

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

In the Matter of Application of)	
)	
ES 172 LLC)	
)	
For License Modification To Operate the)	File No. SAT-MOD-_____
EUTELSAT 172A Satellite at 174° E.L.)	Call Sign S2610
)	
<i>Expedited Action Requested</i>)	
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APPLICATION OF ES 172 LLC

By this application, ES 172 LLC, an indirect, wholly owned subsidiary of Eutelsat S.A. (“Eutelsat”), respectfully requests modification of its license to operate the EUTELSAT 172A satellite (Call Sign S2610) at 172° East Longitude (“E.L.”)¹ to permit operation of the satellite at 174° E.L. ES 172 LLC has filed a request for Special Temporary Authority (“STA”) to relocate EUTELSAT 172A to 174° E.L.² and, contemporaneously herewith, is filing an STA request to operate the satellite at this location during the pendency of this modification application.

ES 172 LLC is the licensee of the EUTELSAT 172A satellite and, together with its Eutelsat affiliates, operates the satellite’s communications payloads to support a wide range of traditional fixed-satellite service (“FSS”) and satellite mobility applications throughout the Asia-Pacific region. The Commission recently granted ES 172 LLC an STA to operate the C-band and Ku-band payloads on EUTELSAT 172B, a new satellite constructed and launched under

¹ See ES 172 LLC, Call Sign S2610, File No. SAT-LOA-20031218-00358 (granted July 13, 2004) (“*EUTELSAT 172A License*”); see also ES 172 LLC, Call Sign S2610, File No. SAT-ASG-20121227-00226 (granted July 11, 2013) (“*ES 172 LLC Assignment*”).

² See ES 172 LLC, Call Sign S2610, File No. SAT-STA-20171117-00157.

authority issued by the government of France, as a replacement for EUTELSAT 172A.³ This will allow EUTELSAT 172A, a satellite specifically designed to provide services in the Asia-Pacific region, to be redeployed to the adjacent 174° E.L. orbital location and be renamed “EUTELSAT 174A.” ES 172 LLC requests expedited Commission review of this application to permit long-term operation of the satellite at this new location at the earliest practicable time.

Grant of the requested license modification would be consistent with Commission rules, policies and precedent. It would also serve the public interest by authorizing the EUTELSAT 172A satellite to remain in the region, thereby increasing capacity available to commercial and U.S. Government users and enhancing competition in the satellite communications marketplace.

I. EUTELSAT 172A License Modification

Pursuant to Section 25.117 of the Commission’s rules, 47 C.F.R. § 25.117, a space station modification application must identify proposed operational changes and include information that may be different from the original license application, but need not restate information that has not changed. The EUTELSAT 172A satellite generally has fixed operational characteristics and beams shaped to cover the Pacific Ocean region.⁴ No material changes to the overall operating parameters of the *EUTELSAT 172A License* are contemplated.⁵ Once located at 174° E.L., the satellite will operate essentially as it does today to provide mobility and other broadband satellite services in the region.

³ See File No. SAT-STA-20171104-00149, Call Sign S3021 (granted Nov. 16, 2017). ES 172 LLC’s application for long-term commercial authority for the EUTELSAT 172B satellite payloads remains pending. See File No. SAT-RPL-20170927-00136, Call Sign S3021.

⁴ See generally *EUTELSAT 172A License* and associated application materials.

⁵ Certain information regarding the operational characteristics of the satellite is updated herein to more accurately reflect the current operating parameters of the satellite. In part, these minor updates reflect changes in calculations and information requirements for satellite applications implemented since grant of the *EUTELSAT 172A License*.

Eutelsat has secured access to the 174° E.L. orbital location from the government of Cyprus, which has certain satellite network filings at this location with the International Telecommunications Union (“ITU”). Specifically, Eutelsat has reached an agreement with the Department of Electronic Communications of the Ministry of Transport, Communications and Works of Cyprus (“DEC”) to permit a satellite to operate at 174° E.L.⁶ Although the satellite will operate at the 174° E.L. orbital location under Cyprus ITU filings, it will remain subject to FCC satellite license authority and ES 172 LLC will exercise ultimate direction and control through inter-company arrangements among ES 172 LLC and its Eutelsat affiliates.

A. Legal Qualifications

The legal qualifications of ES 172 LLC are a matter of record before the Commission.⁷ Eutelsat and its affiliates, including Satelites Mexicanos, S.A. de C.V d/b/a Eutelsat Americas, operate satellites that have been approved by the Commission for inclusion on the Permitted Space Station List or as authorized points of communication for U.S. earth station licensees.

B. Technical Qualifications

In the attached Form 312 (Schedule S) and Engineering Statement, ES 172 LLC demonstrates that it is technically qualified to hold the authorization requested herein. ES 172 LLC provides the information required by Section 25.114 of the Commission’s rules, 47 C.F.R. § 25.114, and demonstrates compliance with relevant Commission rules. Eutelsat also incorporates by reference the technical information, including waiver requests, submitted in connection with the original grant of the *EUTELSAT 172A License*.

⁶ ES 172 LLC understands that, consistent with this agreement, DEC will issue authority to Eutelsat, through its subsidiary ES 174E Ltd., and publish notification of the grant in the next issue of the National Gazette (expected 24 November 2017).

⁷ See generally *ES 172 LLC Assignment*.

Eutelsat would also note that the EUTELSAT 172A satellite will operate in C-band and Ku-band at the 174° E.L. orbital location under the KYPROS-ACHILLEAS and KYPROS-ACHILLEAS-3 ITU satellite network filings. The proposed operation of the satellite will fall within the envelope of the parameters disclosed in these ITU satellite network filings.

II. Grant of this Application Will Serve the Public Interest

Granting ES 172 LLC authority to operate EUTELSAT 172A to the 174° E.L. orbital location would strongly serve the public interest. Although the satellite has been replaced at the 172°E.L. orbital location, it remains capable of providing essential satellite communications services in the Asia-Pacific region and will support urgent U.S. government communications needs in the region. The continued availability of EUTELSAT 172A also will enhance capacity and competition in the region.

Given the substantial investment and long lead times required to design, launch, and operate a GSO communications satellite, it is imperative to obtain the greatest value possible from each satellite asset. Doing so helps keep the cost of satellite-delivered services affordable by maximizing satellite lifetimes and services over which operators can recoup the substantial capital investment required. It also improves reliability and availability of service by ensuring that in-orbit satellite assets can fill new communications needs as they arise.

A. Grant of this Modification Application Would Be Consistent with FCC Rules, Policies and Precedent

Section 25.117(d)(2) of the Commission's rules provides that space station modification application will be grant except in specified circumstance, including that grant would not serve the public interest, convenience and necessity (and several others not relevant here). As discussed herein, grant of the requested modification would strongly serve the public interest. Additional considerations are noted below.

1. The Commission Can Authorize EUTELSAT 172A's Operation Under Non-U.S. ITU Satellite Network Filings at 174° E.L.

Although it may not be commonplace, the Commission has repeatedly authorized U.S.-licensed satellite to operate under non-U.S. satellite network filings at the ITU, subject to appropriate conditions to protect U.S. interests. For example, in 2013, the Commission granted an STA request of EchoStar Satellite Operating Company ("ESOC") to operate a satellite under a Bermuda/UK filing and did not object to bringing into use of that filing.⁸ Similarly, the Commission granted a modification application in which it allowed the AMC-4 satellite to operate under ITU satellite network filings filed by the Colombian Administration, subject to a series of conditions.⁹

The circumstances presented here are analogous to the ESOC decision because there are compelling, *bona fide* reasons to modify the *EUTELSAT 172A License* to permit operations at the 174° E.L. orbital location that have been discussed here and in associated filings with the Commission. Moreover, non-objection to bringing into use of filings under which EUTELSAT 172A will operate is essential to preserving and protecting the U.S. government and commercial satellite services that will be provided by the satellite.

2. Grant of this Application Will Ensure that the EUTELSAT 172A Satellite Remains under FCC Licensing Jurisdiction

ES 172 LCC is pleased to operate the EUTELSAT 172A satellite pursuant to FCC satellite license authority, but certainly has strong ties to France through Eutelsat. In addition, given that operation of EUTELSAT 172A at 174° E.L. will be under Cyprus ITU filings, there

⁸ See EchoStar Satellite Operating Company, *Order and Authorization*, File No. SAT-STA-20130220-00023, Call Sign S2232 (granted April 1, 2013).

⁹ See SES Americom, Inc., File No. SAT-MOD-20100623-00144, Call Sign S2135 (grant stamped Nov. 4, 2010).

are links to that Administration as well. Nonetheless, ES 172 LLC and Eutelsat are pursuing a licensing approach for the satellite that retains Commission licensing authority over the satellite.

The Commission has recognized the strong interests of the United States in serving as a licensing administration for satellite operators,¹⁰ and a grant of this modification application will enhance that status by facilitating EUTELSAT 172A operations at the 174° E.L. orbital location. Among other benefits, a strong U.S. licensing presence in satellite communications helps to promote pro-competitive policy objectives, to ensure the availability of satellite services with global reach to U.S. commercial and federal government customers, and to achieve scale efficiencies in coordination among U.S.-licensed satellite operators.¹¹

Furthermore, the EUTELSAT 172A satellite will continue to operate under Commission authority and be registered to the United States in the United Nations Register of Objects Launched into Outer Space, ensuring responsible stewardship of the satellite while in orbit and mitigation of orbital debris risks in connection with the end-of-life deorbit process.

3. ES 172 LLC Will Exercise Full Direction and Control of EUTELSAT 172A

As it does today, ES 172 LLC will exercise full direction and control over the EUTELSAT 172A satellite through arrangements with its Eutelsat affiliates. In particular, ES 172 LLC will retain the unilateral right to direct the cessation or modification of the satellite's operations without the need for consultation with or approval from Cyprus authorities. This will allow it to comply with any U.S. statute or Commission rule, regulation or order, including but

¹⁰ See, e.g., *Applications of Intelsat LLC for Authority to Operate, and to Further Construct, Launch, and Operate C-band and Ku-band Satellites that Form a Global Communications System in Geostationary Orbit*, Memorandum Opinion Order and Authorization, FCC 00-287, 15 FCC Rcd 15460 (2000), at ¶ 31.

¹¹ *Id.* at ¶¶ 31-33.

not limited to any direction by the U.S. President under Section 706(c) of the Communications Act of 1934, as amended, 47 U.S.C. § 606(c).

4. Orbital Debris Mitigation (§ 25.114(d)(14))

EUTELSAT 172A was launched December 29, 2005, was declared fully operational on February 23, 2006, and has been in orbit since that date. The satellite's orbital debris mitigation and end-of-life measures were review by Eutelsat in the context of its acquisition of the satellite, and they will not change as a result of relocation to the 174° E.L. orbital location. Nonetheless, Eutelsat has prepared an updated space debris mitigation plan for the satellite (to be renamed EUTELSAT 174A) at its new location.

B. Waiver Required by 47 U.S.C. § 304

As required by Section 304 of the Communications Act of 1934, as amended, 47 U.S.C. § 304, ES 172 LLC hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise.

III. CONCLUSION

Based on the foregoing, ES 172 LLC respectfully request that the Commission grant this application at the earliest practicable time.

Attachment A

FCC Form 312, Response to Questions 34 and 40: Foreign Ownership, Officers, Directors, and Ten Percent or Greater Shareholders of ES 172 LLC

ES 172 LLC's ownership structure has been approved by the Commission in connection with the assignment of EUTELSAT 172A, Call Sign 2610, from Eutelsat America Corp. to ES 172 LLC. See SAT-ASG-20121227-00226.

ES 172 LLC is a limited liability company organized pursuant to and in accordance with the Delaware Limited Liability Company Act (6 Del. C. § 18-101 *et seq.*), as amended from time to time. Assignee has a single member, Eutelsat Asia (the "Member"). The Member, which has a registered office at 8 Marina Boulevard #05-02, Marina Bay Financial Centre, Singapore, 018981, wholly owns and controls ES 172 LLC. The Member is a limited exempt private company organized under the laws of Singapore. The sole shareholder of the Member is Eutelsat S.A., a *société anonyme* organized under the laws of France. Eutelsat S.A. is the Eutelsat Group's main operating subsidiary. The address of Eutelsat S.A. is 70 rue Balard, 75015 Paris, France. An organizational chart showing the ownership of ES 172 LLC is attached.

96.37% of Eutelsat S.A.'s share capital is held by Eutelsat Communications S.A., the publicly traded parent of Eutelsat S.A. In addition, the Russian Satellite Communication Company ("RSCC") holds 3.38% of the shares issued by Eutelsat S.A. and 0.31% of the shares of Eutelsat S.A. are held by other non-Eutelsat entities as set out on the ownership chart attached hereto. RSCC and these other entities have no control over Eutelsat S.A. All shareholdings of Eutelsat S.A. (other than the 0.11% of such shares held by Eutelsat S.A.'s employees and executives) are a result of the privatization of Eutelsat S.A., formerly an intergovernmental organization.

26.45% of the share capital of Eutelsat Communications S.A. is held by Bpifrance Participations (formerly named Fonds Stratégique d'Investissement ("FSI")), a *société anonyme* formed in 2008 to enhance equity in France and help stabilize French companies during the economic crisis. Approximately 51% of the FSI's share capital is held by the Caisse des Dépôts et Consignations (the "CDC") and approximately 49% of its share capital is held directly by the French State. Bpifrance Participations must present its strategic plans and annual report to the supervisory commission of the CDC. The Bpifrance Participations' board of directors has ten members. Three of the directors are representatives of the CDC, three of the directors are representatives of the French State and three of the directors are qualified personalities. The chief executive officer of Bpifrance Participations is appointed by its board of directors. The address of Bpifrance Participations is 27-31, avenue du Général Leclerc, 94710 Maisons-Alfort, Cedex, France.

The CDC is a financial institution wholly owned by the French State that serves the general interest and the economic development of France. Approximately 50% of the CDC's recurring and non-recurring net profit is paid to the French State. The CDC is managed by a chief executive officer, who is appointed by the President of the French State. The CDC is

supervised by a supervisory commission of 13 members, all of which are appointed by various sectors of the French government.

7.50% of the share capital of Eutelsat Communications is held by Fonds Stratégique de Participation (FSP). Backed by six major French insurance companies (BNP PARIBAS CARDIF, CNP ASSURANCES, CREDIT AGRICOLE ASSURANCES, SOGECAP (SOCIETE GENERALE group), GROUPAMA and NATIXIS ASSURANCES), the FSP is a long-term equity investor in French companies. Through FSP, insurance companies and key institutional investors with long-term liabilities channel some of France's long-term savings into equity investments.

6.60% of the share capital of Eutelsat Communications S.A. is held by Land Breeze s.a.r.l. Land Breeze s.a.r.l. is organized under the laws of Luxembourg and is a wholly owned subsidiary of China Investment Corp. ("CIC"). Two other subsidiaries of CIC organized under the laws of the People's Republic of China, Flourish Investment Corporation and Best Investment Corporation (together with Land Breeze s.a.r.l., the "CIC Entities"), own 0.06% and 0.01% of the shares of Eutelsat Communications, S.A., respectively. Information about CIC can be found on its website: <http://www.chinainv.cn/cicen/>.

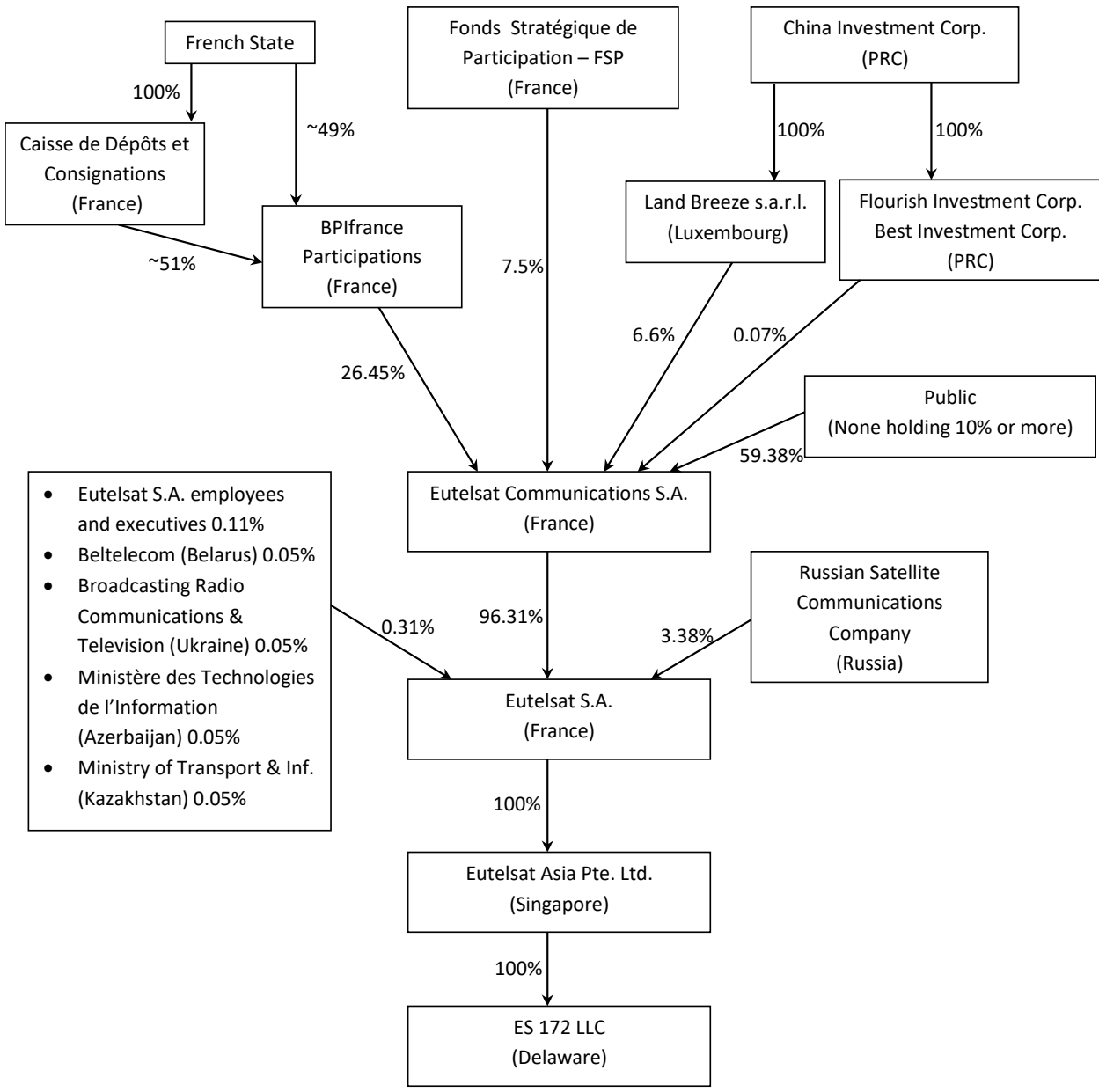
To the best of Eutelsat Communications S.A.'s knowledge, no other shareholders own, directly or indirectly, more than 10% of its share capital or voting rights. Eutelsat Communications S.A. is managed by a board of directors that currently has 10 members (with a maximum of 12 members), each of whom has a four-year renewable term of office. Currently, in addition to the CEO and the chairman of the Board, five of the directors are independent, three are affiliated with the Bpifrance Participations. No decisions of the board of directors can be taken or be blocked by three directors. Neither the Bpifrance Participations, nor any of the CIC Entities or FSP, nor any foreign government or person controlled by or acting on behalf of a foreign government has or will have the right or power to appoint any of Eutelsat Communications S.A.'s principal officers. None of the CIC Entities or FSP has the right or power to appoint any of Eutelsat Communications S.A.'s directors.

More information about Eutelsat Communications S.A., its shareholders, and its governance can be found on its website at www.eutelsat.com.

The following individuals are managers of ES 172 LLC:

Edouard Silverio, President
Michael Freundlich, Vice President

The individuals listed above can be contacted c/o Eutelsat Communications S.A., 70 rue Balard, 75015 Paris, France. Mr. Silverio is a citizen of the Republic of France and Mr. Freundlich is a dual citizen of the United States and the Republic of France.



Attachment B – Regulatory Compliance Matrix

Reference	Reference Location	Topic / Reason for (n/a)
25.114(a)(1)	FCC Form 312, Schedule S, Attachment C	Overall context of filing
25.114(a)(2)	n/a	NGSO constellation
25.114(a)(3)	n/a	Application filed pursuant to two-step procedure
25.114(b)	Form 312	Waiver required by 47 U.S.C 304
25.114(c)(1)	Schedule-S	Applicant info
25.114(c)(2)	Schedule-S	Info for correspondence person
25.114(c)(3)	Schedule-S	Type of authorization
25.114(c)(4)(i)	Schedule-S	Channel frequency, bandwidth and polarization
25.114(c)(4)(ii)	Schedule-S	Maximum EIRP and EIRP density of TX beams
25.114(c)(4)(v)	Schedule-S	RX beam: G/T, SFD
25.114(c)(4)(vi)(A)	Schedule-S	GSO: Antenna Gain Contours
25.114(c)(4)(vi)(B)	n/a	NGSO: Antenna Gain Contours
25.114(c)(4)(vi)(C)	n/a	Shapeable Beams: Antenna Gain Contours
25.114(c)(4)(vi)(D)	n/a	Steerable, non-shapeable beams
25.114(c)(4)(vii)(A-C)	n/a	GSO: Large number of spot beams
25.114(c)(5)(i-v)	Schedule-S	GSO: Orbital parameters
25.114(c)(6)(i-ix)	n/a	NGSO: Orbital parameters
25.114(c)(7)	Schedule-S	Frequency Bands, Types of Service and Coverage Areas
25.114(c)(8)	Schedule-S, See 25.208	TX Beams: PFD
25.114(c)(10)	Schedule-S	Operational Lifetime
25.114(c)(11)	Schedule-S	Common Carrier Status
25.114(c)(13)	n/a	17/24 GHz BSS polarization isolation
25.114(d)(1)	Narrative, Attachment C - Section 2	Overall description
25.114(d)(6)	Narrative	Public Interest
25.114(d)(7)	See 25.140(a)	Interference Analysis
25.114(d)(8)	n/a	L-Band MSS
25.114(d)(9)	n/a	MSS: Multiple Satellites
25.114(d)(10)	n/a	L/S-Band MSS
25.114(d)(11)	n/a	DBS
25.114(d)(12)	n/a	NGSO FSS
25.114(d)(13)(i-ii)	n/a	DBSS
25.114(d)(14)(i-v)	Attachment D - Orbital Debris	Orbital Debris
25.114(d)(15)(i-v)	n/a	17/24 GHz BSS
25.114(d)(16)	n/a	17/24 GHz BSS
25.114(d)(17)	n/a	17/24 GHz BSS
25.114(d)(18)	n/a	17/24 GHz BSS

Reference	Reference Location	Topic / Reason for (n/a)
25.140(a)(3)(i)	Attachment C - Section 14	C-band limits
25.140(a)(3)(ii)	n/a	Ku-band limits
25.140(a)(3)(iii)	Attachment C - Section 14	Ka-band limits
25.140(a)(3)(iv)	n/a	AP30B limits
25.140(a)(3)(v)	Attachment C - Section 14.1	2-degree spacing interference analysis
25.202(e)	Attachment C - Section 7	Frequency Tolerance
25.202(f)(1-3)	Attachment C - Section 8	Out of band - emissions
25.208(a-g)	Attachment C - Section 12	PFD Analysis
25.210(f)	Attachment C - Section 9	Full Frequency Reuse
25.210(j)	Narrative	EW Station keeping tolerance
25.283(a-c)	Attachment D - Orbital Debris	End-of-life Disposal
25.207	Attachment C - Section 10	Cessation of Emissions

Attachment C - Engineering Statement

1. Scope

This Attachment contains additional information regarding the proposed operations of the EUTELSAT 172A satellite at 174° E.L. (to be renamed "EUTELSAT 174A") as required by Section 25.114 and other sections of the Commission's rules that cannot be entered into the Schedule S online submission system. Because this modification application proposes to relocate the satellite by only two degrees, the majority of the information from the original application, File No. SAT-LOA-20031218-00358, remains applicable.

2. General Description (Section 25.114(d)(1))

The satellite will provide the same range of fixed-satellite service ("FSS") and mobility services in the Asia-Pacific region at the 174° E.L. orbital location that it provided at the 172° E.L. orbital location.

The satellite employs 18 C-band transponders and 20 Ku-band transponders using both linear polarizations, thereby providing dual-frequency reuse. The satellite has one C-band beam which provides coverage of the Pacific Ocean Region (POR). The satellite has five (5) regional Ku beams covering: North Pacific, South Pacific, South-West Pacific, South-East Pacific and North-East Asia. A complete technical description of the satellite is provided in the original application, File No. SAT-LOA-20031218-00358.

3. Spacecraft Overview

The satellite was manufactured and supplied by Alcatel Alenia Space based on the Spacebus 4000 bus platform. The satellite is 3-axis stabilized and uses bi-propellant propulsion for initial orbit raising and mono-propellant propulsion for on-station control, repositioning and end-of-life deorbit.

The satellite has two distinct payloads:

- A C-band payload;
- A traditional Ku-band payload connecting five service areas: North Pacific, North East Asia, South-East Pacific, South-West Pacific and South Pacific;

The satellite will operate in C-band and Ku-band at the frequencies listed below:

C-band	Uplink	5925 – 6425 MHz
	Downlink	3700 – 4200 MHz
Ku-band	Uplink	14.0 – 14.5 GHz
	Downlink	10.95 – 11.20 GHz
		11.45 – 11.7 GHz
		12.2 – 12.75 GHz

The satellite provides the following coverage (illustrations of the beam coverage areas is provided in Exhibit 4):

C-band	Pacific Ocean Region (POR)	Western North America, East Asia
Ku-band	North Pacific	East Asia, N Pacific Ocean, Western North America
	North-East Asia	China, Japan, Korea, Philippines
	South-West Pacific	SE Asia, Indonesia, Malaysia, Philippines
	South Pacific	Australia, New Zealand
	South-East Pacific	Hawaii, Fiji, American Samoa, Cook Islands, etc.

4. Telemetry, Tracking and Control (TT&C)

The TT&C sub-system provides for communications during on-station operations, as well as during spacecraft emergencies. C-band telecommand transmissions are normally received and C-band telemetry communications are normally transmitted by the spacecraft through a wide-beam antenna, and they are transmitted and received through a near omni-directional antenna during emergency operations.

TT&C communication channels have been selected at the edge of the assigned C-band in accordance with Section 25.202(g). The satellite utilizes two C-band telemetry channels and one C-band command channel. The C-band telemetry channel center frequencies are 3703.5 MHz and 4199.5 MHz. The C-band command channel center frequency is 5926.5 MHz. TT&C operations will be conducted from earth station facilities located in Australia.

The TT&C beams used for orbital maneuvers and on-station emergencies have gain contours that vary by less than 8 dB across the surface of the Earth, and accordingly the gain at 8 dB below the peak falls beyond the edge of the Earth. Therefore, pursuant to Section 25.114(c)(4)(vi)(A) of the Commission's rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S.

Contact details for the control stations are provided below:

E174A TT&C station 1:

Perth LES
620 Gnangara Road
Landsdale
Western Australia 6065
Australia

E174A TT&C station 2:

Auckland LES
24 Unity Drive North,
Albany,
Auckland
New Zealand

Satellite control center addresses and telephone numbers:

E174A Control Center

Address: Eutelsat
70 rue Balard
75015 Paris
France

E174A control responsible person: H. Schulze

Phone: fixed: / mobile: +33 1 5398 3466
24/7 hours number(s): +33 1 5398 3445

E174A Operations Coordinator: P. Turner

Phone: +33 1 5398 3177

5. Uplink Power Control

The satellite utilizes two Ku-band ULPC channels. The Ku-band ULPC channel center frequencies are 11199 MHz and 12749.5 MHz. The C-band and Ku-band beacons have a bandwidth of 25 kHz.

The coverage patterns of the Ku-band ULPC beam has gain contours that vary by less than 8 dB across the surface of the Earth, and accordingly the gain at 8 dB below the peak falls beyond the edge of the Earth. Therefore, pursuant to Section 25.114(c)(4)(vi)(A) of the Commission's rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S.

6. Frequency Plan

5.1 C-Band

The following tables list the uplink and downlink C-band channel plan for the satellite. This information is also provided in the accompanying Schedule S but is included here for completeness.

Table 1 C-Band Downlink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
01C	36000	3720	V
02C	36000	3740	H
03C	36000	3760	V
04C	36000	3780	H
05C	36000	3800	V
06C	36000	3820	H
07C	36000	3840	V
08C	36000	3860	H
09C	36000	3880	V
10C	36000	3900	H
11C	36000	3920	V
12C	36000	3940	H
13C	72000	3980	V
14C	72000	4000	H
15C	72000	4060	V
16C	72000	4080	H
17C	72000	4140	V
18C	72000	4160	H
CB1	300	3703.5	H
CB2	300	4199.5	V

Table 2 C-Band Uplink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
01C	36000	5945	H
02C	36000	5965	V
03C	36000	5985	H
04C	36000	6005	V
05C	36000	6025	H
06C	36000	6045	V
07C	36000	6065	H
08C	36000	6085	V
09C	36000	6105	H
10C	36000	6125	V
11C	36000	6145	H
12C	36000	6165	V
13C	72000	6205	H
14C	72000	6225	V
15C	72000	6285	H
16C	72000	6305	V
17C	72000	6365	H
18C	72000	6385	V
CMDC	300	5926.5	H

6.2 Ku-Band

The following tables list the uplink and downlink Ku-band channel plan for the satellite. This information is also provided in the accompanying Schedule S but is included here for completeness.

Table 3 Ku-Band Downlink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
1W	72000	10989	V
2W	72000	10989	H
3W	72000	11069	V

4W	72000	11069	H
5W	72000	11149	V
6W	72000	11149	H
1N1	27000	11473	V
2N1	27000	11503	V
3N1	27000	11533	V
4N1	27000	11563	V
5N1	27000	11593	V
6N1	27000	11623	V
7N1	27000	11653	V
8N1	27000	11683	V
1M	36000	12411	V
2M	36000	12411	H
3M	36000	12451	V
4M	36000	12451	H
5M	36000	12491	V
6M	36000	12491	H
1L1	36000	11479	H
2L1	36000	11519	H
3L1	36000	11559	H
4L1	36000	11599	H
5L1	36000	11639	H
6L1	36000	11679	H
1N2	27000	12525	V
2N2	27000	12555	V
3N2	27000	12585	V
4N2	27000	12614	V
5N2	27000	12646	V
6N2	27000	12675	V
7N2	27000	12705	V
8N2	27000	12735	V
1L2	36000	12531	H
2L2	36000	12571	H
3L2	36000	12611	H
4L2	36000	12651	H
5L2	36000	12691	H

6L2	36000	12731	H
KB1	25	11199	R
KB2	25	12749.5	L

Table 4 Ku-Band Uplink Frequency Plan

Channel ID	Bandwidth (kHz)	Center Frequency (MHz)	Polarization
1W	72000	14039	H
2W	72000	14039	V
3W	72000	14119	H
4W	72000	14119	V
5W	72000	14199	H
6W	72000	14199	V
1N	27000	14273	H
2N	27000	14303	H
3N	27000	14333	H
4N	27000	14363	H
5N	27000	14393	H
6N	27000	14423	H
7N	27000	14453	H
8N	27000	14483	H
1M	36000	14159	H
2M	36000	14159	V
3M	36000	14199	H
4M	36000	14199	V
5M	36000	14239	H
6M	36000	14239	V
1L	36000	14279	V
2L	36000	14319	V
3L	36000	14359	V
4L	36000	14399	V
5L	36000	14439	V
6L	36000	14479	V

7. Frequency Tolerance

The frequency tolerance requirements of Section 25.202(e) that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency will be met.

8. Out of Band Emissions

The out-of-band emission limits of Section 25.202(f)(1), (2) and (3) will be met.

9. Frequency Reuse

The satellite employs full frequency reuse on the C-band uplink and downlink by employing dual orthogonal linear polarization.

The satellite employs full frequency reuse on the Ku-band uplink and downlink by employing dual orthogonal linear polarization and frequency reuse across multiple regional and spot beams.

10. Cessation of Emissions

All downlink transmissions can be turned on and off by ground telecommand, thereby causing cessation of emissions from the satellite, as required by Section 25.207 of the Commission's rules.

11. ITU Filings

The satellite will operate in C-band and Ku-band at the 174° E.L. orbital location under the KYPROS-ACHILLEAS and KYPROS-ACHILLEAS-3 ITU satellite network filings. The operation of the satellite will fall within the envelope of the parameters disclosed in these ITU satellite network filings.

12. PFD Analysis

The power flux density ("PFD") limits for space stations operating in the 3700–4200 MHz, 10950–11200 MHz and 11450–11700 MHz are specified in Section 25.208 of the Commission's rules. The Commission's rules do not specify a PFD limit in the 11200–11450 and 12500–12750 MHz band; however, there are PFD limits specified in rule No. 21.16 of the International Telecommunication Union ("ITU") Radio Regulations. The maximum PFD levels for the satellite transmissions were calculated for the bands 3700–4200 MHz, 10950–11200 MHz, 11200–11450 MHz, 11450–11700 MHz and 12200–12750 MHz. The results are provided in Schedule S and show that the downlink power flux density levels of the satellite carriers do not exceed the limits specified in Section 25.208 of the Commission's rules, and those in No. 21.16 of the ITU Radio Regulations, as applicable.

13. Link Budgets

Link analysis for the satellite was conducted for a number of representative carriers in the C-band and Ku-band regional beams. For each of these links, it was assumed that the nearest satellite to the satellite was EUTELSAT 172B operating at 172° E.L. and a hypothetical satellite operating at 176° E.L. In one set of the provided link budgets, all of these satellites were assumed to have the same general operating parameters. In the other set of the link budgets, the adjacent satellites are assumed to be operating at the maximum EIRP densities defined in Section 25.140.

The following assumptions were used in the link budget analysis:

- The link budgets are for clear sky operation.
- The clear sky link margins were chosen to provide sufficient link availability for the service(s).
- All transmitting and receiving earth stations have a cross-polarization isolation value of at least 27 dB within their main beam lobe.

The results of the analysis are shown in Exhibit 1.

14. Interference Analysis

In this section, the information specified in Section 25.140(a) is presented (as required by Section 25.114(d)(7)).

The downlink EIRP density of the satellite transmissions in the C-band will not exceed levels provided in Section 25.140(a)(3)(i), and associated uplink transmissions will not exceed applicable EIRP density envelopes in Sections 25.218 or 25.221(a)(1) unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the satellite.

The downlink EIRP density of the satellite transmissions in the conventional or extended Ku-bands will not exceed levels provided in Section 25.140(a)(3)(ii), and associated uplink transmissions will not exceed applicable EIRP density envelopes in Sections 25.218, 25.222(a)(1), 25.226(a)(1) or 25.227(a)(1) unless the non-routine uplink and/or downlink operation is coordinated with operators of authorized co-frequency space stations at assigned locations within six degrees of the satellite.

14.1 Adjacent Satellite Link Analysis (Section 25.140(a)(3)(v))

The satellite will operate in bands addressed by Section 25.140(a)(3)(v). Since the only commercial satellite operating within two degrees of the satellite is the recently deployed EUTELSAT 172B, which operates in the same bands using similar beams and technical parameters, the impact of those operations is represented by hypothetical satellites having the same operating characteristics located at 172° E.L. and 176° E.L. The satellite at 172° E.L. was assumed to have two adjacent satellites separated by two degrees at 170° E.L. and 174° E.L. The satellite at 176° E.L. was assumed to have two adjacent satellites separated by two degrees at 174° E.L. and 178° E.L.

The link interference analysis demonstrating compatibility of the satellite with these hypothetical satellite networks was performed for representative carriers in the Ku-band uplink and downlink frequency ranges. Other assumptions used in the analysis include:

- The transmitting and receiving earth station antennas have off-axis co-polar gains that are compliant with those specified in Section 25.209(a) of the Commission's rules (non-compliant terminals would still satisfy the off-axis EIRP spectral density limits set forth in the Commission's rules).
- The Adjacent Satellite Interference (ASI) is computed based on EIRP densities.
- The uplink RF power density for each adjacent satellite is based on the maximum allowed in that frequency band (the provided analysis shows both cases where the interfering satellites operate

at maximum power densities and when the interfering satellites are operating at the same power density as the signal of interest)

- The downlink EIRP density for each adjacent satellite is based on the maximum allowed in that frequency band (the provided analysis shows both cases where the interfering satellites operate at maximum EIRP densities and when the interfering satellites are operating at the same EIRP density as the signal of interest).

The results of the Ku-band service interference analysis are shown in Exhibit 2 (for a hypothetical satellite at 172° E.L.) and Exhibit 3 (for a hypothetical satellite at 176° E.L.) and demonstrate that the operation of EUTELSAT 174A will permit the intended services for hypothetical satellites in slots two degrees away while maintaining sufficient link margin.

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

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

/s/

David C Morse, Ph.D.
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EXHIBIT 1: SATELLITE LINK BUDGETS

174° E.L. Satellite - Maximum RF/EIRP Density Interference

	Units	FWD Data	RTN Data	TV Carrier
UPLINK BEAM INFORMATION				
Uplink Beam Name		CUH/CUV	CUH/CUV	CUH/CUV
Uplink Frequency	GHz	6.2	6.2	6.2
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-6.0	-8.0	-6.0
DOWNLINK BEAM INFORMATION				
Downlink Beam Name		CDH/CDV	CDH/CDV	CDH/CDV
Downlink Frequency	GHz	3.9	3.9	3.9
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	32.9	36.9	32.9
ADJACENT SATELLITE 1				
Hypothetical 172° E.L.				
Satellite 1 Orbital Location	deg	172	172	172
Uplink Power Density	dB(W/Hz)	-38.7	-38.7	-38.7
Downlink EIRP Density	dB(W/Hz)	-33.0	-33.0	-33.0
ADJACENT SATELLITE 2				
Hypothetical 176° E.L.				
Satellite 2 Orbital Location	deg	176	176	176
Uplink Power Density	dB(W/Hz)	-38.7	-38.7	-38.7
Downlink EIRP Density	dB(W/Hz)	-33.0	-33.0	-33.0
CARRIER INFORMATION				
Carrier ID		FWD Data	RTN Data	Dig TV
Information Rate	kbps	1500	296	30000
Modulation		QPSK	8PSK	8PSK
FEC Rate		0.20	0.43	0.33
Noise Bandwidth	kHz	3750.0	228.0	30000.0
Minimum C/N, Clear Sky	dB	-2.5	4.2	2.5
UPLINK EARTH STATION				
Earth Station Diameter	meters	4.5	2.4	4.5
Earth Station Gain	dBi	47.4	42.0	47.4
Earth Station Latitude	deg	-37	-20.0	-37
Earth Station Longitude	deg	175	-160.0	175
Earth Station Elevation Angle	deg	47.1	52.3	47.1
DOWNLINK EARTH STATION				
Earth Station Diameter	meters	2.4	4.5	2.4
Earth Station G/T	dB/K	19.2	24.5	19.2
Earth Station Latitude	deg	-20.0	-37	-20.0
Earth Station Longitude	deg	-160.0	175	-160.0
Earth Station Elevation Angle	deg	52.3	47.1	52.3
UPLINK PERFORMANCE				
Uplink Earth Station EIRP	dBW	61.0	50.8	77.5
Uplink Free Space Loss	dB	199.7	199.6	199.7
Uplink Atmospheric Attenuation	dB	0.1	0.1	0.1
Satellite G/T	dB/K	-6.0	-8.0	-6.0
Carrier Noise Bandwidth	dB-Hz	65.7	53.6	74.8
Uplink C/N	dB	18.0	18.1	25.5
DOWNLINK PERFORMANCE				
Downlink EIRP per Carrier	dBW	17.8	9.7	32.9
Downlink Free Space Loss	dB	195.6	195.7	195.6
Downlink Atmospheric Attenuation	dB	0.1	0.1	0.1
Earth Station G/T	dB/K	19.2	24.5	19.2
Carrier Noise Bandwidth	dB-Hz	65.7	53.6	74.8
Downlink C/N	dB	4.1	13.4	10.2
COMPOSITE LINK PERFORMANCE				
C/N Uplink	dB	18.0	18.1	25.5
C/N Downlink	dB	4.1	13.4	10.2
C/I Uplink	dB	21.4	21.4	32.1
C/I Downlink	dB	15.9	15.9	19.9
C/I Uplink Adjacent Satellite 1	dB	13.8	15.8	21.3
C/I Downlink Adjacent Satellite 1	dB	2.9	12.2	8.9
C/I Uplink Adjacent Satellite 2	dB	13.8	15.9	21.3
C/I Downlink Adjacent Satellite 2	dB	2.9	12.2	9.0
C/(N+I) Composite	dB	-1.9	5.7	4.2
Minimum Required C/N	dB	-2.5	4.2	2.5
Excess Clear Sky Link Margin	dB	0.6	1.6	1.7
CARRIER DENSITY LEVELS				
Uplink Power Density	dBW/Hz	-52.2	-44.8	-44.7
Downlink EIRP Density	dBW/Hz	-48.0	-43.9	-41.9

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case	TV Carrier
UPLINK BEAM INFORMATION						
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8	3.8
DOWNLINK BEAM INFORMATION						
Downlink Beam Name		EDH3/EDV3	NDH3/NDV3	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	11.7	11.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	40.6	45.3	53.4	53.4	53.4
ADJACENT SATELLITE 1						
Hypothetical 172° E.L.						
Satellite 1 Orbital Location	deg	172	172	172	172	172
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0	-22.0
ADJACENT SATELLITE 2						
Hypothetical 176° E.L.						
Satellite 2 Orbital Location	deg	176	176	176	176	176
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0	-22.0
CARRIER INFORMATION						
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best	DigTV
Information Rate	kbps	2200	402	7500	938	56250
Modulation		BPSK	8APSK	16APSK	16APSK	8APSK
FEC Rate		0.22	0.52	0.56	0.69	0.42
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3	45000.0
Minimum C/N, Clear Sky	dB	-5.3	5.4	8.2	10.1	3.9
UPLINK EARTH STATION						
Earth Station Diameter	meters	4.5	1.2	4.5	1.2	4.5
Earth Station Gain	dBi	54.6	43.1	54.6	43.1	54.6
Earth Station Latitude	deg	40.0	25.0	10.0	43.5	10.0
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0	125.0
Earth Station Elevation Angle	deg	9.6	13.2	33.0	31.0	33.0
DOWNLINK EARTH STATION						
Earth Station Diameter	meters	1.2	4.5	1.2	4.5	0.9
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Earth Station Latitude	deg	25	40	43.5	10	43.5
Earth Station Longitude	deg	-120	-120	143	125	143
Earth Station Elevation Angle	deg	13.2	9.6	31.0	33.0	31.0
UPLINK PERFORMANCE						
Uplink Earth Station EIRP	dBW	70.7	47.1	58.4	47.6	69.0
Uplink Free Space Loss	dB	207.6	207.5	207.1	207.2	207.1
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0	3.8
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Uplink C/N	dB	20.7	12.3	18.1	20.4	17.4
DOWNLINK PERFORMANCE						
Downlink EIRP per Carrier	dBW	30.8	16.0	38.9	29.0	49.5
Downlink Free Space Loss	dB	205.9	206.0	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Downlink C/N	dB	3.1	15.2	15.7	26.8	12.7
COMPOSITE LINK PERFORMANCE						
C/N Uplink	dB	20.7	12.3	18.1	20.4	17.4
C/N Downlink	dB	3.1	15.2	15.7	26.8	12.7
C/I Uplink	dB	23.8	17.5	21.2	21.2	24.1
C/I Downlink	dB	18.5	14.7	18.0	18.4	17.6
C/I Uplink Adjacent Satellite 1	dB	29.6	21.9	22.7	21.8	22.0
C/I Downlink Adjacent Satellite 1	dB	2.7	15.3	16.1	27.7	13.6
C/I Uplink Adjacent Satellite 2	dB	29.6	22.0	22.6	21.7	21.9
C/I Downlink Adjacent Satellite 2	dB	2.7	15.3	16.1	27.7	13.6
C/(N+I) Composite	dB	-2.0	6.7	9.0	13.0	7.1
Minimum Required C/N	dB	-5.3	5.4	8.2	10.1	3.9
Excess Clear Sky Link Margin	dB	3.3	1.3	0.8	2.9	3.2
CARRIER DENSITY LEVELS						
Uplink Power Density	dBW/Hz	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dBW/Hz	-39.2	-38.1	-26.3	-26.3	-27.0

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case
UPLINK BEAM INFORMATION					
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8
DOWNLINK BEAM INFORMATION					
Downlink Beam Name		ADH4/ADV4	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	12.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dB <i>i</i>	53.4	53.4	53.4	53.4
ADJACENT SATELLITE 1					
Hypothetical 172° E.L.					
Satellite 1 Orbital Location	deg	172	172	172	172
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0
ADJACENT SATELLITE 2					
Hypothetical 176° E.L.					
Satellite 2 Orbital Location	deg	176	176	176	176
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0
CARRIER INFORMATION					
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best
Information Rate	kbps	6000	256	2333	683
Modulation		BPSK	QPSK	QPSK	16APSK
FEC Rate		0.60	0.50	0.35	0.50
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3
Minimum C/N, Clear Sky	dB	-0.4	2.5	0.5	7.3
UPLINK EARTH STATION					
Earth Station Diameter	meters	4.5	0.5	4.5	0.5
Earth Station Gain	dB <i>i</i>	54.6	35.5	54.6	35.5
Earth Station Latitude	deg	40.0	25.0	10.0	43.5
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0
Earth Station Elevation Angle	deg	9.6	13.2	33.0	31.0
DOWNLINK EARTH STATION					
Earth Station Diameter	meters	0.5	4.5	0.5	4.5
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Earth Station Latitude	deg	43.5	10	43.5	10
Earth Station Longitude	deg	143	125	143	125
Earth Station Elevation Angle	deg	31.0	33.0	31.0	33.0
UPLINK PERFORMANCE					
Uplink Earth Station EIRP	dBW	70.7	39.1	58.4	40.6
Uplink Free Space Loss	dB	207.6	207.5	207.1	207.2
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Uplink C/N	dB	20.7	4.3	18.1	13.4
DOWNLINK PERFORMANCE					
Downlink EIRP per Carrier	dBW	43.6	24.1	38.9	29.0
Downlink Free Space Loss	dB	206.2	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Downlink C/N	dB	7.3	23.1	7.4	26.8
COMPOSITE LINK PERFORMANCE					
C/N Uplink	dB	20.7	4.3	18.1	13.4
C/N Downlink	dB	7.3	23.1	7.4	26.8
C/I Uplink	dB	23.8	17.5	21.2	21.2
C/I Downlink	dB	18.5	14.7	18.0	18.4
C/I Uplink Adjacent Satellite 1	dB	29.6	13.9	22.7	14.8
C/I Downlink Adjacent Satellite 1	dB	7.8	24.1	7.8	27.7
C/I Uplink Adjacent Satellite 2	dB	29.6	14.0	22.6	14.7
C/I Downlink Adjacent Satellite 2	dB	7.7	24.0	7.8	27.7
C/(N+I) Composite	dB	2.6	2.9	2.5	8.5
Minimum Required C/N	dB	-0.4	2.5	0.5	7.3
Excess Clear Sky Link Margin	dB	3.0	0.4	2.0	1.3
CARRIER DENSITY LEVELS					
Uplink Power Density	dBW/Hz	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dBW/Hz	-26.4	-30.0	-26.3	-26.3

174° E.L. Satellite – Interferers RF/EIRP Densities Match Signal of Interest

	Units	FWD Data	RTN Data	TV Carrier
UPLINK BEAM INFORMATION				
Uplink Beam Name		CUH/CUV	CUH/CUV	CUH/CUV
Uplink Frequency	GHz	6.2	6.2	6.2
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-6.0	-8.0	-6.0
DOWNLINK BEAM INFORMATION				
Downlink Beam Name		CDH/CDV	CDH/CDV	CDH/CDV
Downlink Frequency	GHz	3.9	3.9	3.9
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dB	32.9	36.9	32.9
ADJACENT SATELLITE 1				
Hypothetical 172° E.L.				
Satellite 1 Orbital Location	deg	172	172	172
Uplink Power Density	dB(W/Hz)	-52.2	-44.8	-44.7
Downlink EIRP Density	dB(W/Hz)	-48.0	-43.9	-41.9
ADJACENT SATELLITE 2				
Hypothetical 176° E.L.				
Satellite 2 Orbital Location	deg	176	176	176
Uplink Power Density	dB(W/Hz)	-52.2	-44.8	-44.7
Downlink EIRP Density	dB(W/Hz)	-48.0	-43.9	-41.9
CARRIER INFORMATION				
Carrier ID		FWD Data	RTN Data	Dig TV
Information Rate	kbps	3750	533	54000
Modulation		QPSK	16APSK	16APSK
FEC Rate		0.50	0.58	0.45
Noise Bandwidth	kHz	3750.0	228.0	30000.0
Minimum C/N, Clear Sky	dB	2.5	8.6	6.4
UPLINK EARTH STATION				
Earth Station Diameter	meters	4.5	2.4	4.5
Earth Station Gain	dB	47.4	42.0	47.4
Earth Station Latitude	deg	-37	-20.0	-37
Earth Station Longitude	deg	175	-160.0	175
Earth Station Elevation Angle	deg	47.1	52.3	47.1
DOWNLINK EARTH STATION				
Earth Station Diameter	meters	2.4	4.5	2.4
Earth Station G/T	dB/K	19.2	24.5	19.2
Earth Station Latitude	deg	-20.0	-37	-20.0
Earth Station Longitude	deg	-160.0	175	-160.0
Earth Station Elevation Angle	deg	52.3	47.1	52.3
UPLINK PERFORMANCE				
Uplink Earth Station EIRP	dBW	61.0	50.8	77.5
Uplink Free Space Loss	dB	199.7	199.6	199.7
Uplink Atmospheric Attenuation	dB	0.1	0.1	0.1
Satellite G/T	dB/K	-6.0	-8.0	-6.0
Carrier Noise Bandwidth	dB-Hz	65.7	53.6	74.8
Uplink C/N	dB	18.0	18.1	25.5
DOWNLINK PERFORMANCE				
Downlink EIRP per Carrier	dBW	17.8	9.7	32.9
Downlink Free Space Loss	dB	195.6	195.7	195.6
Downlink Atmospheric Attenuation	dB	0.1	0.1	0.1
Earth Station G/T	dB/K	19.2	24.5	19.2
Carrier Noise Bandwidth	dB-Hz	65.7	53.6	74.8
Downlink C/N	dB	4.1	13.4	10.2
COMPOSITE LINK PERFORMANCE				
C/N Uplink	dB	18.0	18.1	25.5
C/N Downlink	dB	4.1	13.4	10.2
C/I Uplink	dB	21.4	21.4	32.1
C/I Downlink	dB	15.9	15.9	19.9
C/I Uplink Adjacent Satellite 1	dB	27.3	21.9	27.3
C/I Downlink Adjacent Satellite 1	dB	17.9	23.1	17.9
C/I Uplink Adjacent Satellite 2	dB	27.3	21.9	27.3
C/I Downlink Adjacent Satellite 2	dB	17.9	23.1	17.9
C/(N+I) Composite	dB	3.2	9.3	8.3
Minimum Required C/N	dB	2.5	8.6	6.4
Excess Clear Sky Link Margin	dB	0.7	0.7	1.9
CARRIER DENSITY LEVELS				
Uplink Power Density	dBW/Hz	-52.2	-44.8	-44.7
Downlink EIRP Density	dBW/Hz	-48.0	-43.9	-41.9

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case	TV Carrier
UPLINK BEAM INFORMATION						
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8	3.8
DOWNLINK BEAM INFORMATION						
Downlink Beam Name		EDH3/EDV3	NDH3/NDV3	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	11.7	11.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	40.6	45.3	53.4	53.4	53.4
ADJACENT SATELLITE 1						
Hypothetical 172° E.L.						
Satellite 1 Orbital Location	deg	172	172	172	172	172
Uplink Power Density	dB(W/Hz)	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dB(W/Hz)	-39.2	-38.1	-26.3	-26.3	-27.0
ADJACENT SATELLITE 2						
Hypothetical 176° E.L.						
Satellite 2 Orbital Location	deg	176	176	176	176	176
Uplink Power Density	dB(W/Hz)	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dB(W/Hz)	-39.2	-38.1	-26.3	-26.3	-27.0
CARRIER INFORMATION						
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best	DigTV
Information Rate	kbps	5500	498	9000	972	76500
Modulation		QPSK	8APSK	16APSK	16APSK	8APSK
FEC Rate		0.28	0.65	0.68	0.71	0.57
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3	45000.0
Minimum C/N, Clear Sky	dB	-0.8	7.0	9.9	10.4	6.0
UPLINK EARTH STATION						
Earth Station Diameter	meters	4.5	1.2	4.5	1.2	4.5
Earth Station Gain	dBi	54.6	43.1	54.6	43.1	54.6
Earth Station Latitude	deg	40.0	25.0	10.0	43.5	10.0
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0	125.0
Earth Station Elevation Angle	deg	9.6	13.2	33.0	31.0	33.0
DOWNLINK EARTH STATION						
Earth Station Diameter	meters	1.2	4.5	1.2	4.5	0.9
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Earth Station Latitude	deg	25	40	43.5	10	43.5
Earth Station Longitude	deg	-120	-120	143	125	143
Earth Station Elevation Angle	deg	13.2	9.6	31.0	33.0	31.0
UPLINK PERFORMANCE						
Uplink Earth Station EIRP	dBW	70.7	47.1	58.4	47.6	69.0
Uplink Free Space Loss	dB	207.6	207.5	207.1	207.2	207.1
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0	3.8
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Uplink C/N	dB	20.7	12.3	18.1	20.4	17.4
DOWNLINK PERFORMANCE						
Downlink EIRP per Carrier	dBW	30.8	16.0	38.9	29.0	49.5
Downlink Free Space Loss	dB	205.9	206.0	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Downlink C/N	dB	3.1	15.2	15.7	26.8	12.7
COMPOSITE LINK PERFORMANCE						
C/N Uplink	dB	20.7	12.3	18.1	20.4	17.4
C/N Downlink	dB	3.1	15.2	15.7	26.8	12.7
C/I Uplink	dB	23.8	17.5	21.2	21.2	24.1
C/I Downlink	dB	18.5	14.7	18.0	18.4	17.6
C/I Uplink Adjacent Satellite 1	dB	33.4	22.0	34.1	22.6	34.1
C/I Downlink Adjacent Satellite 1	dB	19.8	31.4	20.4	32.0	18.6
C/I Uplink Adjacent Satellite 2	dB	33.5	22.1	34.0	22.6	34.0
C/I Downlink Adjacent Satellite 2	dB	19.9	31.4	20.4	32.0	18.6
C/(N+I) Composite	dB	2.7	8.1	10.7	13.4	9.1
Minimum Required C/N	dB	-0.8	7.0	9.9	10.4	6.0
Excess Clear Sky Link Margin	dB	3.6	1.1	0.8	3.0	3.1
CARRIER DENSITY LEVELS						
Uplink Power Density	dBW/Hz	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dBW/Hz	-39.2	-38.1	-26.3	-26.3	-27.0

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case
UPLINK BEAM INFORMATION					
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8
DOWNLINK BEAM INFORMATION					
Downlink Beam Name		ADH4/ADV4	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	12.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	53.4	53.4	53.4	53.4
ADJACENT SATELLITE 1					
Hypothetical 172° E.L.					
Satellite 1 Orbital Location	deg	172	172	172	172
Uplink Power Density	dB(W/Hz)	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dB(W/Hz)	-26.4	-30.0	-26.3	-26.3
ADJACENT SATELLITE 2					
Hypothetical 176° E.L.					
Satellite 2 Orbital Location	deg	176	176	176	176
Uplink Power Density	dB(W/Hz)	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dB(W/Hz)	-26.4	-30.0	-26.3	-26.3
CARRIER INFORMATION					
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best
Information Rate	kbps	8000	256	3333	683
Modulation		QPSK	8APSK	QPSK	8PSK
FEC Rate		0.40	0.33	0.50	0.67
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3
Minimum C/N, Clear Sky	dB	1.2	2.5	2.5	7.3
UPLINK EARTH STATION					
Earth Station Diameter	meters	4.5	0.5	4.5	0.5
Earth Station Gain	dBi	54.6	35.5	54.6	35.5
Earth Station Latitude	deg	40.0	25.0	10.0	43.5
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0
Earth Station Elevation Angle	deg	9.6	13.2	33.0	31.0
DOWNLINK EARTH STATION					
Earth Station Diameter	meters	0.5	4.5	0.5	4.5
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Earth Station Latitude	deg	43.5	10	43.5	10
Earth Station Longitude	deg	143	125	143	125
Earth Station Elevation Angle	deg	31.0	33.0	31.0	33.0
UPLINK PERFORMANCE					
Uplink Earth Station EIRP	dBW	70.7	39.1	58.4	40.6
Uplink Free Space Loss	dB	207.6	207.5	207.1	207.2
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Uplink C/N	dB	20.7	4.3	18.1	13.4
DOWNLINK PERFORMANCE					
Downlink EIRP per Carrier	dBW	43.6	24.1	38.9	29.0
Downlink Free Space Loss	dB	206.2	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Downlink C/N	dB	7.3	23.1	7.4	26.8
COMPOSITE LINK PERFORMANCE					
C/N Uplink	dB	20.7	4.3	18.1	13.4
C/N Downlink	dB	7.3	23.1	7.4	26.8
C/I Uplink	dB	23.8	17.5	21.2	21.2
C/I Downlink	dB	18.5	14.7	18.0	18.4
C/I Uplink Adjacent Satellite 1	dB	33.4	14.4	34.1	15.0
C/I Downlink Adjacent Satellite 1	dB	12.1	32.0	12.1	32.0
C/I Uplink Adjacent Satellite 2	dB	33.5	14.5	34.0	15.0
C/I Downlink Adjacent Satellite 2	dB	12.1	32.0	12.1	32.0
C/(N+I) Composite					
C/(N+I) Composite	dB	4.7	3.0	4.6	8.7
Minimum Required C/N	dB	1.2	2.5	2.5	7.3
Excess Clear Sky Link Margin	dB	3.5	0.5	2.1	1.4
CARRIER DENSITY LEVELS					
Uplink Power Density	dBW/Hz	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dBW/Hz	-26.4	-30.0	-26.3	-26.3

EXHIBIT 2: ADJACENT SATELLITE (172° E. L.) LINK BUDGETS

Hypothetical 172° E.L. Satellite - Maximum RF/EIRP Density Interference

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case	TV Carrier
UPLINK BEAM INFORMATION						
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8	3.8
DOWNLINK BEAM INFORMATION						
Downlink Beam Name		EDH3/EDV3	NDH3/NDV3	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	11.7	11.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	40.6	45.3	53.4	53.4	53.4
ADJACENT SATELLITE 1						
		Hypothetical 170° E.L.				
Satellite 1 Orbital Location	deg	170	170	170	170	170
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0	-22.0
ADJACENT SATELLITE 2						
		Eutelsat 174A				
Satellite 2 Orbital Location	deg	174	174	174	174	174
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0	-22.0
CARRIER INFORMATION						
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best	DigTV
Information Rate	kbps	2200	402	7500	938	56250
Modulation		BPSK	8APSK	16APSK	16APSK	8APSK
FEC Rate		0.22	0.52	0.56	0.69	0.42
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3	45000.0
Minimum C/N, Clear Sky	dB	-5.3	5.4	8.2	10.1	3.9
UPLINK EARTH STATION						
Earth Station Diameter	meters	4.5	1.2	4.5	1.2	4.5
Earth Station Gain	dBi	54.6	43.1	54.6	43.1	54.6
Earth Station Latitude	deg	40.0	25.0	10.0	43.5	10.0
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0	125.0
Earth Station Elevation Angle	deg	8.1	11.3	35.1	32.0	35.1
DOWNLINK EARTH STATION						
Earth Station Diameter	meters	1.2	4.5	1.2	4.5	0.9
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Earth Station Latitude	deg	25	40	43.5	10	43.5
Earth Station Longitude	deg	-120	-120	143	125	143
Earth Station Elevation Angle	deg	11.3	8.1	32.0	35.1	32.0
UPLINK PERFORMANCE						
Uplink Earth Station EIRP	dBW	70.7	47.1	58.4	47.6	69.0
Uplink Free Space Loss	dB	207.7	207.6	207.1	207.1	207.1
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0	3.8
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Uplink C/N	dB	20.7	12.2	18.2	20.4	17.5
DOWNLINK PERFORMANCE						
Downlink EIRP per Carrier	dBW	30.8	16.0	38.9	29.0	49.5
Downlink Free Space Loss	dB	205.9	206.0	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Downlink C/N	dB	3.1	15.2	15.7	26.8	12.7
COMPOSITE LINK PERFORMANCE						
C/N Uplink	dB	20.7	12.2	18.2	20.4	17.5
C/N Downlink	dB	3.1	15.2	15.7	26.8	12.7
C/I Uplink	dB	23.8	17.5	21.2	21.2	24.1
C/I Downlink	dB	18.5	14.7	18.0	18.4	17.6
C/I Uplink Adjacent Satellite 1	dB	29.5	21.9	22.7	21.8	22.0
C/I Downlink Adjacent Satellite 1	dB	2.6	15.2	16.2	27.8	13.6
C/I Uplink Adjacent Satellite 2	dB	29.6	21.9	22.7	21.8	22.0
C/I Downlink Adjacent Satellite 2	dB	2.7	15.3	16.1	27.7	13.6
C/(N+I) Composite	dB	-2.1	6.7	9.0	13.0	7.2
Minimum Required C/N	dB	-5.3	5.4	8.2	10.1	3.9
Excess Clear Sky Link Margin	dB	3.3	1.2	0.8	2.9	3.3
CARRIER DENSITY LEVELS						
Uplink Power Density	dBW/Hz	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dBW/Hz	-39.2	-38.1	-26.3	-26.3	-27.0

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case
UPLINK BEAM INFORMATION					
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8
DOWNLINK BEAM INFORMATION					
Downlink Beam Name		ADH4/ADV4	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	12.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	53.4	53.4	53.4	53.4
ADJACENT SATELLITE 1					
		Hypothetical 170° E.L.			
Satellite 1 Orbital Location	deg	170	170	170	170
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0
ADJACENT SATELLITE 2					
		Eutelsat 174A			
Satellite 2 Orbital Location	deg	174	174	174	174
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0
CARRIER INFORMATION					
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best
Information Rate	kbps	6000	256	2333	683
Modulation		BPSK	QPSK	QPSK	16APSK
FEC Rate		0.60	0.50	0.35	0.50
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3
Minimum C/N, Clear Sky	dB	-0.4	2.5	0.5	7.3
UPLINK EARTH STATION					
Earth Station Diameter	meters	4.5	0.5	4.5	0.5
Earth Station Gain	dBi	54.6	35.5	54.6	35.5
Earth Station Latitude	deg	40.0	25.0	10.0	43.5
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0
Earth Station Elevation Angle	deg	8.1	11.3	35.1	32.0
DOWNLINK EARTH STATION					
Earth Station Diameter	meters	0.5	4.5	0.5	4.5
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Earth Station Latitude	deg	43.5	10	43.5	10
Earth Station Longitude	deg	143	125	143	125
Earth Station Elevation Angle	deg	32.0	35.1	32.0	35.1
UPLINK PERFORMANCE					
Uplink Earth Station EIRP	dBW	70.7	39.1	58.4	40.6
Uplink Free Space Loss	dB	207.7	207.6	207.1	207.1
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Uplink C/N	dB	20.7	4.2	18.2	13.4
DOWNLINK PERFORMANCE					
Downlink EIRP per Carrier	dBW	43.6	24.1	38.9	29.0
Downlink Free Space Loss	dB	206.2	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Downlink C/N	dB	7.3	23.2	7.4	26.8
COMPOSITE LINK PERFORMANCE					
C/N Uplink	dB	20.7	4.2	18.2	13.4
C/N Downlink	dB	7.3	23.2	7.4	26.8
C/I Uplink	dB	23.8	17.5	21.2	21.2
C/I Downlink	dB	18.5	14.7	18.0	18.4
C/I Uplink Adjacent Satellite 1	dB	29.5	13.9	22.7	14.8
C/I Downlink Adjacent Satellite 1	dB	7.8	24.1	7.9	27.8
C/I Uplink Adjacent Satellite 2	dB	29.6	13.9	22.7	14.8
C/I Downlink Adjacent Satellite 2	dB	7.8	24.1	7.8	27.7
C/(N+I) Composite	dB	2.6	2.8	2.5	8.6
Minimum Required C/N	dB	-0.4	2.5	0.5	7.3
Excess Clear Sky Link Margin	dB	3.0	0.3	2.1	1.3
CARRIER DENSITY LEVELS					
Uplink Power Density	dBW/Hz	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dBW/Hz	-26.4	-30.0	-26.3	-26.3

Hypothetical 172° E.L. Satellite – Interferers RF/EIRP Densities Match Signal of Interest

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case	TV Carrier
UPLINK BEAM INFORMATION						
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8	3.8
DOWNLINK BEAM INFORMATION						
Downlink Beam Name		EDH3/EDV3	NDH3/NDV3	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	11.7	11.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dB	40.6	45.3	53.4	53.4	53.4
ADJACENT SATELLITE 1						
Hypothetical 170° E.L.						
Satellite 1 Orbital Location	deg	170	170	170	170	170
Uplink Power Density	dB(W/Hz)	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dB(W/Hz)	-39.2	-38.1	-26.3	-26.3	-27.0
ADJACENT SATELLITE 2						
Eutelsat 174A						
Satellite 2 Orbital Location	deg	174	174	174	174	174
Uplink Power Density	dB(W/Hz)	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dB(W/Hz)	-39.2	-38.1	-26.3	-26.3	-27.0
CARRIER INFORMATION						
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best	DigTV
Information Rate	kbps	5500	498	9000	972	76500
Modulation		QPSK	8APSK	16APSK	16APSK	8APSK
FEC Rate		0.28	0.65	0.68	0.71	0.57
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3	45000.0
Minimum C/N, Clear Sky	dB	-0.8	7.0	9.9	10.4	6.0
UPLINK EARTH STATION						
Earth Station Diameter	meters	4.5	1.2	4.5	1.2	4.5
Earth Station Gain	dB	54.6	43.1	54.6	43.1	54.6
Earth Station Latitude	deg	40.0	25.0	10.0	43.5	10.0
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0	125.0
Earth Station Elevation Angle	deg	8.1	11.3	35.1	32.0	35.1
DOWNLINK EARTH STATION						
Earth Station Diameter	meters	1.2	4.5	1.2	4.5	0.9
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Earth Station Latitude	deg	25	40	43.5	10	43.5
Earth Station Longitude	deg	-120	-120	143	125	143
Earth Station Elevation Angle	deg	11.3	8.1	32.0	35.1	32.0
UPLINK PERFORMANCE						
Uplink Earth Station EIRP	dBW	70.7	47.1	58.4	47.6	69.0
Uplink Free Space Loss	dB	207.7	207.6	207.1	207.1	207.1
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0	3.8
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Uplink C/N	dB	20.7	12.2	18.2	20.4	17.5
DOWNLINK PERFORMANCE						
Downlink EIRP per Carrier	dBW	30.8	16.0	38.9	29.0	49.5
Downlink Free Space Loss	dB	205.9	206.0	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Downlink C/N	dB	3.1	15.2	15.7	26.8	12.7
COMPOSITE LINK PERFORMANCE						
C/N Uplink	dB	20.7	12.2	18.2	20.4	17.5
C/N Downlink	dB	3.1	15.2	15.7	26.8	12.7
C/I Uplink	dB	23.8	17.5	21.2	21.2	24.1
C/I Downlink	dB	18.5	14.7	18.0	18.4	17.6
C/I Uplink Adjacent Satellite 1	dB	33.4	22.0	34.1	22.6	34.1
C/I Downlink Adjacent Satellite 1	dB	19.8	31.3	20.5	32.1	18.6
C/I Uplink Adjacent Satellite 2	dB	33.4	22.0	34.1	22.6	34.1
C/I Downlink Adjacent Satellite 2	dB	19.8	31.4	20.4	32.0	18.6
C/(N+I) Composite	dB	2.7	8.1	10.7	13.4	9.2
Minimum Required C/N	dB	-0.8	7.0	9.9	10.4	6.0
Excess Clear Sky Link Margin	dB	3.5	1.0	0.8	3.0	3.1
CARRIER DENSITY LEVELS						
Uplink Power Density	dBW/Hz	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dBW/Hz	-39.2	-38.1	-26.3	-26.3	-27.0

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case
UPLINK BEAM INFORMATION					
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8
DOWNLINK BEAM INFORMATION					
Downlink Beam Name		ADH4/ADV4	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	12.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dB	53.4	53.4	53.4	53.4
ADJACENT SATELLITE 1					
Hypothetical 170° E.L.					
Satellite 1 Orbital Location	deg	170	170	170	170
Uplink Power Density	dB(W/Hz)	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dB(W/Hz)	-26.4	-30.0	-26.3	-26.3
ADJACENT SATELLITE 2					
Eutelsat 174A					
Satellite 2 Orbital Location	deg	174	174	174	174
Uplink Power Density	dB(W/Hz)	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dB(W/Hz)	-26.4	-30.0	-26.3	-26.3
CARRIER INFORMATION					
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best
Information Rate	kbps	8000	256	3333	683
Modulation		QPSK	8APSK	QPSK	8PSK
FEC Rate		0.40	0.33	0.50	0.67
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3
Minimum C/N, Clear Sky	dB	1.2	2.5	2.5	7.3
UPLINK EARTH STATION					
Earth Station Diameter	meters	4.5	0.5	4.5	0.5
Earth Station Gain	dB	54.6	35.5	54.6	35.5
Earth Station Latitude	deg	40.0	25.0	10.0	43.5
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0
Earth Station Elevation Angle	deg	8.1	11.3	35.1	32.0
DOWNLINK EARTH STATION					
Earth Station Diameter	meters	0.5	4.5	0.5	4.5
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Earth Station Latitude	deg	43.5	10	43.5	10
Earth Station Longitude	deg	143	125	143	125
Earth Station Elevation Angle	deg	32.0	35.1	32.0	35.1
UPLINK PERFORMANCE					
Uplink Earth Station EIRP	dBW	70.7	39.1	58.4	40.6
Uplink Free Space Loss	dB	207.7	207.6	207.1	207.1
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Uplink C/N	dB	20.7	4.2	18.2	13.4
DOWNLINK PERFORMANCE					
Downlink EIRP per Carrier	dBW	43.6	24.1	38.9	29.0
Downlink Free Space Loss	dB	206.2	206.2	206.2	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Downlink C/N	dB	7.3	23.2	7.4	26.8
COMPOSITE LINK PERFORMANCE					
C/N Uplink	dB	20.7	4.2	18.2	13.4
C/N Downlink	dB	7.3	23.2	7.4	26.8
C/I Uplink	dB	23.8	17.5	21.2	21.2
C/I Downlink	dB	18.5	14.7	18.0	18.4
C/I Uplink Adjacent Satellite 1	dB	33.4	14.4	34.1	15.0
C/I Downlink Adjacent Satellite 1	dB	12.2	32.1	12.2	32.1
C/I Uplink Adjacent Satellite 2	dB	33.4	14.4	34.1	15.0
C/I Downlink Adjacent Satellite 2	dB	12.1	32.0	12.1	32.0
C/(N+I) Composite	dB	4.7	2.9	4.6	8.7
Minimum Required C/N	dB	1.2	2.5	2.5	7.3
Excess Clear Sky Link Margin	dB	3.5	0.4	2.1	1.5
CARRIER DENSITY LEVELS					
Uplink Power Density	dBW/Hz	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dBW/Hz	-26.4	-30.0	-26.3	-26.3

EXHIBIT 3: ADJACENT SATELLITE (176° E.L.) LINK BUDGETS

Hypothetical 176° E.L. Satellite - Maximum RF/EIRP Density Interference

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case	TV Carrier
UPLINK BEAM INFORMATION						
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8	3.8
DOWNLINK BEAM INFORMATION						
Downlink Beam Name		EDH3/EDV3	NDH3/NDV3	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	11.7	11.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	40.6	45.3	53.4	53.4	53.4
ADJACENT SATELLITE 1						
Eutelsat 174A						
Satellite 1 Orbital Location	deg	174	174	174	174	174
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0	-22.0
ADJACENT SATELLITE 2						
Hypothetical 178° E.L.						
Satellite 2 Orbital Location	deg	178	178	178	178	178
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0	-22.0
CARRIER INFORMATION						
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best	DigTV
Information Rate	kbps	2200	402	7500	938	56250
Modulation		BPSK	8APSK	16APSK	16APSK	8APSK
FEC Rate		0.22	0.52	0.56	0.69	0.42
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3	45000.0
Minimum C/N, Clear Sky	dB	-5.3	5.4	8.2	10.1	3.9
UPLINK EARTH STATION						
Earth Station Diameter	meters	4.5	1.2	4.5	1.2	4.5
Earth Station Gain	dBi	54.6	43.1	54.6	43.1	54.6
Earth Station Latitude	deg	40.0	25.0	10.0	43.5	10.0
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0	125.0
Earth Station Elevation Angle	deg	11.1	15.0	30.8	29.9	30.8
DOWNLINK EARTH STATION						
Earth Station Diameter	meters	1.2	4.5	1.2	4.5	0.9
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Earth Station Latitude	deg	25	40	43.5	10	43.5
Earth Station Longitude	deg	-120	-120	143	125	143
Earth Station Elevation Angle	deg	15.0	11.1	29.9	30.8	29.9
UPLINK PERFORMANCE						
Uplink Earth Station EIRP	dBW	70.7	47.1	58.4	47.6	69.0
Uplink Free Space Loss	dB	207.6	207.5	207.2	207.2	207.2
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0	3.8
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Uplink C/N	dB	20.7	12.3	18.1	20.4	17.4
DOWNLINK PERFORMANCE						
Downlink EIRP per Carrier	dBW	30.8	16.0	38.9	29.0	49.5
Downlink Free Space Loss	dB	205.9	205.9	206.3	206.2	206.3
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Downlink C/N	dB	3.2	15.3	15.6	26.8	12.6
COMPOSITE LINK PERFORMANCE						
C/N Uplink	dB	20.7	12.3	18.1	20.4	17.4
C/N Downlink	dB	3.2	15.3	15.6	26.8	12.6
C/I Uplink	dB	23.8	17.5	21.2	21.2	24.1
C/I Downlink	dB	18.5	14.7	18.0	18.4	17.6
C/I Uplink Adjacent Satellite 1	dB	29.6	22.0	22.6	21.7	21.9
C/I Downlink Adjacent Satellite 1	dB	2.7	15.3	16.1	27.7	13.6
C/I Uplink Adjacent Satellite 2	dB	29.7	22.0	22.6	21.7	21.9
C/I Downlink Adjacent Satellite 2	dB	2.8	15.3	16.1	27.6	13.6
C/(N+I) Composite	dB	-2.0	6.7	9.0	13.0	7.1
Minimum Required C/N	dB	-5.3	5.4	8.2	10.1	3.9
Excess Clear Sky Link Margin	dB	3.4	1.3	0.7	2.9	3.2
CARRIER DENSITY LEVELS						
Uplink Power Density	dBW/Hz	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dBW/Hz	-39.2	-38.1	-26.3	-26.3	-27.0

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case
UPLINK BEAM INFORMATION					
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8
DOWNLINK BEAM INFORMATION					
Downlink Beam Name		ADH4/ADV4	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	12.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dB	53.4	53.4	53.4	53.4
ADJACENT SATELLITE 1					
Eutelsat 174A					
Satellite 1 Orbital Location	deg	174	174	174	174
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0
ADJACENT SATELLITE 2					
Hypothetical 178° E. L.					
Satellite 2 Orbital Location	deg	178	178	178	178
Uplink Power Density	dB(W/Hz)	-50.0	-50.0	-50.0	-50.0
Downlink EIRP Density	dB(W/Hz)	-22.0	-22.0	-22.0	-22.0
CARRIER INFORMATION					
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best
Information Rate	kbps	6000	256	2333	683
Modulation		BPSK	QPSK	QPSK	16APSK
FEC Rate		0.60	0.50	0.35	0.50
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3
Minimum C/N, Clear Sky	dB	-0.4	2.5	0.5	7.3
UPLINK EARTH STATION					
Earth Station Diameter	meters	4.5	0.5	4.5	0.5
Earth Station Gain	dB	54.6	35.5	54.6	35.5
Earth Station Latitude	deg	40.0	25.0	10.0	43.5
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0
Earth Station Elevation Angle	deg	11.1	15.0	30.8	29.9
DOWNLINK EARTH STATION					
Earth Station Diameter	meters	0.5	4.5	0.5	4.5
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Earth Station Latitude	deg	43.5	10	43.5	10
Earth Station Longitude	deg	143	125	143	125
Earth Station Elevation Angle	deg	29.9	30.8	29.9	30.8
UPLINK PERFORMANCE					
Uplink Earth Station EIRP	dBW	70.7	39.1	58.4	40.6
Uplink Free Space Loss	dB	207.6	207.5	207.2	207.2
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Uplink C/N	dB	20.7	4.3	18.1	13.4
DOWNLINK PERFORMANCE					
Downlink EIRP per Carrier	dBW	43.6	24.1	38.9	29.0
Downlink Free Space Loss	dB	206.3	206.2	206.3	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Downlink C/N	dB	7.3	23.1	7.3	26.8
COMPOSITE LINK PERFORMANCE					
C/N Uplink	dB	20.7	4.3	18.1	13.4
C/N Downlink	dB	7.3	23.1	7.3	26.8
C/I Uplink	dB	23.8	17.5	21.2	21.2
C/I Downlink	dB	18.5	14.7	18.0	18.4
C/I Uplink Adjacent Satellite 1	dB	29.6	14.0	22.6	14.7
C/I Downlink Adjacent Satellite 1	dB	7.7	24.0	7.8	27.7
C/I Uplink Adjacent Satellite 2	dB	29.7	14.0	22.6	14.7
C/I Downlink Adjacent Satellite 2	dB	7.7	23.9	7.8	27.6
C/(N+I) Composite	dB	2.6	2.9	2.5	8.5
Minimum Required C/N	dB	-0.4	2.5	0.5	7.3
Excess Clear Sky Link Margin	dB	2.9	0.4	2.0	1.2
CARRIER DENSITY LEVELS					
Uplink Power Density	dBW/Hz	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dBW/Hz	-26.4	-30.0	-26.3	-26.3

Hypothetical 176° E.L. Satellite – Interferers RF/EIRP Densities Match Signal of Interest

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case	TV Carrier
UPLINK BEAM INFORMATION						
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8	3.8
DOWNLINK BEAM INFORMATION						
Downlink Beam Name		EDH3/EDV3	NDH3/NDV3	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	11.7	11.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	40.6	45.3	53.4	53.4	53.4
ADJACENT SATELLITE 1 Eutelsat 174A						
Satellite 1 Orbital Location	deg	174	174	174	174	174
Uplink Power Density	dB(W/Hz)	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dB(W/Hz)	-39.2	-38.1	-26.3	-26.3	-27.0
ADJACENT SATELLITE 2 Hypothetical 178° E.L.						
Satellite 2 Orbital Location	deg	178	178	178	178	178
Uplink Power Density	dB(W/Hz)	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dB(W/Hz)	-39.2	-38.1	-26.3	-26.3	-27.0
CARRIER INFORMATION						
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best	DigTV
Information Rate	kbps	5500	498	9000	972	76500
Modulation		QPSK	8APSK	16APSK	16APSK	8APSK
FEC Rate		0.28	0.65	0.68	0.71	0.57
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3	45000.0
Minimum C/N, Clear Sky	dB	-0.8	7.0	9.9	10.4	6.0
UPLINK EARTH STATION						
Earth Station Diameter	meters	4.5	1.2	4.5	1.2	4.5
Earth Station Gain	dBi	54.6	43.1	54.6	43.1	54.6
Earth Station Latitude	deg	40.0	25.0	10.0	43.5	10.0
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0	125.0
Earth Station Elevation Angle	deg	11.1	15.0	30.8	29.9	30.8
DOWNLINK EARTH STATION						
Earth Station Diameter	meters	1.2	4.5	1.2	4.5	0.9
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Earth Station Latitude	deg	25	40	43.5	10	43.5
Earth Station Longitude	deg	-120	-120	143	125	143
Earth Station Elevation Angle	deg	15.0	11.1	29.9	30.8	29.9
UPLINK PERFORMANCE						
Uplink Earth Station EIRP	dBW	70.7	47.1	58.4	47.6	69.0
Uplink Free Space Loss	dB	207.6	207.5	207.2	207.2	207.2
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0	3.8
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Uplink C/N	dB	20.7	12.3	18.1	20.4	17.4
DOWNLINK PERFORMANCE						
Downlink EIRP per Carrier	dBW	30.8	16.0	38.9	29.0	49.5
Downlink Free Space Loss	dB	205.9	205.9	206.3	206.2	206.3
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	19.8	30.9	19.8	30.9	17.5
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3	76.5
Downlink C/N	dB	3.2	15.3	15.6	26.8	12.6
COMPOSITE LINK PERFORMANCE						
C/N Uplink	dB	20.7	12.3	18.1	20.4	17.4
C/N Downlink	dB	3.2	15.3	15.6	26.8	12.6
C/I Uplink	dB	23.8	17.5	21.2	21.2	24.1
C/I Downlink	dB	18.5	14.7	18.0	18.4	17.6
C/I Uplink Adjacent Satellite 1	dB	33.5	22.1	34.0	22.6	34.0
C/I Downlink Adjacent Satellite 1	dB	19.9	31.4	20.4	32.0	18.6
C/I Uplink Adjacent Satellite 2	dB	33.5	22.1	34.0	22.6	34.0
C/I Downlink Adjacent Satellite 2	dB	20.0	31.4	20.4	31.9	18.6
C/(N+I) Composite	dB	2.8	8.1	10.7	13.4	9.1
Minimum Required C/N	dB	-0.8	7.0	9.9	10.4	6.0
Excess Clear Sky Link Margin	dB	3.6	1.1	0.8	3.0	3.1
CARRIER DENSITY LEVELS						
Uplink Power Density	dBW/Hz	-53.8	-50.1	-61.4	-50.8	-62.1
Downlink EIRP Density	dBW/Hz	-39.2	-38.1	-26.3	-26.3	-27.0

	Units	FWD Worst Case	RTN Worst Case	FWD Best Case	RTN Best Case
UPLINK BEAM INFORMATION					
Uplink Beam Name		NUH2/NUV2	EUH2/EUV2	AUH2/AUV2	AUH2/AUV2
Uplink Frequency	GHz	14.1	14.1	14.1	14.1
Uplink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Uplink Satellite G/T toward Earth Station	dB/K	-0.7	-1.5	3.8	4.8
DOWNLINK BEAM INFORMATION					
Downlink Beam Name		ADH4/ADV4	ADH4/ADV4	ADH4/ADV4	ADH4/ADV4
Downlink Frequency	GHz	12.7	12.7	12.7	12.7
Downlink Beam Polarization		LINEAR	LINEAR	LINEAR	LINEAR
Downlink Satellite EIRP toward Earth Station	dBi	53.4	53.4	53.4	53.4
ADJACENT SATELLITE 1					
Eutelsat 174A					
Satellite 1 Orbital Location	deg	174	174	174	174
Uplink Power Density	dB(W/Hz)	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dB(W/Hz)	-26.4	-30.0	-26.3	-26.3
ADJACENT SATELLITE 2					
Hypothetical 178° E.L.					
Satellite 2 Orbital Location	deg	178	178	178	178
Uplink Power Density	dB(W/Hz)	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dB(W/Hz)	-26.4	-30.0	-26.3	-26.3
CARRIER INFORMATION					
Carrier ID		FWD Data Worst	RTN Data Worst	FWD Data Best	RTN Data Best
Information Rate	kbps	8000	256	3333	683
Modulation		QPSK	8APSK	QPSK	8PSK
FEC Rate		0.40	0.33	0.50	0.67
Noise Bandwidth	kHz	10000.0	256.00	3333.3	341.3
Minimum C/N, Clear Sky	dB	1.2	2.5	2.5	7.3
UPLINK EARTH STATION					
Earth Station Diameter	meters	4.5	0.5	4.5	0.5
Earth Station Gain	dBi	54.6	35.5	54.6	35.5
Earth Station Latitude	deg	40.0	25.0	10.0	43.5
Earth Station Longitude	deg	-120.0	-120.0	125.0	143.0
Earth Station Elevation Angle	deg	11.1	15.0	30.8	29.9
DOWNLINK EARTH STATION					
Earth Station Diameter	meters	0.5	4.5	0.5	4.5
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Earth Station Latitude	deg	43.5	10	43.5	10
Earth Station Longitude	deg	143	125	143	125
Earth Station Elevation Angle	deg	29.9	30.8	29.9	30.8
UPLINK PERFORMANCE					
Uplink Earth Station EIRP	dBW	70.7	39.1	58.4	40.6
Uplink Free Space Loss	dB	207.6	207.5	207.2	207.2
Uplink Atmospheric Attenuation	dB	0.3	0.3	0.3	0.3
Satellite G/T	dB/K	-0.7	-1.5	3.8	7.0
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Uplink C/N	dB	20.7	4.3	18.1	13.4
DOWNLINK PERFORMANCE					
Downlink EIRP per Carrier	dBW	43.6	24.1	38.9	29.0
Downlink Free Space Loss	dB	206.3	206.2	206.3	206.2
Downlink Atmospheric Attenuation	dB	0.2	0.2	0.2	0.2
Earth Station G/T	dB/K	11.5	30.9	11.5	30.9
Carrier Noise Bandwidth	dB-Hz	70.0	54.1	65.2	55.3
Downlink C/N	dB	7.3	23.1	7.3	26.8
COMPOSITE LINK PERFORMANCE					
C/N Uplink	dB	20.7	4.3	18.1	13.4
C/N Downlink	dB	7.3	23.1	7.3	26.8
C/I Uplink	dB	23.8	17.5	21.2	21.2
C/I Downlink	dB	18.5	14.7	18.0	18.4
C/I Uplink Adjacent Satellite 1	dB	33.5	14.5	34.0	15.0
C/I Downlink Adjacent Satellite 1	dB	12.1	32.0	12.1	32.0
C/I Uplink Adjacent Satellite 2	dB	33.5	14.5	34.0	14.9
C/I Downlink Adjacent Satellite 2	dB	12.1	31.9	12.1	31.9
C/(N+I) Composite	dB	4.7	3.0	4.6	8.7
Minimum Required C/N	dB	1.2	2.5	2.5	7.3
Excess Clear Sky Link Margin	dB	3.5	0.5	2.1	1.4
CARRIER DENSITY LEVELS					
Uplink Power Density	dBW/Hz	-53.8	-50.5	-61.4	-50.2
Downlink EIRP Density	dBW/Hz	-26.4	-30.0	-26.3	-26.3

Exhibit 4: Service Areas

This document illustrates the service areas for the uplink and downlink beams in the accompanying Schedule S.

The C-band uplink service area includes the majority of the Pacific Ocean Region (POR) and is illustrated in Figure 1. This diagram reflects the -10dB contour of the antenna pattern. However, the majority of the Pacific Ocean Region is within the -20dB contour. Figure 1 reflects the service area for uplink beams CUH and CUV. This coverage map also reflects the service area for downlink beams CDH and CDV.



Figure 1 C-band POR Coverage from 174°E.L.

The North-East Asia uplink service area includes Japan, the Korean Peninsula, Philippines and East China and is illustrated in Figure 2. It reflects the service area for uplink beams AUH2 and AUV2. This coverage map also reflects the service area for downlink beams ADH4 and ADV4.

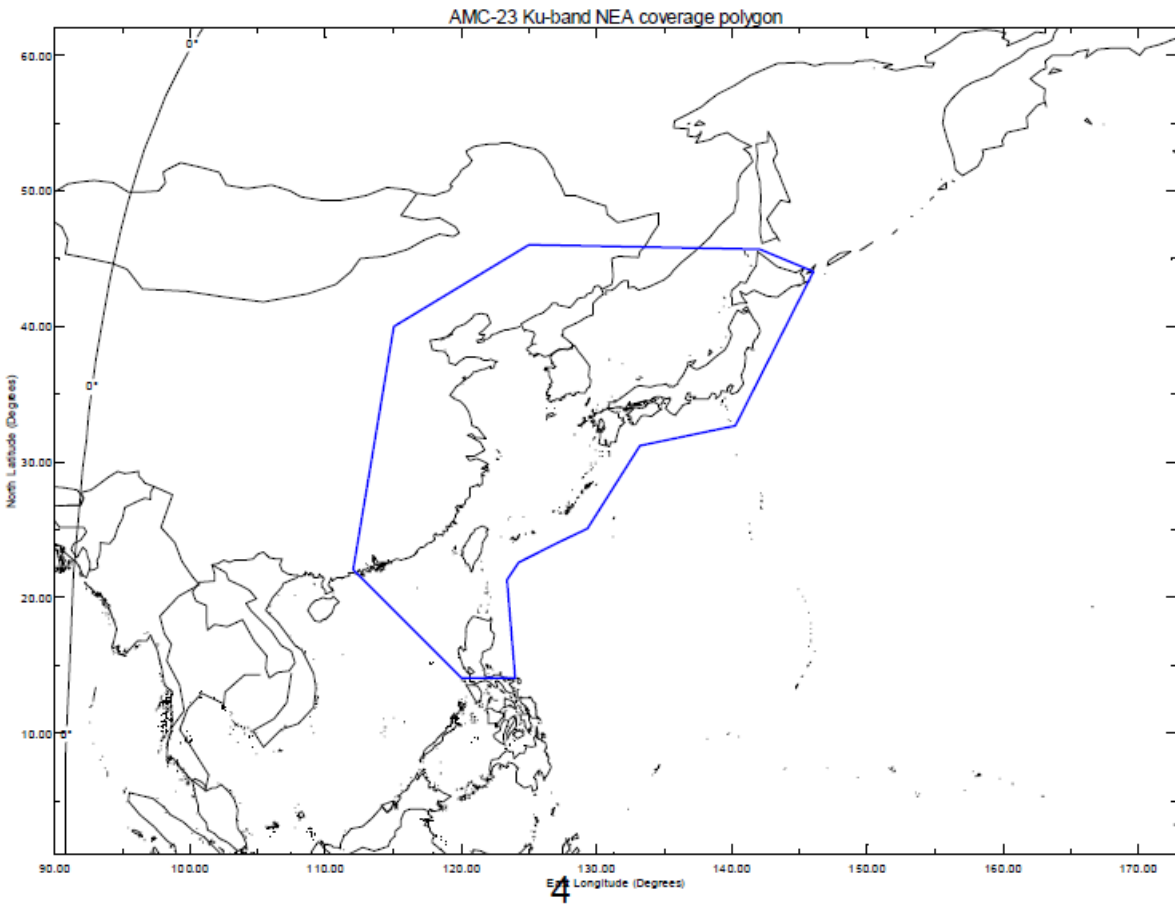


Figure 2 Ku-band North-East Asia Coverage from 174°E.L.

The North Pacific uplink service area includes the northern part of the Pacific Ocean Region (POR) with coverage of eastern part of Asia and western part of North America and is illustrated in Figure 3. It reflects the service area for uplink beams NUH2 and NUV2. This coverage map also reflects the service area for downlink beams NDH1, NDH3, NDV1, and NDV3.

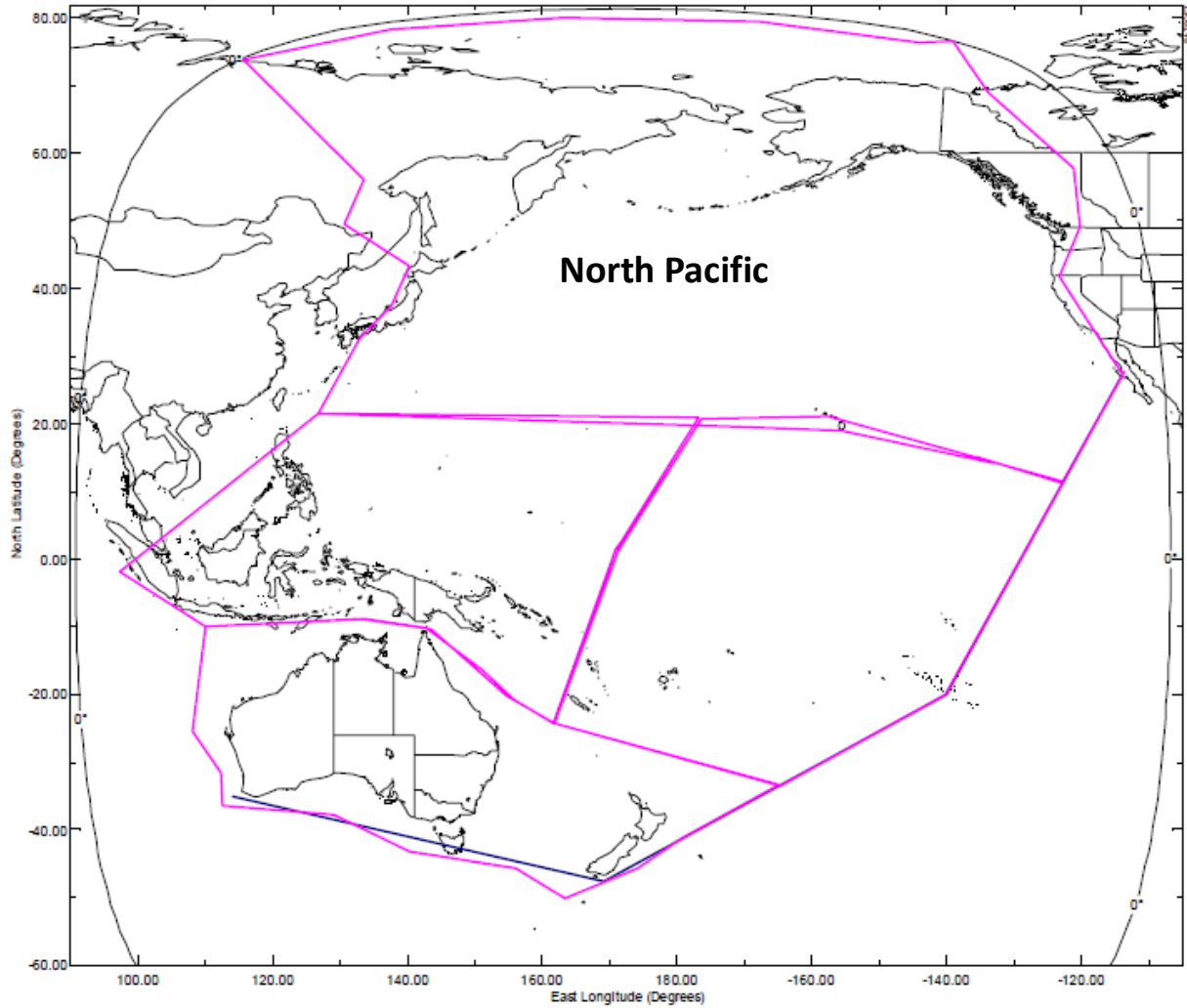


Figure 3 Ku-band North Pacific Coverage from 174°E.L.

The South-East Pacific uplink service area includes the south-eastern part of the Pacific Ocean Region (POR) with coverage of Hawaii, French Polynesia and the Cook Islands and is illustrated in Figure 4. It reflects the service area for uplink beams EUH2 and EUV2. This coverage map also reflects the service area for downlink beams EDH3 and EDV3.

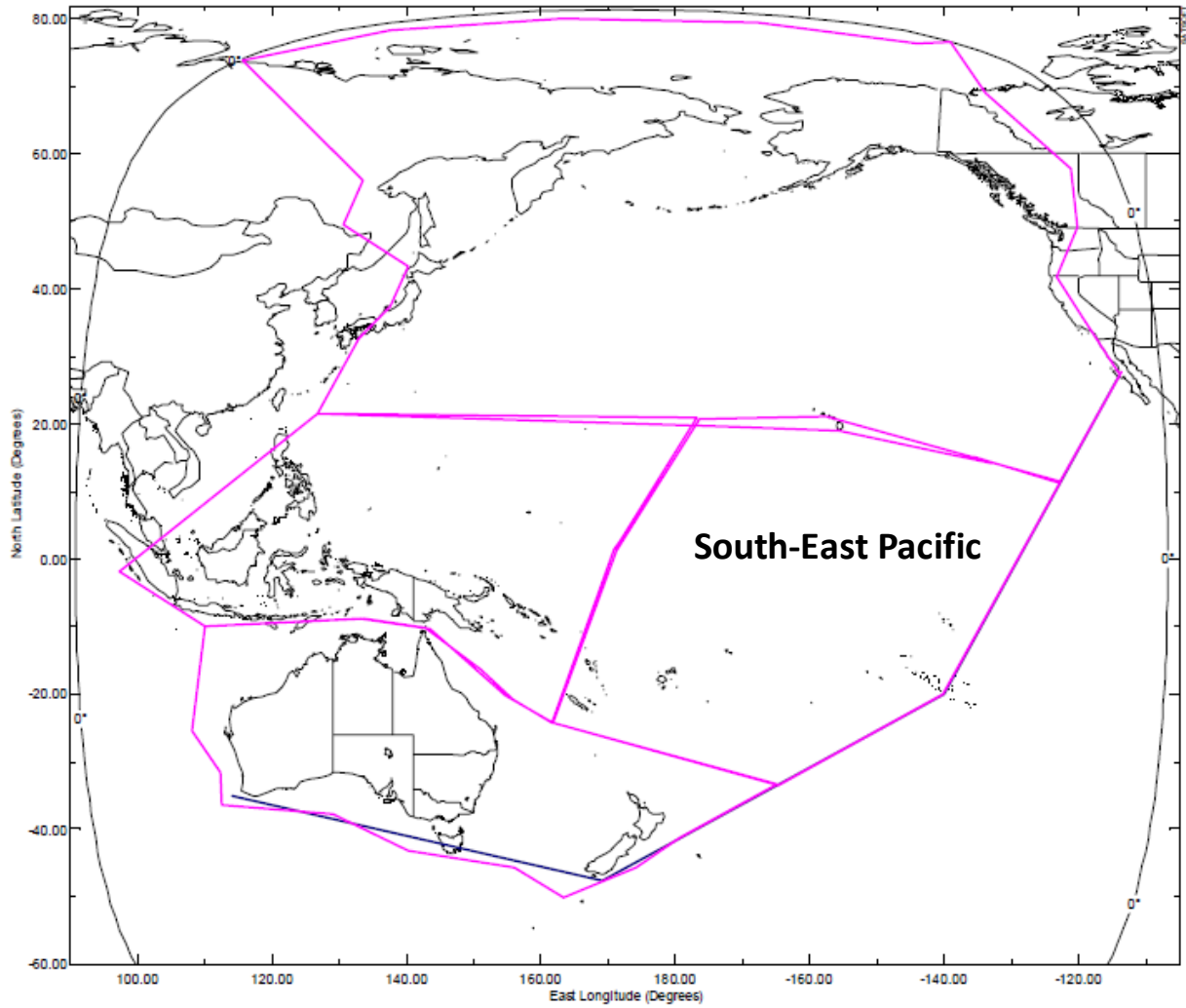


Figure 4 Ku-band South-East Pacific Coverage from 174°E.L.

The South Pacific uplink service area includes the southern part of the Pacific Ocean Region (POR) with coverage of Australia and New Zealand and is illustrated in Figure 5. It reflects the service area for uplink beams SUH2 and SUV2. This coverage map also reflects the service area for downlink beams SDH4 and SDV4.

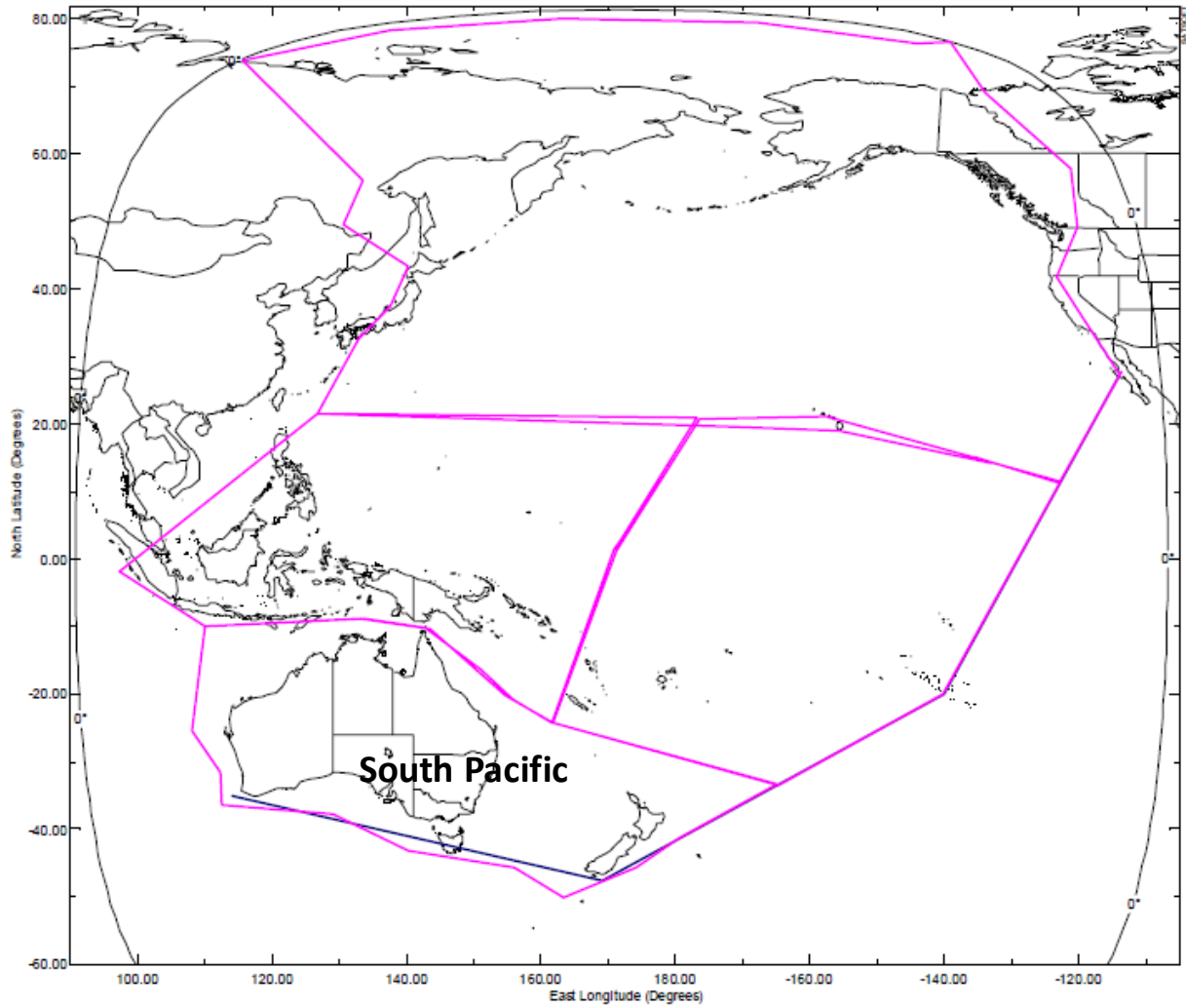


Figure 5 Ku-band South Pacific Coverage from 174°E.L.

The South-West Pacific uplink service area includes the south-western part of the Pacific Ocean Region (POR) with coverage of South-East Asia, Malaysia, Philippines and Indonesia and is illustrated in Figure 6. It reflects the service area for uplink beams WUH2 and WUV2. This coverage map also reflects the service area for downlink beams WDH3 and WDV3.

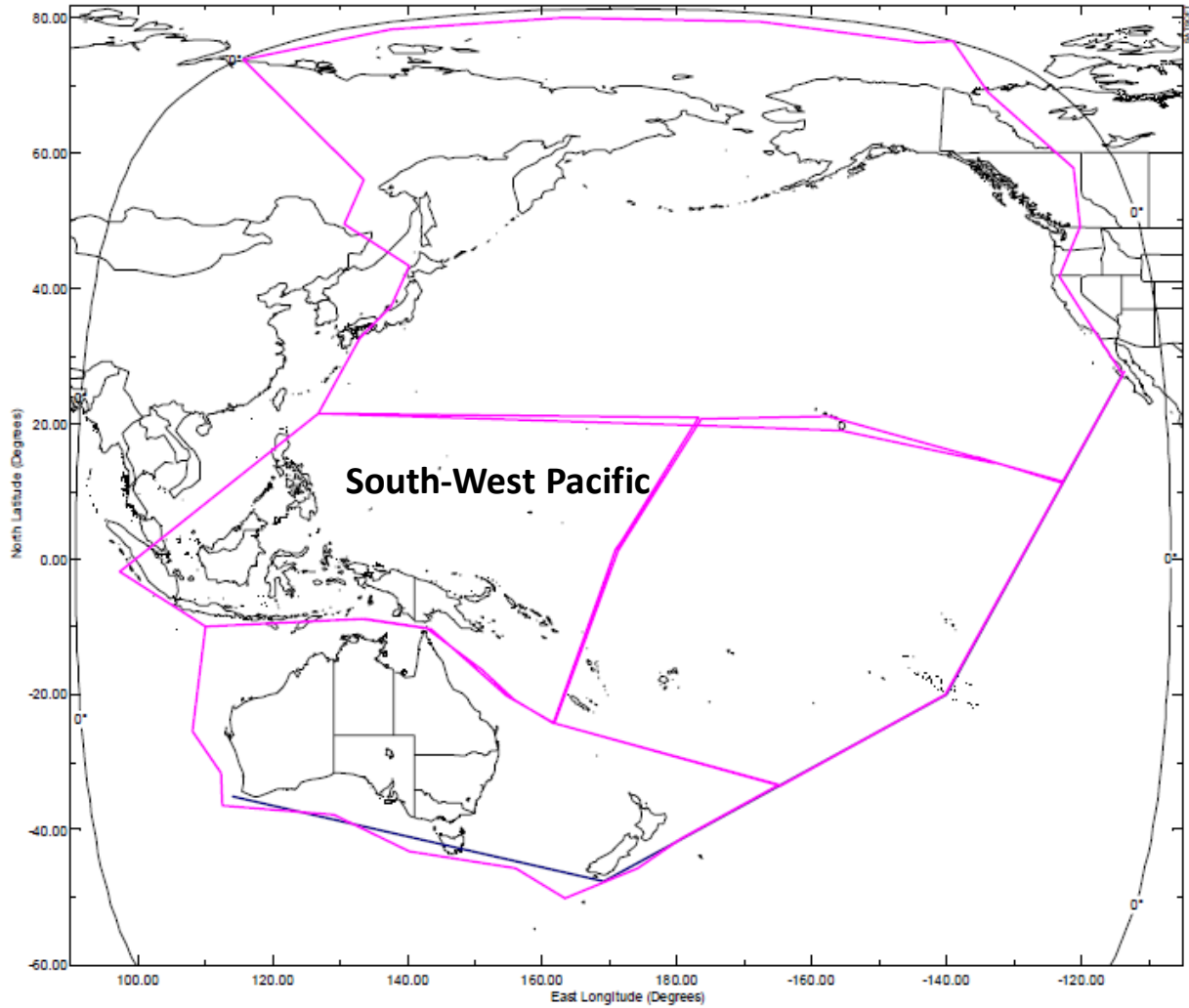



Figure 6 Ku-band South-West Pacific Coverage from 174°E.L.



EUTELSAT 174A Space Debris Mitigation Plan
(prepared for the Federal Communications Commission)

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<i>Prepared by:</i>	<i>Position</i>	<i>Signature</i>	<i>Date</i>
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1. Introduction

This document describes the space debris mitigation plan that Eutelsat Communications S.A (“Eutelsat”) shall apply to the EUTELSAT 174A satellite at the 174° East Longitude (E.L.) orbital location. The satellite, formerly named EUTELSAT 172A and licensed by the Federal Communications Commission to operate at 172° E.L., is being replaced by the EUTELSAT 172B satellite at that location and is available for relocation to 174° E.L.

Eutelsat 174A is based on the Thales Alenia Space Spacebus 4000 bus and it was manufactured according to European standards and specifications. The satellite is 3-axis stabilised and uses bi-propellant chemical propulsion for attitude and on-station control.

Eutelsat 174A was launched in 2005 and the end of its operational life is not expected to be before mid-2022.

2. Related documents

2.1. Applicable Documents

1. EUTELSAT Space Debris Mitigation Plan. Issue 2.0. EUT_CTL_SAT_QMS_PLN_00021, 25 April 2017.
2. FCC. Orbital Debris Mitigation Standard Practices. FCC 04-130. June 21, 2004

2.2. Reference Documents

1. European Code of Conduct for Space Debris Mitigation. Issue 1.0. 28 June 2004.
2. IADC Space Debris Mitigation Guidelines. IADC-02-01. Revision 1. September 2007.
3. Space Product Assurance. Safety. ECSS-Q-40A. 19 April 1996.
4. Orbital Debris Mitigation Standard Practices. FCC 04-130. 21 June 2004.
5. NASA Safety Standard. Guidelines and Assessment Procedures for limiting Orbital Debris. NSS 1740.14. Aug 1995.
6. ITU Environment Protection of the Geostationary Orbit. S.1003. 1993.
7. UNCOPUOS. Technical Report on Space Debris. 1999.

3. EUTELSAT 174A Operations

Eutelsat operates the satellite to control and limit the amount of debris released in a planned manner during normal operations, and assesses and limits 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.

Eutelsat has assessed the amount of debris released in a planned manner and no intentional debris will be released during normal operations of the EUTELSAT 174A spacecraft. A safe operational configuration of the satellite system is ensured thanks to the hardware design and operational procedures

Eutelsat minimizes the probability of the satellite becoming a source of debris by collisions with large debris or other operational satellites. Eutelsat assessed and

determined that, with the exception of the temporary colocation with EUTELSAT 172B at 172° E.L., there are no other satellites located at or sufficiently near EUTELSAT 174A's planned orbital location that might result in overlap of satellite orbit control windows.

EUTELSAT 174A will be controlled within its orbit control window (174.0° E.L. +/- 0.1°) by standard routine periodic orbit correction manoeuvres. In case of anticipated violation of the window, correction manoeuvres would be implemented to avoid such violation.

Eutelsat has assessed the probability of accidental explosions during and after completion of mission operations. Thanks to design safety margins, the probability of occurrence of accidental explosion of the EUTELSAT 174A satellite is negligible.

Satellite design is such that high levels of thruster activity and orbit perturbation do not result when foreseeable onboard events occur

4. EUTELSAT 174A End of life disposal

The post-mission disposal activities have been planned as follows:

1. The orbit of the satellite will be raised by 300 km in order to ensure that the spacecraft will not re-enter into the GEO protected region (GEO height +/- 200 km) in the long term. A mass of 13.3 kg of propellant have been allocated and reserved with a confidence level of 99% to carry out the post-mission disposal manoeuvres. The FCC will be informed of any significant change to the above quantity of propellant.

The minimum perigee height to avoid re-entering into the GEO protected region can be computed using the IADC formula applied to this satellite:

$$\Delta H \text{ (km)} = 235 + 1000 \cdot (A/m) \cdot \text{eff} = 276 \text{ km}$$

where the final term is the effective area/mass ratio of the satellite. Therefore, the planned 300 km above GEO height is sufficient to satisfy the 276 km requirement.

Eutelsat will monitor the remaining propellant to ensure that sufficient fuel remains in the tanks to reach the 300 km minimum perigee.

2. The satellite tracking, telemetry and control operations are planned to avoid interference and coordinated with potentially affected satellite networks.
3. As part of the EOL activities, EUTELSAT 174A energy sources will be rendered inactive such that debris generation will not result from the conversion or dissipation of energy sources onboard the satellite. For EUTELSAT 174A, this involves the following:
 - Discharge the batteries during EOL operations and isolate them from the solar arrays to prevent further electrical energy storage.

- Switch off the momentum wheels.
- Deplete and eventually vent the propellant tanks, which allows depressurizing during passivation operations and results in only negligible residuals remaining in the tanks. In addition, the tanks are “leak before burst” designed. Therefore, the risk of break-up is negligible.
- All pyrotechnic systems are fired at initial stage of satellite operations. Those systems do not generate any debris.

5. Notifications

Eutelsat undertakes to provide the relevant bodies as required (UNCOPUOS, FCC, ITU, French ANFR, etc.) with all appropriate notifications as required by law or regulations for Eutelsat satellites including but not limited to those concerning initial entry of service, location, relocations, inclined orbit operations and de-orbiting operations.