Engineering Statement

1 Introduction

Intelsat License LLC, as debtor in possession (“Intelsat”), seeks authority in this application to redeploy the Galaxy 25 (S2154) satellite to 32.9° E.L./327.1° W.L and to operate the satellite’s C-band beams over a new coverage area in the frequencies 3700-4200 MHz and 5925 - 6425 MHz in order to provide customer service. Intelsat expects to bias the satellite platform on a seasonal basis with November-April designated as the winter season and May-October designated as the summer season. The winter and summer coverage maps are enclosed in Exhibits 5 and 6, respectively.

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. In all other respects, the characteristics of Galaxy 25 are the same as those described in SAT-MOD-20080825-00159.

2 Satellite Overview

The satellite is capable of operating in C-band frequencies listed below and the satellite coverage is provided in Exhibits 5 and 6.

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

2.1 Satellite Characteristics

Galaxy 25 is a Space Systems Loral three-axis stabilized type satellite that has a rectangular outer body structure. Galaxy 25 utilizes two deployable solar array wings and a number of deployable and non-deployable antennas.

[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 25 satellite’s current and proposed C-band coverage does not include the contiguous United States.

The Galaxy 25 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 each of the various subsystems in order to avoid single-point failures.

The structural design of Galaxy 25 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

The Galaxy 25 C-band payload employs channels with a bandwidth of 36 MHz. The C-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 Galaxy 25 uplink and downlink beams, respectively, and Exhibit 4 provides the Schedule S beam designations.

2.3 Telemetry, Command and Ranging ("TC&R") 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 Galaxy 25 command and telemetry subsystem parameters are summarized in Exhibit 3 and in Schedule S. The coverage patterns of the on-station command and telemetry beams are provided in Schedule S. The coverage patterns of the emergency 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 25 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 Galaxy 25 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 satellite 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 25 is a general-purpose communications satellite and has been designed to support various services offered within Intelsat's satellite system. Depending upon the needs of the users, the transponders on Galaxy 25 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 25 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 25 is designed to be compliant with this rule.

Galaxy 25 will comply with the provisions of Section 25.202(f) with regard to its emissions.

6 Orbital Location

Intelsat requests that it be assigned the 32.9° E.L./327.1° W.L. orbital location for Galaxy 25. This location satisfies Galaxy 25 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. Although 32.9° E.L. was entered into Schedule S, the Schedule S software rounded it to 33.0°E.L.

7 International Telecommunication Union ("ITU") Filing

Galaxy 25's operations in the frequencies 3700-4200 MHz and 5925-6425 MHz will rely on the INTELSAT5 33E, INTELSAT7 33E, and INTELSAT9 33E ITU filing of the Administration of the United States.

8 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 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 25 at 32.9° E.L.

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

Galaxy 25 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 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.

As calculated using the NASA Debris Assessment Software, the Galaxy 25 satellite's probability of a collision with large objects is less than 0.01, and with small objects is also less than 0.01

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 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.

9.3 Safe Flights 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 25 is not located at the same orbital location as another satellite or at an orbital location that has an overlapping station keeping volume with another satellite.

Intelsat is also not aware of any system with an overlapping station-keeping volume with Galaxy 25 that is the subject of an ITU 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 300 kilometers above the geostationary arc. Intelsat has reserved 70.3 kilograms of bi-propellant for that purpose.

In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's 2004 Orbital Debris Report and Order.[3] The effective area to mass ratio (Cr*A/M) of the Galaxy 25 satellite is 0.059 m^2/kg, resulting in a minimum perigee disposal altitude under the Inter-Agency Space Debris Coordination Committee formula of 299.8 kilometers above the geostationary arc. Accordingly, Galaxy 25'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).

10 TC&R Control Earth Stations

Intelsat will conduct TC&R operations through one or more of the following teleports: Fuchsstadt, Germany; Hartebeeshoek, South Africa, and Fucino, Italy. Additionally, Intelsat is capable of remotely controlling Galaxy 25 from its facilities in McLean, Virginia or in 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	December 14, 2020
Giselle Creeser Intelsat Director, Spectrum Policy and Engineering	Date

EXHIBIT 1

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	C-Band Beam	C-Band Beam
Schedule S Beam ID	NCHU	NCVU
Frequency Band (MHz)	5925-6425	5925-6425
Polarization	Horizontal	Vertical
G/T (dB/K)	3.9	3.0
Minimum SFD--(dBW/m^2)	-97.9	-95.8
Maximum SFD--(dBW/m^2)	-76.9	-74.8

EXHIBIT 2

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	C-Band Beam	C-Band Beam
Schedule S Beam ID	NCHD	NCVD
Frequency Band (MHz)	3700-4200	3700-4200
Polarization	Horizontal	Vertical
EIRP (dBW)	40.5	40.0
Maximum Beam Peak EIRP Density (dBW/4kHz)	1.0	0.5

EXHIBIT 3

TC&R SUBSYSTEM CHARACTERISTICS

Beam Name	Command Omni	Command Global
Schedule S Beam ID	CMDC	CMDB
Frequencies (MHz)	5926.5	6423.5
Polarization	Vertical	Horizontal
Peak Flux Density at Command Threshold (dBW/m^2-Hz)	-90.0	-90.0

Beam Name	Telemetry Omni	Telemetry Global
Schedule S Beam ID	TLMC	TLMB
Frequencies (MHz)	4195.5	4199.5
Polarization	Vertical	Vertical
Maximum Channel EIRP (dBW)	22.4	21.4
Maximum Beam Peak EIRP Density (dBW/4kHz)	1.4	0.4

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 Beam	NCHU	NCVU	NCHD	NCVD	----	----	----	----
Telemetry Omni	----	----	----	TLMC*	----	----	----	----
Telemetry Global	----	----	----	TLMB*	----	----	----	----
Command Global horn	CMDB*	----	----	----	----	----	----	----
Command Omni	----	CMDC*	----	----	----	----	----	----

** 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-25 Summer Season Coverages

C-Band Coverage Horizontal Downlink

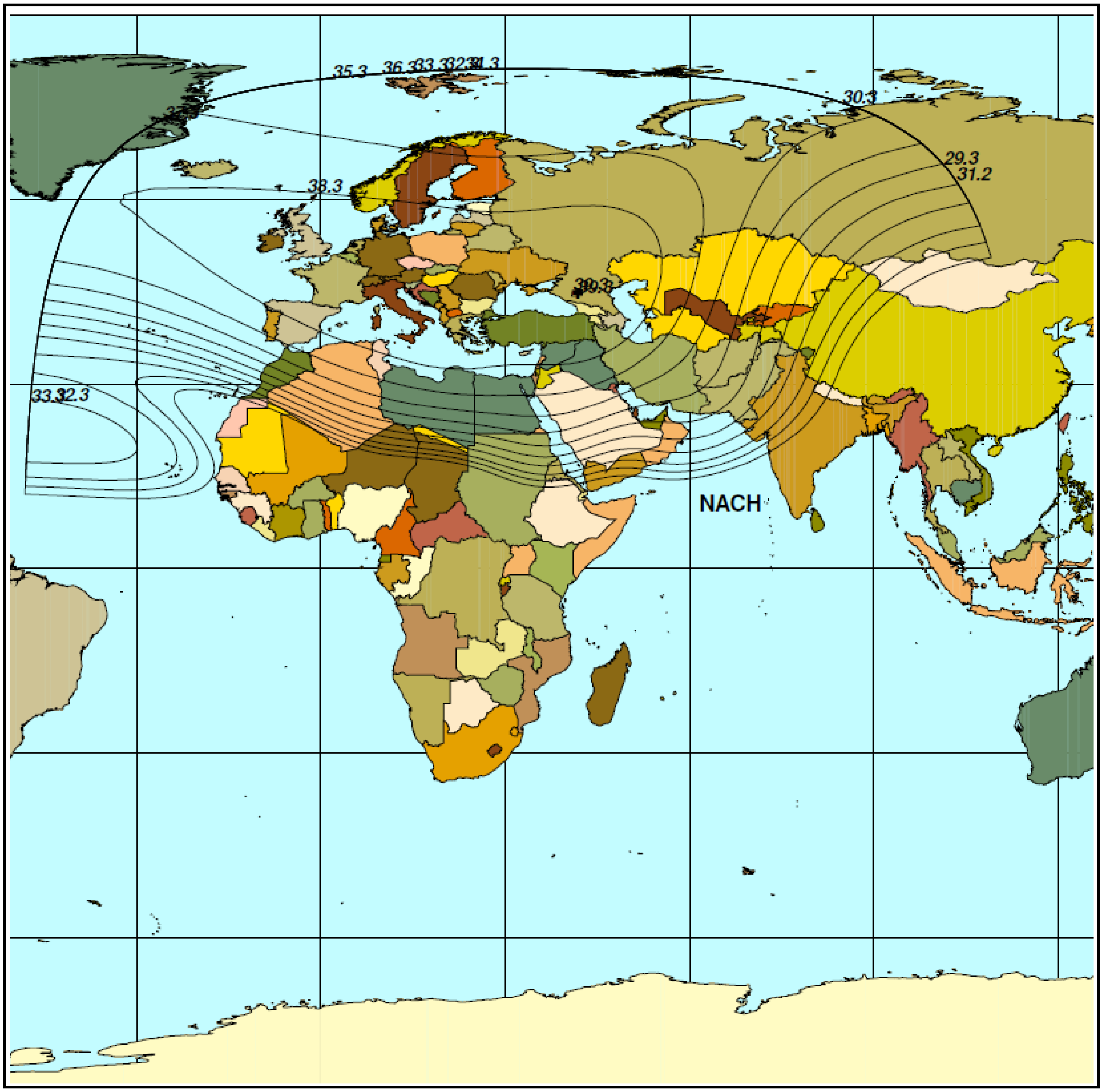

Figure 1: C-band horizontal downlink

C-Band Coverage Vertical Downlink

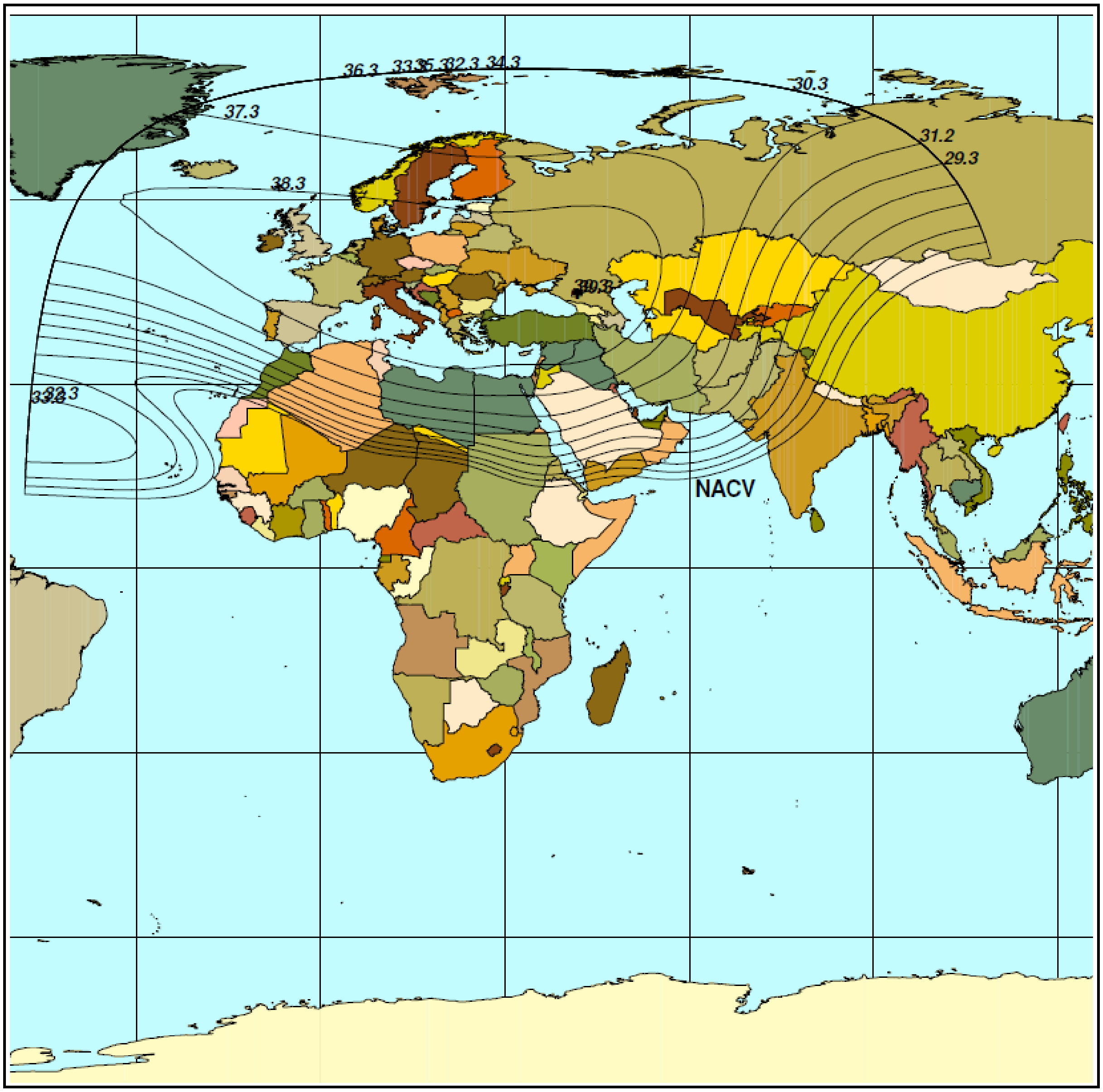

Figure 2: C-band vertical downlink

C-Band Coverage Horizontal Uplink

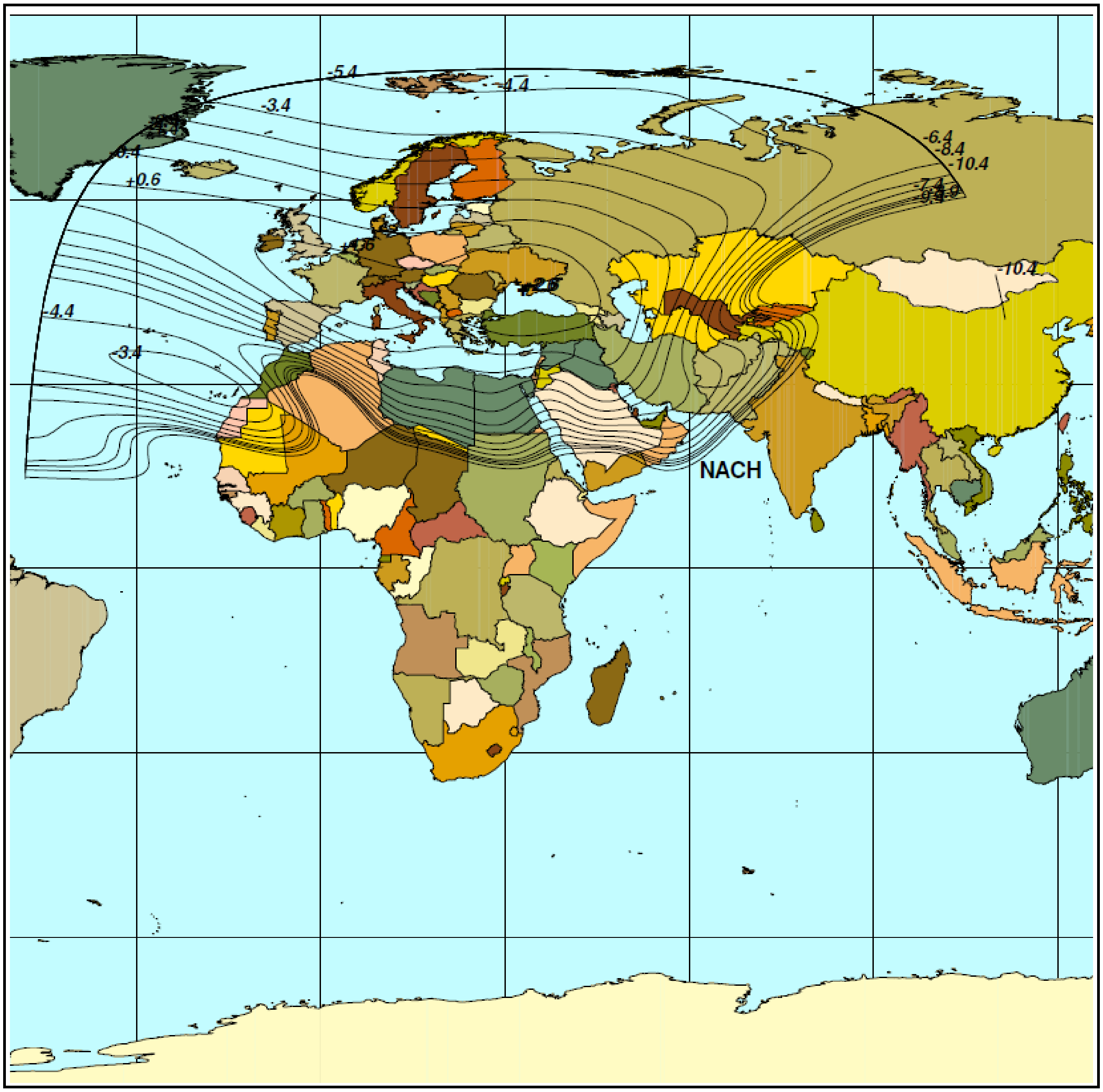

Figure 3: C-band horizontal uplink

C-Band Coverage Vertical Uplink

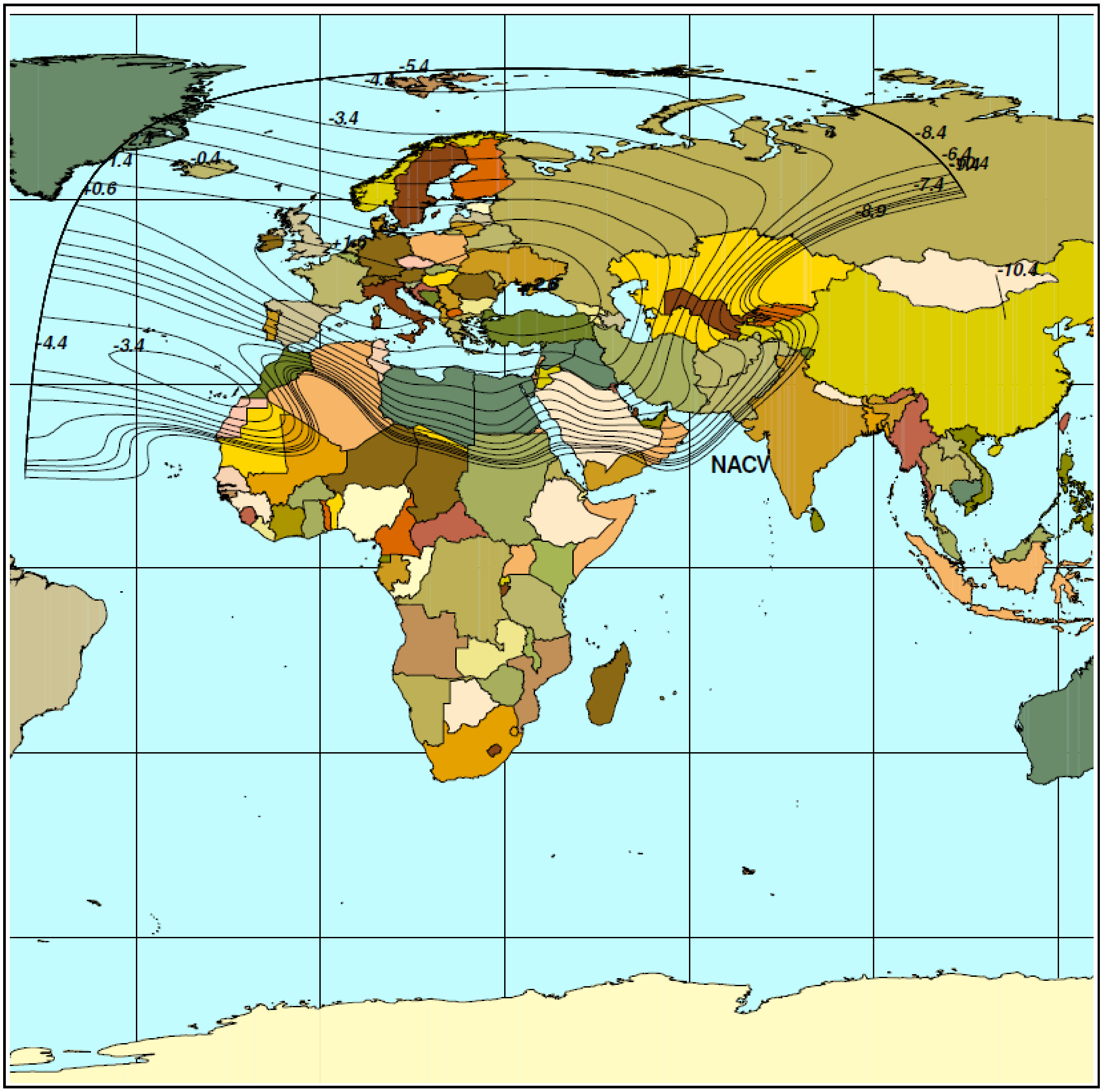

Figure 4: C-band vertical uplink

EXHIBIT 6

Galaxy-25 Winter Season Coverages

C-Band Coverage Horizontal Downlink

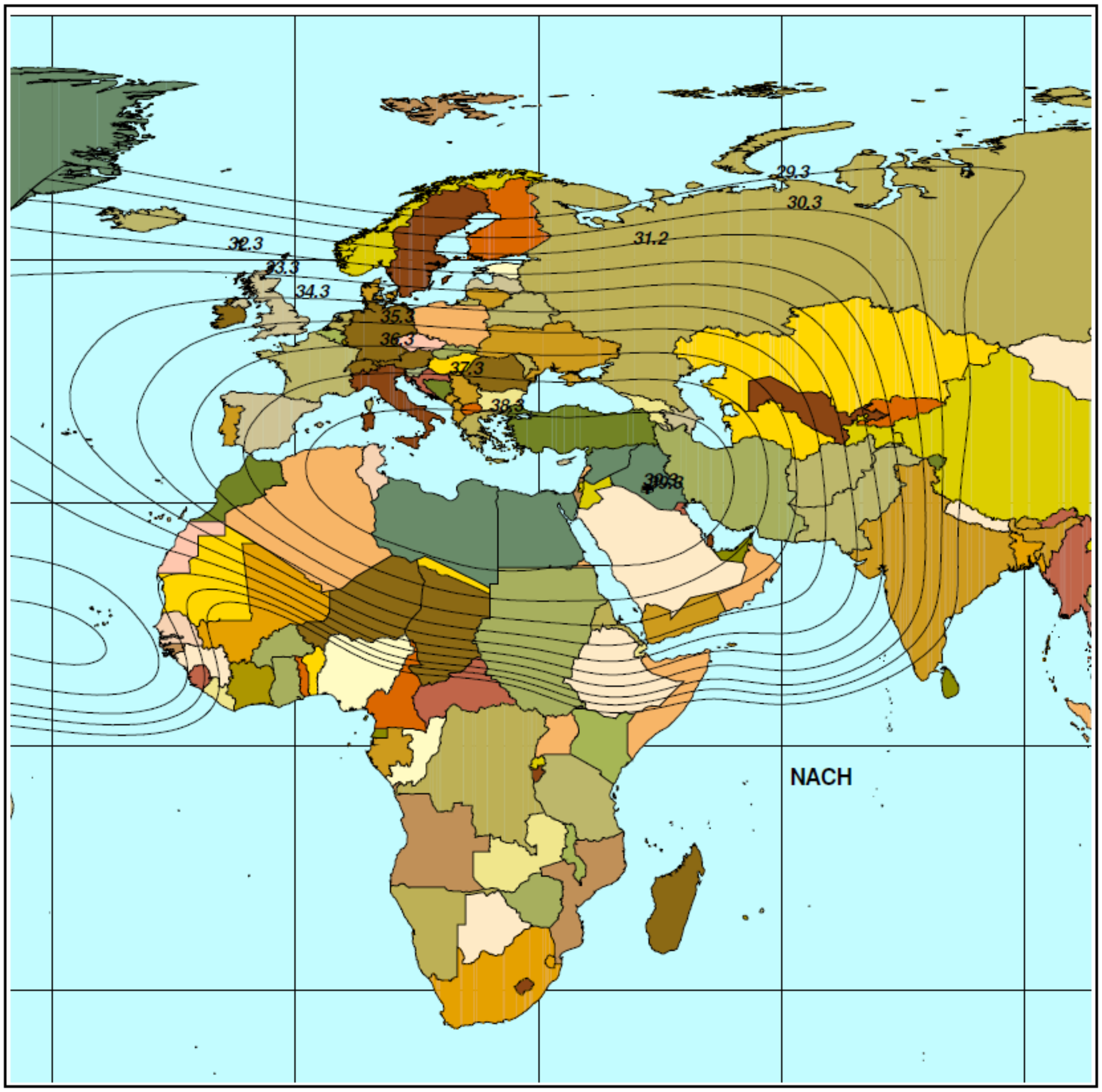

Figure 1: C-band horizontal downlink

C-Band Coverage Vertical Downlink

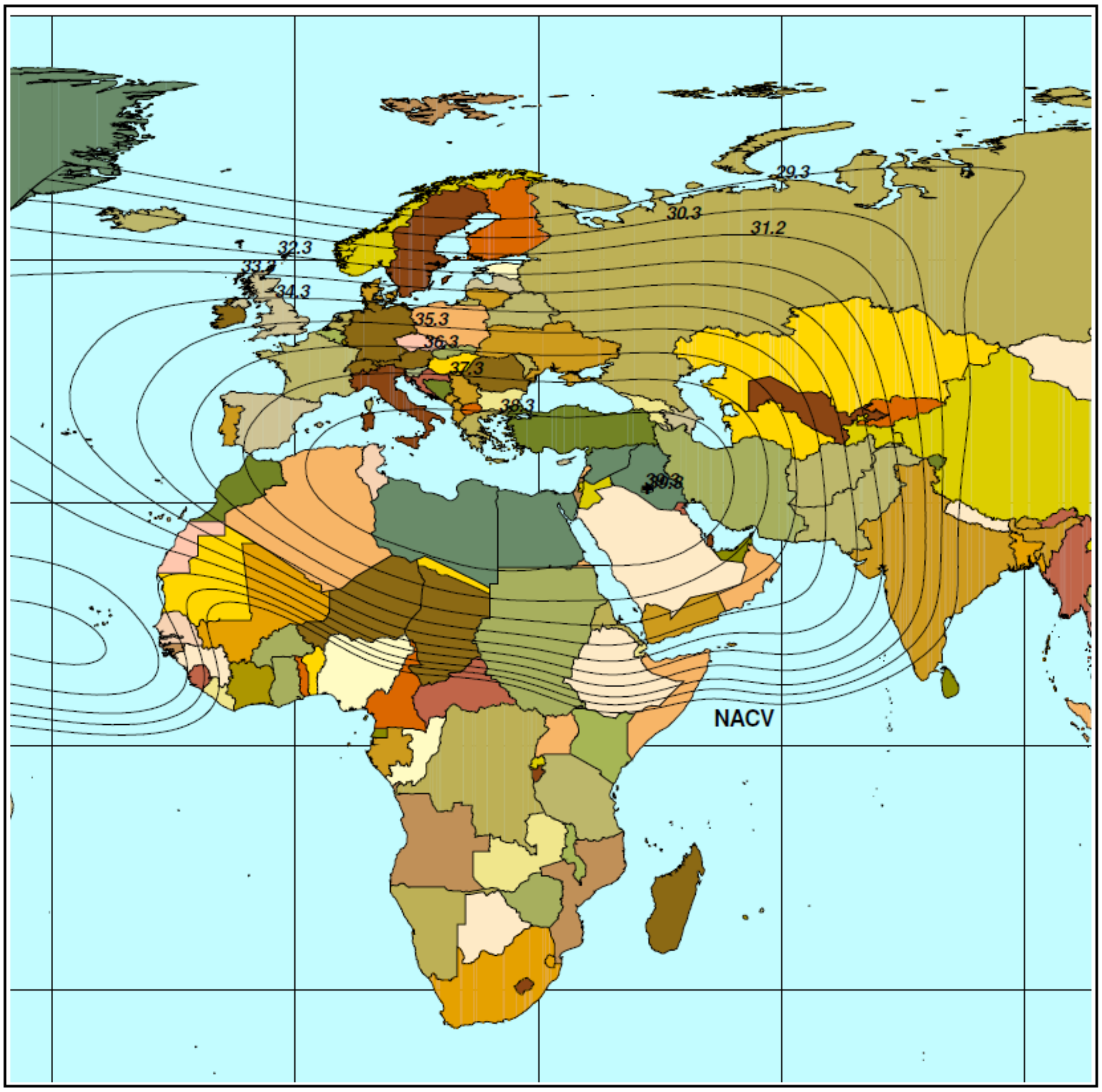

Figure 2: C-band vertical downlink

C-Band Coverage Horizontal Uplink

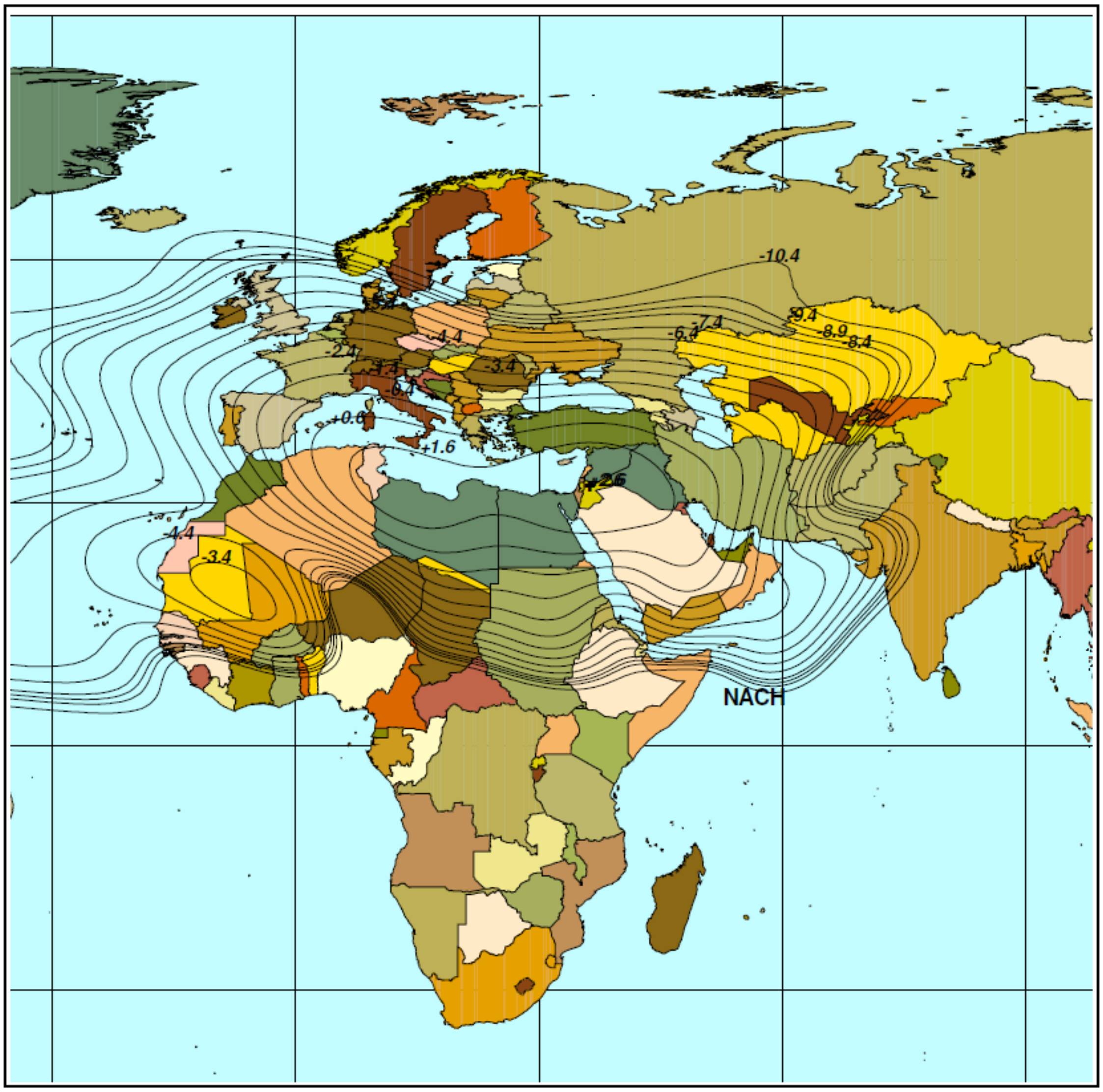

Figure 3: C- band horizontal uplink

C-Band Coverage Vertical Uplink

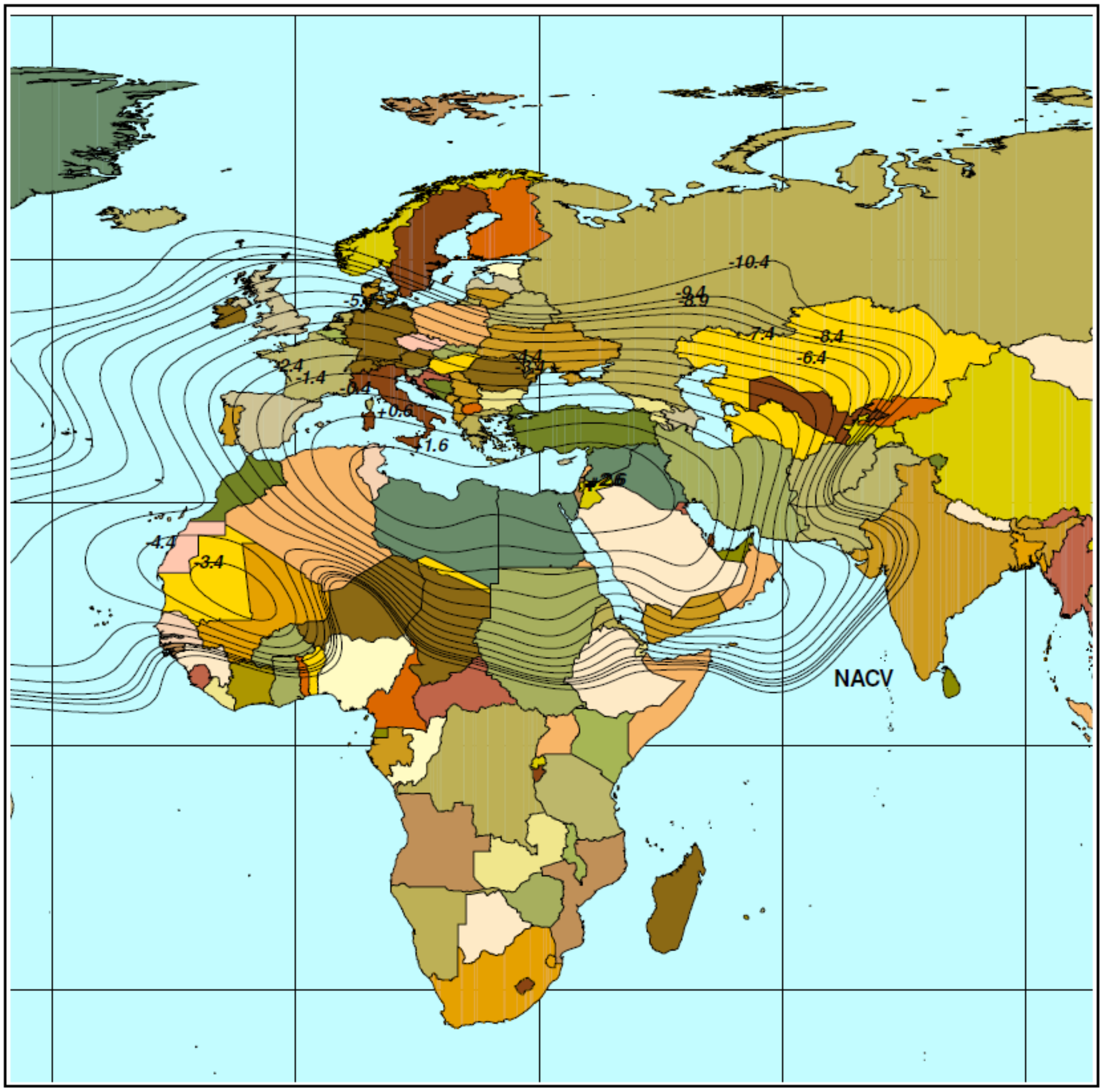

Figure 4: C- band vertical uplink