Engineering Statement

1 Introduction

Intelsat License LLC ("Intelsat") seeks authority in this application to operate Intelsat 902 (Call Sign S2406), at 50.1° W.L. (309.9°E.L). The characteristics of the Intelsat 902 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 this Engineering Statement. In all other respects, the characteristics of Intelsat 902 are the same as those described in SAT-MOD-20160816-00084.

2 Satellite Overview

Intelsat 902 is capable of operating in the C- and Ku-band frequencies listed below:

Direction	Frequency
Uplink	5850-5925 MHz
	5925-6425 MHz
	14000-14500 MHz
Downlink	3625-3700 MHz
	3700-4200 MHz
	10950-11200 MHz
	11450-11700 MHz

The satellite will provide the following coverage at 50.1° W.L.:

Beam	Coverage
Spot 1	CONUS, Canada, Mexico, and Caribbean
Spot 2	CONUS, Canada, and Caribbean
West Hemi	North and South America, Western Europe, Greenland, and Caribbean
East Hemi	Western Africa and Southern Europe
Northwest	Canada, CONUS, and 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.

Southwest	Mexico, South America, and Caribbean
Middle East	Greenland and Western Europe
Southeast	Southern and Western Africa
Northeast	Northern Africa and Southern Europe
Combined East	Africa and Southern Europe
Global	Global

2.1 Satellite Characteristics

Intelsat 902 is a Maxar FS-1300 three-axis stabilized type spacecraft with a rectangular outer-body structure. Intelsat 902 utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

The Intelsat 902 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 satellite; ensure that all internal units are maintained within the required temperature range; and ensure that the satellite can be commanded and controlled with a high level of reliability from launch to the end of its useful life. The satellite design incorporates redundancy in all of the various subsystems in order to avoid single-point failures.

The structural design of the satellite 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 satellite.

2.2 Communication Subsystem

Intelsat 902 provides active communication channels in C- and Ku-bands. In C-band, the active communication channels have a bandwidth of either 36 MHz, 41 MHz, or 72 MHz. In Ku-band, the active communication channels have a bandwidth of either 36 MHz, 72 MHz, or 77 MHz. The Intelsat 902 frequencies, polarization, and channel plan are provided in the Schedule S.

The coverage contours and performance characteristics of the Intelsat 902 beams except for the global beams are provided in the Schedule S. The gain contours of the global beams 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 are therefore not included in Schedule S. Exhibits 1 and 2 provide the beam parameters for the Intelsat 902 uplink and downlink beams, respectively.

Intelsat 902 is equipped with two steerable Ku-band spot beams. Gain contours for these beams are provided in Schedule S. Each steerable beam may be pointed toward any location on the earth that is visible from 50.1° W.L. Regardless of pointing, the coverage contours remain identical in gain and roll-off. Intelsat will ensure that transmissions in these beams are consistent with relevant Commission rules and International Telecommunications Union ("ITU") Radio Regulations.

2.3 Telemetry, Command, and Ranging Subsystem

The TC&R subsystem provides the following functions:

1) acquisition, processing and transmission of satellite telemetry data;

2) reception and retransmission of ground station generated ranging signals; and

3) reception, processing, and distribution of telecommands.

The Intelsat 902 command and telemetry channel frequencies are shown in Exhibit 3. The gain contours of the command and telemetry beam 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 Intelsat 902 command and telemetry subsystem performance are summarized in Exhibit 3.

2.4 Uplink Power Control Subsystem

Intelsat 902 utilizes one C- and two Ku-band channels for ULPC, antenna tracking, and ranging. The gain contours of the ULPC beams 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 are not included in Schedule S. The Intelsat 902 ULPC frequencies and subsystem performance are summarized in Exhibit 3.

2.5 Satellite Station-Keeping

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

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

3 Services

Intelsat 902 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 902 can accommodate television, radio, voice, and data communications. Typical communication services include:

a) compressed digital video;

b) high speed digital data; and

c) digital single channel per carrier data channels.

4 Power Flux Density

The power flux density ("PFD") limits for space stations operating in the 3650-4200 MHz, 10950-11200 MHz, and 11450-11700 MHz bands are specified in Section 25.208. The PFD limits for space stations operating in the 3625-3650 MHz are specified in No. 21.16 of the ITU Radio Regulations. The maximum PFD levels for the Intelsat 902 transmissions were calculated for the 3625-4200 MHz, 10950-11200 MHz, and 11450-11700 MHz bands. As shown in the Schedule S, the downlink PFD levels of the Intelsat 902 carriers do not exceed the limits specified in Section 25.208 or the limits specified in No. 21.16 of the ITU Radio Regulations.

5 Emission Compliance

The satellite was 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.

Intelsat will comply with the provisions of Section 25.202(f) with regard to Intelsat 902 emissions.

6 Orbital Location

Intelsat requests that it be assigned the 309.9° E.L./50.1° W.L. orbital location for Intelsat 902.[2] The 50.1° W.L. location satisfies Intelsat 902 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 ITU Filling

Intelsat 902's operations in the 3700-4200 MHz, 5925-6425 MHz, 10950-11200 MHz, 11450-11700 MHz, and 14000-14500 MHz frequency bands will operate under the notified ITU filings: INTELSAT7 310E, INTELSAT9 310E, and INTELSAT10 310E of the Administration of the United States. Operations in the 5850-5925 MHz frequency band will operate under the ITU filing USASAT-80A of the Administration of the United States. Operations in the 3625-3700 MHz frequency band will operate under the NEW DAWN 35-1 filling of the Administration of Papua New Guinea.

Intelsat requests that the United States state its non-objection to the use of the Papua New Guinea's filings NEW DAWAN 35-1 for operation of the Intelsat -IS-902 satellite in the 3625-3700 MHz frequency band, in accordance with ITU Circular Letter CR/333.

8 Coordination with Co-frequency Space Stations

The downlink equivalent isotropically radiated power ("EIRP") density of the satellite's transmissions in the conventional and extended C-band will not exceed 3 dBW/4kHz for digital transmissions and 8 dBW/4kHz for analog transmissions. 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 902 at 50.1° W.L.

The downlink EIRP density of Intelsat 902 transmissions in the conventional Ku-band will not exceed 14 dBW/4kHz for digital transmissions and 17 dBW/4kHz for analog transmissions. 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

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[2] The Schedule S software has automatically rounded the requested 50.1° W.L. location to 50° W.L.

authorized co-frequency space stations at assigned locations within six degrees of Intelsat 902 at 50.1° W.L.

Therefore, consistent with Section 25.140, the uplink frequency bands: 5850-5925 MHz, 5925-6425 MHz, and 14000-14500 MHz; and the downlink frequency bands: 3625-3700 MHz, 3700-4200 MHz, 10950-11200 MHz, and 11450-11700 MHz do not require an interference or 2-degree analysis.

9 Orbital Debris Mitigation Plan

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

9.1 Satellite Hardware Design

Intelsat 902 is designed such that no debris will be released during normal operations. Intelsat has assessed the probability of collision with meteoroids and other debris. In order to limit the effects of such unlikely collisions critical 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

The manufacturer 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 satellite 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 satellite becoming a source of debris as a result of collisions with large debris or other operational satellites.

During the relocation of Intelsat 902, Intelsat will take all the necessary steps to coordinate the move internally to minimize the risk of collision or interference between Intelsat 902 and any other satellites. Intelsat is unaware of any other FCC licensed satellite, or any other satellite applied for and under consideration by the FCC, that will have an overlapping station-keeping volume with Intelsat 902. Intelsat is also not aware of any satellite with an overlapping station-keeping volume with Intelsat 902 that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

9.4 Post Mission Disposal

In compliance with the FCC's rules, Intelsat intends to dispose of the satellite at the end of its mission by moving the satellite to an altitude of at least 150 kilometers above the geostationary arc .[3] Intelsat has reserved 52.8 kilograms of fuel for this purpose. The reserved fuel figure was determined by the satellite manufacturer and provided for in the propellant budget. This calculation takes into account the expected mass of the satellite at the end of life and the required delta-velocity to achieve the desired orbit and the fuel gauging uncertainty.

10 TC&R Control Earth Stations

Intelsat will conduct TC&R operations through one or more of the following earth stations: Riverside, California; Castle Rock, Colorado; Mountainside, Maryland; or Fucino, Italy. Additionally, Intelsat is capable of remotely controlling Intelsat 902 from its facilities in McLean, VA or Long Beach, CA.

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 23, 2020

Date

Intelsat
Director Spectrum Policy,
Engineering

[3] Satellites launched prior to March 18, 2002 were designated as grandfathered satellites and not subject to a specific disposal altitude. *See* Mitigation of Orbital Debris, *Second Report and Order*, 19 FCC Rcd 11567 (2004). Intelsat 902 was launched on August 30, 2001.

EXHIBIT 1

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	C-Band Global	C-Band Global	C-Band Hemi	C-Band Hemi	C-Band Spot
Schedule S Beam ID	CGLU	CGRU	CWLU	CELU	CNRU
Frequency Band (MHz)	6300 - 6425	6300 - 6425	5850 - 6300	5850 - 6300	5850 - 6300
Polarization	LHCP	RHCP	LHCP	LHCP	RHCP
G/T (dB/K)	-6.5	-5.5	-2.2	1.7	4.3
Minimum SFD-- (dBW/m^2)	-89.8	-90.5	-88.7	-89.9	-89.1
Maximum SFD-- (dBW/m^2)	-67.8	-68.5	-66.7	-67.9	-67.1

Beam Name	C-Band Spot	C-Band Spot	C-Band Spot	C-Band Spot	C-Band Spot
Schedule S Beam ID	CSRU	CMRU	SERU	NERU	CCRU
Frequency Band (MHz)	5850 - 6300	5850 - 6300	5850 - 6300	5850 - 6300	5850 - 6300
Polarization	RHCP	RHCP	RHCP	RHCP	RHCP
G/T (dB/K)	0.2	3.0	3.0	4.0	0.3
Minimum SFD-- (dBW/m^2)	-90.0	-90.1	-88.9	-89.6	-88.9
Maximum SFD-- (dBW/m^2)	-68.0	-68.1	-66.9	-67.6	-66.9

Beam Name	Ku-Band Spot	Ku-Band Spot
Schedule S Beam ID	K1HU	K2VU
Frequency Band (MHz)	14000 - 14500	14000 - 14500
Polarization	Horizontal	Vertical
G/T (dB/K)	8.8	8.6
Minimum SFD-- (dBW/m^2)	-95.0	-95.6
Maximum SFD-- (dBW/m2)	-73.0	-73.6

EXHIBIT 2

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-Band Global	C-Band Global	C-Band Hemi	C-Band Hemi	C-Band Spot
Schedule S Beam ID	CGLD	CGRD	CWRD	CERD	CNLD
Frequency Band (MHz)	4075 - 4200	4075 - 4200	3625 - 4075	3625 - 4075	3625 - 4075
Polarization	LHCP	RHCP	RHCP	RHCP	LHCP
Maximum Beam Peak EIRP (dBW)	35.6	35.4	41.1	45.1	41.8
Maximum Beam Peak EIRP Density (dBW/4kHz)	-3.9	-4.1	1.6	5.6	2.3
Maximum Beam Peak EIRP Density (dBW/Hz)	-40.0	-40.2	-34.5	-30.5	-33.8

Beam Name	C-Band Spot	C-Band Spot	C-Band Spot	C-Band Spot	C-Band Spot
Schedule S Beam ID	CSLD	CMLD	SELD	NELD	CCLD
Frequency Band (MHz)	3625 - 4075	3625 - 4075	3625 - 4075	3625 - 4075	3625 - 4075
Polarization	LHCP	LHCP	LHCP	LHCP	LHCP
Maximum Beam Peak EIRP (dBW)	41.8	43.1	45.6	44.5	47.6
Maximum Beam Peak EIRP Density (dBW/4kHz)	2.3	3.6	6.1	5.0	8.1
Maximum Beam Peak EIRP Density (dBW/Hz)	-33.8	-32.5	-30.0	-31.1	-28.0

Beam Name	Ku-Band Spot1	Ku-Band Spot1	Ku-Band Spot2	Ku-Band Spot2
Schedule S Beam ID	KIVD	KIVE	K2HD	K2HE
Frequency Band (MHz)	10950 - 11200	11450 - 11700	10950 - 11200	11450 - 11700
Polarization	Vertical	Vertical	Horizontal	Horizontal
Maximum Beam Peak EIRP (dBW)	53.2	53.2	53.3	53.3
Maximum Beam Peak EIRP Density (dBW/4kHz)	13.7	13.7	13.8	13.8
Maximum Beam Peak EIRP Density (dBW/Hz)	-22.4	-22.4	-22.3	-22.3

EXHIBIT 3

TC&R SUBSYSTEM CHARACTERISTICS

Beam Name	Command Global	Command Bicone
Schedule S Beam ID	CMDG	CMDB
Frequencies (MHz)	6173.7	6176.3
Polarization	LHCP	LHCP
Peak Flux Density at Command Threshold (dBW/m^2-Hz)	-90	-90

Beam Name	Telemetry Global	Telemetry Bicone	ULPC	ULPC	ULPC
Schedule S Beam ID	TLMG	TLMB	UPKD	UPKC	UPCC
Frequencies (MHz)	3947.5 & 3948	3952.0 & 3952.5	11198.0	11452.0	3950.0
Polarization	RHCP	RHCP	RHCP	RHCP	Vertical
Maximum Channel EIRP (dBW)	7.1	6.8	11.4	11.4	6.6
Maximum Beam Peak EIRP Density (dBW/4kHz)	-13.9	-14.2	3.4	3.4	-1.4
Maximum Beam Peak EIRP Density (dBW/Hz)	-49.9	-50.2	-32.6	-32.6	-37.4

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								
Global Beam	----	----	----	----	CGLU*	CGRU*	CGLD*	CGRD*
West Hemi	----	----	----	----	CWLU	----	CWRD	----
East Hemi	----	----	----	----	CELU	----	CERD	----
Northwest	----	----	----	----	----	CNRU	CNLD	----
Southwest	----	----	----	----	----	CSRU	CSLD	----
Middle East	----	----	----	----	----	CMRU	CMLD	----
Southeast	----	----	----	----	----	SERU	SELD	----
Northeast	----	----	----	----	----	NERU	NELD	----
Combined East	----	----	----	----	----	CCRU	CCLD	----
Telemetry Global	----	----	----	----	----	----	----	TLMG*
Telemetry Bicone	----	----	----	----	----	----	----	TLMB*
Command Global	----	----	----	----	CMDG*	----	----	----
Command Bicone	----	----	----	----	CMDB*	----	----	----
C-band ULPC	----	----	----	UPCC*	----	----	----	----
Ku-Band Beams								
East coast S1	K1HU	----	----	K1VD K1VE	----	----	----	----
East coast S2	----	K2VU	K2HD K2HE	----	----	----	----	----
Ku-band ULPC	----	----	----	----	----	----	----	UPKC* UPKD*

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