Engineering Statement

1 Introduction

Silkwave Africa LLC ("Silkwave") seeks authority in this application to drift the Asiastar satellite from 105E to 21E orbit slot for the purpose of Bring-Back-Into-Use the spectrum frequency of the AFRIBSS IFIC 2438 space station registered in the Master Index of Frequency Registration with the International Telecommunications Union.

For clarity, the AFRIBSS is managed by the United States Federal Communications Commission (FCC) and the Asiastar spacecraft is filed through the Australian administration and managed by the Australian Communications Media Authority (ACMA). The Asiastar spacecraft call sign is ASIABSS IFIC 2470.

The Asiastar and Afristar-1 spacecraft were manufactured as identical satellite designed for Worldspace with the same communications and telemetry and command frequencies. Once at 21E, the Asiastar will provide service coverage to Africa, Middle East, and Southern Europe. The characteristics of the Asiastar spacecraft, as well as its compliance with the various provisions of Part 25 of the Federal Communication Commission's ("FCC or "Commission") rules, are provided in the remainder of this Engineering Statement.

2 Spacecraft Overview

The Asiastar spacecraft, same design as the Afristar-1 satellite, is based on the Matra Marconi Space (MMS) EUROSTAR 2000+ platform in his high power configuration (designed to accommodate payloads of up to 550 kg and 5.5 kW), coupled to an ALCATEL payload providing 2 missions in parallel :

- processed communication mission (LHCP),

- transparent communication mission for direct broadcasting of digital radio (RHCP)

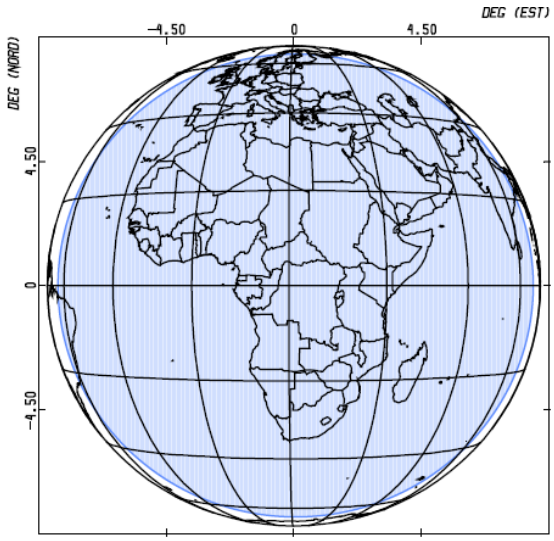
Currently Airbus is the manufacturer providing expert advice for in orbit engineering operations, systems, subsystems, and hardware analysis.

The spacecraft that is operating in the X-Band and L-Band frequencies listed in the table below.

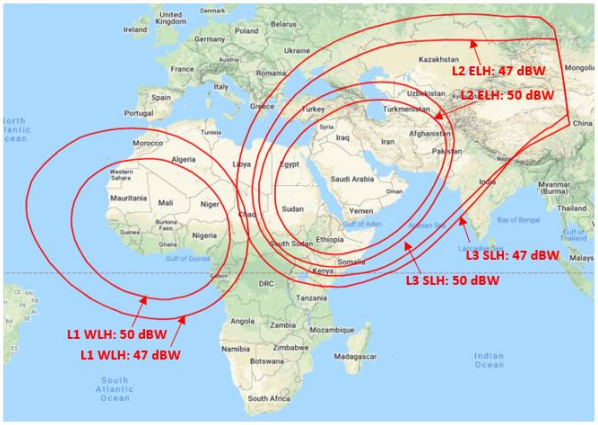
Direction	Frequency
Uplink	7025–7075 MHz
Downlink	1452–1492 MHz

The spacecraft provides the following coverage:

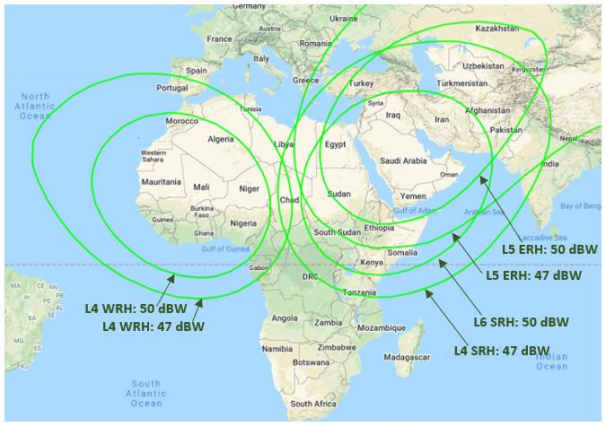
Frequency band	Beam	Coverage
L-Band	Spots	Africa, Middle East, and Southern Europe



X-Band Global Uplink



L-Band Steerable Beams 1-3 (LHCP)



L-Band Steerable Beams 4-6 (RHCP)

2.1 Spacecraft Characteristics

Asiastar is a three-axis stabilized type spacecraft that has a rectangular outer body structure. Asiastar utilizes two deployable solar array wings and two deployable antennas.

The Asiastar spacecraft is composed of the following subsystems:

1) Thermal
2) Power
3) Attitude Control
4) Propulsion
5) Telemetry, Command and Ranging ("TC&R")
6) 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 the ability that the spacecraft can be commanded and controlled with the industry level of reliability from launch to the end of its useful life. The spacecraft design incorporates redundancy in each of the various subsystems in order to minimize single point failures.

The structural design of Asiastar provides mechanical support for all subsystems. The structure supports the communication antennas, solar arrays, and the thrusters. It serves as a stable platform for the alignment of all critical elements of the spacecraft.

2.2 Communication Subsystem

Asiastar provides active communication channels at L-band frequencies. The L-band payload employs channels with bandwidth at 2.5 MHz per beam. The Asiastar frequency and polarization plan is provided in Schedule S.

The coverage contours and performance characteristics for the spot beams are provided in Schedule S. The latitude and longitude of each L-band spot beam's maximum gain point on the Earth are provided in Exhibit 1 and in conformance for the operating frequencies with Section 25.114(c)(4)(vii)(B) of the Commission's rules. Additionally, in Exhibit 2, Silkwave has included the Schedule S beam designation for all beams.

The performance characteristics of all Asiastar beams are provided in Schedule S.

Exhibits 3 and 4 provide the beam parameters for the Asiastar uplink and downlink beams, respectively.

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 Asiastar command and telemetry subsystem performance is summarized in Exhibit 5 and in Schedule S.

2.5 Satellite Station-Keeping

The spacecraft will be maintained within 0.05° of its nominal longitudinal position in the east-west direction. Accordingly, it will comply with Section 25.210(j) of the Commission's rules.

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

Asiastar will be a Broadcast Satellite Services communications satellite and has been designed to support data transmission to mobile users. Typical communication services include:

a) Compressed digital video

b) Compressed audio data

c) High speed digital data

d) Telematic data

4 Power Flux Density ("PFD")

The maximum PFD levels for the Asiastar transmissions were calculated for the bands 1452-1492 MHz. The results are provided in Schedule S and show that the downlink PFD levels. Silkwave plan to conduct extensive coordination with countries of services in Africa, Middle East, and Southern Europe prior to bringing the satellite frequencies into use.

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. Asiastar is designed to be compliant with the provisions of this rule.

Silkwave will comply with the provisions of Section 25.202(f) of the Commission's rules with regard to Silkwave 2 emissions.

6 Orbital Location

Asiastar will be using the 21E orbital longitude location that the FCC and ITU had granted in 1999. The location also ensures that the maximum operational, economic, and public interest benefits will be derived for Africa, Middle East, and Southern Europe.

7 ITU Filings

Asiastar operating frequency bands in 7025-7075 MHz and 1452-1492 MHz have been coordinated under the Administration of the United States' International Telecommunication Union ("ITU") filing AFRIBSS. Silkwave is seeking support from the FCC to forward the application and the associated information to the ITU.

8 Coordination Statement and Certifications

As stated in the Power Flux Density summary, the downlink EIRP density of Asiastar transmissions in the L-band serving Africa, Middle East, and Southern Europe will be coordinated with countries in the area of services.

9 Orbital Debris Mitigation Plan

Silkwave is committed 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

First, Airbus (Matra Marconi Space / Alcatel) is an experience manufacturer and the Asiastar was constructed to ensure adherence to the requirements of orbital debris mitigation.

The spacecraft is designed such that no debris will be released during normal operations. Analysis will be done to assess the probability of collision with meteoroids and other small debris (<1 cm diameter) and the manufacturer will be taking the following steps to limit the effects of such collisions:

(1) critical spacecraft components are located inside the protective body of the spacecraft and properly shielded; and (2) all spacecraft subsystems have redundant components to ensure no single-point failures. The spacecraft does not use any subsystems for end-of-life disposal that are not used for normal operations.

9.2 Minimizing Accidental Explosions

Silkwave will work with the manufacturer to assess the probability of accidental explosions during and after completion of mission operations. The spacecraft 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, Silkwave 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

Silkwave 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. Asiastar will not be located at the same orbital location as another satellite or at an orbital location that has an overlapping station keeping volume with another satellite.

9.4 Post Mission Disposal

At the end of the mission, Silkwave will dispose of the spacecraft by moving it to an altitude of at least 280 kilometers above the geostationary arc. The requirements are part of the technical requirements contract with the manufacturer to allocate the reserved fuel for disposal.

In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order. The effective area to mass ratio (Cr*A/M) of the Asiastar spacecraft is 0.045 m^2/kg, resulting in a minimum perigee disposal altitude under the Inter-Agency Space Debris Coordination Committee formula of 280 kilometers above the geostationary arc. Accordingly, the Asiastar planned disposal orbit complies with the FCC's rules.

The reserved fuel figure was determined by the spacecraft manufacturer and provided for in the propellant budget. This figure was 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. The fuel gauging uncertainty has been taken into account in these calculations.

10 TC&R Control Earth Stations

Silkwave will conduct TC&R operations through one or more of the following earth stations: Port Louis, Mauritius and Usingen, Germany as previously used for operating the Afristar-1 satellite.

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.

Aug 16, 2020

Michael Do
Silkwave Holdings Limited
Chief Operating Officer

Date

EXHIBIT 1
L-band SPOT BEAM BORESIGHT LOCATIONS

Beam Designation	Latitude (°N)	Longitude (°E)
L-band Beams		
L1	16.78	-2.124
L2	29.927	44.754
L3	14.858	42.503
L4	16.78	-2.124
L5	29.927	44.754
L6	14.858	42.503

EXHIBIT 2
Beam Polarizations and GXT File Names

Schedule S Beam GXT File Names				
	Polarization			
Beam Description	**RHCP**	**LHCP**	**GXT File Name**	
X-Band				
Uplink	X		X1.gxt	
Command		X		
L-Band				**Contour Label**
L1		X	L-Band-1.gxt	L1WLH
L2		X	L-Band-2.gxt	L2ELH
L3		X	L-Band-3.gxt	L3SLH
L4	X		L-Band-4.gxt	L4WRH
L5	X		L-Band-5.gxt	L5ERH
L6	X		L-Band-6.gxt	L6SRH
Telemetry	X			

EXHIBIT 3

COMMUNICATION SUBSYSTEM UPLINK BEAM PARAMETERS

Beam Name	**X-Band**	**X-Band**
Schedule S Beam ID	X1	X1
Frequency Band (MHz)	7025 - 7075	
Polarization	LHCP	RHCP
G/T (dB/K)	-8	-8
Minimum SFD--(dBW/m^2)	**-115**	**-115**
Maximum SFD--(dBW/m^2)	**-75.0**	**-75.0**

EXHIBIT 4

COMMUNICATION SUBSYSTEM DOWNLINK BEAM PARAMETERS

Beam Name	L-Band Spot	L-Band Spot
Schedule S Beam ID	L1 – L3	L4 – L6
Frequency Band (MHz)	1452 - 1492	
Polarization	LHCP	RHCP
Maximum Beam Peak EIRP (dBW)	53.7	53.7
Maximum Beam Peak EIRP Density (dBW/Hz)	-10.3	-10.3

EXHIBIT 5
TC&R SUBSYSTEM CHARACTERISTICS

Beam Name	X-Band Antenna	S-Band Antenna	
Center Frequencies (MHz)	7073, 7074	2037.270, 2038.863	
Command Carrier Bandwidth (MHz)	1.0	1.0	
Polarization	LHCP	Circular	
Peak Flux Density at Command Threshold (dBW/m^2-Hz)	-98	-97	

Beam Name	L-Band Antenna	S-Band Antenna
Frequencies (MHz)	1452.3, 1491.7	2212.42, 2214.15
Polarization	RHCP	Circular
Maximum Channel EIRP (dBW)	9	-6.8
Maximum Beam Peak EIRP Density (dBW/Hz)	-38	-53.8