Engineering Statement

1 Introduction

Intelsat License LLC ("Intelsat") seeks authority in this application to operate the Intelsat 5 satellite (S2704) at the 166.15° E.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 are provided in this Engineering Statement and the accompanying Schedule S.

2 Spacecraft Overview

Intelsat 5 is capable of operating in the following C- and Ku-band frequencies:

Direction	Frequency
Uplink	5925-6425 MHz
	12750-13250 MHz
	14000-14250 MHz
Downlink	3700-4200 MHz
	10700-10950 MHz
	11200-11450 MHz
	11450-11700 MHz

The spacecraft provides the following coverage a 166.15° E.L.:

Beam Name	Coverage Area	Frequency Band
Pacific	Asia Pacific, Canada, and Western United States (including Alaska)	C-band
Pacific	Asia Pacific, Canada, and Western United States (including Alaska)	Ku-band
China Japan	China and Northeastern Asia	Ku-band
Japan	Northeastern Asia	Ku-band
Spot	Pacific (including Hawaii)	Ku-band

2.1 Spacecraft Characteristics

Intelsat 5 is a Boeing BS-601HP three-axis stabilized spacecraft with a rectangular outer-body structure. Intelsat 5 utilizes two deployable solar array wings and four mechanically adjustable reflectors (East, West, North, and South).

The Intelsat 5 spacecraft is composed of the following subsystems:

- Thermal;
- Power;
- Attitude Control;
- Propulsion;
- Telemetry, Tracking, and Command ("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 design incorporates redundancy in all subsystems in order to avoid single-point failures.

The structural design of Intelsat 5 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 C- and Ku-band frequencies, polarization, and channel plan as well as the 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.

The satellite's command and telemetry channel frequencies and performance are provided 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 visible 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 are not included in Schedule S.

2.4 ULPC Subsystem

Intelsat 5 utilizes two Ku-band channels 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 with Schedule S. Intelsat 5'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

Intelsat 5 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 Intelsat 5 can provide a range of communications services, including compressed digital video, high speed digital data, and digital single carrier per channel data channels.

4 Power Flux Density

The power flux density limits for space stations operating in the C-, Ku-bands specified in Section 25.208. As provided in Schedule S, the Intelsat 5 transmissions do not exceed these limits.

5 Emission Compliance

Section 25.202(e) of the Commission's rules requires that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency. Intelsat 5 is designed to be compliant with the provisions of this rule.

Intelsat 5 will comply with the provisions of Section 25.202(f) with regard to its emissions.

6 Orbital Location

Intelsat requests that Intelsat 5 be assigned the 166.15° E.L. orbital location. The 166.15° E.L. location satisfies Intelsat 5 requirements for optimizing coverage, elevation angles, and service availability. Although 166.15° E.L. was entered into Schedule S, the Schedule S software rounded it to 166.0° E.L.

7 International Telecommunication Union Filing

Intelsat 5's operations in the 3700-4200 MHz, 5925-6425 MHz, and 14000-14250 MHz frequency bands will use the notified and coordinated USASAT-14H and USASAT-60B filings under the Administration of the United States.

Intelsat 5's operations in the 10700-10950 MHz, 11200-11450 MHz, and 12750-13250 MHz will use ODYSSEY FSS-166E filings under the Administration of Federal Republic of Germany ("Germany").

Intelsat 5's operations in the 11450-11700 MHz frequency band will use ODYSSEY-166E filings under the Administration of Germany.

Intelsat respectfully requests that the United States Administration state its non-objection to the German Administration's use of Intelsat 5 for purposes of bringing into use the ODYSSEY-166E filing and maintaining the ODYSSEY FSS-166E filing.

8 Coordination with Co-frequency Space Stations

The downlink equivalent isotropically radiated power ("EIRP") density of the satellite's transmissions in the conventional C-band will not exceed 3 dBW/4 kHz for digital transmissions or 8 dBW/4 kHz for analog transmissions. The associated uplink transmissions will not exceed applicable EIRP density envelopes 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 Intelsat 5 at 166.15° E.L.

The downlink EIRP density of the satellite's transmissions in the conventional or extended Ku-band will not exceed 14 dBW/4 kHz for digital transmissions or 17 dBW/4 kHz for analog transmissions, and associated uplink transmissions will not exceed applicable EIRP density envelopes 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 Intelsat 5 at 166.15° E.L.

9 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.

9.1 Spacecraft Hardware Design

Intelsat 5 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.

9.2 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 satellite, 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.

9.3 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.

Intelsat is not aware of any other FCC licensed system, or any other system applied for and under consideration by the Commission, having an overlapping station-keeping volume with Intelsat 5. Intelsat is also not aware of any system with an overlapping station-keeping volume with the satellite that is the subject of an International Telecommunication Union filing and that is either in orbit or progressing towards launch.

9.4 Post Mission Disposal

At the end of the mission, Intelsat will dispose of the spacecraft by moving it to an altitude of at least 150 kilometers above the geostationary arc. Intelsat has reserved 25.5 kilograms of bi-propellant for that purpose.

In its *Second Report and Order* in IB Docket 02-54, Mitigation of Orbital Debris,[1] the FCC declared that satellites launched prior to March 18, 2002, such as the Intelsat 5 satellite, would be designated as grandfathered satellites not subject to a specific disposal altitude. Therefore, the planned disposal orbit for Intelsat 5 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.

10 TT&C Control Earth Stations

Intelsat will conduct TT&C operations through one or more of the following earth stations: Kumsan, Korea; Regency Park, Mingenew, Lockridge, Australia; Paumalu, Hawaii and Filmore, California. Additionally, Intelsat is capable of remotely controlling Intelsat 5 from its facilities in McLean, Virginia and or in Long Beach, California.

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

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 8, 2023
Giselle Creeser Intelsat US LLC Director, Spectrum Policy and Engineering	Date

EXHIBIT 1

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	C-band Pacific	C-band Pacific	Ku-band Pacific	Ku-band North Pacific	Ku-band Pacific
Schedule S Beam ID	PCVU	PCHU	PKHU	NPVU	P1HU
Frequency Band (MHz)	5925-6425	5925-6425	14000-14250	12750-132450	12750-13250
Polarization	Vertical	Horizontal	Horizontal	Vertical	Horizontal
G/T (dB/K)	0.2	0.6	2.9	4.6	2.9
Minimum SFD-- (dBW/m^2)	-96.2	--96.6	-91.9	-93.6	-91.9
Maximum SFD-- (dBW/m^2)	-81.2	-81.6	-76.9	-78.6	-76.9

EXHIBIT 2

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-band Pacific	C-band Pacific	Spot	Japan	China Japan	China Japan
Schedule S Beam ID	PCHD	PCVD	SKVD	JPHD	C1HD	CKHD
Frequency Band (MHz)	3700-4200	3700-4200	11450-11700	11200-11450	10700-10950	11200-11450
Polarization	Horizontal	Vertical	Vertical	Vertical	Horizontal	Horizontal
Maximum Beam Peak EIRP Density (dBW/Hz)	-34.0	-34.6	-27.0	-23.0	-21.6	-21.6
Maximum Beam Peak EIRP (dBW)	41.6	41.0	48.6	52.6	54	54
Maximum Beam Peak EIRP Density (dBW/4kHz)	2.1	1.5	9.1	13.1	14.5	14.5

EXHIBIT 3

TT&C SUBSYSTEM CHARACTERISTICS

Beam Name	Command Global Horn	Command pipe	Command pipe
Schedule S Beam ID	CMDG	CMDB	CMDP
Frequencies (MHz)	14498	14498	13999
Polarization	Horizontal	Horizontal	RHCP
Peak Flux Density at Command Threshold (dBW/m^2)	-104.8	--104.8	-92.5

Beam Name	Telemetry Global Horn	Telemetry Pipe	Telemetry Bicone	ULPC1	ULPC2
Schedule S Beam ID	TLMG	TLMP	TLMB	UPCR	UPCL
Frequencies (MHz)	11451 & 11452	11451 & 11452	12747.5	11454	11454
Polarization	Horizontal	RHCP	Vertical	RHCP	LHCP
Maximum Channel EIRP (dBW)	9.2	10.2	9	11.4	11.4
Maximum Beam Peak EIRP Density (dBW/4kHz)	-11.8	-10.8	-12.0	-6.4	-6.4
Maximum Beam Peak EIRP Density (dBW/Hz)	-47.8	-46.8	-48.0	-32.6	-32.6

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 (H-Pol.)**	**Uplink (V-Pol.)**	**Downlink (H-Pol.)**	**Downlink (V-Pol.)**	**Uplink (LHCP)**	**Uplink (RHCP)**	**Downlink (LHCP)**	**Downlink (RHCP)**
C-band Beams								
Pacific Beam	PCHU	PCVU	PCHD	PCVD	----	----	----	----
Ku-band Beams								
North Pacific	----	NPVU	----	----	----	----	----	----
Pacific	PKHU P1HU	----	----	----	----	----	----	----
Chin Japan	----	----	CKHD C1HD	----	----	----	----	----
Japan	----	----	----	JKVD	----	----	----	----
Spot steerable	----	----	----	SKVD	----	----	----	----
Telemetry Global Horn	TLMG* TLMB*	----	----	----	----	----	----	----
Telemetry Bicone	TLM1* TLM2*	----	----	----	----	----	----	----
Telemetry Pipe	----	----	----	----	----	----	----	TLMP*
Command Pipe	CMDG*	----	----	----	----	CMDP*	----	----
Command Horn	CMDB*	----	----	----	----	----	----	----
Ku-band ULPC	----	----	----	----	----	----	UPCL*	UPCR*

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