

APPLICATION FOR EXPERIMENTAL LICENSE

TABLE OF CONTENTS

I.	Background and System Description	1
A.	Orbital Parameters	2
B.	Ground Segment	4
II.	Frequency Use and Spectrum Sharing	4
A.	400.48-400.52 MHz (space-to-Earth)	4
1.	Technical Specifications	4
2.	Compliance with U.S. Table of Frequency Allocations.....	5
B.	2025-2110 MHz (Earth-to-space)	5
1.	Technical Specifications	5
2.	Compliance with U.S. Table of Frequency Allocations.....	6
III.	Waiver Requests	6
A.	2025-2110 MHz (Earth-to-space)	7
B.	47 C.F.R. § 5.115	7
IV.	ITU Compliance.....	8
V.	Conclusion	8

Exhibit A.	ITU Cost Recovery Letter
Exhibit B.	NTIA Space Record Data Form
Exhibit C.	Ground Stations
Exhibit D.	Orbital Debris Assessment Report
Exhibit E.	Technical Annex

APPLICATION

Astro Digital US, Inc. (“Astro Digital”) requests authority to launch and operate the Frazier satellite in non-geostationary orbit (“NGSO”) to conduct a dragsail demonstration. This application is submitted under Part 5 of the Federal Communication Commission (“FCC” or “Commission”). A completed Form 442, Application Narrative, Technical Annex, orbital debris assessment report (“ODAR”), International Telecommunication Union (“ITU”) cost-recovery letter, NTIA Space Record Data Form, and ground station exhibit, are included with this application. ITU documentation for Frazier is contemporaneously provided to the Commission under separate cover.

Astro Digital is an established “mission-as-a-service” provider and offers turnkey mission planning, licensing, and flight operation services to customers. By standardizing mission logistics, including the communications system, on an established and proven spacecraft and operational system, Astro Digital seeks to make government, commercial and scientific access to space timelier and more cost-effective for others.

I. Background and System Description

Astro Digital is an experienced satellite operator. Astro Digital has provided a mission-as-a-service offering to the market by utilizing the same Corvus bus and radios, with the same frequency bands as its previously-authorized Landmapper system, *i.e.*, the UHF and S-band frequencies.¹

Astro Digital seeks to deliver a holistic and seamless solution for its customers to fulfill space missions in a timely and cost-effective manner by providing customers with a turnkey

² No satellite imaging license is required for this use.

system for space missions. From manufacturing to licensing, Astro Digital provides a comprehensive and robust business solution to achieve mission goals efficiently.

By standardizing the logistics of spacecraft manufacturing and deployment on behalf of customers through innovative processes and mission-proven experience, Astro Digital removes the primary difficulties with any space mission and increases accessibility to space for educational, commercial, and government customers alike. For the reasons stated above, Astro Digital submits that grant of this application is in the public interest.

The Frazier satellite is scheduled for launch in February 2025. Astro Digital proposes to conduct an experimental demonstration of the Spinnaker Dragsail, a passive deorbiting device. The dragsail, composed of thin-membrane deployable structures, significantly increases the satellite's frontal area, thereby enhancing aerodynamic drag and accelerating orbital decay. The experiment aims to validate the effectiveness of this deorbiting technology. An onboard camera will capture images of the dragsail deployment. This experiment promises to contribute to the advancement of space debris mitigation techniques, offering a novel solution to a critical issue in satellite operations²

A. Orbital Parameters

The Frazier satellite will be launched within the following range of orbital parameters:

Orbital Altitude Deployment Range: 510 km \pm 15 km, circular

Target Deployment Altitude: 510 km

Orbit type: Sun-synchronous orbit

Inclination: 97.6 degrees \pm 1 degree

² No satellite imaging license is required for this use.

Longitude of the Descending Node: 10:30

B. Ground Segment

Provided in Exhibit C is a table identifying the ground stations that Astro Digital intends to use with the Frazier satellite and the relevant frequency bands.

II. Frequency Use and Spectrum Sharing

Astro Digital requests use of the frequencies identified in Table 1. Frequencies.

Frequency Band	Direction	Use
UHF		
400.48-400.52 MHz	space-to-Earth	Launch and Early Operations (“LEOPS”) and Telemetry, Tracking, and Command (“TT&C”)
S band		
2025-2110 MHz	Earth-to-space	TT&C

Table 1. Frequencies

A. 400.48-400.52 MHz (space-to-Earth)

1. Technical Specifications

Astro Digital requests authorization to use the UHF frequencies for telemetry. The satellite’s primary telemetry transmitter will operate at a maximum data rate of 38.4 kbps and have a maximum transmission bandwidth of 60 kHz. Astro Digital has previously coordinated the use of the UHF frequencies with relevant Federal spectrum managers for other systems. Pursuant to those discussions, Astro Digital intends to maintain a minimum distance of 4000 kilometers from the NASA International Space Station (NORAD Designation 25544 or international spacecraft ID 1998-067A) during its UHF downlink sessions with a cooperating

ground station.³ Astro Digital will also ensure that its operations will not exceed the long-term interference criteria specified in Table 2 (Type C) of Recommendation ITU-R RS.1263-2 to protect DoC/NOAA radiosondes operations in the U.S. and its Possessions.⁴ Further, Astro Digital is able to modify the specific frequency channel in the band as necessary to facilitate frequency sharing.

2. Compliance with U.S. Table of Frequency Allocations

The 400.15-401 MHz band (space-to-Earth) band is allocated internationally and in the U.S., *inter alia*, for federal and non-federal space operation use on a secondary basis.⁵ For the Frazier satellite, the 400.15-401 MHz band will be used for LEOPS and TT&C. Accordingly, Astro Digital's use of these frequencies for telemetry is consistent with the table of allocations.

B. 2025-2110 MHz (Earth-to-space)

1. Technical Specifications

Astro Digital requests authorization to use the S-band uplinks for TT&C. The primary command receiver will operate at a maximum data rate of 250 kbps and have a maximum emission bandwidth of 300 kHz. Two patch antennas located on the NADIR and Zenith surfaces of the spacecraft (-Z and +Z, respectively) will be summed together so that both antennas can simultaneously receive signals. Both patch antennas utilize RHCP.

Astro Digital previously coordinated the use of the S-band TT&C uplink with relevant Federal spectrum managers, and those coordinated satellites operate on a single 300 kHz channel centered at 2055.0 MHz for its Landmapper system. Astro Digital believes it should be able to

³ See, e.g., Stamp Grant, Astro Digital, ICFS File No. SAT-MOD-20210319-00036, at Condition 14 (granted May 28, 2021).

⁴ See *id.* at Condition 13.

⁵ This band is also allocated to mobile-satellite services and space research on a primary basis.

coordinate operations for the Frazier satellite. The technical information provided in the Technical Annex and Form 442 is based on this representative channel. However, Astro Digital is able to modify the specific frequency channel in the band as necessary to facilitate coordination.

2. Compliance with U.S. Table of Frequency Allocations

The 2025-2110 MHz band is allocated to space operations, *inter alia*, in all ITU regions. In the United States, space operations are limited to Federal operators.⁶ Astro Digital will transmit on these frequencies from one U.S.-based ground station and three non-U.S. ground stations. Accordingly, the proposed use is consistent with the International Table of Frequency Allocations. As discussed in the waiver section below, Astro Digital requests a waiver of the U.S. Table of Frequency Allocations for use of this uplink frequency for the single U.S. ground station.

III. Waiver Requests

The Commission may waive any of its rules if there is “good cause” to do so.⁷ In general, waiver is appropriate if (1) special circumstances warrant a deviation from the general rule; and (2) such deviation would better serve the public interest than would strict adherence to the rule.⁸ Generally, the Commission will grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would

⁶ See 47 C.F.R. § 2.106 n.US347.

⁷ See 47 C.F.R. § 1.3; *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990); *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

⁸ See *Northeast Cellular*, 897 F.2d at 1166.

otherwise serve the public interest.⁹ Astro Digital submits that good cause exists to waive the following.

A. 2025-2110 MHz (Earth-to-space)

Astro Digital requests a waiver of the U.S. Table of Frequency Allocations for use of the 2025-2110 MHz band for space operations use from one U.S. earth station. As discussed above, the 2025-2110 MHz band is allocated to space operations, space research, and EESS, *inter alia*, in all ITU regions, and in the United States, space operations are limited to Federal operators.¹⁰ Use of this band will be coordinated ensuring that operations will not cause harmful interference to federal operators. Additionally, sharing of spectrum will be possible because the Frazier satellite will operate only for a short period of time, and other satellites using these frequencies transmit and receive only in short periods of time while visible to a receiving/transmitting earth station main beam. For harmful interference to occur, satellites belonging to different systems would have to be visible to the earth station and transmitting or receiving using the same frequencies at the exact same time. In such an unlikely event, the resulting inline interference could be avoided by coordinating with federal satellite transmissions so that they do not occur simultaneously. Accordingly, mutual exclusivity between the Frazier satellite and other systems using the same frequency band is unlikely. For the reasons above, Astro Digital requests a waiver of the U.S. Table of Frequency Allocations for use of this band for the U.S. earth station.

B. 47 C.F.R. § 5.115

Astro Digital respectfully requests a waiver for Section 5.115 of the Commission's Rules, which requires that experimental stations transmit the call sign at the end of each transmission in

⁹ See *WAIT Radio*, 418 F.2d at 1157.

¹⁰ See 47 C.F.R. § 2.106 n.US347.

either clear voice or Morse code. The equipment does not have the ability to do so. Also, the equipment maximizes the full duration of the downlink communication time. Astro Digital understands the intent of the rule requiring station identification is a means to allow others to trace unwanted interference and assumes that Astro Digital's planned federal frequency coordination process will reduce the likelihood of unwanted interference. As such, Astro Digital submits a waiver is warranted here.

IV. ITU Compliance

Astro Digital has prepared the ITU Advance Publication Information submission for its proposed system and is contemporaneously providing this information to the Commission under separate cover. Contemporaneously with this application, Astro Digital is submitting a signed ITU cost-recovery letter.

V. Conclusion

For the reasons stated above, Astro Digital submits that the public interest would be served by grant of the application.

Tony Lin
Emma Marion
DLA Piper LLP (US)
500 8th Street NW
Washington, DC 20004

Counsel for Astro Digital US, Inc.

Respectfully submitted,

/s/ Jack Ackohen

Jack Ackohen
Program Manager
Astro Digital US, Inc.
3047 Orchard Pkwy
San Jose, CA 95134
+1 408 316-2485

Dated: July 24th, 2024