Engineering Statement

1 Introduction

Intelsat License LLC, as debtor in possession ("Intelsat"), seeks authority to launch and operate the Galaxy 34 satellite at the 129.0° W.L orbital location. Galaxy 34 will replace Galaxy 12 (S2422), which currently operates at the 129.0° W.L orbital location. 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,[1] are provided in the remainder of this Engineering Statement.

2 Spacecraft Overview

Galaxy 34 is capable of operating in the C-band frequencies listed below.

Direction	Frequency
Uplink	5925-6425 MHz
Downlink	3700-4200 MHz[2]

The spacecraft provides the following coverage:

Frequency band	Beam	Coverage
C-band	Wide, Fixed	North America including Alaska and Hawaii; Central America; and the Caribbean

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

[2] Following completion of the C-band transition, the Galaxy 34 satellite will not downlink in the 3700-4000 MHz band to fixed earth stations in the contiguous United States, except as allowed at two consolidated TT&C/Gateway locations in Brewster, Washington and Andover, Maine. *See Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343, ¶ 134 (2020).

2.1 Spacecraft Characteristics

Galaxy 34 is a Northrop Grumman Space Systems GeoStar 3 three-axis stabilized type spacecraft that has a rectangular outer body structure. Galaxy 34 utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

The Galaxy 34 satellite is composed of the following subsystems:

- Thermal;
- Power;
- Attitude Control;
- Propulsion;
- Telemetry, Command and Ranging ("TC&R");
- 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 design incorporates redundancy for all the various subsystems in order to avoid single-point failures.

The structural design of Galaxy 34 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 34 satellite employs channels with bandwidths of 36 MHz, 43 MHz, and 125 MHz. The frequencies, polarization, and channel plan as well as the coverage contours and performance characteristics for the satellite beams are provided in Schedule S. Exhibits 1 and 2 provide the beam parameters for the uplink and downlink beams, respectively, and Exhibit 4 provides the Schedule S beam designations.

2.3 Telemetry, Command and Ranging Subsystem

The 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.

The satellite's TT&C frequencies are tunable and selectable via ground command in 100 kHz steps.

The Galaxy 34 satellite's command and telemetry channel frequencies and performance are shown in Exhibit 3. 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 34 utilizes one 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. Galaxy 34's ULPC frequencies and subsystem performance are summarized in Exhibit 3.

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, and thruster perturbations, etc.).

3 Services

Galaxy 34 is a general-purpose communications satellite and has been designed to support various services offered within the Intelsat satellite system. Depending upon the needs of the users, the transponders on Galaxy 34 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 3700-4200 MHz band is specified in Section 25.208. As provided in Schedule S, the Galaxy 34 transmissions do not exceed these limits.

5 Emission Compliance

Galaxy 34 is designed to be compliant with Section 25.202(e), which requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency.

Galaxy 34 will comply with the provisions of Section 25.202(f) with regard to its emissions.

6 Orbital Location

Intelsat requests that Galaxy 34 be assigned the 129.0° W.L. orbital location as a replacement satellite for Galaxy 12, which is currently licensed and operating at 129.0° 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. The 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 34 at 129.0° 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 34 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 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.

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 34 will replace Galaxy 12 at 129.0° W.L. These satellites may be nominally collocated during transfer of traffic and Intelsat will ensure that sufficient spatial separation is achieved between these two satellites through the use of orbit eccentricity and inclination offsets to minimize the risk of collision.

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 Galaxy 34. Intelsat is also not aware of any system with an overlapping station-keeping volume with the Galaxy 34 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 253.8 kilometers above the geostationary arc. Intelsat will reserve 26.0 kilograms of hydrazine for this purpose.

In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order.[3] The effective area to mass ratio (Cr*A/M) of the satellite is 0.017 m^2/kg, resulting in a minimum perigee disposal altitude under the Inter-Agency Space Debris Coordination Committee formula of 253.8 kilometers above the geostationary arc. Accordingly, Galaxy 34's planned disposal orbit complies with the FCC's rules.

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.

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

9 TC&R Control Earth Stations

Intelsat will conduct TC&R operations through earth stations at one or more of the following teleports: Napa, California; Hagerstown, Maryland; Fillmore, California; Riverside, California; Castle Rock, Colorado; Brewster, Washington; Andover, Maine; Paumalu, Hawaii; and Ellenwood, Georgia. Additionally, Intelsat is capable of remotely controlling Galaxy 34 from its facilities in McLean, Virginia and Long Beach, California.

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	March 25, 2021
Giselle Creeser Intelsat US LLC Director, Spectrum Policy and Engineering	Date

EXHIBIT 1

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	C-Band North America	C-Band North America
Schedule S Beam ID	CAHU	CAVU
Frequency Band (MHz)	5925-6425	5925-6425
Polarization	Horizontal	Vertical
G/T (dB/K)	3.5	3.5
Minimum SFD--(dBW/m^2)	-116	-116
Maximum SFD--(dBW/m^2)	-81	-81

EXHIBIT 2

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-Band North America	C-Band North America
Schedule S Beam ID	CAHD	CAVD
Frequency Band (MHz)	3700-4200	3700-4200
Polarization	Horizontal	Vertical
Maximum Beam Peak EIRP (dBW)	46.1	46.1
Maximum Beam Peak EIRP Density (dBW/4kHz)	6.6	6.6
Maximum Beam Peak EIRP Density (dBW/Hz)	-29.5	-29.5

EXHIBIT 3

TC&R SUBSYSTEM CHARACTERISTICS

Beam Name	Command 1 Omni	Command 1 Global H	Command 1 Global H	Command 2 Omni	Command 2 Global H	Command 2 Global H
Schedule S Beam ID	CMR1	CMV1	CMH1	CMR2	CMH2	CMV2
Frequencies (MHz)	6420.0*	6420.0*	6420.0*	6423.0*	6423.0*	6423.0*
Polarization	RHCP	Vertical	Horizontal	RHCP	Horizontal	Vertical
Peak Flux Density at Command Threshold (dBW/m^2-Hz)	-80.0	-80.0	-80.0	-80.0	-80.0	-80.0

*Tunable with 100 kHz step (5925-6425 MHz)

Beam Name	Telemetry 1 Dish	Telemetry 1 Global	Telemetry 1 Global	Telemetry 2 Dish	Telemetry 2 Global	Telemetry 2 Global	ULPC Dish
Schedule S Beam ID	TLME	TLMG	TLMH	TLMA	TLMC	TLMD	UPC1
Frequencies (MHz)	4199.25**	4199.25**	4199.25**	4198.25**	4198.25**	4198.25**	4199.95
Polarization	LHCP	Horizontal	Vertical	LHCP	Horizontal	Vertical	RHCP
Maximum Channel EIRP (dBW)	8	8	8	8	8	8	9
Maximum Beam Peak EIRP Density (dBW/4kHz)	-11.4	-11.4	-11.4	-11.4	-11.4	-11.4	1
Maximum Beam Peak EIRP Density (dBW/Hz)	-47.4	-47.4	-47.4	-47.4	-47.4	-47.4	-35.0

**Tunable with 100 kHz step (3700-4200 MHz)

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

EXHIBIT 4
Beam Polarizations and GXT File Names

	Schedule S Beam Names							
	Linear Polarization				Circular Polarization			
Beam Designation	**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 North America, Alaska, Hawaii & Caribbean	CAHU	CAVU	CAHD	CAVD	----	----	----	----
Telemetry 1	----	----	TLMG*	TLMH*	----	----	TLME*	----
Telemetry 2	----	----	TLMC*	TLMD*	----	----	TLMA*	----
Command 1	CMH1*	CMV1*	----	----	----	CMR1*	----	----
Command 2	CMH2*	CMV2	----	----	----	CMR2*	----	----
ULPC	----	----	----	----	----	----	----	UPC1*

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