



**INTELSAT**

*Envision. Connect. Transform.*

January 6, 2017

Ms. Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street, S.W.  
Washington, D.C. 20554

Re: Erratum to Application for Authority to Launch and Operate Intelsat 37e, a Replacement Satellite with New Frequencies; Call Sign (S2972)  
File No. SAT-LOA-20160915-00089

Dear Ms. Dortch:

Intelsat License LLC (“Intelsat”) herein corrects typographical errors in the Ka-band frequencies in its above referenced Application for Authority to Launch and Operate Intelsat 37e (S2972). The errors are only found in the application narrative and the Engineering Statement; there is no error in the Schedule S.

Specifically, both portions of the application should list the 29.5-30 GHz band. Intelsat inadvertently reflected the band as 29.25-30 GHz and, in one chart, as 29.5-3 GHz. Corrected versions of both documents are attached. Corrections have been made to page 3, 4, 6, and 8 of the narrative and pages 1, 10, and 16 of the Engineering Statement.

Please direct any questions regarding this supplement to the undersigned at (703) 559-6949.

Respectfully submitted,

Cynthia J. Grady  
Regulatory Counsel  
Intelsat Corporation

cc: Stephen Duall  
Kathryn Medley  
Jay Whaley

Before the  
**Federal Communications Commission**  
Washington, DC 20554

In the Matter of

Intelsat License LLC

Application for Authority to Launch and Operate Intelsat 37e, a Replacement Satellite With New Frequencies, at 18.0° W.L. (342.0° E.L.)

File No. SAT-LOA-\_\_\_\_\_

**APPLICATION FOR AUTHORITY TO LAUNCH AND OPERATE  
INTELSAT 37e, A REPLACEMENT SATELLITE WITH NEW FREQUENCIES,  
AT 18.0° W.L.**

Intelsat License LLC (“Intelsat”), pursuant to Section 25.114 of the Federal Communications Commission’s (“FCC” or “Commission”) rules,<sup>1</sup> hereby applies to launch and operate a C/Ku/Ka-band replacement satellite with new frequencies, to be known as Intelsat 37e, at the 18.0° W.L. orbital location. Intelsat 37e, one of Intelsat’s EPIC<sup>NG</sup> platform satellites, is scheduled for launch in the third quarter of 2017 and, after traffic transition, will replace the Intelsat 901 satellite (call sign S2405), which is currently operating at 18.0° W.L.<sup>2</sup> Intelsat 37e will operate on a non-common carrier basis.<sup>3</sup>

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<sup>1</sup> 47 C.F.R. § 25.114.

<sup>2</sup> See *INTELSAT LLC, Application to Modify Authorizations to Operate, and to Further Construct, Launch, and Operate C-band and Ku-band Satellites that Form a Global Communications System in Geostationary Orbit; Request for Special Temporary Authority to Conduct In-Orbit Testing of the INTELSAT 902 satellite at 58.5° E.L.; Request for Special Temporary Authority to Relocate the INTELSAT 901 Satellite to 53° W.L.*, Order and Authorization, 16 FCC Rcd 16208 (2001) (“Intelsat 901 Authorization”). During traffic transition, Intelsat 901 and Intelsat 37e will occupy the same station-keeping box. Following traffic transition, and subject to receipt of FCC approval, Intelsat 901 will be redeployed to a different location. Intelsat will file an application to relocate the Intelsat 901 satellite as soon as possible after determining a redeployment plan that best meets customer needs.

As demonstrated below, Intelsat is legally and technically qualified to launch and operate its proposed replacement satellite with new frequencies. Moreover, grant of this application will serve the public interest by ensuring continuity of service to customers in the C- and Ku-bands at the 18.0° W.L. orbital location and by adding new Ka-band capacity at the location. In accordance with the Commission's requirements,<sup>4</sup> this application has been filed electronically as an attachment to FCC Form 312 and Schedule S.

**I. INTELSAT IS QUALIFIED TO HOLD THE AUTHORIZATION REQUESTED HEREIN**

**A. Legal Qualifications**

Intelsat is legally qualified to hold the space station authorization requested in this application. The information provided in the attached Form 312 demonstrates Intelsat's compliance with the Commission's basic legal qualifications. In addition, Intelsat already holds multiple Commission satellite licenses, and its legal qualifications are a matter of record before the Commission.<sup>5</sup>

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<sup>3</sup> Section 310(b) is not applicable to this license because Intelsat 37e, like all other satellites licensed to Intelsat, will operate on a non-common carrier basis. *See Applications of The News Corp. Ltd. and The DIRECTV Group, Inc. (Transferors) and Constellation, LLC, Carlyle PanAmSat I, LLC, Carlyle PanAmSat II, LLC, PEP PAS, LLC and PEOP PAS, LLC (Transferees) for Authority to Transfer Control of PanAmSat Licensee Corp.*, Public Notice, 19 FCC Rcd 15424, 15425 (n.5) (Int'l Bur. 2004).

<sup>4</sup> 47 C.F.R. § 25.114(c).

<sup>5</sup> *See Constellation, LLC, Carlyle PanAmSat I, LLC, Carlyle PanAmSat II, LLC, PEP PAS, LLC, and PEOP PAS, LLC, Transferors and Intelsat Holdings, Ltd., Transferee, Consolidated Application for Authority to Transfer Control of PanAmSat Licensee Corp. and PanAmSat H-2 Licensee Corp.*, Memorandum Opinion and Order, 21 FCC Rcd 7368, 7381 ¶ 23 (rel. June 19, 2006) ("The Commission previously has determined that PanAmSat and Intelsat are qualified to hold licenses.").

## **B. Technical Qualifications**

In the attached Form 312, Schedule S, and Engineering Statement, Intelsat demonstrates that it is technically qualified to hold the authorization requested herein. Specifically, Intelsat provides the information currently required by Section 25.114 of the Commission's rules. In addition, the Engineering Statement provides information demonstrating Intelsat's compliance with the Commission's orbital debris mitigation rules.<sup>6</sup>

## **C. Operational Frequencies**

The following chart shows the frequencies that will be used by the Intelsat 37e satellite at 18.0° W.L. and the frequencies that are currently used by the Intelsat 901 satellite at that location.

	<b>Intelsat 901</b>	<b>Intelsat 37e</b>
3400 - 3625 MHz		✓
3625 - 3700 MHz	✓	✓
3700 - 4200 MHz	✓	✓
5850 - 5925 MHz	✓	✓
5925 - 6425 MHz	✓	✓
6425 - 6650 MHz		✓
10700 -10950 MHz	✓	✓
10950 - 11200 MHz	✓	✓
11200 - 11450 MHz		✓
11450 - 11700 MHz	✓	✓
11700 - 11950 MHz		✓
12500 - 12750 MHz		✓
13000 - 13250 MHz		✓
13750 - 14000 MHz		✓
14000 - 14500 MHz	✓	✓
18300 - 18800 MHz		✓
19700 - 20200 MHz		✓
28350 - 28850 MHz		✓
29500 - 30000 MHz		✓

<sup>6</sup> *Mitigation of Orbital Debris, Second Report and Order, 19 FCC Rcd 11567 (2004).*

All of the existing frequencies licensed on Intelsat 901 are also on Intelsat 37e. In addition, Intelsat 37e contains new frequencies at 3400-3625 MHz, 6425-6650 MHz, 11200-11450 MHz, 11700-11950 MHz, 12500-12750 MHz, 13000-13250 MHz, 13750-14000 MHz, 18300-18800 MHz, 19700-20200 MHz, 28350-28850 MHz, and 29500-30000 MHz that are not on the Intelsat 901 satellite.

#### **D. Waiver Requests**

To the extent necessary, Intelsat requests waiver of the following technical rules: (1) Section 25.210(a)(1), which requires use of orthogonal linear polarization;<sup>7</sup> (2) Section 25.210(a)(3), which requires the ability to switch polarization sense upon ground command;<sup>8</sup> (3) Section 25.210(i)(1), which requires antenna cross-polarization isolation such that the ratio of the on-axis co-polar gain to the on-axis cross-polar gain of the antenna in the assigned frequency band be at least 30 dB within its primary coverage area;<sup>9</sup> and (4) Section 25.140(a), which requires an interference analysis to show compatibility of a proposed fixed-satellite service (“FSS”) system with respect to authorized space stations within two degrees of the proposed orbital location.<sup>10</sup>

Under Section 1.3 of the Commission’s rules, the Commission has authority to waive its rules “for good cause shown.”<sup>11</sup> Good cause exists if “special circumstances warrant a deviation from the general rule and such deviation will serve the public interest” better than adherence to the

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<sup>7</sup> 47 C.F.R. § 25.210(a)(1).

<sup>8</sup> 47 C.F.R. § 25.210(a)(3).

<sup>9</sup> 47 C.F.R. § 25.210(i)(1).

<sup>10</sup> 47 C.F.R. § 25.140(a).

<sup>11</sup> 47 C.F.R. § 1.3; *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969).

general rule.<sup>12</sup> In determining whether waiver is appropriate, the Commission should “take into account considerations of hardship, equity, or more effective implementation of overall policy.”<sup>13</sup>

Good cause exists here for the requested waivers of Sections 25.210(a)(1), 25.210(a)(3), and 25.210(i)(1). Each of these requirements has been eliminated in the 2015 Part 25 Streamlining Order.<sup>14</sup> That order was published in the Federal Register with an effective date of September 19, 2016.<sup>15</sup> Given that the Commission has concluded that these rule provisions no longer serve the public interest, and the rules will no longer be in effect at the time this application is granted, waiver is warranted.

Intelsat also seeks waiver of the requirement in existing Section 25.140(a) to provide a two-degree interference analysis for the Intelsat 37e satellite.<sup>16</sup> Intelsat provides in the Engineering Statement the certifications and interference analyses required under Section 25.140(a)(3) of the Commission’s rules, as modified pursuant to the 2015 Part 25 Streamlining Order.<sup>17</sup> The 2015 Part 25 Streamlining Order states that the new rules will be applied to pending applications.<sup>18</sup> Moreover, to the extent waiver is required, the same public interest rationales for modification of Section 25.140(a) as part of the 2015 Part 25 Streamlining Order justify a waiver

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<sup>12</sup> *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

<sup>13</sup> *WAIT Radio*, 418 F.2d at 1159.

<sup>14</sup> *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, Second Report and Order, 30 FCC Rcd 14713, 14817 ¶ 333 (2015) (“2015 Part 25 Streamlining Order”).

<sup>15</sup> *International Bureau Announces Effective Date of Rules Adopted in the Part 25 Second Report and Order; Guidance on Filing Submissions Under Two-Part Application Process for GSO FSS Space Station Licenses*, Public Notice, DA 16-1036 (Sept. 13, 2016).

<sup>16</sup> 47 C.F.R. § 25.140(a).

<sup>17</sup> *2015 Part 25 Streamlining Order* at 14755.

<sup>18</sup> *Id.* at 14825.

of the rule in this case to allow Intelsat to provide the certification rather than the interference analysis.<sup>19</sup>

**E. No U.S. Operations In 3400-3600 MHz And 12500-12700 MHz**

Intelsat understands that the 3400-3600 MHz and 12500-12700 MHz bands are not allocated for FSS GSO operations in the United States. The Intelsat 37e satellite will operate in these frequencies at 18.0° W.L. only in beams that cover Regions 1 and 3, where use of these frequencies for FSS is consistent with the frequency allocations. Because Intelsat 37e will not operate in these frequencies in the United States, the frequency restrictions and conditions in the U.S. Table of Frequency Allocations are not applicable to the requested authority.<sup>20</sup>

**F. Milestone and Bond Requirements**

Intelsat 37e will be subject to the milestone and bond posting requirements set forth in Sections 25.164 and 25.165 of the Commission's rules because the 3400-3625 MHz, 6425-6650 MHz, 11200-11450 MHz, 11700-11950 MHz, 12500-12750 MHz, 13000-13250 MHz, 13750-14000 MHz, 18300-18800 MHz, 19700-20200 MHz, 28350-28850 MHz, and 29500-30000 MHz frequencies are included on Intelsat 37e but are not on the Intelsat 901 satellite it is replacing.<sup>21</sup> Intelsat will comply with the milestone and bond requirements in effect at time of grant.<sup>22</sup>

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<sup>19</sup> *Id.* at 14754-55. *See also* Application to Launch and Operate Intelsat 33e, a Replacement Satellite With New Frequencies, File No. SAT-LOA-20150327-00016, Stamp Grant, ¶ 6 (Feb. 25, 2016) (waiving Section 25.210(i)(1)'s cross-polarization requirement based on modified Part 25 rules adopted in the 2015 Part 25 Streamlining Order).

<sup>20</sup> To the extent necessary, Intelsat seeks waiver of the U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106, for the bands 3400-3600 MHz and 12500-12700 MHz.

<sup>21</sup> 47 C.F.R. §§ 25.164 and 25.165.

<sup>22</sup> The Commission's 2015 Part 25 Streamlining Order revises Sections 25.164 and 25.165 to eliminate several milestones and replace the existing bond requirements with an escalating bond framework. *See 2015 Part 25 Streamlining Order* at 14849-14851.

## II. GRANT OF THIS APPLICATION WILL SERVE THE PUBLIC INTEREST

The Commission recognizes a “replacement expectancy” in orbital locations in order to protect the large investments made by satellite operators. The agency has stated,

[G]iven the huge costs of building and operating satellite space stations, there should be some assurance that operators will be able to continue to serve their customers. The Commission has therefore stated that, when the orbit location remains available for a U.S. satellite with the technical characteristics of the proposed replacement satellite, it will generally authorize the replacement satellite at the same location.<sup>23</sup>

In this case, Intelsat holds a replacement expectancy for the 18.0° W.L. orbital location because the Commission authorized Intelsat to operate Intelsat 901 at that location.<sup>24</sup>

In addition, grant of this application will serve the public interest by ensuring continuity of service to consumers from the 18.0° W.L. orbital location. Intelsat stands ready to deploy a replacement satellite to the 18.0° W.L. orbital location before Intelsat 901 reaches the end of its useful life or is relocated, and has made concrete steps toward constructing Intelsat 37e. The Commission has stated that granting replacement applications ensures that service will be provided to consumers as efficiently as possible because the current licensee will be familiar with the service requirements and, given its experience, should be able to deploy a replacement satellite in the shortest possible time.<sup>25</sup>

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<sup>23</sup> *Columbia Communications Corporation Authorization to Launch and Operate a Geostationary C-band Replacement Satellite in the Fixed-Satellite Service at 37.5° W.L.*, Memorandum Opinion and Order, 16 FCC Rcd 20176, ¶ 7 (2001) (citing *Assignment of Orbital Locations to Space Stations in Domestic Fixed-Satellite Service*, Memorandum Opinion and Order, 3 FCC Rcd 6972, n.31 (1988) and *GE American Communications, Inc.*, Order and Authorization, 10 FCC Rcd 13775, ¶ 6 (Int’l Bur. 1995)).

<sup>24</sup> See Intelsat 901 Authorization, *supra* n.2.

<sup>25</sup> See *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, 18 FCC Rcd 1962, ¶ 83 (2003) (“Repairing or even replacing a malfunctioning satellite, for all its complexity, requires less time than designing and constructing a new system. Even in the worst case where a satellite is



In addition, the Intelsat 37e satellite will allow Intelsat to expand its service offering in the region, for the benefit of consumers, by adding additional Ku-band capacity, as well as new Ka-band capacity, at the location. The expansion of capacity and additional services available on the Intelsat 37e satellite will serve the public interest.

### **III. INTELSAT ACCEPTS SECTION 316 PETITION CONDITIONS**

Intelsat understands and accepts that its license to operate Intelsat 37e at 18.0° W.L., with the exception of the 3400-3625 MHz, 6425-6650 MHz, 10700-10950 MHz, 11700-11950 MHz, 12500-12750 MHz, 13000-13250 MHz, 13750-14000 MHz, 18300-18800 MHz, 19700-20200 MHz, 28350-28850 MHz, and 29500-30000 MHz frequencies, will be conditioned as follows:

- (a) Intelsat shall remain a signatory to the Public Services Agreement between Intelsat and the International Telecommunications Satellite Organization (“ITSO”) that was approved by the ITSO Twenty-fifth Assembly of Parties, as amended.
- (b) No entity shall be considered a successor-in-interest to Intelsat under the ITSO Agreement for licensing purposes unless it has undertaken to perform the obligations of the Public Services Agreement approved by the Twenty-fifth Assembly of Parties, as amended.<sup>26</sup>

### **IV. ITU COST RECOVERY**

Intelsat is aware that processing fees are currently charged by the ITU for satellite filings, and that Commission applicants are responsible for any and all fees charged by the ITU.<sup>27</sup> Intelsat is aware of and unconditionally accepts this requirement and responsibility to pay any ITU cost recovery fees associated with the ITU filings that the Commission makes on behalf of Intelsat for

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destroyed, a licensee can ordinarily replace a lost satellite with a ground spare at the next available launch window, or procure a technically identical satellite in an expedient manner since it would have already completed the complex design process.”).

<sup>26</sup> See *Petition of the Int’l. Telecomms. Satellite Org. under Section 316 of the Commc’ns Act*, as amended, IB 06-137, File No. SAT-MS-20060710-00076, Order of Modification, 23 FCC Rcd 2764, 2769-71 ¶¶ 11-13 (Int’l Bur. 2008).

<sup>27</sup> See *Implementation of ITU Cost Recovery Charges for Satellite Network Filings*, Public Notice, DA 01-2435 (Oct. 19, 2001).

the satellite proposed in this Application, as well as any ITU filings associated with any satellite system for which Intelsat may request authorization at a later date.

**V. USE OF THE 3625-3650 MHz, 3650-3700 MHz, 5850-5925 MHz, 10950-11200 MHz, 11450-11700 MHz, 13000-13250 MHz, AND 13750-14000 MHz FREQUENCY BANDS**

Intelsat understands that operations in the 3625-3650 MHz, 5850-5925 MHz, 10950-11200 MHz, 11450-11700 MHz, 13000-13250 MHz, and 13750-14000 MHz frequency bands are subject to certain limitations and obligations, which Intelsat accepts and will fulfill.<sup>28</sup> Specifically, for operations in the 3625-3650 MHz frequency band, Intelsat accepts the following condition:

- Intelsat's use of the 3625-3650 MHz (space-to-Earth) band is subject to US245 of the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, US245, which states that the 3600-3650 MHz use of the non-Federal fixed-satellite service is limited to international inter-continental systems and is subject to case-by-case electromagnetic compatibility analysis.

For operations in the 3650-3700 MHz frequency band, Intelsat accepts the following condition:

- Intelsat's use of the 3650-3700 MHz (space-to-Earth) band is subject to NG185 of the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, NG185, which states that the 3650-3700 MHz use of the non-Federal fixed-satellite service is limited to international inter-continental systems.

For operations in the 5850-5925 MHz frequency band, Intelsat accepts the following condition:

- Intelsat's use of the 5850-5925 MHz band (Earth-to-space) is subject to footnote US245 of the United States Table of Frequency Allocations, 47 C.F.R. §2.106, US245, which states that the 5850-5925 MHz use of the non-Federal fixed-satellite service is limited to international inter-continental systems and is subject to case-by-case electromagnetic compatibility analysis. Intelsat shall not claim protection from radiolocation transmitting stations operating in accordance with footnote G2.

For operations in the 10950-11200 MHz frequency band, Intelsat accepts the following conditions:

- Operations in the 10950-11200 MHz frequency band shall comply with the terms of footnote US211 to the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, US211, which urges applicants for airborne or space station assignments to

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<sup>28</sup> Intelsat is also aware that frequencies in the 28.6-28.85 GHz band are secondary for GSO FSS. 47 C.F.R. § 25.202(a)(1).

take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference.

- Operations in the 10950-11200 MHz frequency band are limited to international operations in accordance with footnote NG52 to the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, NG52.

For operations in the 11450-11700 MHz frequency band, Intelsat accepts the following condition:

- Intelsat's use of the 11450-11700 MHz band (space-to-Earth) is subject to footnote US211 to the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, US211, which urges applicants for airborne or space station assignments to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference, consistent with footnote US74.
- Operations in the 11450-11700 MHz frequency band are limited to international operations in accordance with footnote NG52 to the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, NG52.

For operations in the 13000-13250 MHz band,<sup>29</sup> Intelsat accepts the following condition:

- Operations in the 13000-13250 MHz band (Earth-to-space) are limited to international operations in accordance with footnote NG52 to the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, NG52.

For operations in the 13750-14000 MHz band, Intelsat accepts the following conditions:

- In the 13750-14000 MHz band (Earth-to-space), receiving space stations in the fixed-satellite service shall not claim protection from radiolocation transmitting stations operating in accordance with the United States Table of Frequency Allocations.
- Pursuant to footnote US337 of the United States Table of Frequency Allocations, 47 C.F.R. § 2.106, any earth station in the United States and its possessions communicating with the Intelsat 37e space station in the 13750-13800 MHz band (Earth-to-space) is required to coordinate through National Telecommunications and Information Administration's ("NTIA") Interdepartment Radio Advisory Committee's ("IRAC") Frequency Assignment Subcommittee ("FAS") to minimize interference to the National Aeronautics and Space Administration Tracking and Data Relay Satellite System, including manned space flight.

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<sup>29</sup> Intelsat is aware that footnote US251 applies to this frequency band. At 18.0° W.L., however, Intelsat 37e cannot see Goldstone, California.

- Operations of any earth station in the United States and its possessions communicating with the Intelsat 37e space station in the 13750-14000 MHz band (Earth-to-space) shall comply with footnote US356 of United States Table of Frequency Allocations, 47 C.F.R. § 2.106, US356, which specifies a mandatory minimum antenna diameter of 4.5 meters and a non-mandatory minimum and maximum equivalent isotropically radiated powers (“e.i.r.p.”). Operations of any earth station located outside the United States and its possessions communicating with the Intelsat 37e space station in the 13750-14000 MHz band (Earth-to-space) shall be consistent with footnote 5.502 to the ITU Radio Regulations, which allows a minimum antenna diameter of 1.2 meters for earth stations of a geostationary satellite orbit network and specifies mandatory power limits.
- Operators of earth stations accessing the Intelsat 37e space station in the 13750-14000 MHz band are encouraged to cooperate voluntarily with the National Aeronautics and Space Administration (“NASA”) in order to facilitate continued operation of NASA's Tropical Rainfall Measuring Mission (“TRMM”) satellite.

## VI. CONCLUSION

Based on the foregoing, Intelsat respectfully requests that the Commission grant this replacement satellite application.

Respectfully submitted,

*/s/ Susan H. Crandall*

Susan H. Crandall  
Associate General Counsel  
Intelsat Corporation

Jennifer D. Hindin  
Colleen King  
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1776 K Street, N.W.  
Washington, DC 20006

September 15, 2016

**Exhibit A**  
**FCC Form 312, Response to Question 34: Foreign Ownership**

The Commission previously approved foreign ownership in Intelsat License LLC (“Intelsat”), in the *Intelsat-Serafina Order*.<sup>1</sup> In December 2009 and October 2011, the Commission also approved *pro forma* changes in Intelsat’s foreign ownership.<sup>2</sup> There have been no other material changes to Intelsat’s foreign ownership since the date of the *Intelsat-Serafina Order*.

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<sup>1</sup> *Intelsat Holdings, Ltd. and Serafina Holdings Limited, Consolidated Application for Consent to Transfer of Control of Holders of Title II and Title III Authorizations*, Memorandum Opinion and Order, 22 FCC Rcd 22,151 (2007).

<sup>2</sup> See *Intelsat North America LLC, Intelsat LLC, PanAmSat Licensee Corp., PanAmSat H-2 Licensee Corp., and Intelsat New Dawn Company, Ltd., Applications for Pro Forma Transfer of Control*, File Nos. SAT-T/C-20091125-00128, SAT-T/C-20091125-00124, SAT-T/C-20091125-00127, SAT-T/C-20091125-00125, SAT-T/C-20091125-00126, SES-T/C-20091125-01505, SES-T/C-20091125-01502, SES-T/C-20091125-01506, SES-T/C-20091125-01504 and SES-T/C-20091125-01503 (granted Dec. 3, 2009); *Intelsat Application for Pro Forma Transfer of Control*, File Nos. SAT-T/C-20110810-00160, SAT-T/C-20110811-00161, SES-T/C-20110811-00948, SES-T/C-20110812-00963 (granted Oct. 13, 2011), and 0004825139 (granted Oct. 19, 2011).

**Exhibit B**  
**FCC Form 312, Response to Question 36: Cancelled Authorizations**

Intelsat License LLC (“Intelsat”) has never had an FCC license “revoked.” However, on June 26, 2000, the International Bureau “cancelled” two Ka-band satellite authorizations issued to a former Intelsat entity, PanAmSat Licensee Corp. (“PanAmSat”),<sup>3</sup> based on the Bureau’s finding that PanAmSat had not satisfied applicable construction milestones.<sup>4</sup> In that same order, the Bureau denied related applications to modify the cancelled authorizations. PanAmSat filed an application for review of the Bureau’s decision, which the Commission denied, and subsequently filed an appeal with the United States Court of Appeals for the District of Columbia Circuit, which was dismissed in January 2003 at PanAmSat’s request. Notwithstanding the fact that the Bureau’s action does not seem to be the kind of revocation action contemplated by question 36, Intelsat is herein making note of the decision in the interest of absolute candor and out of an abundance of caution. In any event, the Bureau’s action with respect to PanAmSat does not reflect on Intelsat’s basic qualifications, which are well-established and a matter of public record.

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<sup>3</sup> All licenses previously held by PanAmSat Licensee Corp. have been assigned to Intelsat License LLC. See IBFS File Nos. SAT-ASG-20101203-00252 (granted Dec. 23, 2010), SES-ASG-20101203-0150 (granted Dec. 20, 2010), and SES-ASG-20101206-01502 (granted Dec. 20, 2010).

<sup>4</sup> See *PanAmSat Licensee Corp.*, Memorandum Opinion and Order, 15 FCC Rcd 18720 (IB 2000).

**Exhibit C**  
**FCC Form 312, Response to Question 40:**  
**Officers, Directors, and Ten Percent or Greater Shareholders**

The officers and directors/managers of Intelsat License LLC are as follows:

Officers:

Jacques Kerrest, Chairman  
Franz Russ, Deputy Chairman  
Michelle Bryan, Secretary  
Mirjana Hervy, Director, Finance

Board of Managers:

Jacques Kerrest  
Franz Russ  
Michelle Bryan

The business address of all Intelsat License LLC officers and members of the Board of Managers is:  
4 rue Albert Borschette  
L-1246 Luxembourg

Intelsat License LLC is a Delaware limited liability company that is wholly owned by Intelsat License Holdings LLC, also a Delaware limited liability company. Intelsat License Holdings LLC is wholly owned by Intelsat Jackson Holdings S.A., a Luxembourg company. Intelsat Jackson Holdings S.A. is wholly owned by Intelsat (Luxembourg) S.A., a Luxembourg company. Intelsat (Luxembourg) S.A. is wholly owned by Intelsat Investments S.A., a Luxembourg company. Intelsat Investments S.A. is wholly owned by Intelsat Holdings S.A., a Luxembourg company. Intelsat Holdings S.A. is wholly owned by Intelsat Investment Holdings S.à r.l., a Luxembourg company. Intelsat Investment Holdings S.à r.l. is wholly owned by Intelsat S.A., a Luxembourg company. Each of these entities may be contacted at the following address: 4 rue Albert Borschette, L-1246 Luxembourg.

Intelsat S.A.'s ownership was approved by the Commission as part of the *Intelsat-Serafina Order* and the recent Intelsat Pro Forma and is incorporated by reference. See *Intelsat Holdings, Ltd. and Serafina Holdings Limited, Consolidated Application for Consent to Transfer of Control of Holders of Title II and Title III Authorizations*, Memorandum Opinion and Order, 22 FCC Rcd 22,151 (2007) (“*Intelsat-Serafina Order*”); *Intelsat Application for Pro Forma Transfer of Control*, File Nos. SAT-T/C-20110810-00160, SAT-T/C-20110811-00161, SES-T/C-20110811-00948, SES-T/C-20110812-00963 (granted Oct. 13, 2011), and 0004825139 (granted Oct. 19, 2011) (“*Intelsat Pro Forma*”). On May 16, 2012, the International Bureau granted an application to transfer control of Intelsat pursuant to a public offering of newly issued voting shares by Intelsat, subsequent voting share sales by current shareholders and possible private placements of newly issued voting shares. *In the Matter of Intelsat Global Holdings, S.A., Applications to Transfer Control of Intelsat Licenses and Authorizations from BC Partners Holdings Limited to Public Ownership*, Order, DA 12-768 (rel. May 16, 2012). This change of control has not yet been fully consummated.

# Engineering Statement

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## 1 Introduction

Intelsat License LLC (“Intelsat”) seeks authority in this application to launch and operate a new satellite designated as Intelsat 37e. This spacecraft will operate from 18.0° W.L. and will replace the Intelsat 901 spacecraft currently operating at that location.

The characteristics of the Intelsat 37e spacecraft, as well as its compliance with the various provisions of Part 25 of the Federal Communication Commission’s (“FCC” or “Commission”) rules, are provided in the remainder of this Engineering Statement.

## 2 Spacecraft Overview

Intelsat 37e is a Boeing model 702MP spacecraft that is capable of operating in C-band, Ku-band, and Ka-band frequencies listed in the table below.

C-band:	Uplink:	5850 – 6650 MHz
	Downlink:	3400 – 4200 MHz
Ku-band:	Uplink:	13000 – 13250 MHz
		13750 – 14500 MHz
	Downlink:	10700 – 11700 MHz
		11700 – 11950 MHz
		12500 – 12750 MHz
Ka-band:	Uplink:	28350 – 28850 MHz
		29500 – 30000 MHz
	Downlink:	18300 – 18800 MHz
		19700 – 20200 MHz

The spacecraft provides the following coverage:

C-band:	Wide Beams:	Africa/Europe, Central Africa, and Latin America
	4 Spot Beams:	Europe, North America, South America, Falkland Islands
	Global Beam:	Global Coverage



Ku-band:	55 Spot beams:	Africa, Europe, Middle East, South America, North America, and Asia
	Wide Beam:	Europe, Middle East, and Asia
	Shaped Beam:	Algeria
	Steerable Spot Beam	
Ka-band:	Steerable Spot Beam	

## 2.1 Spacecraft Characteristics

Intelsat 37e is a three-axis stabilized type spacecraft that has a rectangular outer body structure. Intelsat 37e utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

The Intelsat 37e spacecraft is composed of the following subsystems:

- 1) Thermal
- 2) Power
- 3) Attitude Control
- 4) Propulsion
- 5) Telemetry, Command and Ranging (“TC&R”)
- 6) Uplink Power Control (“ULPC”)
- 7) Communications

These subsystems maintain the correct position and attitude of the spacecraft, ensure that all internal units are maintained within the required temperature range, and ensure that the spacecraft can be commanded and controlled with a high level of reliability from launch to the end of its useful life. The spacecraft design incorporates redundancy in each of the various subsystems in order to avoid single point failures.

The structural design of Intelsat 37e provides mechanical support for all subsystems. The structure supports the communication antennas, solar arrays, and thrusters. It also provides a stable platform for preserving the alignment of critical elements of the spacecraft.

A summary of the basic spacecraft characteristics is provided in Exhibit 1.

## 2.2 Communication Subsystem

Intelsat 37e provides active communication channels at C-band, Ku-band, and Ka-band frequencies. Since channel bandwidth in each frequency band can be varied via on-board processing, only the range of frequencies over which each beam can operate and the polarization plan is specified in Schedule S.

Intelsat 37e utilizes a multiple spot-beam architecture in Ku-band in which each spot beam has an identical design, and each Ku-band gateway beam also has an identical design. Therefore, the coverage contours and performance characteristics for only a single representative spot beam and a single representative gateway beam are provided in Schedule S. The latitude and longitude of each Ku-band spot beam's maximum gain point on the Earth and of each Ku-band gateway beam's maximum gain point on the Earth are provided in Exhibits 2 and 3 respectively in conformance with Section 25.114(c)(4)(vii)(B) of the Commission's rules.

The performance characteristics of all Intelsat 37e beams are provided in Schedule S. The coverage contours of all Intelsat 37e beams except for those with their -8.0 dB contour extending beyond the edge of the Earth are provided with Schedule S. Exhibits 4 and 5 provide the beam parameters for the Intelsat 37e uplink and downlink beams, respectively.

Additionally, Intelsat has included the Schedule S beam designation for all beams in Exhibit 7.

Intelsat 37e is equipped with two steerable spot beams, one in Ku-band and one in Ka-band. Gain contours for both beams are provided in Schedule S. Each steerable beam may be pointed toward any location on the earth that is visible from 18.0° W.L., and the coverage contours will remain identical in gain and roll-off regardless of pointing. Intelsat will ensure that transmissions in these beams are consistent with the Commission's rules and the ITU Radio Regulations as they pertain to the Fixed Satellite Service.

The level of cross-polarization isolation of all Intelsat 37e beams is equal to or greater than 22 dB. This level was the best that the satellite manufacturer could achieve without causing excessive degradation in the performance of the beam and/or in the size of the beams' coverage area. Intelsat has taken this level of isolation into account in its planned operations.

Due to the extensive number of C-, Ku-, and Ka-band channel and beam combinations, the uplink channels and downlink channels have been listed separately in the Schedule S S10 "Space Station Transponders" table.<sup>1</sup> Customer requirements will dictate the final interconnections. Some typical configurations will use uplink and downlink channels within one beam using the same band; others will have uplink and downlink channels in separate beams on any band to provide communications links between or within regions.

The Ka-, Ku- and C-band communication subsystems are all inter-connected, allowing any frequency combination for the uplink and downlink connectivity at sub-beam

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<sup>1</sup> Two Ka-band channels are not switchable and their connections are shown in the Transponder Table.

level. Additionally, a beam can have multiple connections to several other beams by splitting the beam into sub-beams with variable sizes.

### **2.3 Telemetry, Command and Ranging Subsystem**

The telemetry, command and ranging (“TC&R”) subsystem provides the following functions:

- 1) Acquisition, processing and transmission of spacecraft telemetry data;
- 2) Reception and retransmission of ground station generated ranging signals; and
- 3) Reception, processing and distribution of telecommands.

Intelsat 37e can be commanded through the use of two command channels that can have center frequencies in the ranges 5850.5 - 5853.0 MHz and 6422.0 - 6424.5 MHz, selectable via ground command in 100 kHz steps. The coverage patterns of the on-station command and telemetry beams as well as the wide-angle 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 FCC’s rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S. The Intelsat 37e command and telemetry subsystem performance is summarized in Exhibit 6.

### **2.4 Uplink Power Control Subsystem**

Intelsat 37e utilizes one C-band, three Ku-band, and one Ka-band carriers for uplink power control (“ULPC”), antenna tracking, and ranging. The coverage patterns of the C-band, Ku-band, and Ka-band beams 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 FCC’s rules, contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S. The Intelsat 37e ULPC subsystem performance is summarized in Exhibit 6.

### **2.5 Satellite Station-Keeping**

The spacecraft will be maintained within  $0.05^\circ$  of its nominal longitudinal position in the east-west direction. Accordingly, it is in compliance with Section 25.210(j) of the Commission’s rules.

The attitude of the spacecraft will be maintained with accuracy consistent with the achievement of the specified communications performance, after taking into account all error sources (i.e., attitude perturbations, thermal distortions, misalignments, orbital tolerances and thruster perturbations, etc.).

### **3 Services and Emission Designators**

Intelsat 37e will be a general purpose communications satellite and has been designed to support various services offered within the Intelsat's satellite system. Depending upon the needs of the users, the transponders on Intelsat 37e can accommodate television, radio, voice, and data communications. Typical communication services include:

- a) Compressed digital video
- b) High speed digital data
- c) Digital single channel per carrier ("SCPC") data channels

Emission designators and allocated bandwidths for representative communication carriers are provided in Schedule S.

### **4 Power Flux Density ("PFD")**

The power flux density ("PFD") limits for space station transmissions in certain bands are contained in Section 25.208 of the Commission's rules. The limits in certain other bands not covered by Section 25.208 are specified in No. 21.16 of the ITU Radio Regulations. The applicable rules for the Intelsat 37e transmit bands are indicated in the following table:

## Applicable Power Flux Density Rules

From (MHz)	To (MHz)	FCC 25.208	ITU RR 21.16
3400	3650		X
3650	4200	X	
10700	10950		X
10950	11200	X	
11200	11450		X
11450	11700	X	
11700	11950	No applicable rule	
12200	12750		X
18300	19700	X	
19700	20200	No applicable rule	

Neither the Commission’s rules nor the ITU Radio Regulations specify any PFD limits for the 11700 – 11950 MHz or the 19700-20200 MHz bands applicable to geostationary satellites operating in the Fixed Satellite Service.

The maximum PFD levels for the Intelsat 37e transmissions were calculated for the bands indicated in the table. The PFD levels were also calculated for the Intelsat 37e telemetry and ULPC carriers. The results are provided in Schedule S and show that the downlink power flux density levels of the Intelsat 37e carriers do not exceed the limits specified in Section 25.208 of the Commission’s rules or the limits specified in No. 21.16 of the ITU Radio Regulations.

### **5 Emission Compliance**

Section 25.202(e) of the FCC’s rules requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. Intelsat 37e is designed to be compliant with the provisions of this rule.

Intelsat will comply with the provisions of Section 25.202(f) of the Commission’s rules with regard to Intelsat 37e emissions.

### **6 Orbital Location**

Intelsat requests that it be assigned the 18.0° W.L. orbital location for Intelsat 37e. The 18.0° W.L. location satisfies Intelsat 37e requirements for optimizing coverage, elevation angles, and service availability. Additionally, the location also ensures that the maximum operational, economic, and public interest benefits will be derived.

## **7 Coordination Statement and Certifications**

The downlink EIRP density of Intelsat 37e transmissions in the conventional or extended C-bands will not exceed 3 dBW/4kHz for digital transmissions or 8 dBW/4kHz for analog transmissions, 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 Intelsat 37e at 18.0° W.L.

The downlink EIRP density of Intelsat 37e transmissions in the conventional or extended Ku-bands will not exceed 14 dBW/4kHz for digital transmissions or 17 dBW/4kHz for analog transmissions, 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 Intelsat 37e at 18.0° W.L.

Intelsat 37e downlink transmissions in the conventional Ka-band will not generate power flux-density at the Earth's surface in excess of -118 dBW/m<sup>2</sup>/MHz and that associated uplink operation will not exceed applicable EIRP density envelopes in Section 25.138(a) 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 Intelsat 37e at 18.0° W.L.

Intelsat 37e operations in the 13000 – 13250 MHz, 10700 – 10950 MHz, and 11200 – 114500 MHz bands will take into account the applicable requirements of Appendix 30B of the ITU's Radio Regulations. There are no United States Appendix 30B ITU filings within 6° of 18.0° W.L., and therefore there are no compatibility issues with Intelsat 37e operations under Appendix 30B with respect to United States ITU Appendix 30B filings.

Intelsat 37e will also operate in three bands addressed by Section 25.140(a)(3)(v): the 3400 - 3600 MHz, 12500 - 12750 MHz, and 28600 - 28850 MHz bands. The operations of Intelsat 37e in the bands 3400 - 3600 MHz and 12500 - 12750 MHz have been coordinated with the operators of the previously authorized co-frequency space stations at locations two degrees away. Since the operations of Intelsat 37e in the 28600 - 28850 MHz band have not been coordinated, the impact of those operations on hypothetical satellites having the same operating characteristics as Intelsat 37e located at 16.0° W.L. and 20.0° W.L. was analyzed. The satellite at 20.0° W.L. was assumed to have two adjacent satellites separated by 2°: Intelsat 37e at 18.0° W.L. and a hypothetical satellite having the same operating characteristics as Intelsat 37e located at 22.0° W.L. The satellite at 16.0° W.L. was assumed to have two adjacent satellites separated by 2°:

Intelsat 37e at 18.0° W.L. and a hypothetical satellite having the same operating characteristics as Intelsat 37e located at 14.0° W.L.<sup>2</sup>

It was also assumed for the analysis that in the plane of the geostationary satellite orbit, all transmitting and receiving earth station antennas have off-axis co-polar gains that are compliant with the limits specified in Section 25.209(a) of the FCC's rules. All other assumptions and the results of the analysis are documented in Exhibit 8.

## **8 Orbital Debris Mitigation Plan**

Intelsat is proactive in ensuring safe operation and disposal of this and all spacecraft under its control. The four elements of debris mitigation are addressed below.

### **8.1 Spacecraft Hardware Design**

The spacecraft is designed such that no debris will be released during normal operations. Intelsat has assessed the probability of collision with meteoroids and other small debris (<1 cm diameter) and has taken the following steps to limit the effects of such collisions: (1) critical spacecraft components are located inside the protective body of the spacecraft and properly shielded; and (2) all spacecraft subsystems have redundant components to ensure no single-point failures. The spacecraft does not use any subsystems for end-of-life disposal that are not used for normal operations.

### **8.2 Minimizing Accidental Explosions**

Intelsat has assessed the probability of accidental explosions during and after completion of mission operations. The spacecraft is designed in a manner to minimize the potential for such explosions. Propellant tanks and thrusters are isolated using redundant valves and electrical power systems are shielded in accordance with standard industry practices. At the completion of the mission and upon disposal of the spacecraft, Intelsat will ensure the removal of all stored energy on the spacecraft by depleting all propellant tanks, venting all pressurized systems and by leaving the batteries in a permanent discharge state.

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<sup>2</sup> Other satellites in the vicinity of 18.0° W.L. were not included in the interference analysis because they are not licensed by the United States nor do they have U.S. market access. Intelsat is coordinating the use of the overlapping frequencies pursuant to ITU rules.

### **8.3 Safe Flight Profiles**

Intelsat has assessed and limited the probability of the space station becoming a source of debris as a result of collisions with large debris or other operational space stations. With the exception of Intelsat 901 during the transition of traffic, Intelsat 37e will not be located at the same orbital location as another satellite or at an orbital location that has an overlapping station-keeping volume with another satellite.

During the transition of traffic from Intelsat 901, Intelsat will take all the necessary steps, to minimize the risk of collision between Intelsat 901 and Intelsat 37e. With the exception of Intelsat 901, Intelsat is not aware of any other FCC licensed system, or any other system applied for and under consideration by the FCC, having an overlapping station-keeping volume with Intelsat 37e. Intelsat is also not aware of any system with an overlapping station-keeping volume with Intelsat 37e that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

### **8.4 Post-Mission Disposal**

At the end of the mission, Intelsat intends to dispose of the spacecraft by moving it to an altitude of at least 286.6 kilometers above the geostationary arc. Intelsat has reserved 7.0 kilograms of fuel for this purpose.

In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order.<sup>3</sup> The effective area to mass ratio ( $Cr^*A/M$ ) of the Intelsat 37e spacecraft is  $0.047 \text{ m}^2/\text{kg}$ , resulting in a minimum perigee disposal altitude under the Inter-Agency Space Debris Coordination Committee formula of 286.6 kilometers above the geostationary arc. Accordingly, the Intelsat 37e planned disposal orbit complies with the FCC's rules.

The reserved fuel figure was determined by the spacecraft manufacturer and provided for in the propellant budget. This figure was calculated taking into account the expected mass of the satellite at the end of life and the required delta-velocity to achieve the desired orbit. The fuel gauging uncertainty has been taken into account in these calculations.

## **9 ITU Filings**

On Intelsat 37e, the frequencies 3400-4200 MHz, 5850-6650 MHz, 13.75-14.5 GHz, 10.95-11.2 GHz, 11.45-11.95 GHz, and 12.5-12.75 GHz will be operated using the United Kingdom filing UKNETSAT-18W in addition to the notified filings of the Administration of the United States.

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<sup>3</sup> *Mitigation of Orbital Debris*, Second Report and Order, IB Docket No. 02-54, FCC 04-130 (rel. June 21, 2004).



The frequencies 28.35-28.85 GHz, 29.5-30 GHz, 18.3-18.8 GHz and 19.7-20.2 GHz also will be operated under United Kingdom filing UKNETSAT-18W.

The frequencies 10.7-10.95 GHz, 11.2-11.45 GHz and 13.0-13.25 GHz will be operated under United Kingdom filings UKFSS-18W and UKFSS-18W-A.

Intelsat requests that the United States state its non-objection to the use of the United Kingdom's filings UKNETSAT-18W, UKFSS-18W, and UKFSS-18W-A for operation of the Intelsat 37e satellite, in accordance with ITU Circular Letter CR/333 (May 2, 2012).

Intelsat is also submitting herewith United States filings:

- USASAT-101E, that includes the 10.7-10.95 GHz, 11.2-11.45 GHz, and 13.0-13.25 GHz bands.
- USASAT-71P, that includes all Intelsat-37e bands except for those included in USASAT-101E.

These two new USASAT filings contain all the frequencies to be used by Intelsat 37e.

## **10 TC&R Control Earth Stations**

Intelsat will conduct TC&R operations through one or more of the following earth stations: Fuchsstadt, Germany; Mountainside, MD; Hartebeesthoek, South Africa; or Fucino, Italy. Additionally, Intelsat is capable of remotely controlling Intelsat 37e from its facilities in McLean, VA or in Long Beach, CA.

# Certification Statement

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I hereby certify that I am a technically qualified person and am familiar with Part 25 of the Commission's rules. The contents of this engineering statement were prepared by me or under my direct supervision and to the best of my knowledge are complete and accurate.

*/s/ Dick Evans*

September 15, 2016

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Dick Evans

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Date

Intelsat

Senior Principal Regulatory Engineer

## EXHIBIT 1

### SUMMARY OF SPACECRAFT CHARACTERISTICS

<b>General Spacecraft Characteristics</b>	
Spacecraft Name	Intelsat 37e
Orbital Location	18.0° W.L.
Spacecraft Manufacturer	Boeing
Spacecraft Model	702MP
Spacecraft Type	3-axis stabilized
Spacecraft Expected Lifetime	15 years
Eclipse Capability	100%
Station-keeping	
North-South	±0.05°
East-West	±0.05°
Propulsion Type	Arcjet

## EXHIBIT 2

### Ku-band SPOT BEAM LOCATIONS

Beam Designation	Longitude (°E)	Latitude (°N)	Beam Designation	Longitude (°E)	Latitude (°N)
<b>Ku-Band User Beams</b>			<b>Ku-Band User Beams</b>		
Ku Spot 1	-1.04	56.57	Ku29	42.51	-1.64
Ku Spot 2	22.24	58.95	Ku30	15.99	-10.04
Ku Spot 3	-12.03	41.51	Ku31	29.8	-10.18
Ku Spot 4	0.8	42.13	Ku32	15.01	-18.67
Ku Spot 5	15.97	43.31	Ku33	29.22	-19.06
Ku Spot 6	40.47	45.87	Ku34	20.05	-29.69
Ku Spot 7	-7.42	31.03	Ku35	29.05	-28.27
Ku Spot 8	3.86	31.56	Ku36	-82.98	36.88
Ku Spot 9	17.01	32.43	Ku37	-85.64	26.42
Ku Spot 10	35.71	33.98	Ku38	-94.02	15.64
Ku Spot 11	-13.04	21.8	Ku39	-67.15	16.05
Ku Spot 12	-3.24	22.1	Ku40	-68.32	7.18
Ku Spot 13	7.4	22.56	Ku41	-53.79	4.23
Ku Spot 14	19.94	23.24	Ku42	-73.55	-2.52
Ku Spot 15	37.77	24.39	Ku43	-57.64	-3.61
Ku Spot 16	-16.35	13.62	Ku44	-46.02	-4.75
Ku Spot 17	-7.41	13.38	Ku45	-36.16	-7.57
Ku Spot 18	2.2	13.66	Ku46	-68	-11.3
Ku Spot 19	12.9	14.05	Ku47	-53.56	-12.76
Ku Spot 20	26.01	14.59	Ku48	-42.98	-15
Ku Spot 21	47.78	15.59	Ku49	-68.32	-21.5
Ku Spot 22	-12.39	5.30	Ku50	-53.33	-23.09
Ku Spot 23	-2.98	5.65	Ku51	-41.77	-24.02
Ku Spot 24	6.75	5.88	Ku52	-71.29	-32.96
Ku Spot 25	17.87	6.15	Ku53	-52.64	-33.15
Ku Spot 26	32.32	6.52	Ku54	-77.26	-45.72
Ku Spot 27	30.1	39.8	Ku55	-84.24	-59.12
Ku Spot 28	24.28	-1.73	Ku56	-26.51	5.68

### EXHIBIT 3

#### GATEWAY BEAM LOCATIONS

<b>Beam Designation</b>	<b>Longitude (°E)</b>	<b>Latitude (°N)</b>
<b>Ku-Band Gateway Beams</b>		
G1	-1.04	56.57
G2	22.24	58.95
G8	3.86	31.56
G9	17.01	32.43
G23	-2.98	5.65
G24	6.75	5.88
G27	30.1	39.8
G28	24.28	-1.73
G30	15.99	-10.04
G35	29.05	-28.27
G36	-82.98	36.88
G40	-68.32	7.18
G51	-41.77	-24.02

## EXHIBIT 4

### COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	Africa-Europe	Africa-Europe	Central Africa	Central Africa
Schedule S Beam ID	CELU	CERU	CALU	CARU
Frequency Band (MHz)	6090-6325	6090-6325	5860-6090	5860-6090
Polarization	LHCP	RHCP	LHCP	RHCP
G/T (dB/K)	-0.9	-1.0	2.9	2.9
Minimum SFD-- (dBW/m <sup>2</sup> )	-108.0	-106.0	-106.1	-106.1
Maximum SFD-- (dBW/m <sup>2</sup> )	-80.0	-78.0	-78.1	-78.1

Beam Name	Latin America	Latin America	Europe	Europe
Schedule S Beam ID	CMLU	CMRU	C1LU	C1RU
Frequency Band (MHz)	5860-6090	5860-6090	5860-6090	5860-6090
Polarization	LHCP	RHCP	LHCP	RHCP
G/T (dB/K)	0.7	0.7	12.9	12.9
Minimum SFD-- (dBW/m <sup>2</sup> )	-104.3	-104.3	-110	-110
Maximum SFD-- (dBW/m <sup>2</sup> )	-76.3	-76.3	-82	-82

Beam Name	North America	North America	South America	South America
Schedule S Beam ID	C2LU	C2RU	C3LU	C3RU
Frequency Band (MHz)	6090-6330	6090-6330	6090-6330	6090-6330
Polarization	LHCP	RHCP	LHCP	RHCP
G/T (dB/K)	13.1	13.1	11.6	11.6
Minimum SFD-- (dBW/m <sup>2</sup> )	-110	-110	-110.1	-110.1
Maximum SFD-- (dBW/m <sup>2</sup> )	-82	-82	-82.1	-82.1

Beam Name	Falkland Islands	C-band Global	C-band Global	Ku User K56
Schedule S Beam ID	C4RU	CGLU	CGRU	K56U
Frequency Band (MHz)	6090-6330	6330-6450	6330-6450	14125-14250
Polarization	RHCP	LHCP	RHCP	Horizontal
G/T (dB/K)	12.3	-5.9	-5.9	10.2
Minimum SFD-- (dBW/m <sup>2</sup> )	-109.3	-106.8	-106.8	-113.9
Maximum SFD-- (dBW/m <sup>2</sup> )	-81.3	-78.8	-78.8	-85.9

Beam Name	Ku User	Ku User	Algeria	Gateway
Schedule S Beam ID	KUHU	KUVU	KZVU	KGHU
Frequency Band (MHz)	14000-14500	14000-14500	14000-14175	13000-13250 13750-14000
Polarization	Horizontal	Vertical	Vertical	Horizontal
G/T (dB/K)	14.4	14.4	11.7	13.7
Minimum SFD-- (dBW/m <sup>2</sup> )	-114.0	-114.0	-116.3	-113.8
Maximum SFD-- (dBW/m <sup>2</sup> )	-86	-86	-88.3	-85.8

Beam Name	Gateway	Ku Steerable	Ku Steerable	Ka Steerable
Schedule S Beam ID	KGUV	KSHU	KSVU	ASLU
Frequency Band (MHz)	13000-13250 13750-14000	14000-14500	14000-14500	28350-28850 29500-30000
Polarization	Vertical	Horizontal	Vertical	LHCP
G/T (dB/K)	13.7	12	12	11.3
Minimum SFD-- (dBW/m <sup>2</sup> )	-113.8	-113.2	-113.2	-96.8
Maximum SFD-- (dBW/m <sup>2</sup> )	-85.8	-85.2	-85.2	-75.8

Beam Name	Ka Steerable
Schedule S Beam ID	ASRU
Frequency Band (MHz)	28350-28850 29500-30000
Polarization	RHCP
G/T (dB/K)	11.3
Minimum SFD-- (dBW/m <sup>2</sup> )	-96.8
Maximum SFD-- (dBW/m <sup>2</sup> )	-75.8

## EXHIBIT 5

### COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	Africa-Europe	Africa-Europe	Central Africa	Central Africa
Schedule S Beam ID	CELD	CERD	CALD	CARD
Frequency Band (MHz)	3864-4102	3864-4102	3625-3864	3625-3864
Polarization	LHCP	RHCP	LHCP	RHCP
Maximum Beam Peak EIRP (dBW)	43.3	43.3	47.9	47.9
Maximum Beam Peak EIRP Density (dBW/4kHz)	-3.1	-3.1	1.6	1.6

Beam Name	Latin America	Latin America	Europe	Europe
Schedule S Beam ID	CMLD	CMRD	CILD	CIRD
Frequency Band (MHz)	3625-3864	3704-3864	3400-3864	3400-3864
Polarization	LHCP	RHCP	LHCP	RHCP
Maximum Beam Peak EIRP (dBW)	46.5	46.5	52.1	52.1
Maximum Beam Peak EIRP Density (dBW/4kHz)	0.2	0.2	2.9	2.9

Beam Name	North America	South America	South America	South America
Schedule S Beam ID	C2LD	C2RD	C3LD	C3RD
Frequency Band (MHz)	3870-4100	3870-4100	3870-4100	3870-4100
Polarization	LHCP	RHCP	LHCP	RHCP
Maximum Beam Peak EIRP (dBW)	52.1	52.1	51.8	51.8
Maximum Beam Peak EIRP Density (dBW/4kHz)	5.8	5.8	5.5	5.5

Beam Name	Falkland Islands	C-band Global	C-band Global	Ku User K56
Schedule S Beam ID	C4RD	CGLD	CGRD	K56D
Frequency Band (MHz)	3870-4100	4102-4194	4102-4194	10950-11075
Polarization	RHCP	LHCP	RHCP	Horizontal
Maximum Beam Peak EIRP (dBW)	51.4	38	38	50.3
Maximum Beam Peak EIRP Density (dBW/4kHz)	5.1	-3.9	-3.9	6.9



Beam Name	Ku User	Ku User	Algeria	Gateway
<b>Schedule S Beam ID</b>	KDHD	KDVD	KZHD	KGHD
<b>Frequency Band (MHz)</b>	10950-11200, 11450-11950, 12500-12750	10950-11200, 11450-11950, 12500-12750	10950-11125	10700-10950, 11200-11450
<b>Polarization</b>	Horizontal	Vertical	Vertical	Horizontal
<b>Maximum Beam Peak EIRP (dBW)</b>	51.0	51.0	51.5	50.8
<b>Maximum Beam Peak EIRP Density (dBW/4kHz)</b>	10.6	10.6	6.3	7.4

Beam Name	Gateway	Ku Steerable	Ku Steerable	Ka Steerable
<b>Schedule S Beam ID</b>	KGVD	KSVD	ASLD	ASRD
<b>Frequency Band (MHz)</b>	10700-10950, 11200-11450	10950-11075, 11450-11700	18300-18800, 19700-20200	18300-18800, 19700-20200
<b>Polarization</b>	Vertical	Vertical	LHCP	RHCP
<b>Maximum Beam Peak EIRP (dBW)</b>	50.8	56.0	58.0	58.0
<b>Maximum Beam Peak EIRP Density (dBW/4kHz)</b>	7.4	7.8	10.6	10.6

## EXHIBIT 6

### TC&R and ULPC SUBSYSTEM CHARACTERISTICS

Beam Name	Command – Global	Command – Pipe	Command-Hemi
<b>Schedule S Beam ID</b>	CGVU	CPLU	CHLU
<b>Frequencies (MHz)</b>	6423.25	6423.25	5851.75
<b>Bandwidth (MHz)</b>	3.7	3.7	3.7
<b>Polarization</b>	Vertical	LHCP	LHCP
<b>Peak Flux Density at Command Threshold (dBW/m<sup>2</sup>-Hz)</b>	-75.0	-60	-60.0

Beam Name	Telemetry – Global	Telemetry – Pipe	Telemetry – Hemi
<b>Schedule S Beam ID</b>	TGHD	TPRD	THRD
<b>Frequencies (MHz)</b>	4197.75, 4199.25, 4198.25, 4198.75	4197.75, 4199.25, 4198.25, 4198.75	4197.75, 4199.25, 4198.25, 4198.75
<b>Polarization</b>	Horizontal	RHCP	RHCP
<b>Maximum Channel EIRP (dBW)</b>	7.9	6.4	7.9
<b>Maximum Beam Peak EIRP Density (dBW/4kHz)</b>	-12.1	-13.6	-21.6

Beam Name	ULPC	ULPC	ULPC
<b>Schedule S Beam ID</b>	CLVD	KLRD	ALVD
<b>Frequencies (MHz)</b>	4199.75	11199.0, 11451.5, &12501.0	20199.5
<b>Polarization</b>	Vertical	RHCP	Vertical
<b>Maximum Channel EIRP (dBW)</b>	11.0	13.0	21.0
<b>Maximum Beam Peak EIRP Density (dBW/4kHz)</b>	3.0	5.0	13.0

*Note: RHCP: Right Hand Circular Polarization, LHCP: Left Hand Circular Polarization*

## EXHIBIT 7

### Beam Polarizations and GXT File Names

Schedule S Beam GXT File Names								
Beam Designation	Linear Polarization				Circular Polarization			
	Uplink (H-Pol.)	Uplink (V-Pol.)	Downlink (H-Pol.)	Downlink (V-Pol.)	Uplink (LHCP)	Uplink (RHCP)	Downlink (LHCP)	Downlink (RHCP)
<b>C-Band Beams</b>								
Africa & Europe	----	----	----	----	CELU	CERU	CELD	CERD
Central Africa	----	----	----	----	CALU	CARU	CALD	CARD
Latin America	----	----	----	----	CMLU	CMRU	CMLD	CMRD
Europe	----	----	----	----	C1LU	C1RU	C1LD	C1RD
North America	----	----	----	----	C2LU	C2RU	C2LD	C2RD
South America	----	----	----	----	C3LU	C3RU	C3LD	C3RD
Falkland Islands	----	----	----	----	----	C4RU	C4LD	----
Global	----	----	----	----	CGLU*	CGRU*	CGLD*	CGRD*
ULPC Global	----	----	----	CLVD*	----	----	----	----
Telemetry Global	----	----	TGHD*	----	----	----	----	----
Command Global	----	CGVU*	----	----	----	----	----	----
Telemetry Pipe	----	----	----	----	----	----	----	TPRD*
Telemetry Hemi	----	----	----	----	----	----	----	THRD*
Command Pipe	----	----	----	----	CPLU*	----	----	----
Command Hemi	----	----	----	----	CHLU*	----	----	----
<b>Ku-Band Beams</b>								
User Beams	KUHU	KUVU	KUHD	KUVD	----	----	----	----
Elliptical User	K56U	----	----	K56D	----	----	----	----
Algeria	----	KZVU	KZHD	----	----	----	----	----
Gateway	KGHU	KGVU	KGHD	KGVD	----	----	----	----
Steerable	KSHU	KSVU	KSHD	KSVD	----	----	----	----
ULPC Global	----	----	----	----	----	----	----	KLRD*
<b>Ka-Band Beam</b>								
Steerable Spot	----	----	----	----	ASLU	ASRU	ASLD	ASRD
ULPC Global	----	ALVD*	----	----	----	----	----	----

*\* GXT files are not provided for the indicated beams because their -8 dB gain contours extend beyond the edge of the Earth.*

**EXHIBIT 8**  
**HYPOTHETICAL 20.0°W.L. SATELLITE INTERFERENCE ANALYSIS**

Uplink Beam Name	ASLU & ASRU	ASLU & ASRU	ASLU & ASRU	ASLU & ASRU
Uplink Frequency (MHz)	28600 - 28850	28600 - 28850	28600 - 28850	28600 - 28850
Uplink Beam Polarization	LHCP & RHCP	LHCP & RHCP	LHCP & RHCP	LHCP & RHCP
Uplink Beam Peak G/T (dB/K)	11.3	11.3	11.3	11.3
Uplink Beam Peak SFD (dBW/m2)	-75.8	-75.8	-75.8	-75.8
Uplink Relative Contour Level (dB)	-6.3	-6.3	-6.3	-6.3
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	ASRD & ASLD	ASRD & ASLD	ASRD & ASLD	ASRD & ASLD
Downlink Frequency (MHz)	18300 - 18800	18300 - 18800	18300 - 18800	18300 - 18800
Downlink Beam Polarization	RHCP & LHCP	RHCP & LHCP	RHCP & LHCP	RHCP & LHCP
Downlink Beam Peak EIRP (dBW)	58.0	58.0	58.0	58.0
Downlink Relative Contour Level (dB)	-6.0	-6.0	-6.0	-6.0
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 37e			
Orbital Location	18° W.L.	18° W.L.	18° W.L.	18° W.L.
Uplink Power Density (dBW/Hz)	-45.0	-45.0	-45.0	-45.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 22° W.L.			
Orbital Location	22° W.L.	22° W.L.	22° W.L.	22° W.L.
Uplink Power Density (dBW/Hz)	-45	-45	-45.0	-45.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	10M3G7W	1M45G7W	400KG7W
Carrier Modulation	QPSK	QPSK	BPSK	BPSK
Information Rate(kbps)	21600	6000	512	128
Code Rate	1/2x188/204	1/2x188/204	R1/2	R1/2
Occupied Bandwidth(kHz)	24376	6771	1229	307
Allocated Bandwidth(kHz)	36000	10300	1450	400
Minimum C/N, Rain (dB)	7.3	4.3	3.4	3.4
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	3.5	3.5	3.0	2.8
Earth Station Gain (dBi)	58.9	58.9	57.5	56.9
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	2.7	2.7	2.8	3.0
Earth Station Gain (dBi)	53.2	53.2	53.4	54.1
Earth Station G/T (dB/K)	30.8	30.8	31.0	31.7
<b>COMPOSITE LINK PERFORMANCE</b>				
C/N Thermal Uplink (dB)	22.2	22.2	21.1	20.5
Uplink Interference C/I (dB)	13.7	9.7	6.5	4.9
Uplink Adjacent Satellite C/I (dB)	16.0	16.0	16.0	16.0
Intermodulation C/IM (dB)	25.5	25.4	24.3	23.8
Downlink Thermal C/N (dB)	22.4	18.3	15.1	13.6
Downlink Interference C/I (dB)	25.5	25.4	24.3	23.8
Downlink Adjacent Satellite C/I (dB)	22.4	18.3	15.1	13.6
Subtotal C/N (dB)	10.6	7.6	4.9	3.4
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	9.1	6.1	3.4	1.9
Minimum Required C/N (dB)	7.3	4.3	3.4	3.4

# HYPOTHETICAL 16.0°W.L. SATELLITE INTERFERENCE ANALYSIS

Uplink Beam Name	ASLU & ASRU	ASLU & ASRU	ASLU & ASRU	ASLU & ASRU
Uplink Frequency (MHz)	28600 - 28850	28600 - 28850	28600 - 28850	28600 - 28850
Uplink Beam Polarization	LHCP & RHCP	LHCP & RHCP	LHCP & RHCP	LHCP & RHCP
Uplink Beam Peak G/T (dB/K)	11.3	11.3	11.3	11.3
Uplink Beam Peak SFD (dBW/m2)	-75.8	-75.8	-75.8	-75.8
Uplink Relative Contour Level (dB)	-6.3	-6.3	-6.3	-6.3
<b>DOWNLINK BEAM INFORMATION</b>				
Downlink Beam Name	ASRD & ASLD	ASRD & ASLD	ASRD & ASLD	ASRD & ASLD
Downlink Frequency (MHz)	18300 - 18800	18300 - 18800	18300 - 18800	18300 - 18800
Downlink Beam Polarization	RHCP & LHCP	RHCP & LHCP	RHCP & LHCP	RHCP & LHCP
Downlink Beam Peak EIRP (dBW)	58.0	58.0	58.0	58.0
Downlink Relative Contour Level (dB)	-6.0	-6.0	-6.0	-6.0
<b>ADJACENT SATELLITE 1</b>				
Satellite Name	Intelsat 37e			
Orbital Location	18° W.L.	18° W.L.	18° W.L.	18° W.L.
Uplink Power Density (dBW/Hz)	-45.0	-45.0	-45.0	-45.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>ADJACENT SATELLITE 2</b>				
Satellite Name	Hypothetical 14° W.L.			
Orbital Location	14° W.L.	14° W.L.	14° W.L.	14° W.L.
Uplink Power Density (dBW/Hz)	-45	-45	-45.0	-45.0
Beam Peak Downlink EIRP Density (dBW/Hz)	-20.0	-20.0	-20.0	-20.0
<b>CARRIER INFORMATION</b>				
Carrier ID	36M0G7W	10M3G7W	1M45G7W	400KG7W
Carrier Modulation	QPSK	QPSK	BPSK	BPSK
Information Rate(kbps)	21600	6000	512	128
Code Rate	1/2x188/204	1/2x188/204	R1/2	R1/2
Occupied Bandwidth(kHz)	24376	6771	1229	307
Allocated Bandwidth(kHz)	36000	10300	1450	400
Minimum C/N, Rain (dB)	7.3	4.3	3.4	3.4
<b>UPLINK EARTH STATION</b>				
Earth Station Diameter (meters)	3.5	3.5	3.0	2.8
Earth Station Gain (dBi)	58.9	58.9	57.5	56.9
<b>DOWNLINK EARTH STATION</b>				
Earth Station Diameter (meters)	2.7	2.7	2.8	3.0
Earth Station Gain (dBi)	53.2	53.2	53.4	54.1
Earth Station G/T (dB/K)	30.8	30.8	31.0	31.7
<b>COMPOSITE LINK PERFORMANCE</b>				
C/N Thermal Uplink (dB)	22.2	22.2	21.1	20.5
Uplink Interference C/I (dB)	13.7	9.7	6.5	4.9
Uplink Adjacent Satellite C/I (dB)	16.0	16.0	16.0	16.0
Intermodulation C/IM (dB)	25.5	25.4	24.3	23.8
Downlink Thermal C/N (dB)	22.4	18.3	15.1	13.6
Downlink Interference C/I (dB)	25.5	25.4	24.3	23.8
Downlink Adjacent Satellite C/I (dB)	22.4	18.3	15.1	13.6
Subtotal C/N (dB)	10.6	7.6	4.9	3.4
Antenna Mispointing and Other Losses (dB)	1.5	1.5	1.5	1.5
Total C/N (dB)	9.1	6.1	3.4	1.9
Minimum Required C/N (dB)	7.3	4.3	3.4	3.4