Engineering Statement

1 Introduction

Intelsat License LLC, as debtor in possession ("Intelsat"), seeks to amend its pending application to modify the authorization for the Galaxy 14 satellite (S2385) to add a request for authorization to redeploy Galaxy 14 to, and operate the satellite at, 32.9° E.L.; add a waiver request; and to amend its request to extend the license term of the Galaxy 14 satellite. The characteristics of Galaxy 14, 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.

2 Spacecraft Overview

Galaxy 14 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	Middle East, Europe, and North Africa

Intelsat expects to bias the satellite platform on a seasonal basis to meet customer requirements at this new orbital location. The October-March time period is designated as the winter season and April-September time period is designated as the summer season. The winter and summer coverage maps are included in Exhibits 5 and 6, respectively.

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[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] The Galaxy 14 satellite's proposed C-band coverage does not include the contiguous United States.

2.1 Spacecraft Characteristics

Galaxy 14 is a Northrop Grumman Space Systems Star 2.2 three-axis stabilized type satellite that has a rectangular outer body structure. Galaxy 14 utilizes two deployable solar array wings and fixed deployable and non-deployable antennas.

The Galaxy 14 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 14 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 14 C-band payload employs channels with bandwidth of 36 MHz. The C-band 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 Galaxy 14 command and telemetry subsystem parameters are summarized in Exhibit 3 and Schedule S. 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 14 utilizes two C-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 in Schedule S. Galaxy 14'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, thruster perturbations, etc.).

3 Services

Galaxy 14 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 14 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 proposed Galaxy 14 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 14 is designed to comply with this rule. Galaxy 14's emissions will also comply with Section 25.202(f).

6 Orbital Location

Intelsat requests that Galaxy 14 be assigned the 32.9° E.L. orbital location as a replacement satellite for Galaxy 25 (S2154). Although 32.9° E.L. was entered into Schedule S, the Schedule S software rounded it to 33.0°E.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 and 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 14 at 32.9° E.L.

8 Orbital Debris Mitigation Plan

Intelsat is proactive in ensuring the 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 14 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 active units are turned off.

Due to the design of Galaxy 14, Intelsat will not be able to vent all pressurized systems. Upon disposal Intelsat will vent the satellite's fuel and helium tank. However, because of the spacecraft design, Intelsat will not be able to vent the two oxidizer tanks on Galaxy 14. To the extent necessary, Intelsat seeks a waiver of Sections 25.114(d)(14)(ii) and 25.283(c).[3]

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 14 will replace Galaxy 25 at 32.9° E.L. and these satellites will be nominally collocated during transfer of traffic. Additionally, Intelsat 28 (S2751) is licensed to operate at 32.8° E.L. In both cases, Intelsat will ensure that sufficient spatial separation is achieved between the satellites through the use of orbit eccentricity and inclination offsets to minimize the risk of collision.

Other than the aforementioned temporary colocation of Galaxy 25, Intelsat is not aware of any other FCC licensed system, or any other system applied for and under consideration by the Commission, that would have an overlapping station-keeping volume with Galaxy 14 at 32.9° E.L. Additionally, Intelsat is also not aware of any system with an overlapping station-keeping volume with the Galaxy 14 that is the subject of an International Telecommunications Union 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 270.1 kilometers above the geostationary arc. Intelsat has reserved 31.06 kilograms of bi-propellant for that purpose.[4] In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order.[5] The effective area to mass ratio (Cr*A/M) of the satellite is 0.032 m^2/kg, resulting in a minimum perigee disposal altitude under the Inter-Agency Space Debris Coordination Committee formula of 270.1 kilometers above the geostationary arc. Accordingly, Galaxy 14's planned disposal orbit complies with the Commission's rules.

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[3] *See* Legal Narrative at 3-6.

[4] 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.

[5] *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: Fuchsstadt, Germany; Hartebeeshoek, South Africa; and Fucino, Italy. Additionally, Intelsat is capable of remotely controlling Galaxy 14 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 2, 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	2.8
Minimum SFD-- (dBW/m^2)	-116.5	-115.8
Maximum SFD-- (dBW/m^2)	-81.5	-80.8

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)	42.9	42.4
Maximum Beam Peak EIRP Density (dBW/4kHz)	3.4	2.9
Maximum Beam Peak EIRP Density (dBW/Hz)	-32.7	-33.2

EXHIBIT 3

TC&R SUBSYSTEM CHARACTERISTICS

Beam Name	Command 1 Dish	Command 1 Omni	Command 1 Global
Schedule S Beam ID	CMV1	CMR1	CMR2
Frequencies (MHz)	6420.50	6420.50	6420.50
Polarization	Vertical	RHCP	RCHP
Peak Flux Density at Command Threshold (dBW/m^2-Hz)	-80.0	-80.0	-80.0

Beam Name	Telemetry 1 Dish	Telemetry 1 Omni	Telemetry 1 Global	Telemetry 2 Dish	Telemetry 2 Omni	Telemetry 2 Global
Schedule S Beam ID	TLME	TLMF	TLMG	TLMA	TLMB	TLMC
Frequencies (MHz)	4198.00	4198.00	4198.00	4199.875	4199.875	4199.875
Polarization	Horizontal	LHCP	LHCP	Horizontal	LHCP	LHCP
Maximum Channel EIRP (dBW)	11.27	11.27	11.27	12.03	12.03	12.03
Maximum Beam Peak EIRP Density (dBW/4kHz)	-9.7	-9.7	-9.7	-8.9	-8.9	-8.9
Maximum Beam Peak EIRP Density (dBW/Hz)	-45.7	-45.7	-45.7	-45.0	-45.0	-45.0

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

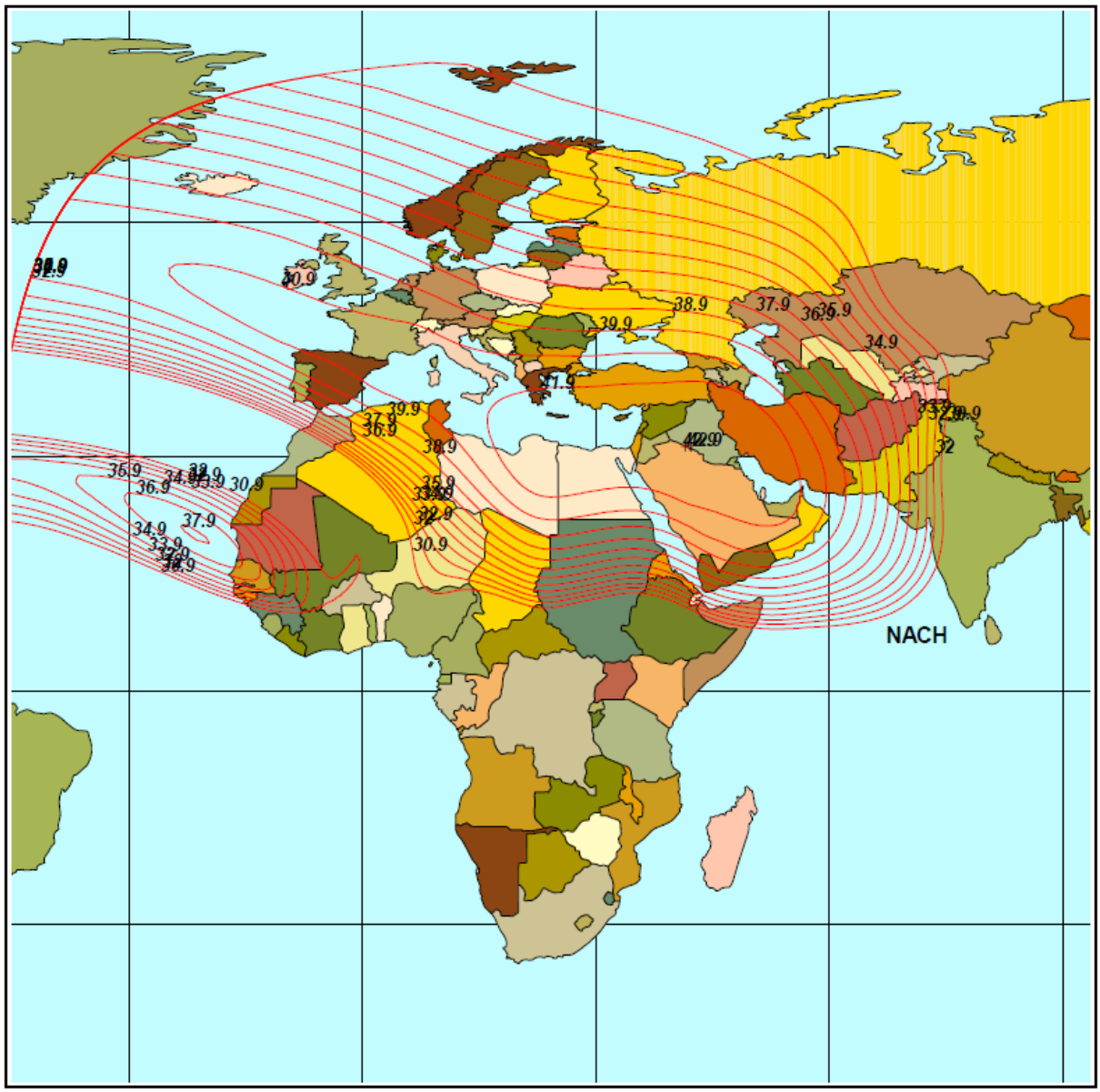
EXHIBIT 4
Beam Polarizations and GXT File Names

	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								
C-band	CAHU	CAVU	CAHD	CAVD	----	----	----	----
Telemetry 1	----	----	TLME*	----	----	----	TLMF* TLMG*	----
Telemetry 2	----	----	TLMA*	----	----	----	TLMB* TLMC*	----
Command 1	----	CMV1*	----	----	----	CMR1* CMR2*	----	----

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

EXHIBIT 5
Galaxy-14 Winter Season Coverages

Space-to-Earth Transmissions



Earth-to-space Transmissions

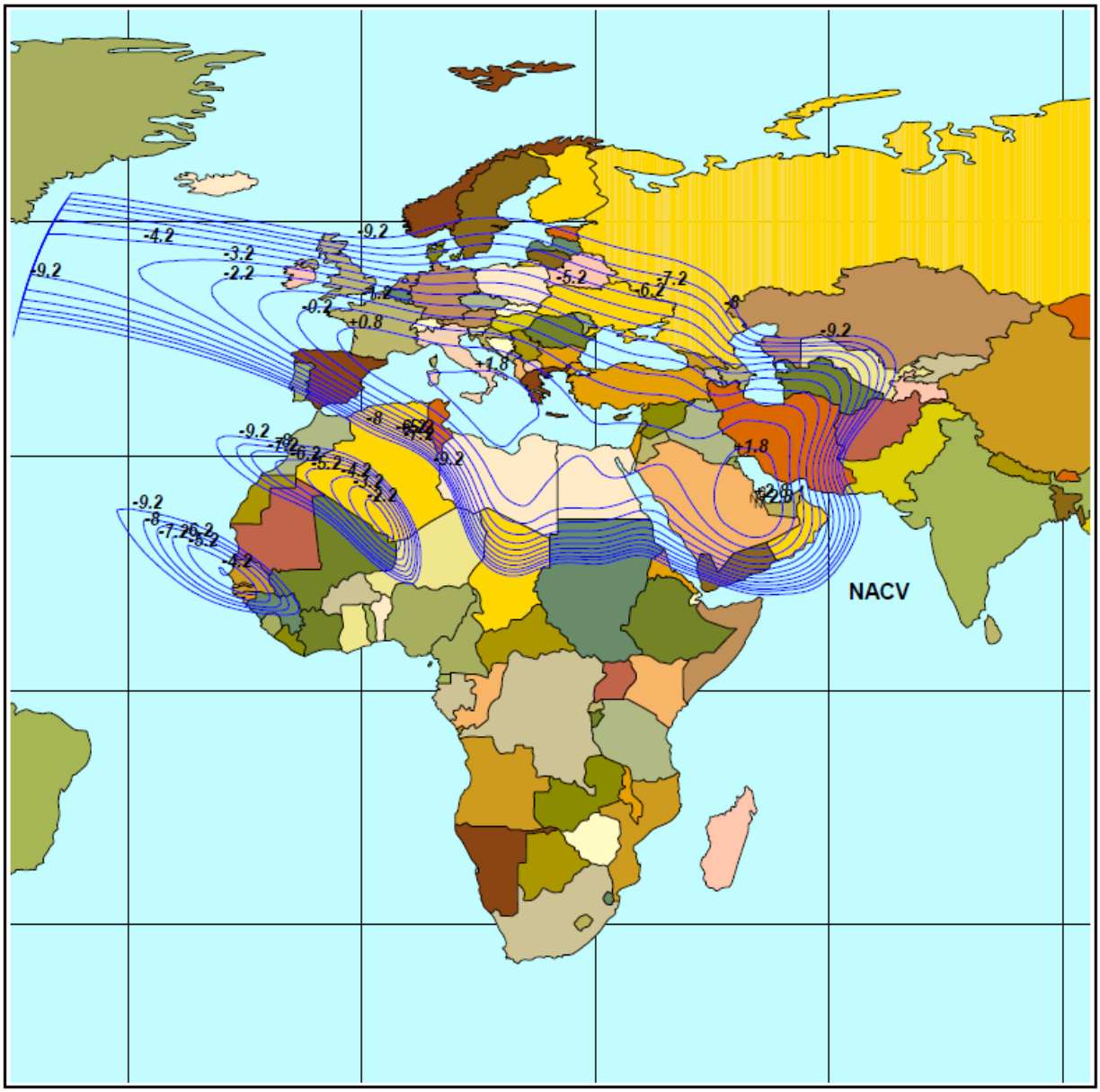
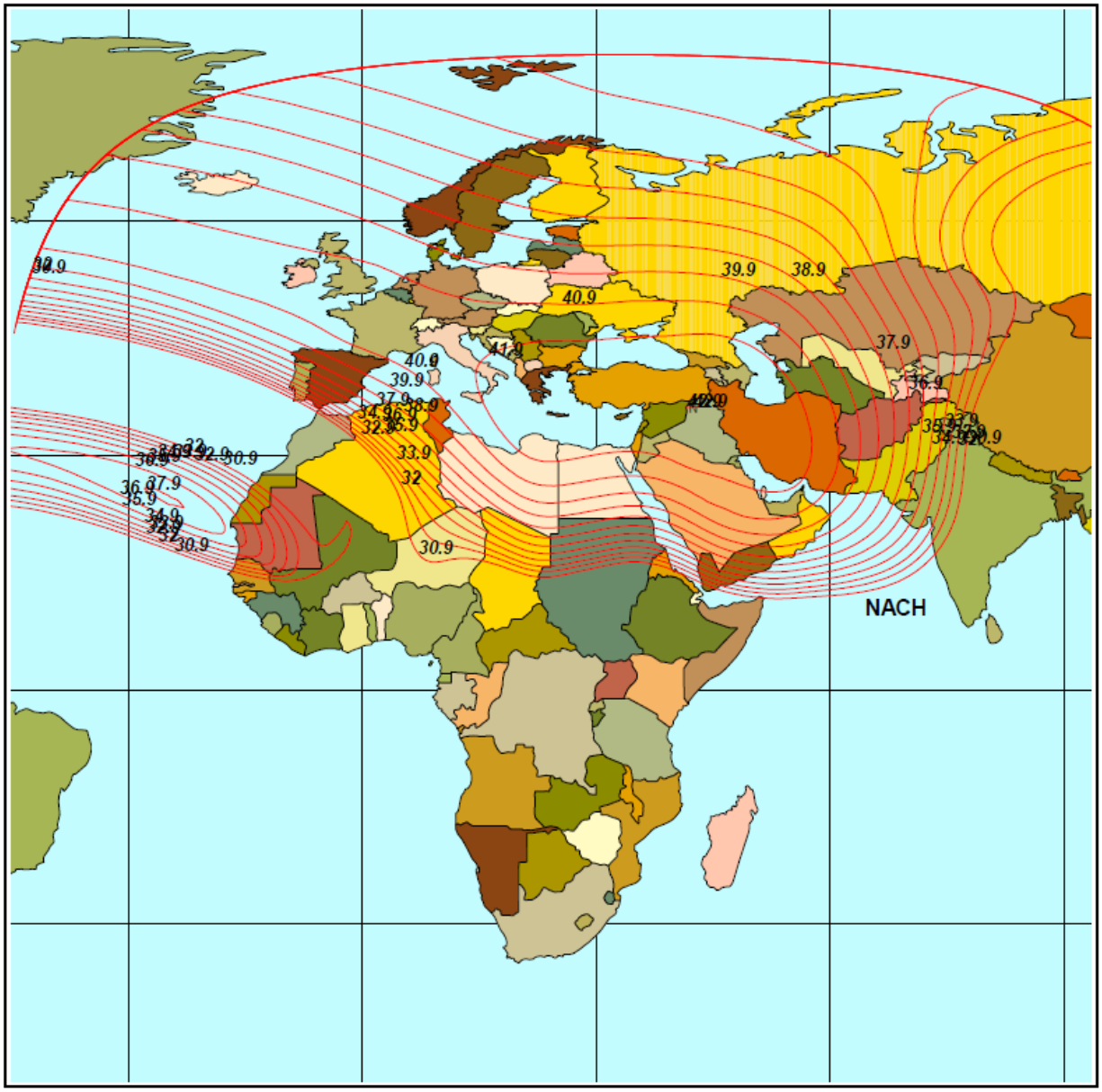


EXHIBIT 6
Galaxy-14 Summer Season Coverages

Space-to-Earth Transmissions



Earth-to-space Transmissions