
Tel: 613-748-8700

28 January 2019

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

Re: AC BidCo LLC Application for earth stations aboard aircraft ("ESAA") terminals

To Whom It May Concern:

This letter certifies that Telesat is aware that AC BidCo LLC ("AC BidCo") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku-band transmit/receive terminals AES1 and AES2 for the provision of Aeronautical Mobile Satellite Service (Call Sign E120106) and that AC BidCo seeks additional authorization for these aeronautical Ku-band earth stations to utilize the Telstar 18 VANTAGE ("T18V") satellite at 138°E orbital location under the current FCC rules for Earth Stations Aboard Aircraft ("ESAA"), including Section 25.227.

Based on the information provided by AC BidCo, Telesat (i) certifies that the use of the ESAA transmit/receive terminals AES1 and AES2 by AC BidCo, installed and operated in accordance with the AC BidCo application and the above conditions, is consistent with the existing coordination agreements with all adjacent satellite operators within +/- 6 degrees from T18V; (ii) acknowledges that the proposed operation of these terminals has the potential to receive harmful interference from adjacent satellite networks that may be unacceptable; and (iii) confirms that if the FCC authorizes the operations proposed by AC BidCo, Telesat will take into consideration the power density levels associated with such operations in future satellite network coordination with adjacent satellite operators.

Yours Sincerely,

BAHRAM BORNA
Senior Systems Engineer
Telesat

MD-A-18-060

SKY Perfect JSAT Corporation

SKY Perfect JSAT Corporation
AKASAKA INTERCITY AIR
1-8-1, Akasaka, Minato-ku
Tokyo 107-0052, Japan
TEL +81-3-5571-7800

January 31st, 2019

Federal Communications Commission
International Bureau
445 12th Street, SW
Washington, DC 20554
UNITED STATES OF AMERICA

To whom it may concern

This letter certifies that JSAT is aware that AC BidCo LLC ("AC BidCo") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku band transmit/receive terminals AES1 and AES2 for the provision of Aeronautical Mobile Satellite Service (Call Sign E120106). AC BidCo seeks additional authorization for these aeronautical Ku-band earth stations to also utilize JCSAT-3A at 128° EL under the current rules for Earth Stations Aboard Aircraft (ESAA), including Section 25.227

JSAT certifies that the use of the ESAA transmit/receive terminals AES1 and AES2 by AC BidCo, installed and operated in accordance with the AC BidCo application and the above conditions, is consistent with existing coordination agreements with all adjacent satellite operators within +/-6 degrees of orbital separation fromJCSAT-3A.

If the FCC authorizes the operations proposed by AC BidCo in its application, JSAT will include the power density levels, as described above, in all future satellite network coordination with the other adjacent satellite operators. AC BidCo shall comply with all such coordination agreements reached by the satellite operators.

Yours sincerely,

Y. Moriai — Jan. 31, 2019

Yutaka Moriai

General Manager, Mobile Business Division

Global Business Group

Space Business Unit

SKY Perfect JSAT

ASIASAT
Reaching Further, Bringing You Closer

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Phone +852 2600 9162

Email wfng@asiasat.com

Ref: TM21/220119/0007

22 January 2019

Federal Communications Commission
International Bureau
445 12th Street, SW
Washington, DC 20554
UNITED STATES OF AMERICA

To whom it may concern

This letter certifies that Asia Satellite Telecommunications Co. Ltd. ("AsiaSat") is aware that AC BidCo LLC ("AC BidCo") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku band transmit/receive terminals AES1 and AES2 for the provision of Aeronautical Mobile Satellite Service (Call Sign E120106). AC BidCo seeks additional authorization for these aeronautical Ku-band earth stations to also utilize AsiaSat 9 at 122 EL under the current rules for Earth Stations Aboard Aircraft (ESAA), including Section 25.227

AsiaSat certifies that the use of the ESAA transmit/receive terminals AES1 and AES2 by AC BidCo, installed and operated in accordance with the AC BidCo application and the above conditions, is consistent with existing coordination agreements with all adjacent satellite operators within +/-6 degrees of orbital separation from AsiaSat 9.

If the FCC authorizes the operations proposed by AC BidCo in its application, AsiaSat will include the power density levels, as described above, in all future satellite network coordination with the other adjacent satellite operators. AC BidCo shall comply with all such coordination agreements reached by the satellite operators.

Yours sincerely,

Mr. Wai Fai NG

Manager, Communication Engineering

亞太通信衛星有限公司
APT SATELLITE COMPANY LIMITED
香港新界大埔工業村大貴街22號
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Email info@apstar.com

25 Jan 2019

Federal Communications Commission
International Bureau
445 12th Street, SW
Washington, DC 20554
UNITED STATES OF AMERICA

To whom it may concern

This letter certifies that APT Satellite Company Limited is aware that AC BidCo LLC ("AC BidCo") is planning to seek authorization from the Federal Communications Commission ("FCC") to operate Ku band transmit/receive terminals AES1 and AES2 for the provision of Aeronautical Mobile Satellite Service (Call Sign E120106). AC BidCo seeks additional authorization for these aeronautical Ku-band earth stations to also utilize APSTAR-6C at 134E under the current rules for Earth Stations Aboard Aircraft (ESAA), including Section 25.227

APT Satellite Company Limited certifies that the use of the ESAA transmit/receive terminals AES1 and AES2 by AC BidCo, installed and operated in accordance with the AC BidCo application and the above conditions, is consistent with existing coordination agreements with all adjacent satellite operators within +/-6 degrees of orbital separation from APSTAR-6C.

If the FCC authorizes the operations proposed by AC BidCo in its application, APT Satellite Company Limited will include the power density levels, as described above, in all future satellite network coordination with the other adjacent satellite operators. AC BidCo shall comply with all such coordination agreements reached by the satellite operators.

Yours sincerely,

Zhang

Simpson Zhang

Vice President

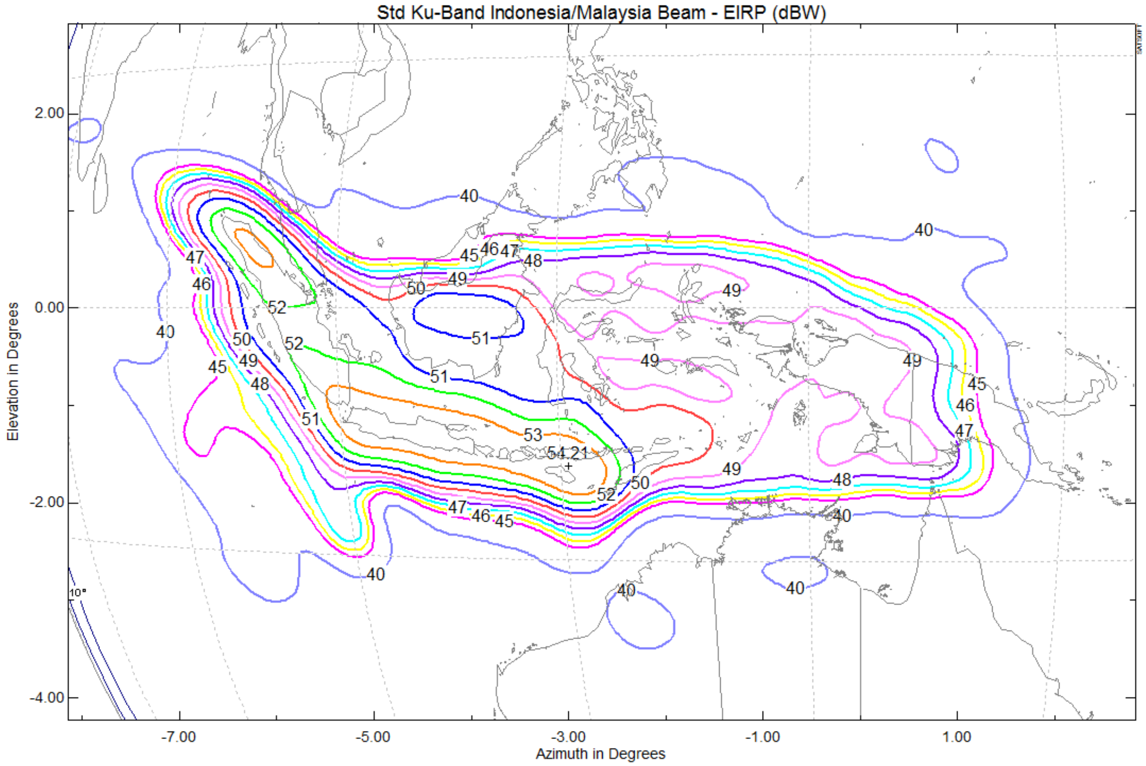
APT Satellite Company Limited

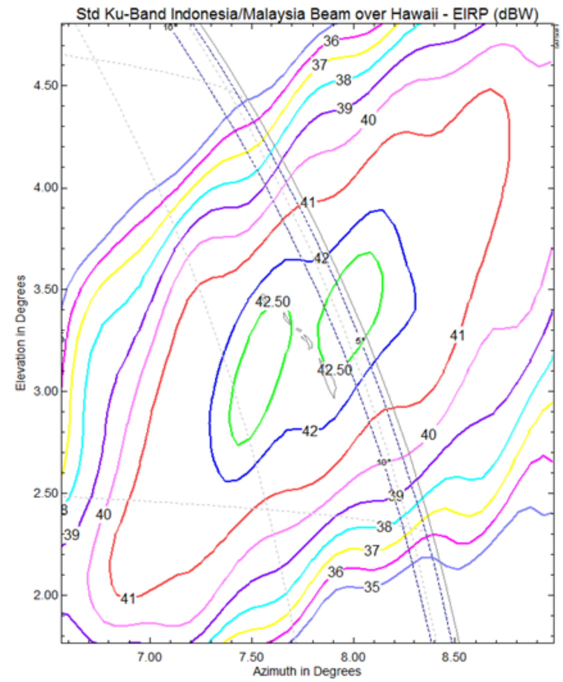
ANNEX 4:

Coverage Maps, Link Budgets, and Orbital Debris Mitigation Statements

T18V Coverage Maps

T18V Ku-band Indonesia/Malaysia Typical EIRP

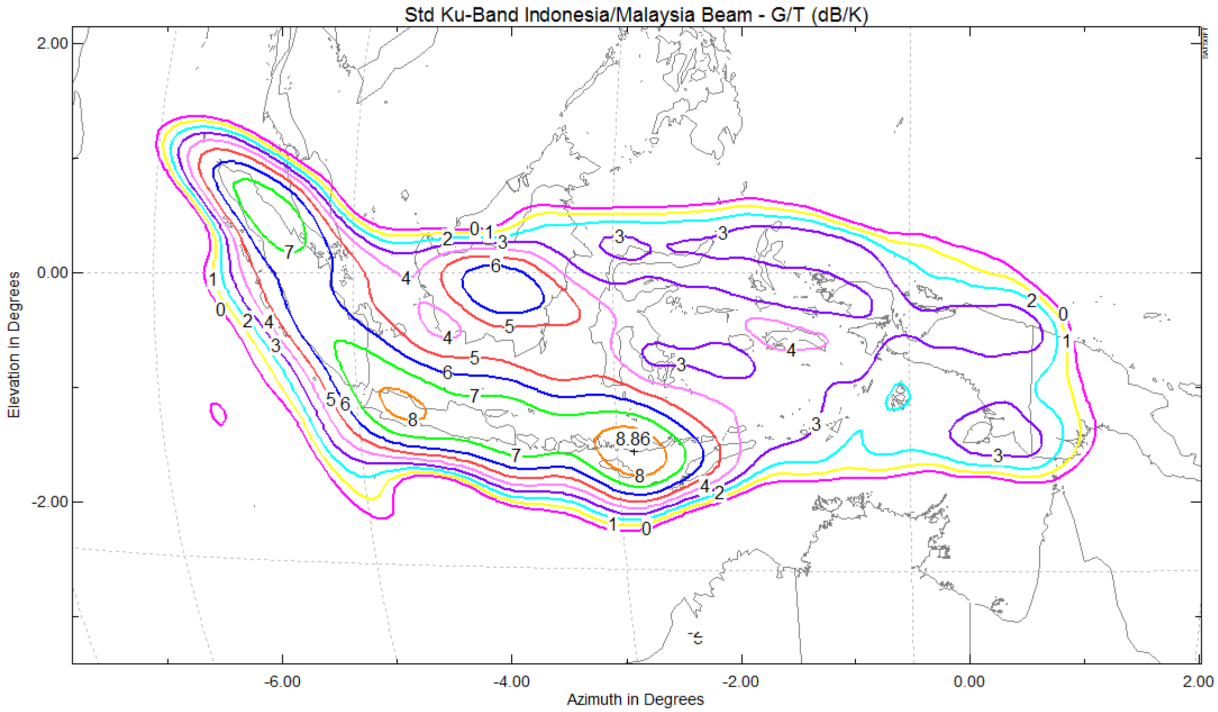


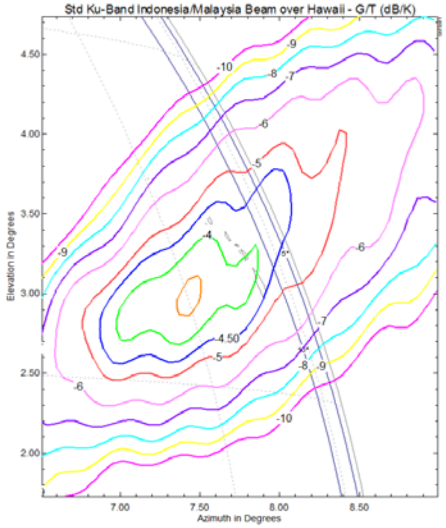


Over Hawaii

T18V Coverage Maps

T18V Ku-band Indonesia/Malaysia Typical G/T

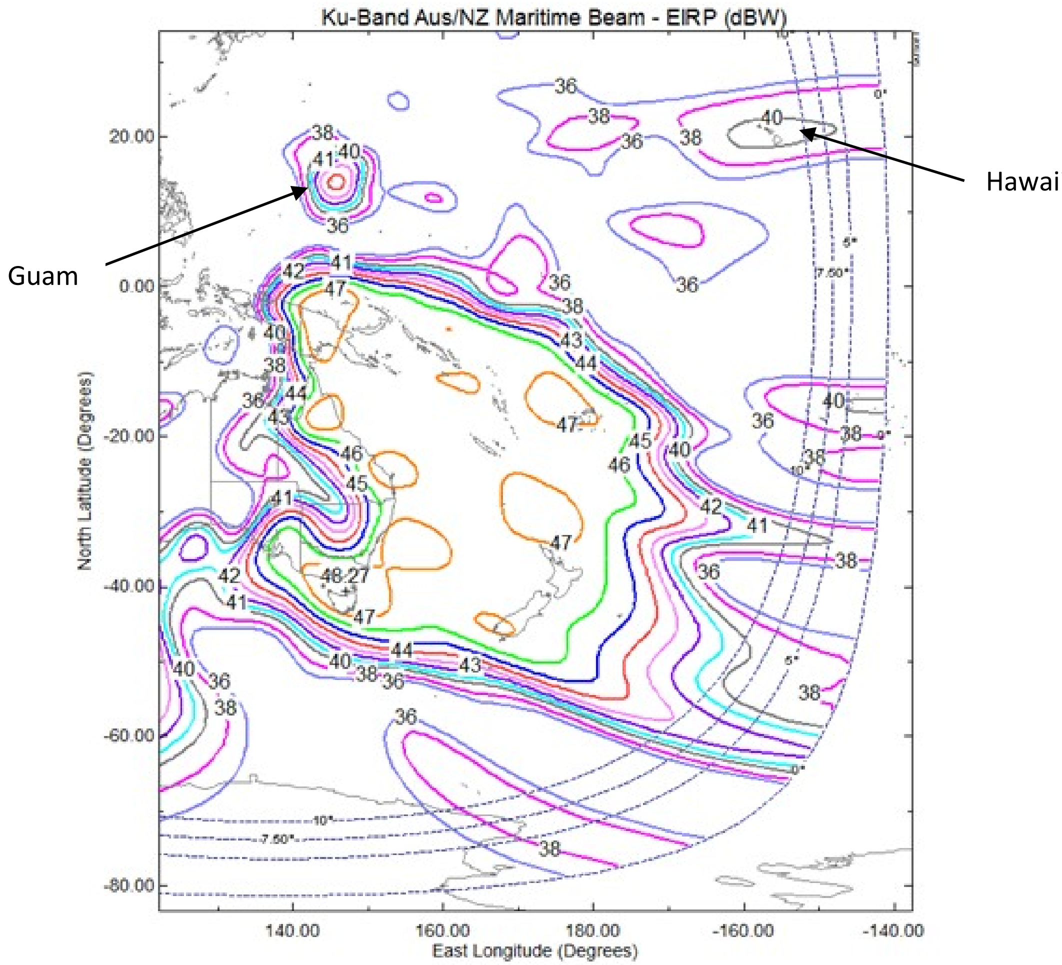




Over Hawaii

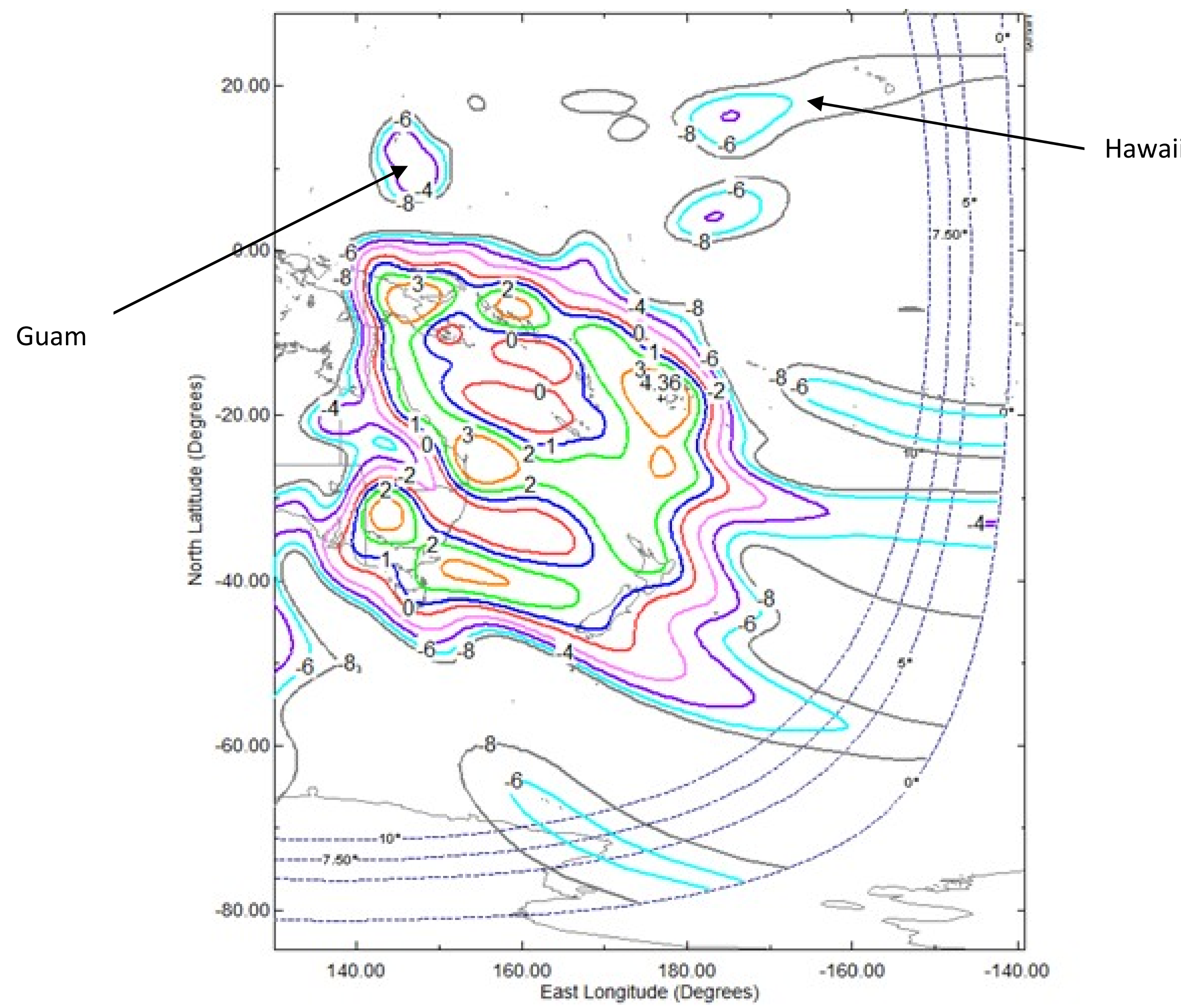
T18V Coverage Maps

T18V Ku-band Australia/New Zealand Typical EIRP



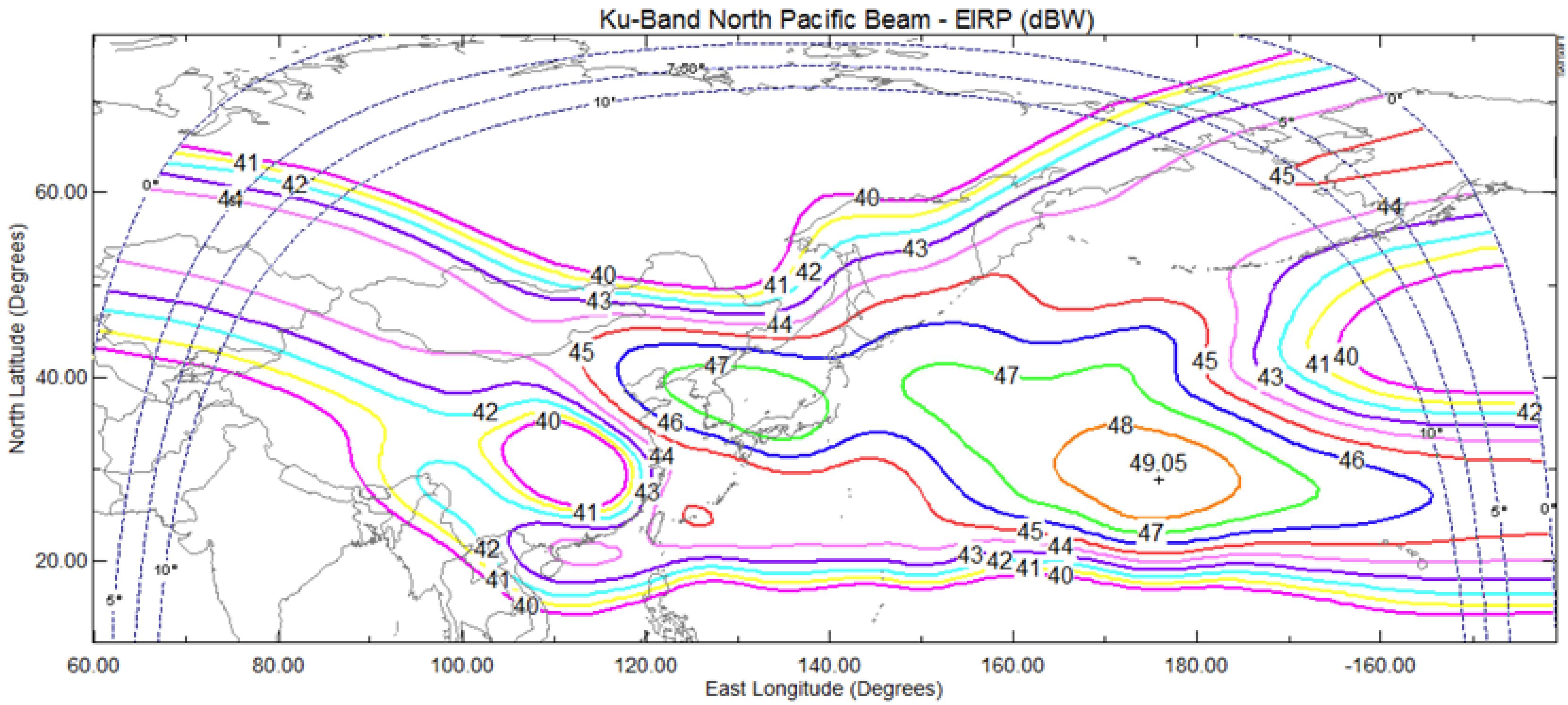
T18V Coverage Maps

T18V Ku-band Australia/New Zealand Typical G/T



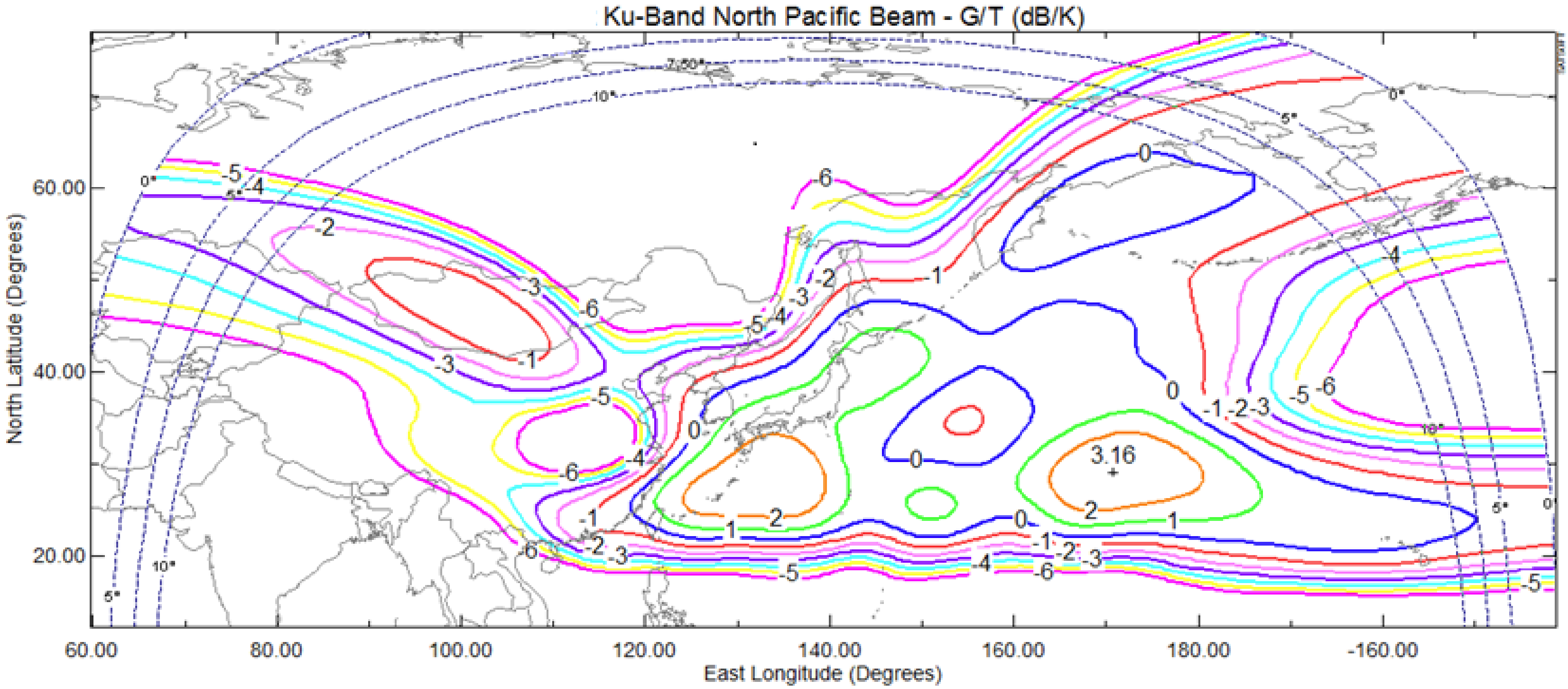
T18V Coverage Maps

T18V Ku-band North Pacific Typical EIRP



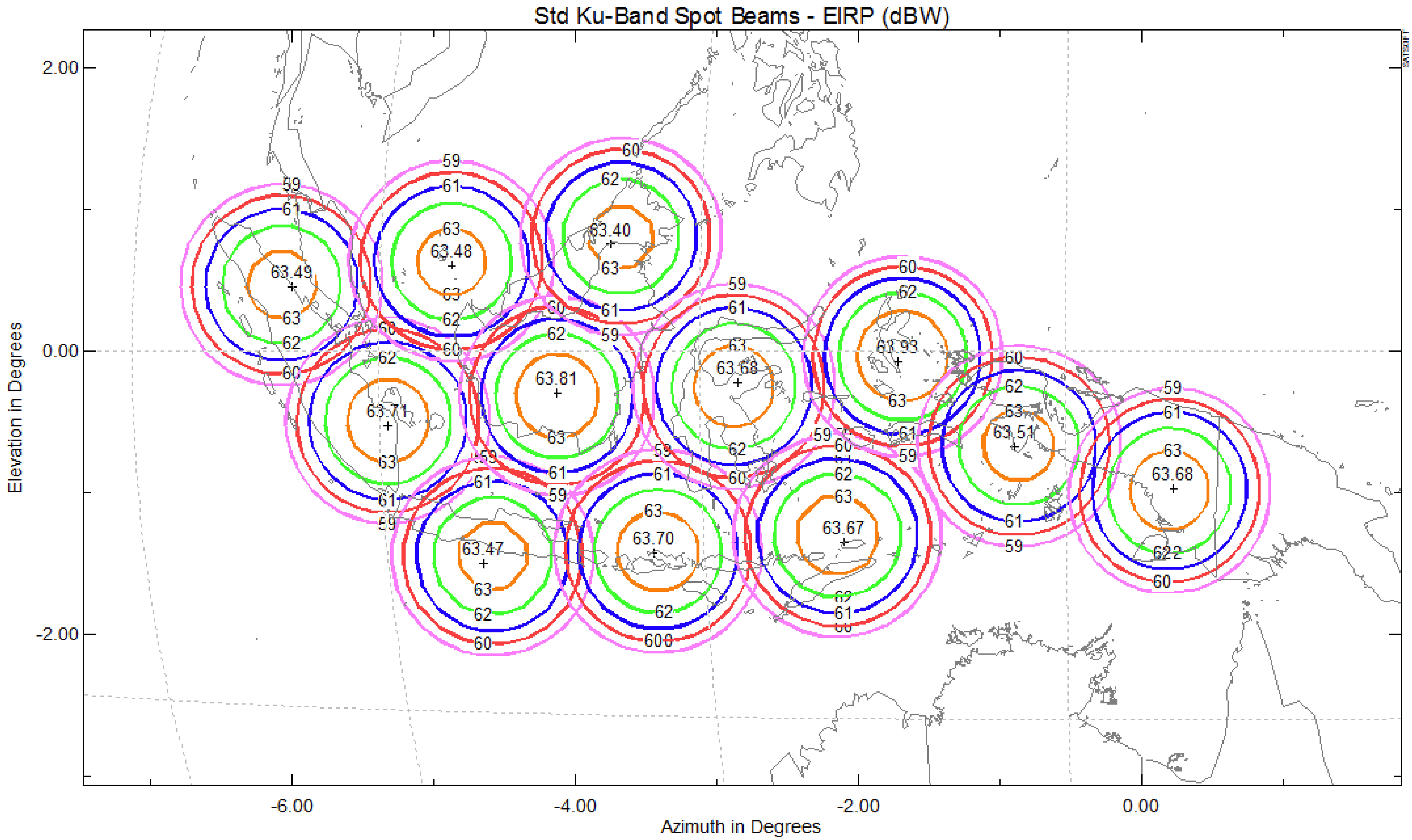
T18V Coverage Maps

T18V Ku-band North Pacific Typical G/T



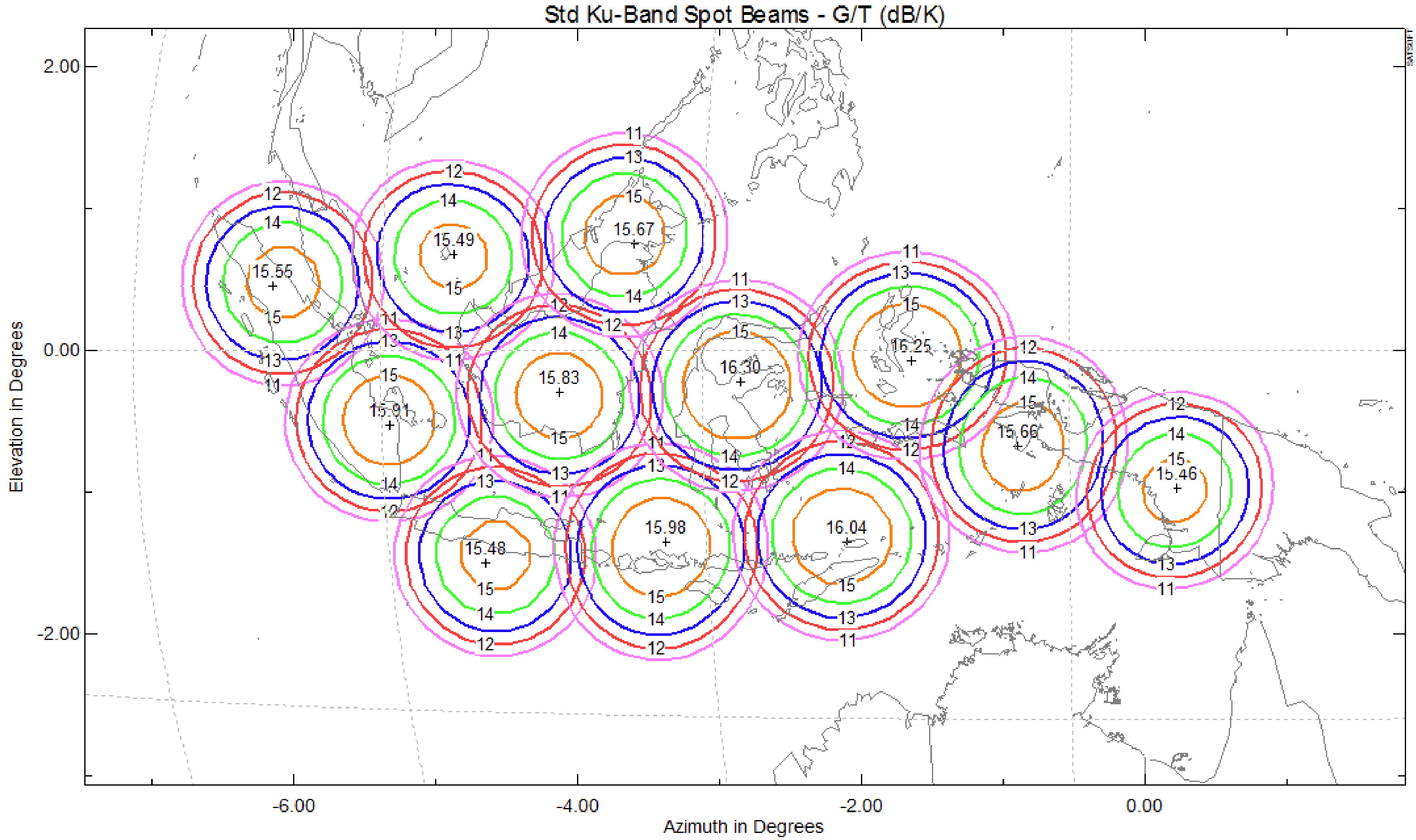
T18V Coverage Maps

T18V Ku-band Spots Typical EIRP



T18V Coverage Maps

T18V Ku-band Spots Typical G/T



T18V Link Budget: AeroSat Antenna (AES1)

Forward Link Budget

Hub	Sydney	
Required Eb/No	1.3	dB
Modulation	4-PSK	
Info Rate	47,420	Kbps
FEC Rate	0.483	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-85.9	dBW/m²
Transponder Atten	0	dB
Transponder ID		

Hub Transmit

Frequency	14.041	GHz
Satellite G/T	2	dB/°K
Antenna Diameter	7.2	m
Carrier EIRP	74.62	dBW
Ant. Input PFD	-24.27	dBW/4kHz
Path Loss	206.81	dB
Atm/Point/Pol Loss	0.12	dB

Aircraft Receive Terminal

Frequency	11.481	GHz
Satellite EIRP	46	dBW
Downlink PFD@ Beam Center	9.71	dBW/4kHz
Receive Gain	58	dB
Terminal G/T	11.22	dB/°K
Path Loss	205.27	dB
Other Losses	0.08	dB

Transponder

Total OPBO	0	dB
Carrier OPBO	0	dB
C/No Thermal Up	98.30	dB-Hz
C/No Thermal Dn	79.96	dB-Hz
C/Io Total	86.1	dB-Hz
C/No+Io	78.96	dB-Hz
Add'l Link Margin	0.76	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	54	MHz

Return Link Budget

Terminal	Aerosat Ku Remote	
Required Eb/No	-1.7	dB
Modulation	2-PSK	
Info Rate	5714	Kbps
FEC Rate	0.372	
Carrier Spacing	1.20	
Carrier Spreading	1.20	
Satellite SFD @ 2 dB/K	-85.9	dBW/m²
Transponder Atten	0	dB
Transponder ID		

Aircraft Transmit Terminal

Frequency	11.542	GHz
Satellite G/T	0	dB/°K
Antenna Diameter	0.4	m
Carrier EIRP	39.89	dBW
Ant Input PFD	-14.45	dBW/4kHz
Path Loss	207.06	dB
Atm/Point/Pol Loss	0.10	dB

Hub Receive

Frequency	11.542	GHz
Satellite EIRP	49	dBW
Downlink PFD@ Beam Center	-10.67	dBW/4kHz
Hub G/T	35.29	dB/°K
Path Loss	205.10	dB
Other Losses	0.09	dB

Transponder

Total OPBO	3	dB
Carrier OPBO	35.43	dB
C/No Thermal Up	60.83	dB-Hz
C/No Thermal Dn	72.27	dB-Hz
C/Io Total	74.97	dB-Hz
C/No+Io	60.38	dB-Hz
Add'l Link Margin	0.21	dB
% BW per cxr	3.41	%
% Power per cxr	0.06	%
Xpdr BW Alloc	1.84	MHz

T18V Link Budget: ThinKom Antenna (AES2)

Forward Link Budget

Hub	Sydney	
Required Eb/No	3.2	dB
Modulation	4-PSK	
Info Rate	63,326	Kbps
FEC Rate	0.645	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-85.9	dBW/m^2
Transponder Atten	0	dB
Transponder ID		

Hub Transmit

Frequency	14.041	GHz
Satellite G/T	2	dB/°K
Antenna Diameter	7.2	m
Carrier EIRP	74.62	dBW
Ant. Input PFD	-24.27	dBW/4kHz
Path Loss	206.81	dB
Atm/Point/Pol Loss	0.12	dB

Aircraft Receive Terminal

Frequency	11.481	GHz
Satellite EIRP	46	dBW
Downlink PFD@ Beam Center	9.92	dBW/4kHz
Receive Gain	58	dB
Terminal G/T	13.95	dB/°K
Path Loss	205.27	dB
Other Losses	0.07	dB

Transponder

Total OPBO	0	dB
Carrier OPBO	0	dB
C/No Thermal Up	98.30	dB-Hz
C/No Thermal Dn	82.70	dB-Hz
C/Io Total	86.1	dB-Hz
C/No+Io	80.99	dB-Hz
Add'l Link Margin	0.88	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	54	MHz

Return Link Budget

Terminal	Thinkom 2Ku Remote	
Required Eb/No	-1.7	dB
Modulation	2-PSK	
Info Rate	5714	Kbps
FEC Rate	0.372	
Carrier Spacing	1.20	
Carrier Spreading	1.20	
Satellite SFD @ 2 dB/K	-85.9	dBW/m^2
Transponder Atten	0	dB
Transponder ID		

Aircraft Transmit Terminal

Frequency	11.542	GHz
Satellite G/T	0	dB/°K
Antenna Diameter	0.6	m
Carrier EIRP	39.89	dBW
Ant Input PFD	-21.25	dBW/4kHz
Path Loss	207.06	dB
Atm/Point/Pol Loss	0.10	dB

Hub Receive

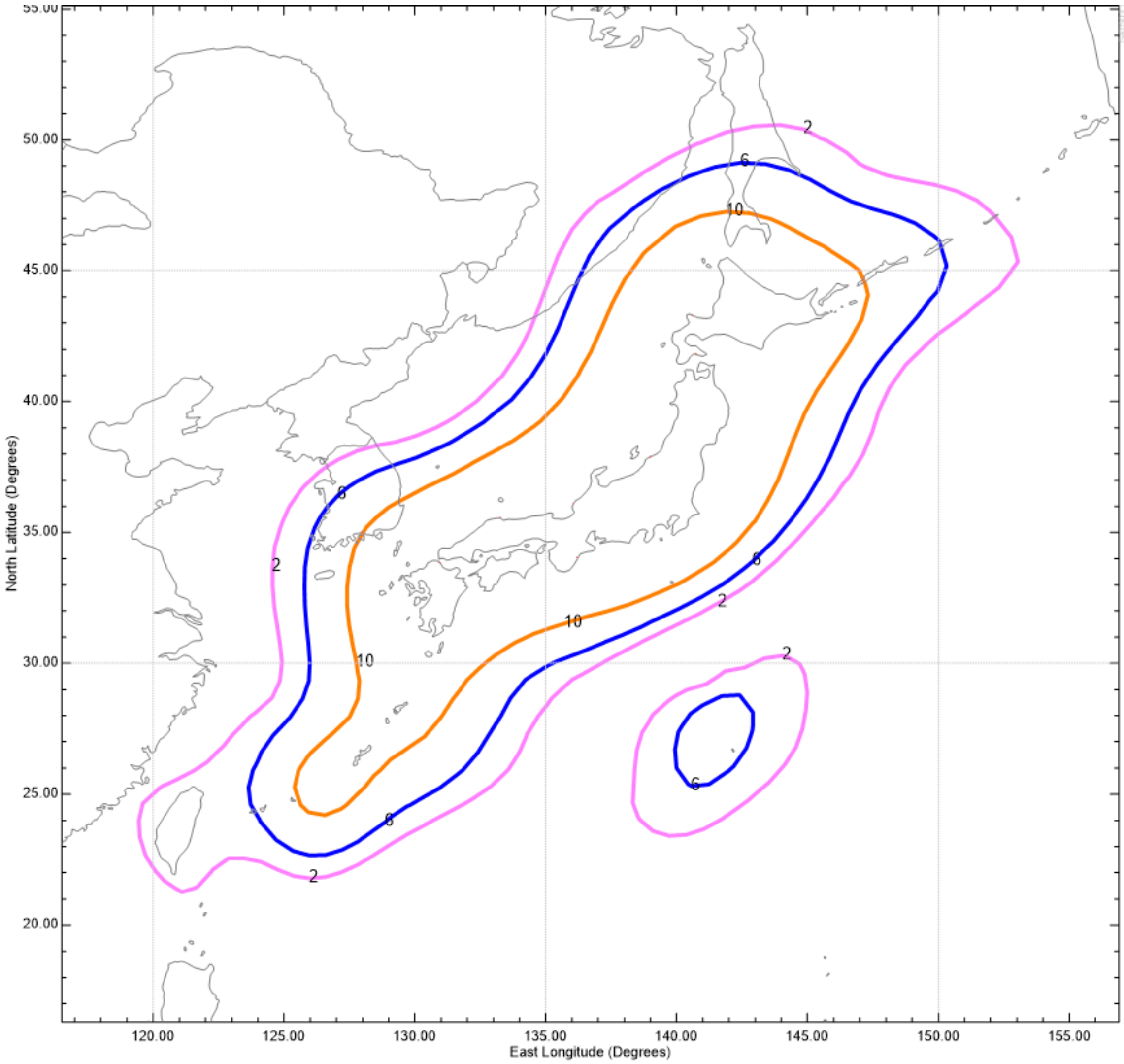
Frequency	11.542	GHz
Satellite EIRP	49	dBW
Downlink PFD@ Beam Center	-10.67	dBW/4kHz
Hub G/T	35.29	dB/°K
Path Loss	205.10	dB
Other Losses	0.09	dB

Transponder

Total OPBO	3	dB
Carrier OPBO	35.43	dB
C/No Thermal Up	60.83	dB-Hz
C/No Thermal Dn	72.27	dB-Hz
C/Io Total	74.97	dB-Hz
C/No+Io	60.38	dB-Hz
Add'l Link Margin	0.21	dB
% BW per cxr	3.41	%
% Power per cxr	0.06	%
Xpdr BW Alloc	1.84	MHz

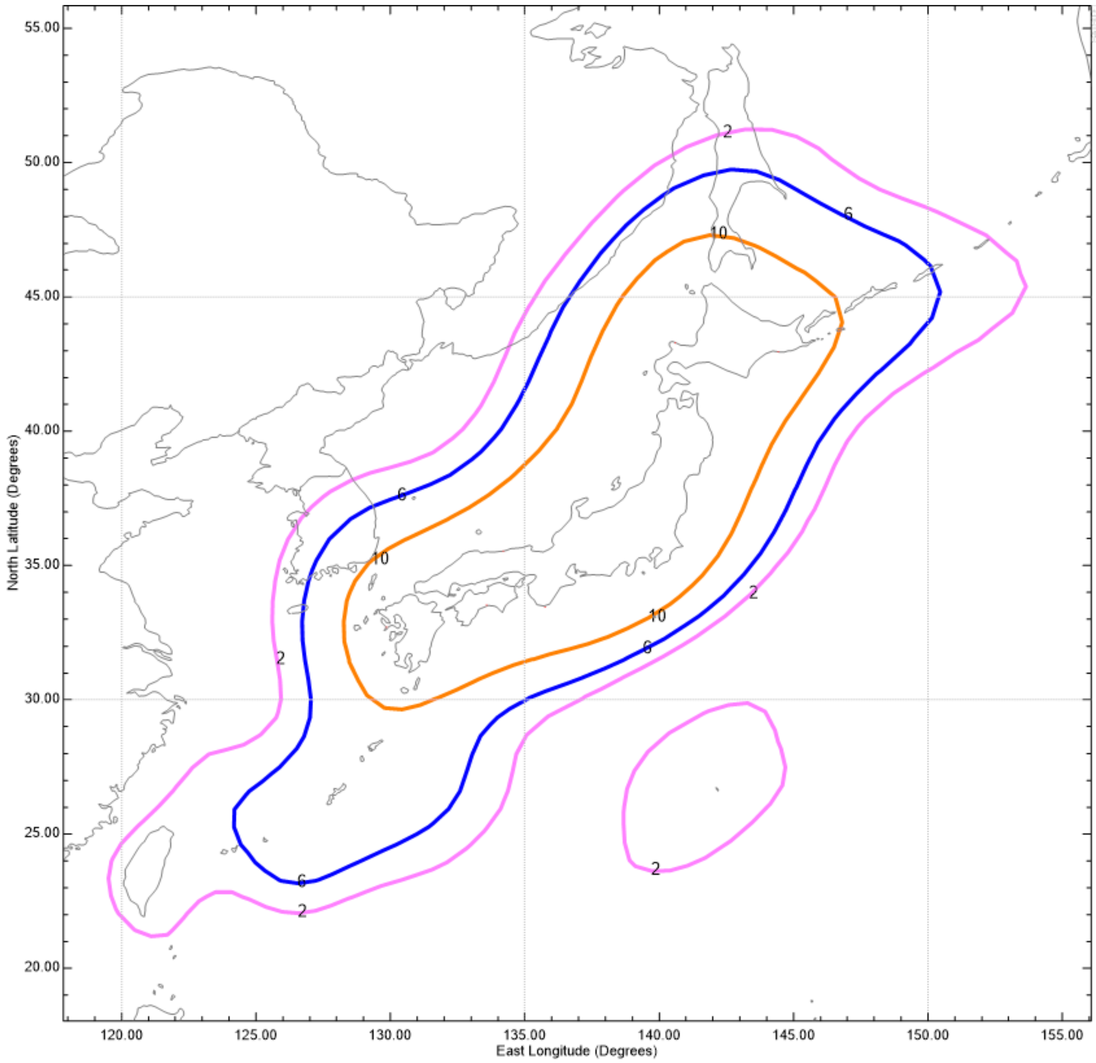
JCSAT-3A Coverage Maps

Japan Beam Horizontal G/T



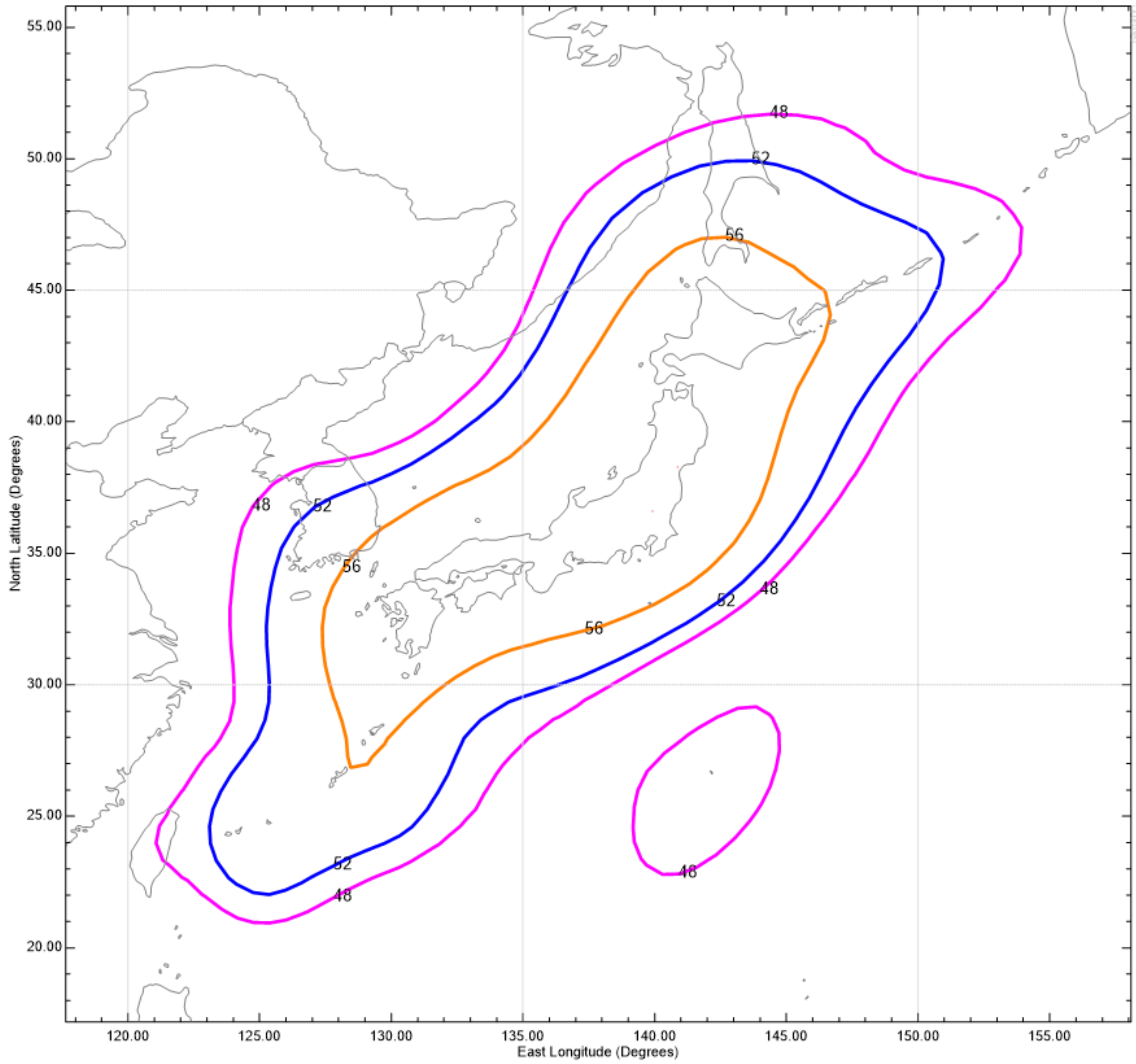
JCSAT-3A Coverage Maps

Japan Beam Vertical G/T



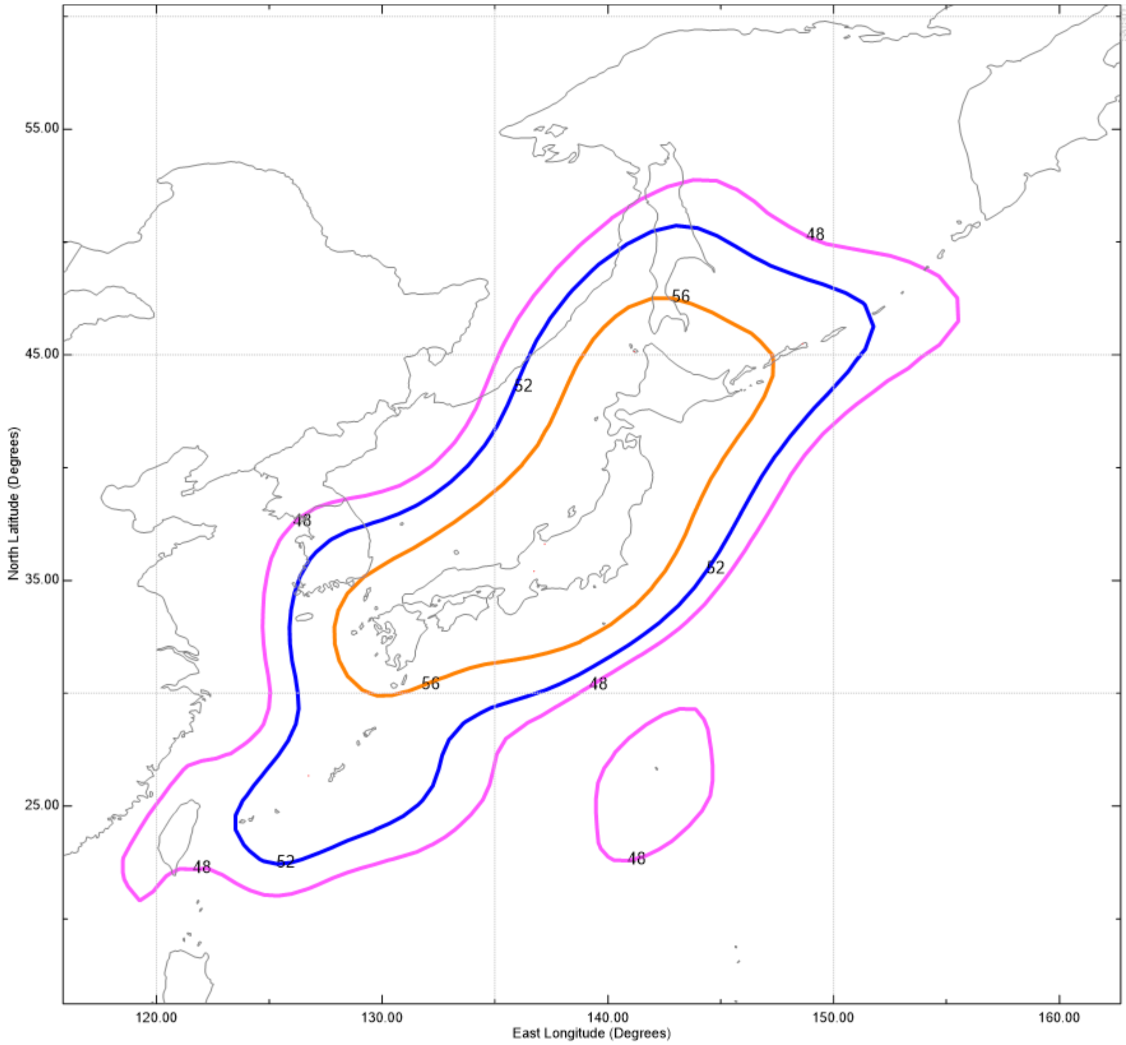
JCSAT-3A Coverage Maps

Japan Beam Horizontal EIRP



JCSAT-3A Coverage Maps

Japan Beam Vertical EIRP



JCSAT-3A Link Budget: AeroSat Antenna (AES1)

Forward Link Budget

Hub	Yokohama	
Required Eb/No	5.8	dB
Modulation	8-PSK	
Info Rate	56,724	Kbps
FEC Rate	0.580	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-81.7	dBW/m²
Transponder Atten	0	dB
Transponder ID		

Hub Transmit

Frequency	14.176	GHz
Satellite G/T	12.8	dB/°K
Antenna Diameter	5	m
Carrier EIRP	63.84	dBW
Ant. Input PFD	-30.37	dBW/4kHz
Path Loss	206.91	dB
Atm/Point/Pol Loss	0.12	dB

Aircraft Receive Terminal

Frequency	12.268	GHz
Satellite EIRP	52	dBW
Downlink PFD@ Beam Center	17.49	dBW/4kHz
Receive Gain	55.1	dB
Terminal G/T	11.78	dB/°K
Path Loss	205.46	dB
Other Losses	0.12	dB

Transponder

Total OPBO	2	dB
Carrier OPBO	2	dB
C/No Thermal Up	98.21	dB-Hz
C/No Thermal Dn	84.36	dB-Hz
C/Io Total	86.55	dB-Hz
C/No+Io	82.20	dB-Hz
Add'l Link Margin	1.27	dB
% BW per cxr	99.61	%
% Power per cxr	100	%
Xpdr BW Alloc	36	MHz

Return Link Budget

Terminal	Aerosat Ku Remote	
Required Eb/No	4.4	dB
Modulation	4-PSK	
Info Rate	2085	Kbps
FEC Rate	0.679	
Carrier Spacing	1.20	
Carrier Spreading	1.20	
Satellite SFD @ 2 dB/K	-82.1	dBW/m²
Transponder Atten	0	dB
Transponder ID		

Aircraft Transmit Terminal

Frequency	14.216	GHz
Satellite G/T	6	dB/°K
Antenna Diameter	0.4	m
Carrier EIRP	40.44	dBW
Ant Input PFD	-14.4	dBW/4kHz
Path Loss	206.74	dB
Atm/Point/Pol Loss	0.07	dB

Hub Receive

Frequency	12.468	GHz
Satellite EIRP	57.9	dBW
Downlink PFD@ Beam Center	1.4	dBW/4kHz
Hub G/T	31.43	dB/°K
Path Loss	205.79	dB
Other Losses	0.10	dB

Transponder

Total OPBO	3.50	dB
Carrier OPBO	31.35	dB
C/No Thermal Up	68.13	dB-Hz
C/No Thermal Dn	80.68	dB-Hz
C/Io Total	74.60	dB-Hz
C/No+Io	67.06	dB-Hz
Add'l Link Margin	0.79	dB
% BW per cxr	5.14	%
% Power per cxr	0.16	%
Xpdr BW Alloc	1.85	MHz

JCSAT-3A Link Budget: ThinKom Antenna (AES2)

Forward Link Budget

Hub	Yokohama	
Required Eb/No	8	dB
Modulation	8-PSK	
Info Rate	7100	Kbps
FEC Rate	0.726	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-81.7	dBW/m^2
Transponder Atten	0	dB
Transponder ID		

Hub Transmit

Frequency	14.176	GHz
Satellite G/T	12.8	dB/°K
Antenna Diameter	5	m
Carrier EIRP	63.84	dBW
Ant. Input PFD	-30.37	dBW/4kHz
Path Loss	206.91	dB
Atm/Point/Pol Loss	0.12	dB

Aircraft Receive Terminal

Frequency	12.268	GHz
Satellite EIRP	52	dBW
Downlink PFD@ Beam Center	17.49	dBW/4kHz
Receive Gain	55.1	dB
Terminal G/T	14.46	dB/°K
Path Loss	205.46	dB
Other Losses	0.06	dB

Transponder

Total OPBO	2	dB
Carrier OPBO	2	dB
C/No Thermal Up	98.21	dB-Hz
C/No Thermal Dn	87.04	dB-Hz
C/Io Total	86.55	dB-Hz
C/No+Io	83.63	dB-Hz
Add'l Link Margin	0.49	dB
% BW per cxr	99.61	%
% Power per cxr	100	%
Xpdr BW Alloc	36	MHz

Return Link Budget

Terminal	Thinkom 2Ku Remote	
Required Eb/No	4.4	dB
Modulation	4-PSK	
Info Rate	1864	Kbps
FEC Rate	0.607	
Carrier Spacing	1.20	
Carrier Spreading	1.20	
Satellite SFD @ 2 dB/K	-82.1	dBW/m^2
Transponder Atten	0	dB
Transponder ID		

Aircraft Transmit Terminal

Frequency	14.216	GHz
Satellite G/T	6	dB/°K
Antenna Diameter	0.6	m
Carrier EIRP	40.44	dBW
Ant Input PFD	-21.7	dBW/4kHz
Path Loss	206.74	dB
Atm/Point/Pol Loss	0.07	dB

Hub Receive

Frequency	12.468	GHz
Satellite EIRP	57.9	dBW
Downlink PFD@ Beam Center	1.4	dBW/4kHz
Hub G/T	31.43	dB/°K
Path Loss	205.79	dB
Other Losses	0.10	dB

Transponder

Total OPBO	3.50	dB
Carrier OPBO	31.35	dB
C/No Thermal Up	68.13	dB-Hz
C/No Thermal Dn	80.68	dB-Hz
C/Io Total	74.6	dB-Hz
C/No+Io	67.06	dB-Hz
Add"l Link Margin	0.79	dB
% BW per cxr	5.14	%
% Power per cxr	0.16	%
Xpdr BW Alloc	1.85	MHz

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Tokyo 107-0052, Japan
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MD-A-18-072

JCSAT-3A Orbital Debris Mitigation Plan

This section addresses requirements contained in Section 25.114(d)(14)(i)-(iv) of the Commission's rules.

a. Debris Release Assessment-25.114(d)(14)(i). JSAT has assessed and limited the amount of debris released in a planned manner during normal operations and has assessed and limited the probability of the spacecraft becoming a source of debris by collisions with small debris or meteoroids.

   The only phase of the mission in which portions of the spacecraft separated from the main spacecraft body was during deployment. During deployment, however, all separation and deployment mechanisms were designed to contain all debris generated when activated so as to ensure that no debris left the spacecraft. The assessment found no other sources for debris throughout the mission.

   In the event of collisions with small debris or meteoroids, the spacecraft hardware has been designed with redundant units such that individual faults will not cause the loss of the entire spacecraft. All critical components (e.g., computers and control devices) are built within the structure and shielded from external influences. Items that could not be built within the spacecraft nor shielded (e.g., antennas) are able to withstand impact.

   The spacecraft can be controlled through both the normal payload antenna and wide angle antennas. The likelihood of both being damaged during a small body collision is minimal.

b. Accidental Explosion Assessment-25.114(d)(14)(ii). JSAT has assessed and limited the probability of accidental explosions during and after completion of mission operations. The spacecraft employs the LM A2100 satellite bus. This type of spacecraft has a history of successful on-orbit operations without fragmentation of the satellite into pieces of debris. All batteries and propellant tanks are monitored for pressure or temperature variations. Alarms in the Satellite Control Center inform controllers of any variations. Additionally, long-term trending analysis is performed to monitor for any unexpected trends.

The batteries are operated utilizing the manufacturer's automatic recharging scheme. Doing so ensures that charging terminates normally without building up additional heat and pressure. As this process occurs wholly within the spacecraft, it also affords protection from command link failures (on the ground). In order to ensure that the spacecraft has no explosive risk after it has been successfully de-orbited, all stored energy sources onboard the spacecraft will be depleted or secured and all propulsion lines and latch valves will be vented. All battery chargers will be turned off, and batteries will be left in a permanent discharge state.

However, at the end of the satellite'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 LM A2100 series spacecraft that cannot now be changed or remedied. Information regarding the residual oxidizer in the tanks is as follows:

Item	Tank Volume (in^3)	Number of Tanks	End of life mass (kg)	Temp. (deg. C)	End of life pressure (psia)
Oxidizer	20037	2 – Inter-connected	22.8	23.3	262.7

c. Assessment Regarding Collision with Large Debris and Other Space Stations-25.114(d)(14)(iii). JSAT has also assessed and limited the probability of the spacecraft becoming the source of debris by collisions with large debris or other operational space stations. In addition, COSMOS2526 is operated around the same orbital slot by Russian military and government. JSAT is not aware of any other FCC- or non-FCC licensed spacecraft that are operational or planned to be deployed at 128° E.L. or to nearby orbital locations such that there would be an overlap with the stationkeeping volume of JCSAT-3A. In order to monitor nearby objects, JSAT receives CDM (Conjunction Data Messages) from CSpOC in a timely manner. As a result of CDM evaluation, collision avoidance operation will be implemented if needed.

d. Post-Mission Disposal Plans-25.114(d)(14)(iv). Post-mission disposal of the satellite from operational orbit will be accomplished by maneuvering it to a disposal orbit 300 km above the geostationary arc. The propellant budget for orbit raising is included in the satellite design, and all propellants will be vented when accomplished.

See Appendix-A for details.

Appendix-A Analysis for Post-Mission Disposal Plan

1) Post-mission disposal altitude

The minimum post-mission disposal altitude above the geostationary orbit is calculated as follows (using the IADC formula):

$235 \text{ km} + (1000 \cdot CR \cdot A/m) = 273 \text{ km}$

CR =1.18 JCSAT-3A Solar radiation pressure coefficient

A= 60 m^2 JCSAT-3A Area based on deployed on-station configuration

M= 1844 kg JCSAT-3A dry mass

Planned post-mission disposal altitude: 300 km

Margin to minimum altitude requirement: 27 km

2) Propellant budget for post-mission disposal

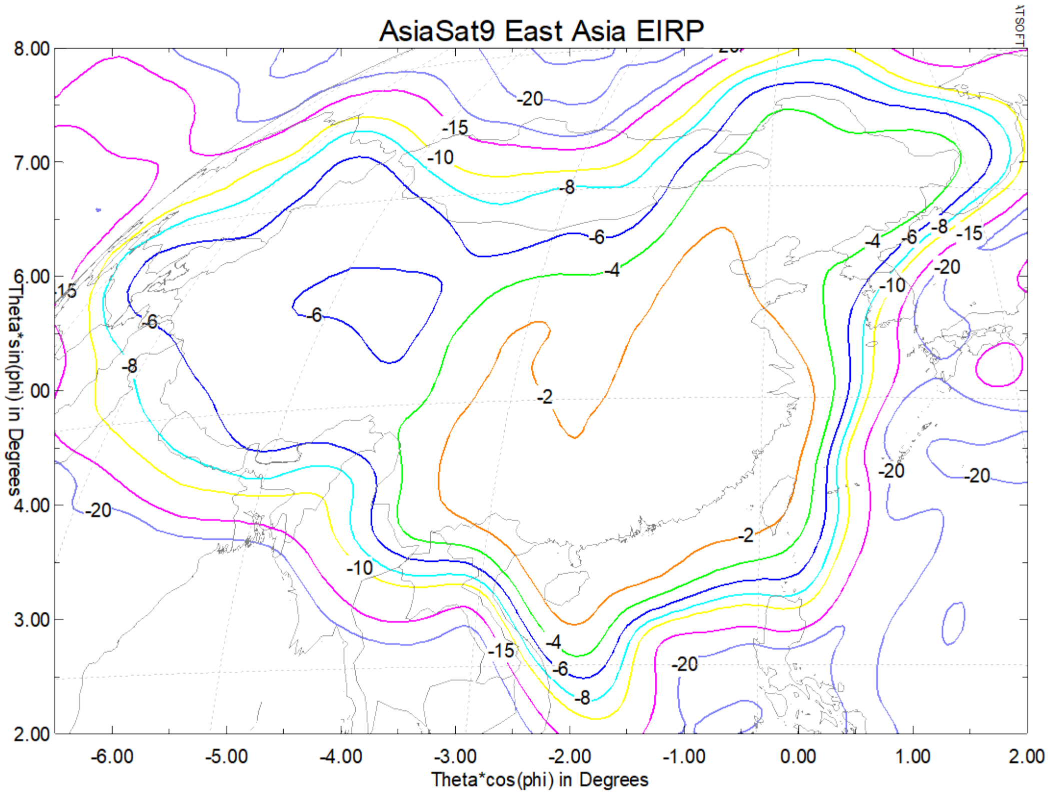
The amount of propellant reserved for the post-mission orbital raising is shown in the table below.

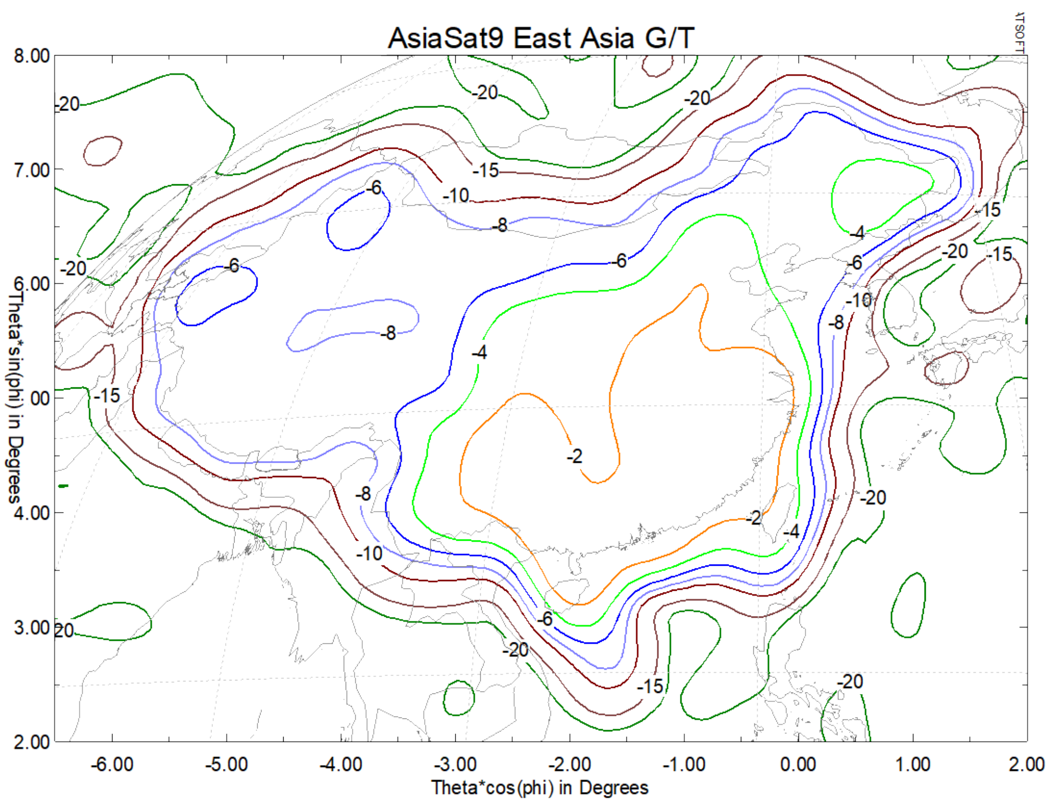
Disposal altitude	GEO + 300 km
Required Delta V	10.9m/s
Effective Isp	194.3 sec
Spacecraft Mass after orbital raising	1917.2 kg
Required propellant (reserved)	11.2 kg

The propellant budget is based on -3 sigma worst case analysis incorporating on-orbit performance deviations for the propulsion and attitude control subsystem.

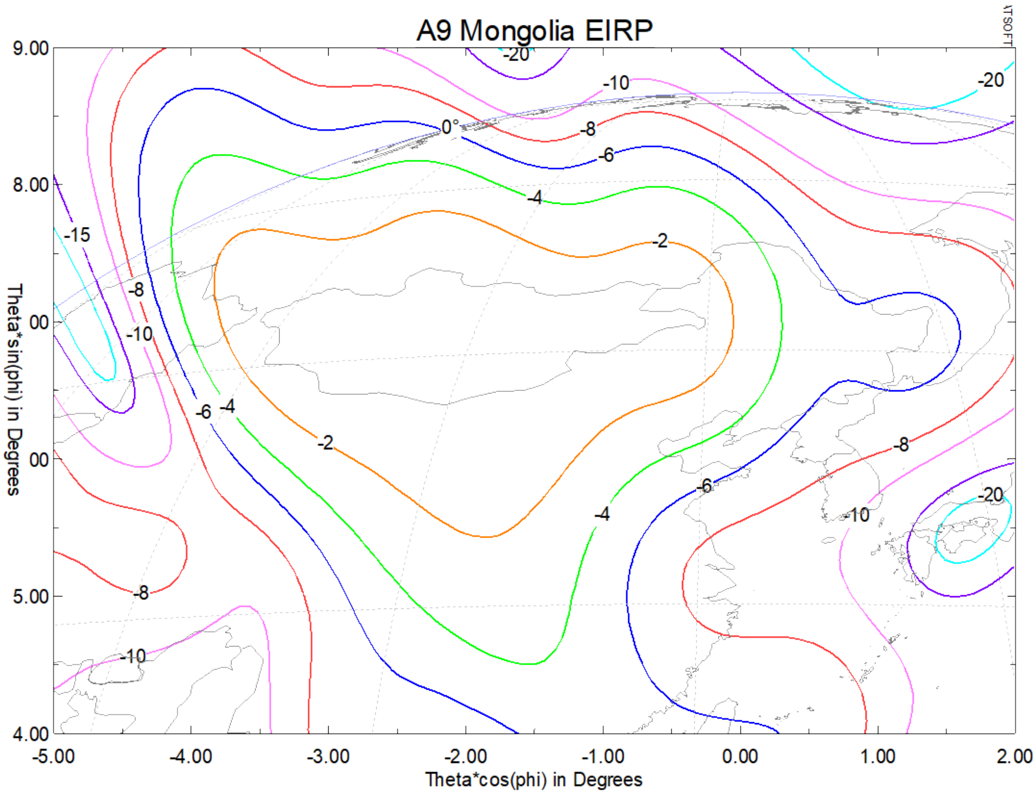
In order to ensure the reserved propellant at the time of disposal, three propellant gauging methods are employed during on-orbit operations: Book-keeping, Pressure-Volume-Temperature (PVT) and Propellant Tank Thermal Capacity Gauging. All three methods can be used and compared to track the remaining propellant in conservative approach throughout the mission life.

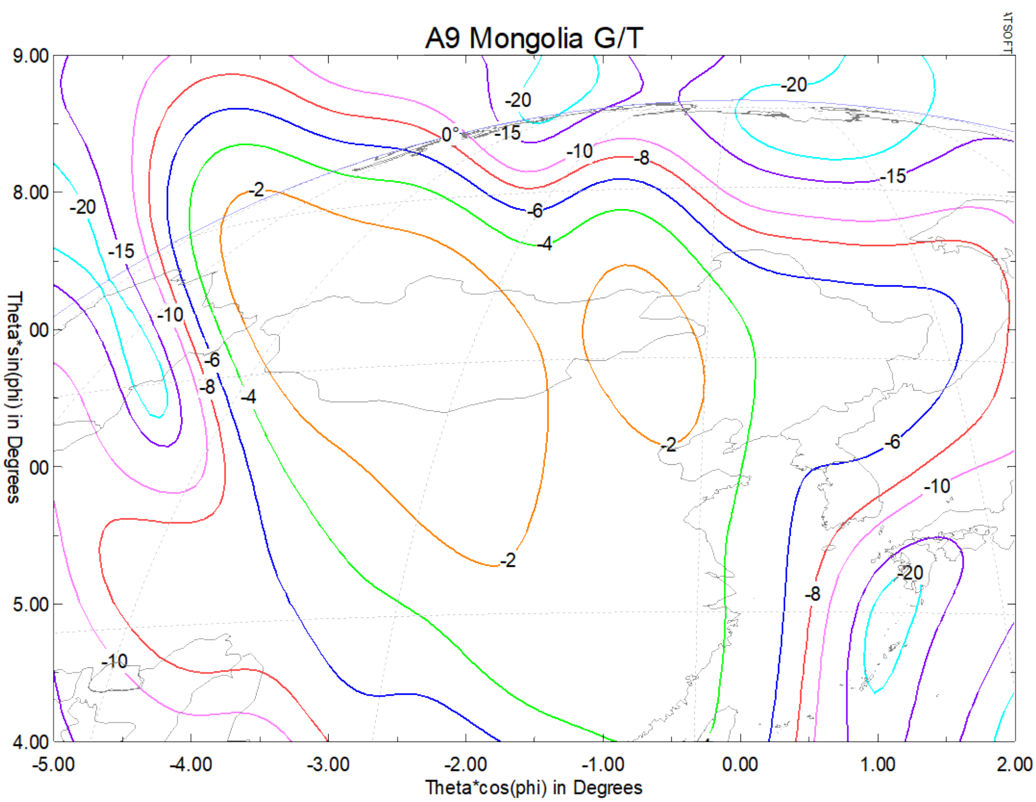
AsiaSat-9 Coverage Maps





AsiaSat-9 Coverage Maps





AsiaSat-9 Link Budget: AeroSat Antenna (AES1)

Forward Link Budget

Hub	Beijing	
Required Eb/No	1.3	dB
Modulation	4-PSK	
Info Rate	47,420	Kbps
FEC Rate	0.483	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-84	dBW/m²
Transponder Atten	0	dB
Transponder ID		
Hub Transmit		
Frequency	13.850	GHz
Satellite G/T	7	dB/°K
Antenna Diameter	6.2	m
Carrier EIRP	67.59	dBW
Ant. Input PFD	-30.52	dBW/4kHz
Path Loss	206.76	dB
Atm/Point/Pol Loss	0.11	dB
Aircraft Receive Terminal		
Frequency	11.048	GHz
Satellite EIRP	49	dBW
Downlink PFD@ Beam Center	12.11	dBW/4kHz
Receive Gain	65	dB
Terminal G/T	11.22	dB/°K
Path Loss	205.16	dB
Other Losses	0.14	dB
Transponder		
Total OPBO	2	dB
Carrier OPBO	2	dB
C/No Thermal Up	96.31	dB-Hz
C/No Thermal Dn	81.02	dB-Hz
C/Io Total	88.21	dB-Hz
C/No+Io	80.16	dB-Hz
Add'l Link Margin	0.95	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	54	MHz

Return Link Budget

Terminal	Aerosat Ku Remote	
Required Eb/No	0.3	dB
Modulation	4-PSK	
Info Rate	1886	Kbps
FEC Rate	0.307	
Carrier Spacing	1.20	
Carrier Spreading	1.20	
Satellite SFD @ 2 dB/K	-84	dBW/m²
Transponder Atten	0	dB
Transponder ID		
Aircraft Transmit Terminal		
Frequency	14.166	GHz
Satellite G/T	2	dB/°K
Antenna Diameter	0.4	m
Carrier EIRP	43.04	dBW
Ant Input PFD	-14.31	dBW/4kHz
Path Loss	207.32	dB
Atm/Point/Pol Loss	0.16	dB
Hub Receive		
Frequency	12.416	GHz
Satellite EIRP	54	dBW
Downlink PFD@ Beam Center	-4.91	dBW/4kHz
Hub G/T	31.80	dB/°K
Path Loss	205.81	dB
Other Losses	0.10	dB
Transponder		
Total OPBO	3	dB
Carrier OPBO	31.05	dB
C/No Thermal Up	66.06	dB-Hz
C/No Thermal Dn	76.73	dB-Hz
C/Io Total	77.61	dB-Hz
C/No+Io	65.44	dB-Hz
Add"l Link Margin	0.26	dB
% BW per cxr	6.83	%
% Power per cxr	0.16	%
Xpdr BW Alloc	3.69	MHz

AsiaSat-9 Link Budget: ThinKom Antenna (AES2)

Forward Link Budget

Hub	Beijing	
Required Eb/No	1.3	dB
Modulation	4-PSK	
Info Rate	47,420	Kbps
FEC Rate	0.483	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-84	dBW/m²
Transponder Atten	0	dB
Transponder ID		

Hub Transmit

Frequency	13.850	GHz
Satellite G/T	7	dB/°K
Antenna Diameter	6.2	m
Carrier EIRP	67.59	dBW
Ant. Input PFD	-30.52	dBW/4kHz
Path Loss	206.76	dB
Atm/Point/Pol Loss	0.11	dB

Aircraft Receive Terminal

Frequency	11.048	GHz
Satellite EIRP	49	dBW
Downlink PFD@ Beam Center	12.11	dBW/4kHz
Receive Gain	65	dB
Terminal G/T	11.22	dB/°K
Path Loss	205.16	dB
Other Losses	0.14	dB

Transponder

Total OPBO	2	dB
Carrier OPBO	2	dB
C/No Thermal Up	96.31	dB-Hz
C/No Thermal Dn	81.02	dB-Hz
C/Io Total	88.21	dB-Hz
C/No+Io	80.22	dB-Hz
Add'l Link Margin	1.01	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	54	MHz

Return Link Budget

Terminal	Thinkom 2Ku Remote	
Required Eb/No	0.3	dB
Modulation	4-PSK	
Info Rate	1886	Kbps
FEC Rate	0.307	
Carrier Spacing	1.20	
Carrier Spreading	1.20	
Satellite SFD @ 2 dB/K	-84	dBW/m²
Transponder Atten	0	dB
Transponder ID		

Aircraft Transmit Terminal

Frequency	14.166	GHz
Satellite G/T	2	dB/°K
Antenna Diameter	0.6	m
Carrier EIRP	43.44	dBW
Ant Input PFD	-19.71	dBW/4kHz
Path Loss	207.32	dB
Atm/Point/Pol Loss	0.16	dB

Hub Receive

Frequency	12.416	GHz
Satellite EIRP	54	dBW
Downlink PFD@ Beam Center	-4.91	dBW/4kHz
Hub G/T	31.80	dB/°K
Path Loss	205.81	dB
Other Losses	0.10	dB

Transponder

Total OPBO	3	dB
Carrier OPBO	31.05	dB
C/No Thermal Up	66.06	dB-Hz
C/No Thermal Dn	76.73	dB-Hz
C/Io Total	77.61	dB-Hz
C/No+Io	65.44	dB-Hz
Add"l Link Margin	0.26	dB
% BW per cxr	6.83	%
% Power per cxr	0.16	%
Xpdr BW Alloc	3.69	MHz

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AsiaSat 9 Orbital Debris Mitigation Plan

47 C.F.R. Section 25.114(d)(14): A description of the design and operational strategies that will be used to mitigate orbital debris, including the following information:

(i) A statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;

(ii) A statement that the space station operator has assessed and limited the probability of accidental explosions during and after completion of mission operations. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application;

(iii) A statement that the space station operator 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. Where a space station will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other space stations, the statement must include an analysis of the potential risk of collision and a description of what measures the space station operator plans to take to avoid in-orbit collisions. If the space station operator is relying on coordination with another system, the statement must indicate what steps have been taken to contact, and ascertain the likelihood of successful coordination of physical operations with, the other system. The statement must disclose the accuracy—if any—with which orbital parameters of non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a system is not able to maintain orbital tolerances, *i.e.*, it lacks a propulsion system for orbital maintenance, that fact should be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. Where a space station requests the assignment of a geostationary-Earth orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites might overlap. If so, the statement must include a statement as to the identities of those parties and the measures that will be taken to prevent collisions;

(iv) A statement detailing the post-mission disposal plans for the space station at end of life, including the quantity of fuel—if any—that will be reserved for post-mission disposal maneuvers. For geostationary-Earth orbit space stations, the statement must disclose the altitude selected for a post-mission disposal orbit and the calculations that are used in deriving the disposal altitude. The statement must also include a casualty risk assessment if planned post-mission disposal involves

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Asia Satellite Telecommunications Company Limited

atmospheric re-entry of the space station. In general, an assessment should include an estimate as to whether portions of the spacecraft will survive re-entry and reach the surface of the Earth, as well as an estimate of the resulting probability of human casualty.

The AsiaSat 9 spacecraft is a reliable Space Systems/Loral ("SSL") 1300 spacecraft, which is widely known as a mature product and one of the most reliable satellite platforms, and is designed and has been demonstrated to withstand the harsh space environment. In general, the SSL 1300 spacecraft design has taken orbital debris mitigation into account and is aligned with general industry practices and standards.

(i) Debris Release Assessment

AsiaSat has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. The satellite has been designed such that no debris will be released by the spacecraft under the normal operation of the satellite. In the event of collisions with small debris or meteoroids, the spacecraft hardware has been designed with redundant units such that individual faults will not cause the loss of the entire spacecraft and the spacecraft will retain the post-mission disposal capability. All critical components (e.g. on-board processors and control devices etc.) have been built within the structure and shielded from external influences. External items that could not be installed within the spacecraft structure nor shielded (e.g. antennas and attitude sensors etc.) are able to withstand impact. The spacecraft can be controlled through both the normal communications payload antennas and the wide angle omni antennas. The likelihood of both being damaged during a collision with small debris or meteoroids is minimal.

(ii) Accidental Explosion Assessment

AsiaSat has assessed and limited the probability of accidental explosions during and after completion of mission operations. The failure modes for all equipment have been reviewed to assess the possibility of an accidental explosion onboard the spacecraft. In order to ensure that the spacecraft does not explode on-orbit AsiaSat will continue to operate the satellite in accordance with SSL's recommended procedures. All batteries and propellant tanks are monitored for pressure or temperature variations. All critical satellite parameters are telemetered from the spacecraft and limits are checked by the real-time computers in the SOC (Satellite Operations Centre) and any out-of-limit conditions will alert the on-duty SOC controllers to take the required action. Additionally, long term trending analysis will be performed to monitor for any unexpected or anomalous trends.

Batteries are operated under SSL's automatic recharging scheme. This means normal battery charging termination does not require ground commanding to ensure no additional heat and pressure build up in the battery cells. Furthermore, each battery cell is protected by individual over voltage and over current protection circuits. As this process occurs wholly within the spacecraft, it also affords protection from command link failures from the ground station.

To protect the propulsion subsystem, propellant tanks are operated in a blow down mode during on-orbit operation. At the completion of orbit raising, the pressurant was isolated from the propellant tanks. Therefore the pressure in the propellant tanks will decrease as the propellant is consumed during the stationkeeping manoeuvres over the life of the spacecraft. There is also a regulator installed between the pressurant tanks and the propellant tanks such that if a pressure valve fails open the propellant tanks would not be over-pressurized.

To ensure that the spacecraft has no explosive risk after it has been successfully de-orbited, all stored energy onboard the spacecraft will be removed. Firstly, all latch valves will be open to ensure all residual propellant and pressurant are vented out and released. All battery chargers will be turned off and batteries will be left in a permanent discharge state. All remaining active pyrotechnics will be fired to eliminate explosive risk. All reaction wheels will be turned off to release all stored kinetic energy. These steps will ensure that no build-up of energy can occur resulting in an explosion in the years after the spacecraft is de-orbited.

(iii) Assessment Regarding Collision with Large Debris and Other Space Stations

AsiaSat 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.

AsiaSat 9 is operating at GEO at longitude of 122 deg E +/-0.1 deg and using industry standard and time proven techniques in the station-keeping maneuvering and orbit determination. These are the same techniques that AsiaSat has and continues to use for all its spacecraft fleet.

To minimize the possibility of a large body impact collision, the proximity of other known Space Stations / satellites has been assessed. In addition to working with other satellite operators of all known neighbouring satellites, AsiaSat utilizes other methods to identify the collision risk. All satellites in GEO or near GEO are tracked by downloading the orbital parameters from the NORAD database every day, and an internal satellite movement report is generated to AsiaSat's Engineering and Operations staff. AsiaSat will also get alerts from the JSpOC for any approaching bodies.

Any new spacecraft launch or satellite relocation will be closely monitored to verify that no new spacecraft will be introduced in the vicinity of AsiaSat 9. In the event that some spacecraft does locate within the vicinity of AsiaSat 9, AsiaSat will coordinate and work closely with that satellite operator on orbit control and stationkeeping strategies as it has done in the past with many other operators.

(iv) Post-Mission Disposal Plans

As a licensed satellite operator in Hong Kong, AsiaSat complies with the requirements as stipulated by the "Guidelines for De-commissioning of Satellite" (the "Guidelines") issued by OFCA (Hong Kong Office of Communications Authority) and adheres to prevailing international best practices and standards to reduce space debris.

According to the Guidelines, which are also consistent with the FCC requirement in §25.283 of the Commission's rules pertaining to end-of-life satellite disposal, any expired satellite which has to be

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de-orbited to outer space shall be disposed to an orbit with a delta-perigee (Δa) higher than geosynchronous orbit of no less than:

235 km + (1000 x CR x A/m)

where CR is the solar pressure radiation coefficient of the spacecraft, and A/m is the solar pressure area-to-mass ratio, in square meters per kilogram, of the spacecraft.

AsiaSat will take into account this requirement for any de-orbit of the AsiaSat 9 satellite and will reserve sufficient propellant in order to conform to the regulations set forth in the Guidelines:

	Δa requirement	Propellant Needed
AsiaSat 9	279 km	12.17 kg

Any remaining propellant will be consumed by further raising the orbit until combustion is no longer possible. The remaining species of propellant, i.e. Oxidizer (N_2O_4) or Fuel (MMH), will be vented, placing the spacecraft's propulsion subsystem in a "safe" state.

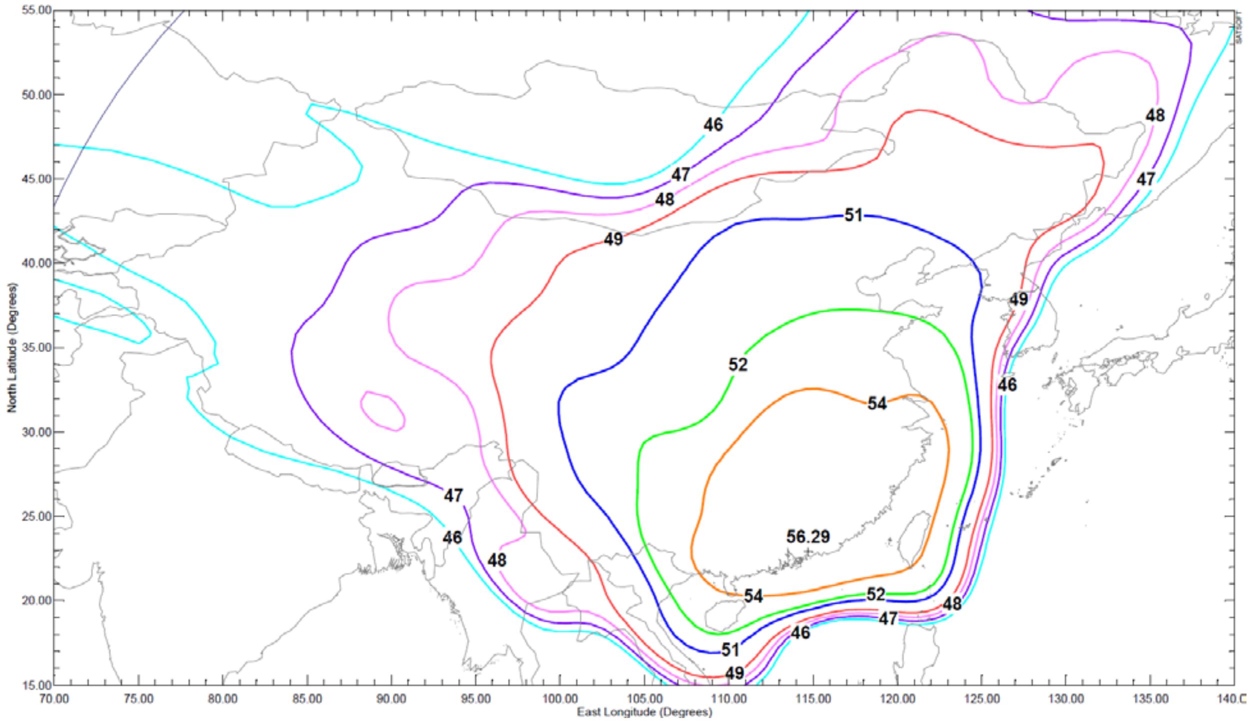
Propellant tracking is accomplished using a bookkeeping method. This method will track the number of jet seconds utilized for stationkeeping, momentum control and other attitude control events. From jet seconds, amount of propellant consumed is determined. This process has been calibrated using data collected from thruster tests conducted on the ground.

Asia Satellite Telecommunications Company Limited

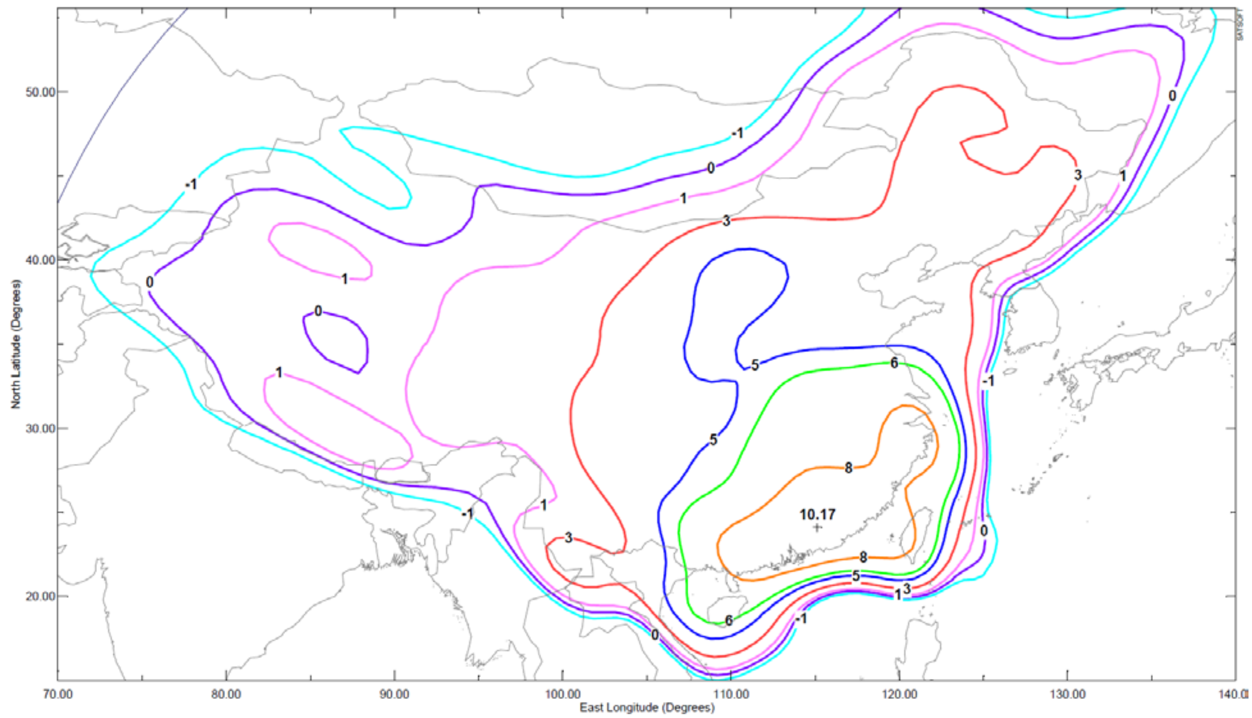
Will Ma

William Ma
Satellite Engineering & Orbital Dynamics Manager

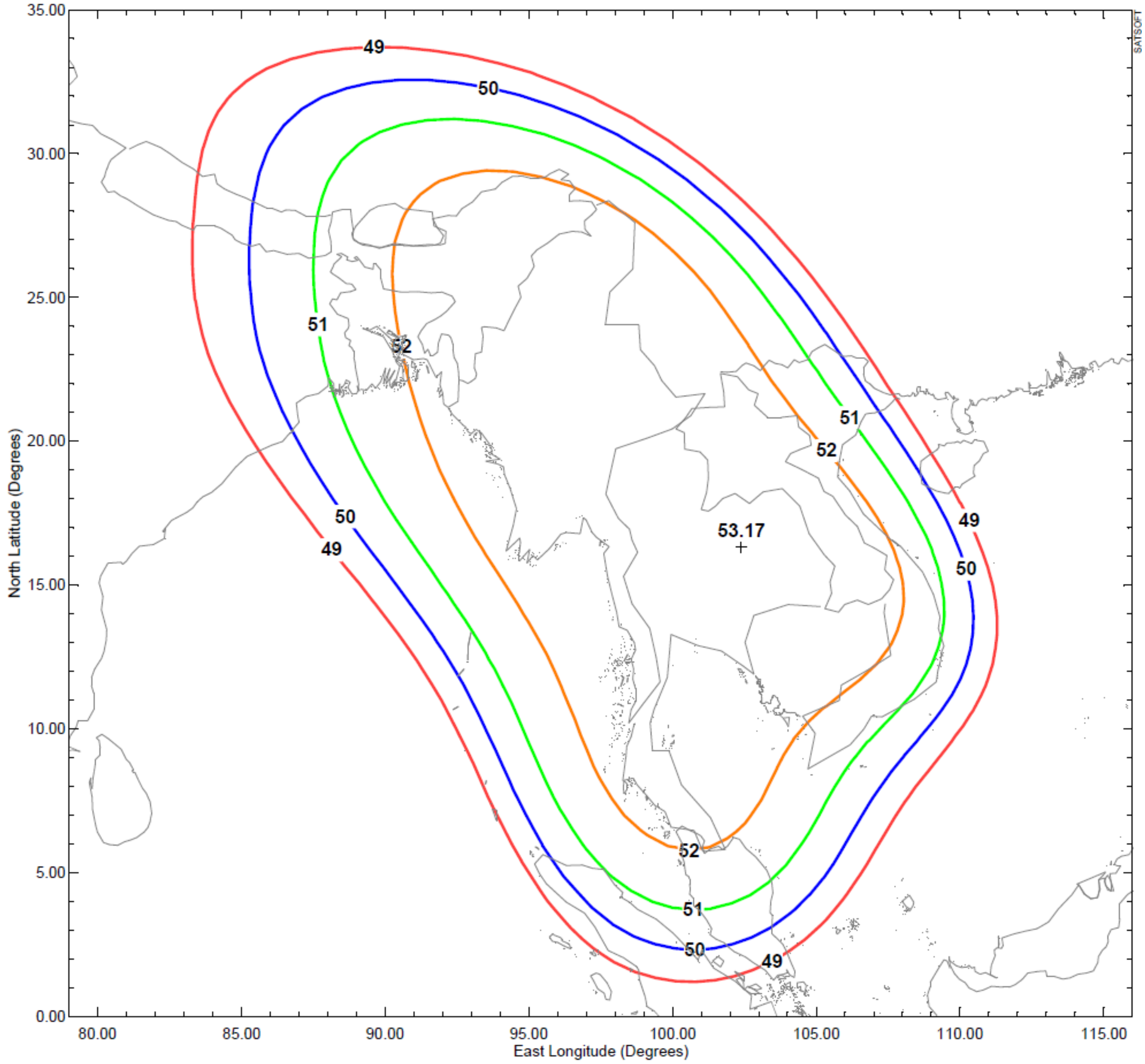
Ku-band China Beam Downlink EIRP contour (dBW)



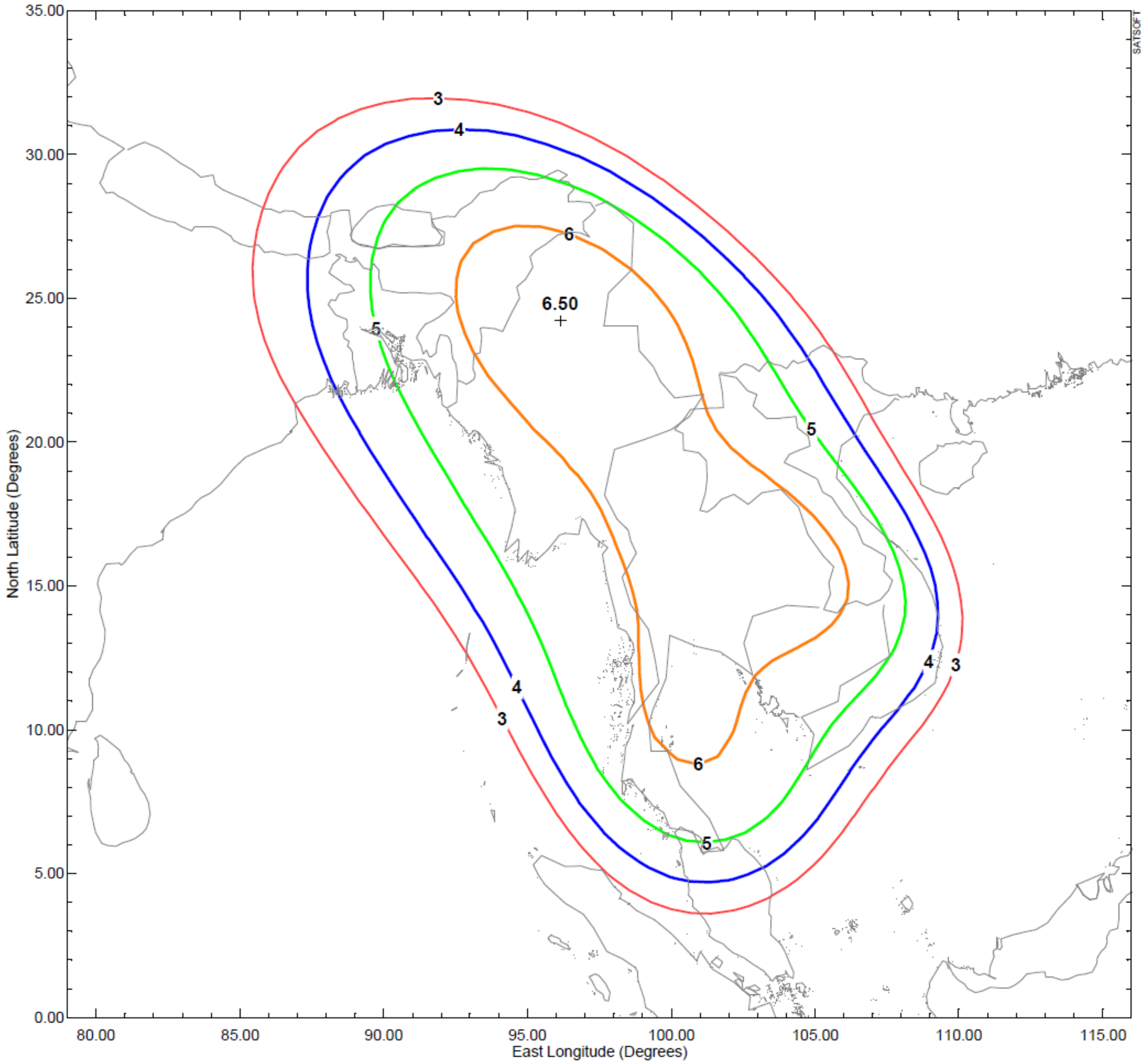
Ku-band China Beam Uplink G/T contour (dB/K)



Ku-band IC Beam Downlink EIRP contour (dBW)



Ku-band IC Beam Uplink G/T contour (dB/K)



APSTAR 6C Link Budget: AeroSat Antenna (AES1)

Forward Link Budget

Hub	Beijing	
Required Eb/No	10.5	dB
Modulation	16-PSK	
Info Rate	94,777	Kbps
FEC Rate	0.724	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-88	dBW/m2
Transponder Atten	8	dB
Transponder ID		
Hub Transmit		
Frequency	14.223	GHz
Satellite G/T	4.85	dB/°K
Antenna Diameter	9	m
Carrier EIRP	70.80	dBW
Ant. Input PFD	-28.66	dBW/4kHz
Path Loss	207.05	dB
Atm/Point/Pol Loss	0.12	dB
Aircraft Receive Terminal		
Frequency	12.475	GHz
Satellite EIRP	56.8	dBW
Downlink PFD@ Beam Center	17.47	dBW/4kHz
Receive Gain	60	dB
Terminal G/T	11.39	dB/°K
Path Loss	205.68	dB
Other Losses	0.05	dB
Transponder		
Total OPBO	0.50	dB
Carrier OPBO	0.50	dB
C/No Thermal Up	97.08	dB-Hz
C/No Thermal Dn	90.56	dB-Hz
C/Io Total	90.69	dB-Hz
C/No+Io	87.15	dB-Hz
Add'l Link Margin	0.0	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	36	MHz

Return Link Budget

Terminal	Aerosat Ku Remote	
Required Eb/No	0.3	dB
Modulation	4-PSK	
Info Rate	2407	Kbps
FEC Rate	0.333	
Carrier Spacing	1.20	
Carrier Spreading	1.25	
Satellite SFD @ 2 dB/K	-88	dBW/m²
Transponder Atten	8	dB
Transponder ID		
Aircraft Transmit Terminal		
Frequency	14.263	GHz
Satellite G/T	9.76	dB/°K
Antenna Diameter	0.4	m
Carrier EIRP	36.06	dBW
Ant Input PFD	-21.08	dBW/4kHz
Path Loss	206.81	dB
Atm/Point/Pol Loss	0.06	dB
Hub Receive		
Frequency	12.475	GHz
Satellite EIRP	52.01	dBW
Downlink PFD@ Beam Center	0.71	dBW/4kHz
Hub G/T	38.52	dB/°K
Path Loss	205.91	dB
Other Losses	0.10	dB
Transponder		
Total OPBO	3	dB
Carrier OPBO	27.53	dB
C/No Thermal Up	67.55	dB-Hz
C/No Thermal Dn	85.59	dB-Hz
C/Io Total	76.51	dB-Hz
C/No+Io	66.97	dB-Hz
Add'l Link Margin	0.3	dB
% BW per cxr	10.67	%
% Power per cxr	0.35	%
Xpdr BW Alloc	3.8	MHz

APSTAR 6C Link Budget: ThinKom Antenna (AES2)

Forward Link Budget

Hub	Beijing	
Required Eb/No	11.3	dB
Modulation	16-PSK	
Info Rate	101,191	Kbps
FEC Rate	0.773	
Carrier Rolloff	1.1	
Satellite SFD @ 2 dB/K	-88	dBW/m²
Transponder Atten	8	dB
Transponder ID		

Hub Transmit

Frequency	14.223	GHz
Satellite G/T	4.85	dB/°K
Antenna Diameter	9	m
Carrier EIRP	70.80	dBW
Ant. Input PFD	-28.66	dBW/4kHz
Path Loss	207.05	dB
Atm/Point/Pol Loss	0.12	dB

Aircraft Receive Terminal

Frequency	12.475	GHz
Satellite EIRP	56.8	dBW
Downlink PFD@ Beam Center	17.17	dBW/4kHz
Receive Gain	60	dB
Terminal G/T	13.11	dB/°K
Path Loss	205.68	dB
Other Losses	0.05	dB

Transponder

Total OPBO	0.50	dB
Carrier OPBO	0.50	dB
C/No Thermal Up	97.08	dB-Hz
C/No Thermal Dn	92.28	dB-Hz
C/Io Total	91.19	dB-Hz
C/No+Io	88.10	dB-Hz
Add'l Link Margin	0.16	dB
% BW per cxr	100	%
% Power per cxr	100	%
Xpdr BW Alloc	36	MHz

Return Link Budget

Terminal	Thinkom 2Ku Remote	
Required Eb/No	0.3	dB
Modulation	4-PSK	
Info Rate	2407	Kbps
FEC Rate	0.333	
Carrier Spacing	1.20	
Carrier Spreading	1.25	
Satellite SFD @ 2 dB/K	-88	dBW/m²
Transponder Atten	8	dB
Transponder ID		

Aircraft Transmit Terminal

Frequency	14.263	GHz
Satellite G/T	9.76	dB/°K
Antenna Diameter	0.62	m
Carrier EIRP	36.06	dBW
Ant Input PFD	-28.3	dBW/4kHz
Path Loss	206.81	dB
Atm/Point/Pol Loss	0.06	dB

Hub Receive

Frequency	12.475	GHz
Satellite EIRP	52.01	dBW
Downlink PFD@ Beam Center	0.71	dBW/4kHz
Hub G/T	38.52	dB/°K
Path Loss	205.91	dB
Other Losses	0.10	dB

Transponder

Total OPBO	3	dB
Carrier OPBO	27.53	dB
C/No Thermal Up	67.55	dB-Hz
C/No Thermal Dn	85.59	dB-Hz
C/Io Total	76.51	dB-Hz
C/No+Io	66.97	dB-Hz
Add'l Link Margin	0.3	dB
% BW per cxr	10.67	%
% Power per cxr	0.35	%
Xpdr BW Alloc	3.84	MHz

Statement on Conformity of APSTAR-6C Satellite with FCC Rules regarding Orbital Debris Mitigation

APT Satellite Company Limited ("APT") provides the following showing regarding compliance with 47 C.F.R. § 25.114(d)(14)(i)-(iv) and §25.283 of the Federal Communications Commission's ("FCC") rules regarding the orbital debris mitigation/end-of-life disposal of the APSTAR-6C satellite. In addition, APT acknowledges that the APSTAR-6C orbital debris mitigation/end-of-life disposal plan is consistent with guidelines issued by the Office of Telecommunications Authority ("OFTA") of Hong Kong in July 2007.

(http://tel_archives.ofca.gov.hk/en/report-paperguide/guidance-notes/gn_200706.pdf)

a. Debris Release Assessment-§25.114(d)(14)(i).

APT has assessed the operations of APSTAR-6C and has determined that no debris has been released by the spacecraft. All separation and deployment mechanisms were fully controlled by China Academy of Space Technology and the launching service provider and no debris is planned to leave the spacecraft after the commission of service.

In the spacecraft integration and manufacturing phase, the stiffness and strength of the satellite structure are verified by a series of test, including the vibration and acoustics test. These tests prove that the structure is tough enough to provide the protection of the satellite components and capable to reduce generation of space debris to the maximum extent possible during a collision.
All critical components (i.e. the Service Module, the Communication Module and the Upper Module) are built within the structure.

The APSTAR-6C spacecraft can be controlled through both the dish antennas and omni antennas. In the different control mode (Normal Mode, Earth Pointing Mode, Inertial Attitude Acquisition Mode and Sun Acquisition Mode), the omni and dish antennas can be used accordingly.

Furthermore, the spacecraft redundancy scheme protects against the failure of any one component by having spare components available. In case, if the primary component fails, the other redundant unit remains functional to maintain the satellites mission. The reliability has been assessed for each subsystem and for each phase of the mission, based on the analysis, the bus reliability is greater than 0.71 at 15 years. According to the goal of the design, there is no item in the bus whose failure will cause loss of the satellite mission unless that item has a probability of success that is superior or equal to 0.99 for 15 years. This redundancy scheme should ensure the control and de-orbit capability of the satellite after a collision.

b. Accidental Explosion Assessment-§25.114(d)(14)(ii).

APT has conducted the assessment the possibility of an accidental explosion onboard APSTAR-6C via reviewing failure modes for all equipment. In order to ensure that the spacecraft does not explode on orbit, the designers of the spacecraft have taken specific precautions. All batteries and fuel tanks are monitored for pressure or temperature variations. Alarms in the SCC (Satellite Control Center) inform controllers of any variations. Additionally, long-term trending analysis will be performed to monitor for any unexpected trends. Operationally, batteries will be operated utilizing the manufacturer's automatic recharging scheme during eclipse season. This scheme will ensure that the batteries will not over-charge. Under the FDIR process, in the event that an overcharge condition is detected, overcharge protection will be triggered to prevent from overheated and do not raise its internal pressure for Li-Ion battery cells.

APSTAR-6C uses a bipropellant system. In order to protect the propulsion system, fuel tanks will all be operated in a blow down mode. At the completion of orbit raising, the helium tanks were isolated from the propulsion system by firing of pyrotechnic valves. This causes the pressure in the propellant tanks to decrease over the life of the spacecraft. In order to ensure that the spacecraft has no explosive risk after it has been successfully de-orbited, all stored energy onboard the spacecraft will be removed except for a small amount of pressurant remaining when the valves were sealed after orbit raising, discussed below in Section (d).

Upon successful de-orbit of the spacecraft, based on the procedure, all propulsion lines and latch valves will be vented and left open. All battery chargers will be turned off and batteries will be left in a permanent discharge state. These steps will ensure that no buildup of energy can occur resulting in an explosion after the spacecraft de-orbited.

c. Assessment Regarding Collision with Larger Debris and Other Space Stations-§25.114(d)(14)(iii).

APT has also conducted the assessment of the probability of APSTAR-6C becoming a source of debris by collisions with large debris or other operational space stations. The probability of the collision between APSTAR-6C and other Space stations is negligible as Orbital Analyst regularly determines the satellite's orbit trends and assess the risk of collision based on ranging result. As a standard practice, in case of other satellite flyby or collocation with APSTAR-6C, the orbital ephemeris data of both sides is exchanged prior to and during operations and the avoidance maneuver is planned accordingly.

APT will maintain APSTAR-6C within 0.05° of the assigned orbital position (134 E.L.) in both the longitude and latitude, this orbit is mainly for geo-stationary satellite, all of the necessary coordination agreements have been successfully completed and signed to ensure the stable and interference-free operation of APSTAR-6C at this orbital slot, and all such notification information has been filed and registered with ITU. APT will continue to monitor launch details to verify that no new spacecraft takes residence in the vicinity of the APSTAR-6C spacecraft unless ongoing operational coordination is conducted with the nearby satellite(s).

d. Post-Mission Disposal Plans-§25.114(d)(14)(iv) and §25.283.

At the completion of its mission, APSTAR-6C will be removed from its geostationary orbit at 134 E.L. to a perigee altitude no less than 262.4 km above the standard geostationary orbit of 35,786 km. This post-disposal perigee takes into account gravitational perturbations and solar radiation pressure that could alter the satellite orbit in the years after decommissioning. APT has planned the tracking telemetry and control transmissions required for end-of-life repositioning so as to avoid electrical interference to other space stations, and coordinated with any potentially affected satellite networks.

Further, in accordance with Section 25.283(c), the minimum post-mission disposal altitude above the geostationary-Earth orbit (i.e., minimum perigee) is calculated as follows (using the relevant IADC formula):

235 km + (1000·CR·A/M)
=235 km +1000×59.1/2155
=262.4 km Here:

CR =Solar radiation pressure coefficient;
A= Average cross sectional area based on deployed on-station configuration;
Notes: **CR·A is a parameter derived by Orbital determination software** ≈59.1 m^2**;**
M= Satellite dry mass ≈2,155 kg (the satellite mass at de-orbit);

The amount of fuel reserved for the post-mission orbital raising is shown below:
Disposal altitude: GEO + 300 km (set 300 km as a target to instead 262.4 km to cover uncertainties);
Required Delta V: 10.94 m/s.
Required fuel (reserved): **11.04 kg**.

The propellant needed to achieve the minimum deorbit altitude is based on the delta-V required and specified by the spacecraft manufacturer, the required mass of propellant for de-orbit operation will be reserved in the tank before the end of life. Propellant tracking is accomplished using a bookkeeping method, this method is provided by the satellite manufacture with a good accuracy.
Any propellant in excess of expected bookkeeping values will be consumed by further raising the orbit until combustion is no longer possible.

Finally, all stored energy sources on board the satellite will be discharged by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures. The table below provides further information regarding the amount of helium (pressure, container and volume) from the APSTAR-6C propulsion system remaining at end-of-life:

APSTAR-6C (DFH-4)		
container		**status on end of life**
1	**fuel**	vent by leaving thruster valve open
2	**oxidizer**	vent by leaving thruster valve open
3	**helium**	sealed: 50litre,6Mbar,0-40°C
4	**helium**	sealed: 50litre,6Mbar,0-40°C
5	**helium**	sealed: 50litre,6Mbar,0-40°C

APSTAR
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As noted above, propellant and oxidizer tanks will be vented at end-of-life by leaving the thruster valve open. The three (3) helium tanks, however, are sealed after orbit raising, cannot be reopened and will have residual helium at a pressure of 6MPa until the end-of-life. The existence of residual helium is a result of the satellite design – isolating the helium tanks after orbit-raising for reducing the risks associated with valves between these tanks and pressurized fuel/oxidizer tanks during the long operating life. The remaining helium pressure is far below tank's qualified pressure tolerance at 30MPa. Accordingly, APT requests a waiver of §25.283 of the Commission's rules with respect to the remaining helium.

Yours truly,

Su Peng

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Su Peng
APT SCC Director

APT Satellite Company Limited

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ANNEX 5:

AC BidCo Certifications

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

1. AC BidCo's target space station operators have confirmed that AC BidCo's proposed ESAA operations over international waters are within coordinated parameters for adjacent satellites up to 6 degrees away on the geostationary arc.
2. AC BidCo 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
for AC BidCo LLC

March 4, 2019