

Engineering Statement

1 Introduction

Together with the accompanying Schedule S and GXT files, Intelsat License LLC (“Intelsat”) herein demonstrates that it is technically qualified to hold the authority sought in this application to launch and operate Galaxy 36, a replacement satellite with new frequencies at 89.0° W.L. Galaxy 36 will replace Galaxy 28 (S2160).¹ The characteristics of the satellite, as well as its compliance with the various provisions of Part 25 of the Federal Communications Commission’s (“FCC” or “Commission”) rules,² are provided in the remainder of this Engineering Statement.

2 Spacecraft Overview

While Intelsat is only seeking authority to operate in C-, and Ku-band at 89.0° W.L., Galaxy 36 has the capability to operate in the frequencies listed in the table below.

Direction	Frequency
Uplink	5925-6425 MHz
	12750-13250 MHz
	13750-14500 MHz
	27500-30000 MHz ³
Downlink	3700-4200 MHz
	10700-11200 MHz
	11700-12200 MHz
	12200-12450 MHz ⁴
	17700-20200 MHz

¹ See Legal Narrative at n. 3.

² Unless otherwise stated, all references to rule sections in this document refer to sections in Title 47 of the Code of Federal Regulations.

³ Intelsat is not seeking authority to operate in the 27500-30000 MHz band at 89.0° W.L. at this time.

⁴ Intelsat is not seeking authority to operate in the 12200-12450 MHz band at 89.0° W.L. at this time.

The spacecraft will provide: C-band coverage of North America (including Alaska and Hawaii), Central America, and the Caribbean; and Ku-band coverage of the Contiguous United States; Central America; and Caribbean.

2.1 Spacecraft Characteristics

Galaxy 36 is a Maxar FS 1300-122 three-axis stabilized type spacecraft that has a rectangular outer body structure. Galaxy 36 utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

The Galaxy 36 satellite is composed of the following subsystems:

- thermal;
- power;
- attitude control;
- propulsion;
- telemetry, tracking, and control (“TT&C”);
- uplink power control (“ULPC”); and
- 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’s design incorporates redundancy for all the various subsystems in order to avoid single-point failures.

The structural design of Galaxy 36 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.

2.2 Communication Subsystem

The Galaxy 36 C- and Ku-band frequencies, polarizations, channel plans, coverage contours, and performance characteristics are provided in Schedule S.

Exhibits 1 and 2 provide the beam parameters for the C- and Ku-band uplink and downlink beams, respectively, and Exhibit 3 provides the Schedule S beam designations.

2.3 TT&C Subsystem

The TT&C 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.

Galaxy 36 is equipped with two tunable command receivers and two tunable telemetry transmitters. The center command frequency on each receiver and transmitter is selectable via ground command in 100 kHz steps within the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) frequency ranges.

The satellite's command and telemetry channel frequencies and performance are shown in Exhibit 4. The coverage patterns of the command and telemetry 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), contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S.

2.4 Uplink Power Control Subsystem

Galaxy 36 utilizes one C-band channel for ULPC, antenna tracking, and ranging. The coverage patterns of the ULPC 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), contours for these beams are not required to be provided and the associated GXT files have not been included in Schedule S. The ULPC frequencies and subsystem performance are summarized in Exhibit 4.

2.5 Satellite Station-Keeping

The satellite will be maintained within 0.05° of its nominal longitudinal position in the east-west direction in compliance with Section 25.210(j).

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, thruster perturbations, etc.).

3 Services

Galaxy 36 is a general-purpose communications satellite and has been designed to support various services offered within the Intelsat communications system. Depending upon the needs of the users, the transponders on Galaxy 36 can provide a range of communications services, including compressed digital video, high speed digital data, and digital single channel per carrier data channels.

4 Power Flux Density

The power flux density limits for space stations operating in the C- and Ku-band are specified in Section 25.208. As provided in Schedule S, the Galaxy 36 transmissions do not exceed these limits.

5 Emission Compliance

Section 25.202(e) requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. Galaxy 36 is designed to be compliant with the provisions of this rule.

Galaxy 36 will comply with the provisions of Section 25.202(f) with regard to its emissions.

6 Orbital Location

Intelsat requests that Galaxy 36 be assigned the 89.0° W.L. orbital location as a replacement satellite for Galaxy 28, which is currently licensed and operating at 89.0° W.L.

7 Coordination Statement and Certifications

The downlink effective isotropic radiated power (“EIRP”) density of the satellite’s transmissions in the conventional C-band will not exceed 3 dBW/4kHz for digital transmissions or 8 dBW/4kHz for analog transmissions, and in the conventional and extended Ku-band the downlink EIRP density will not exceed 14 dBW/4kHz for digital transmissions or 17 dBW/4kHz for analog transmissions.

Associated uplink transmissions will not exceed the applicable EIRP density envelope in Section 25.218 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 Galaxy 36 at 89.0° W.L.

Operations in the 10700-10950 MHz (space-to-Earth) and 12750-13250 MHz (Earth-to-space) bands will be consistent with applicable Appendix 30B International Telecommunication Union (“ITU”) Radio Regulations. Further, there are no other U.S. ITU filings under Appendix 30B within at least 10° of 89° W.L.

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

Galaxy 36 is designed such that no debris will be released during normal operations. Intelsat has assessed the probability of collision with meteoroids and small debris. In order to limit the effects of such unlikely collisions critical satellite components are located inside the protective body of the satellite and are properly shielded. The satellite 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 satellite 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 the spacecraft's stored energy by depleting the propellant tanks, venting the pressurized systems, and by leaving the batteries in a permanent discharge state.

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.

Galaxy 36 and Galaxy 28 will be collocated at 89.0° W.L. Intelsat will ensure that sufficient spatial separation is achieved between these two satellites through the use of orbit eccentricity and inclination offsets and thus minimize the risk of collision.

With the exception of Galaxy 28, Intelsat is not aware of any FCC-authorized system, or any other system applied for and under consideration by the FCC, having an overlapping station-keeping volume with Galaxy 36. Intelsat is also not aware of any system with an overlapping station-keeping volume with the satellite 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 will dispose of the spacecraft by moving it to an altitude of at least 262.0 kilometers above the geostationary arc. Intelsat has reserved 55.0 kilograms of bi-propellant for that purpose.⁵

In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order.⁶ The effective area to mass ratio ($Cr \cdot A/M$) of the satellite is 0.023 m²/kg, resulting in a minimum perigee disposal altitude under the Inter-Agency Space Debris Coordination Committee formula of 262.0 kilometers above the geostationary arc. Accordingly, Galaxy 36's planned disposal orbit complies with the FCC's rules.

⁵ The reserved propellant figure is an estimate. This figure is 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.

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

9 TT&C Control Earth Stations

Intelsat will conduct TT&C operations through earth stations at one or more of the following teleports: Fillmore, California; Napa, California; Riverside, California; Castle Rock, Colorado; Ellenwood, Georgia; Paumalu, Hawaii; Andover, Maine; Hagerstown, Maryland; and Brewster, Washington. Additionally, Intelsat is capable of remotely controlling Galaxy 36 from its facilities in Long Beach, California and McLean, Virginia.

Certification Statement

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/ Giselle Creeser

June 7, 2022

Giselle Creeser
Intelsat US LLC
Director, Spectrum Policy and
Engineering

Date

EXHIBIT 1

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	C-band Western Arc	C-band Wester Arc	C-band Hemi Beam 45W	C-band Hemi Beam 45W
Schedule S Beam ID	CWHU	CWVU	CHHU	CHVU
Frequency Band (MHz)	5925-6425	5925-6425	5925-6425	5925-6425
Polarization	Horizontal	Vertical	Horizontal	Vertical
G/T (dB/K)	4.62	4.62	4.62	4.62
Minimum SFD-- (dBW/m ²)	-102.0	-102.0	-102.0	-102.0
Maximum SFD-- (dBW/m ²)	-77.0	-77.0	-77.0	-77.0

Beam Name	Ku-band	Ku-band	Ku-band	Ku-band
Schedule S Beam ID	KUHU	KUVU	K1HU	K1VU
Frequency Band (MHz)	12750-13250	12750-13250	13750-14500	13750-14500
Polarization	Horizontal	Vertical	Horizontal	Vertical
G/T (dB/K)	2.08	2.08	2.08	2.08
Minimum SFD-- (dBW/m ²)	-91	-91	-91	-91
Maximum SFD-- (dBW/m ²)	-66	-66	-66	-66

EXHIBIT 2

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-band Western Arc	C-band Western Arc	C-band Hemi Beam	C-band Hemi Beam
Schedule S Beam ID	CWHD	CWVD	CHHD	CHVD
Frequency Band (MHz)	3700-4200	3700-4200	3700-4200	3700-4200
Polarization	Horizontal	Vertical	Horizontal	Vertical
Maximum Beam Peak EIRP (dBW)	46.3	46.3	46.3	46.3
Maximum Beam Peak EIRP Density (dBW/4kHz)	6.3	6.3	6.3	6.3
Maximum Beam Peak EIRP Density (dBW/Hz)	-29.3	-29.3	-29.3	-29.3

Beam Name	Ku-band	Ku-band	Ku-band	Ku-band
Schedule S Beam ID	KUHD	KUVD	K1HD	K1VD
Frequency Band (MHz)	10700-11200	10700-11200	11700-12200	11700-12200
Polarization	Horizontal	Vertical	Horizontal	Vertical
Maximum Beam Peak EIRP (dBW)	49.14	49.14	49.14	49.14
Maximum Beam Peak EIRP Density (dBW/4kHz)	-0.4	-0.4	-0.4	-0.4
Maximum Beam Peak EIRP Density (dBW/Hz)	-36.4	-36.4	-36.4	-36.4

EXHIBIT 3

Beam Polarizations and GXT File Names

Beam Designation	Schedule S Beam Names							
	Linear Polarization				Circular Polarization			
	Uplink	Uplink	Downlink	Downlink	Uplink	Uplink	Downlink	Downlink
	(H-Pol.)	(V-Pol.)	(H-Pol.)	(V-Pol.)	(LHCP)	(RHCP)	(LHCP)	(RHCP)
C-band Beams								
C band	CWHU CHHU	CWVU CHVU	CWHD CHHD	CWVD CHVD	----	----	----	----
Telemetry 1	----	----	TLMB [*]	TLMC [*]	----	----	TLMA [*]	----
Telemetry 2	----	----	TLME [*]	TLMF [*]	----	----	TLMD [*]	----
Command 1	CMD2 [*]	CMD3 [*]	----	----	----	CMD1 [*]	----	----
Command 2	CMD5 [*]	CMD6 [*]	----	----	----	CMD4 [*]	----	----
ULPC	----	----	----	----	----	----	----	UPC1 [*]
Ku-band Beams								
Ku-band	KUHU K1HU	KUVU K1VU	KUHD K1HD	KUVD K1VD	----	----	----	----

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

EXHIBIT 4

TT&C SUBSYSTEM CHARACTERISTICS

Beam Name	Command 1 Omni	Command 1 Global	Command 1 Global	Command 2 Omni	Command 2 Global	Command 2 Global
Schedule S Beam ID	CMD1	CMD2	CMD3	CMD4	CMD5	CMD6
Frequencies (MHz) ¹	6422.0	6422.0	6422.0	6424.5	6424.5	6424.5
Polarization	RHCP	Horizontal	Vertical	RHCP	Horizontal	Vertical
Peak Flux Density at Command Threshold (dBW/m2-Hz)	-80.0	-80.0	-80.0	-80.0	-80.0	-80.0

Beam Name	Telemetry 1 Omni	Telemetry 1 Global	Telemetry 1 Global	ULPC Dish
Schedule S Beam ID	TLMA	TLMB	TLMC	UPC1
Frequencies (MHz) ²	4197.5	4197.5	4197.5	4199.95
Polarization	LHCP	Horizontal	Vertical	RHCP
Maximum Channel EIRP (dBW)	8	8	8	9
Maximum Beam Peak EIRP Density (dBW/4kHz)	-11.4	-11.4	-11.4	1
Maximum Beam Peak EIRP Density (dBW/Hz)	-47.4	-47.4	-47.4	-35

Beam Name	Telemetry 2 Omni	Telemetry 2 Global	Telemetry 2 Global
Schedule S Beam ID	TLMD	TLME	TLMF
Frequencies (MHz) ³	4199.00	4199.00	4199.00
Polarization	LHCP	Horizontal	Vertical
Maximum Channel EIRP (dBW)	8	8	8
Maximum Beam Peak EIRP Density (dBW/4kHz)	-11.4	-11.4	-11.4
Maximum Beam Peak EIRP Density (dBW/Hz)	-47.4	-47.4	-47.4

RHCP: Right Hand Circular Polarization

LHCP: Left Hand Circular Polarization

¹ The center frequencies given are representative. See § 2.3.

² *Id.*

³ *Id.*