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**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of

Umbra Lab, Inc.

Application for Authority to Launch and
Operate a Non-Geostationary Satellite
Orbit System in the Earth Exploration-
Satellite Service

File No.: _____

APPLICATION

Umbra Lab, Inc. (“Umbra”) hereby requests authorization for Umbra to launch and operate four (4) synthetic aperture radar (“SAR”) Earth-Exploration Satellite Service (“EESS”) microsatellites in low-Earth, non-geostationary orbit (“NGSO”) (hereinafter “Block 3 Tranche 1”). Consistent with the information required by the Commission’s Rules, Umbra has also provided a completed Form 312, Schedule S, Technical Attachment, Orbital Debris Assessment Report (“ODAR”), the Interference Analysis, and Ownership exhibit. This application is submitted under the Commission’s streamlined licensing procedures governing small satellites.¹

I. INTRODUCTION

A. UMBRA BACKGROUND

Umbra is a Delaware corporation headquartered in Santa Barbara, California, founded in 2015 with the goal of providing space-based commercial remote sensing services using SAR for defense, intelligence, and analytics customers.

¹ 47 C.F.R. § 25.122. *See also Streamlining Licensing Procedures for Small Satellites*, 34 FCC Rcd. 13077 (2019) (“*SmallSat R&O*”).

B. MISSION DESCRIPTION

Through the Umbra SAR satellites, Umbra provides affordable and easily accessible on-demand, high-quality, and high-resolution SAR imagery via an integrated web platform to its government and commercial customers. U.S. government and commercial customers increasingly seek to procure Umbra's spaceborne SAR imagery.

The Commission previously granted Umbra authorizations to launch and operate 10 satellites which have all been successfully launched.² With the addition of the Block 3 Tranche 1 satellites that total number is not exceeded due to attrition. The satellites in the Block 3 Tranche 1 systems will have largely the same radiofrequency and orbital characteristics as those in the previously granted licenses. The material differences between the Block 3 Tranche 1 satellites and the Block 2.1 satellites³ are listed below for the Commission's convenience:

- The Block 3 Tranche 1 satellites (Umbra-11 to Umbra-14) have updates to satellite systems to improve overall performance, reliability, and deeper levels of subsystem command and control and associated changes to ODAR as required.
- In the event there are launch delays, Umbra may install an incremental improvement to the SAR instrument on the Umbra-14 satellite utilizing a higher power amplifier. The SAR instrument of this Umbra-14 satellite will have a higher maximum EIRP of 83 dBW.⁴ The Block 3 Tranche 1 satellites will operate on slightly different frequency channels in the same S-band frequencies to provide increased isolation between spacecraft intended for

² See Stamp Grant, Umbra Lab, Inc., IBFS File No. SAT-MOD-20220627-00065; SAT-AMD-20220926-00127 (granted Dec. 1, 2022); Stamp Grant, Umbra Lab, Inc., IBFS File No. SAT-LOA-20230411-00079 (granted October 5, 2023); Stamp Grant, Umbra Lab, Inc., ICFS File No. SAT-LOA-20240222-00038; SAT-AMD-20240329-00070 (partially granted May 27, 2024).

³ See Stamp Grant, Umbra Lab, Inc., ICFS File No. SAT-LOA-20240222-00038; SAT-AMD-20240329-00070 (partially granted May 27, 2024).

⁴ To be clear, the Umbra –11 to Umbra-13 satellites will have the same maximum EIRP of 76.9 dBW as previously granted for other satellites in the Umbra SAR constellation.

close formation flight. Though no spacecraft are anticipated for the Block 3 Tranche 1 satellites to operate in formation, Umbra intends to establish and retain the technical paradigm for the constellation moving forward. A new center frequency is used for all RHCP S-band links used for all even-numbered spacecraft for uplink (2100 MHz) and downlink (2274 MHz).⁵

- Due to operational challenges resulting from the solar environment at this time, Umbra intends to operate all the Block 3 Tranche 1 satellites at a slightly higher operational altitude (565 km nominally). Lastly, Umbra-14 will be operated in a circular inclined orbit whereas all previous satellites have been polar.

In connection with the above changes, Umbra is providing an updated:

- a. power flux density analysis⁶ showing compliance with ITU Radio Regulation 21.16;
- b. Interference Analysis: and
- c. ground station list (for the Block 3 Tranche 1 satellites) to accommodate operations in polar and inclined orbital plane(s).

1. SPACE SEGMENT

The Block 3 Tranche 1 will consist of four (4) Evolved Expendable Launch Vehicle Secondary Payload Adapter (“ESPA”) class satellites. The deployed satellite features a large

⁶ See Technical Attachment, Section 5.3.

circular reflector which serves as the primary SAR payload antenna. Detailed information regarding the satellites is in the Technical Attachment and Orbital Debris Assessment Report.

2. ORBITAL INFORMATION

A detailed description of the Block 3 Tranche 1 nominal orbital information is contained in the Technical Attachment.⁷ Umbra will inform the Commission if it anticipates any material changes to these characteristics.

3. GROUND SEGMENT

Umbra will utilize several commercial ground station providers (collectively “Commercial RGTs”) which operate ground stations around the world as a service, for both payload and telemetry, tracking, and command (“TT&C”) communications with Block 3 Tranche 1. Commercial RGTs work with Umbra, national regulatory authorities, and international regulatory authorities to obtain all necessary licenses for station operations and transmission approval. Umbra may also communicate with Federal ground stations to support Federal government customers. The ground station locations are included in the Technical Attachment.⁸

Mission control of the Block 3 Tranche 1 satellites is located at Umbra’s headquarters in Santa Barbara, California with a mobile backup. Umbra maintains a 24/7/365 operations hotline and on-call staff, which can act upon any interference-related requests. Constant monitoring via automated and human systems allows for quick response to technical or regulatory questions or concerns.

4. FREQUENCY PLAN

i. Bands

⁷ See Technical Attachment, Section 2.1.

⁸ See Exh. E, Ground Station Locations.

Umbra requests use of the frequencies listed below and described in detail in Table 2 of Technical Attachment for its communication links.

Table 1. Frequency Bands of Operation

Link Name	Band (MHz)
Mission Data Downlink Band 1	8025–8400
Mission Data Downlink Band 2	8025–8400
EESS (Active) Band 1	9200–10400
EESS (Active) Band 2	9300–9900
TT&C Downlink Band 1	2200–2290
TT&C Downlink Band 2	2200–2290
TT&C Uplink Band 1	2025–2110
TT&C Uplink Band 2	2025–2110

The frequencies proposed to be used for the Block 3 Tranche 1 satellites are materially the same as previously authorized Umbra satellites. The only notable difference is an update to the center frequency of the S-band TT&C channels supporting RHCP polarization. This change has been made for internal operational reasons and not in response to any identified interference issues or other similar concerns. Umbra intends to coordinate the proposed spectrum use with Federal spectrum managers.

Block 3 Tranche 1 satellites are designed to avoid any harmful interference with other satellite systems, including other EESS systems and protected terrestrial systems.⁹

ii. Spectrum Sharing Capabilities

The Commission has categorically exempted systems operating under the streamlined rules from the Part 25 processing round and default service requirements. In lieu of the processing round rules, the Commission requires applicants to “(a) certify that operations of its satellites will not

⁹ See Technical Attachment, Section 5.

interfere with those of existing operators, (b) certify that it will not materially constrain future operators from using the assigned frequency band(s), and (c) provide a brief narrative description illustrating the methods by which both current and future operators will not be materially constrained.”¹⁰ In *SmallSat R&O*, the Commission provided examples of types of systems that would meet these requirements, including EESS systems.¹¹

Umbra certifies that the operations of its satellites will not interfere with those of existing operators, and that it will not materially constrain future operators from using the requested frequency bands. Umbra is committed to ensuring equitable sharing among all licensed co-frequency spectrum users and will coordinate authorized spectrum use with relevant operators to assure that critical services are not impacted by the operation of the Umbra system. A more detailed discussion of compliance with all requirements for the avoidance of harmful interference is contained in the Technical Attachment.¹²

1. X-Band Mission Data Downlink (8025–8400 MHz)

This band is allocated to EESS on a primary basis for non-Federal use on a case-by-case basis.¹³ Block 3 Tranche 1 is an EESS system, and accordingly, use of this band is consistent with the U.S. Table of Frequency Allocations. The interference analysis for this band is provided in the Technical Attachment.¹⁴

2. S-Band TT&C Uplink (2025–2110 MHz)

This band is allocated on a primary basis across all ITU regions to EESS, subject to applicable conditions on a case-by-case basis and the limitation that any use may not cause harmful

¹² See Technical Attachment, Sections 4-7.

¹³ See 47 C.F.R. § 2.106 n.US258.

¹⁴ See Technical Attachment, Sections 5.2, 5.4, and 6.2–6.5.

interference to authorized Federal and non-Federal operations.¹⁵ Because Block 3 Tranche 1 is an EESS system, use of this band is consistent with the U.S. Table of Frequency Allocations.

3. S-Band TT&C Downlink (2200–2290 MHz)

This band is allocated to Space Operations (space-to-Earth) and EESS (space-to-Earth), among other services, on a co-primary basis across all ITU regions.¹⁶ In the U.S., this band is allocated only for Federal use.¹⁷ Umbra will use the S-band downlink to communicate with non-U.S. ground stations and with Federal ground stations, therefore use of this band is consistent with the U.S. Table of Frequency Allocations.¹⁸

4. X-Band Radar (9200–10400 MHz)

The 600 MHz frequency is used for low bandwidth imaging and utilizes the 9300–9900 MHz band for SAR imaging under an Earth Exploration-Satellite Service (active) allocation. In the U.S., this band is allocated for non-Federal EESS (active) use on a secondary basis and for Federal EESS (active) on a primary basis, in each case subject to certain conditions.¹⁹ Internationally, the band is allocated for EESS (active) on a primary basis, subject to certain conditions.²⁰ This frequency band is currently being used by other similar SAR systems, including the German TerraSAR-X satellite, the Italian COSMO-SkyMed system, the Finnish ICEYE satellites, and others in China and India.

¹⁵ See 47 C.F.R. § 2.106 n.US347.

¹⁶ 47 C.F.R. § 2.106 nn.5.392, US96.

¹⁷ *Id.* at nn.5.392, US303.

¹⁸ See *generally* 47 C.F.R. § 2.106 nn.5.392, US303. To the extent necessary, Umbra requests waiver of the U.S. Table of Frequency Allocations to permit the proposed transmissions to non-U.S. ground stations. See *infra* Section IV.A.

¹⁹ See 47 C.F.R. § 2.106 nn.5.476A, US476A.

²⁰ See, e.g., ITU Radio Regulations, Vol. 1: Articles, Art. 5, at 134, 154 nn.5.427, 5.475A, 5.475B, 5.476A (2024).

The 1200 MHz frequency channel is for high-bandwidth SAR imaging applications and utilizes the wider 9200–10400 MHz band. The additional frequencies (9200–9300 MHz,²¹ 9900–10000 MHz,²² and 10000–10400 MHz²³) are allocated internationally to EESS (active) by the ITU, subject to certain conditions.²⁴ The FCC, however, has not adopted this allocation in the U.S. Table of Frequency Allocations.²⁵ This frequency band is currently being used by other similar SAR systems, such as the Italian COSMO-Skymed Second Generation system.

As explained in Section IV.A, the Technical Attachment,²⁶ and the Interference Analysis, Umbra’s use of the above X-band frequencies is consistent with international allocations and will not cause harmful interference to other authorized operations.

5. LAUNCH SCHEDULE

The satellites are scheduled for rideshare launches on the following SpaceX missions.

Table 1: Scheduled Rideshare Launches

Satellite	Rocket Launch	Launch Quarter
Umbra-11	SpaceX Transporter-14	Q2 2025
Umbra-12	SpaceX TSIS-2	Q4 2025
Umbra-13	SpaceX Transporter-15	Q4 2025
Umbra-14	SpaceX Mid-Mission (TBD)	Q4 2025

²¹ Both the ITU and the U.S. Table of Frequency Allocations (Non-Federal) allocate use of this band to Maritime Radionavigation (primary) and Radiolocation (secondary). 47 C.F.R. § 2.106 nn.5.474D, US110.

²² Both the ITU and the U.S. Table of Frequency Allocations (Non-Federal) allocate use of this band to Radiolocation. 47 C.F.R. § 2.106 n.5.474D.

²³ *Id.*

²⁴ See 47 C.F.R. § 2.106 nn.5.474A, 5.474B, 5.474C, 5.474D.

²⁵ See *infra* Section IV.A (requesting waiver of the U.S. Table of Frequency Allocations for use of these frequencies for EESS (active)).

²⁶ See Technical Attachment, Sections 5.3, 5.6, and 6.6-6.7.

Umbra will ensure the deorbit of the satellites within the six-year license term,²⁷ as required under the streamlined Part 25 license rules.²⁸ A detailed description of and associated timeline of how Umbra plans to ensure compliance is documented in section 7.3 of ODAR.

II. GRANT OF THE APPLICATION IS IN THE PUBLIC INTEREST

Block 3 Tranche 1 satellites significantly increase the available supply of high fidelity, timely SAR data. Such data can be used for diverse applications, such as climate science, precision agriculture, property and casualty insurance, search and rescue, and national defense, to name a few. Additionally, increased availability of Umbra data will help meet significant U.S. government demand for national security missions, including maritime surveillance, disaster response, asset monitoring, and foundational feature mapping. Umbra data can achieve the highest spatial resolution available on the commercial market. Moreover, the combination of superior imaging reliability and industry leading spatial resolution of the Block 3 Tranche 1 provides Umbra's customers with access to extremely high-fidelity imaging with more global capacity, higher mean time to access, and lower latency. Grant of this application further facilitates the growth of the U.S. commercial SAR industry, advancing critical national infrastructure. For the above reasons, Umbra submits that grant of this application serves the public interest.

²⁷ 47 C.F.R. § 25.121(a)(3) (licenses for applications filed pursuant to § 25.122 shall be issued for a period of six-years).

²⁸ 47 C.F.R. § 25.122(c)(2) ("The total in-orbit lifetime for any individual space station will be six years or less").

III. ADDITIONAL LEGAL MATTERS

A. SMALL SATELLITE CERTIFICATIONS

Consistent with the requirements for streamlined treatment under Section 25.122,²⁹ Umbra hereby certifies that the space stations to be operated under the requested license meet the following criteria:

1. The space stations will operate only in non-geostationary orbit.
2. The total in-orbit lifetime for any individual space station will be six years or less.
3. The space stations will be deployed at an orbital altitude of 600 km or below.³⁰ Additionally, the space stations will maintain a propulsion system and have the ability to make collision avoidance maneuvers using propulsion.³¹
4. Each space station will be identifiable by a unique signal-based telemetry marker distinguishing it from other space stations or space objects.
5. The space stations will release no operational debris.
6. Umbra has assessed and limited the probability of accidental explosions, including those resulting from the conversion of energy sources on board the space stations into energy that fragments the spacecraft.
7. The probability of a collision between each space station and any other large object (10 centimeters or larger) during the orbital lifetime of the space station is 0.001 or less as

²⁹ 47 C.F.R. § 25.122(c).

³⁰ The Block 3 Tranche 1 satellites will be deployed at 590 km.

³¹ Although 47 C.F.R. § 25.122(c)(3) only requires that proposed space stations either (i) be deployed at an orbital altitude of 600 km or below or (ii) be capable of making collision avoidance and deorbit maneuvers using propulsion to be qualified for streamlined processing, the Block 3 Tranche 1 satellites will satisfy both of these requirements.

calculated using current National Aeronautics and Space Administration (“NASA”) software or other higher fidelity model.

8. The space stations will be disposed of post-mission through atmospheric re-entry. The probability of human casualty from portions of the spacecraft surviving re-entry and reaching the surface of the Earth is zero as calculated using current NASA software or other higher fidelity models.

9. Operation of the space stations will be compatible with existing operations in the authorized frequency bands. Operations will not materially constrain future space station entrants from using the authorized frequency bands.

10. The space stations can be commanded by command originating from the ground to immediately cease transmissions and Umbra will have the capability to eliminate harmful interference when required under the terms of the license or other applicable regulations.

11. Each space station is 10 cm or larger in its smallest dimension.

12. Each space station will have a mass of 180 kg or less, including any propellant.

13. The probability that any individual space station will become a source of debris by collision with small debris or meteoroids that would cause loss of control and prevent disposal is 0.01 (1 in 100) or less.

14. Upon receipt of a space situational awareness conjunction warning, Umbra will review and take all possible steps to assess the collision risk and mitigate the collision risk if necessary. As appropriate, steps to assess and mitigate the collision risk should include but are not limited to: contacting the operator of any active spacecraft involved in such a warning; sharing ephemeris data and other appropriate operational information with any such operator; and modifying space station attitude and/or operations.³²

³² *Id.*

B. OWNERSHIP INFORMATION

Ownership information is provided in an attachment to this application.

IV. REQUESTS FOR WAIVER

The Commission may waive any of its rules if there is “good cause” to do so. 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.³³ 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 otherwise serve the public interest.³⁴ Umbra submits that good cause exists to waive the following rules.

C. U.S. TABLE OF FREQUENCY ALLOCATIONS

a. 9200-9300 MHz, 9900-10000 MHz, and 10000-10400 MHz

Umbra requests waiver of the U.S. Table of Frequency Allocations to permit use of the following bands for EESS (active): 9200–9300 MHz, 9900–10000 MHz, and 10000–10400 MHz. With respect to each band, the ITU allocated the frequencies for EESS (active) on a primary basis³⁵ and Umbra seeks to provide an EESS (active) service. Block 3 Tranche 1 complies with these international requirements and will not cause harmful interference to other authorized operations.³⁶ Though the FCC has not yet adopted these international allocations, the Commission previously found that a waiver was justified and in the public interest based on Umbra's extensive non-interference analysis.³⁷ For this application, Umbra submits an Interference Analysis in Exhibit C, accounting for the proposed, total constellation size (including previously authorized satellites), which similarly demonstrates that the constellation protects other Federal and non-Federal operations. Additionally, Umbra will coordinate operations in this band to minimize potential

³³ *Ne. Cellular Tel. Co., L.P. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

³⁴ *Id.*; *see also* *WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969).

³⁵ ITU Radio Regulations, Vol. 1: Articles, Art. 5, at 154 nn.5.474A, 5.474B, 5.474C, 5.474D (2024).

³⁶ *See* Technical Attachment, Sections 5.3, 5.5-5.6, and 6.6-6.7.; *see also* Interference Analysis.

³⁷ *See supra* note 3, Condition #3.

interference. For these reasons and those provided in the Technical Attachment and Interference Analysis, Umbra submits that this waiver is justified.

A. SCHEDULE S REQUIREMENTS

Umbra also requests a limited waiver of Section 25.114(c), which requires certain information to be provided in the Schedule S.³⁸ Because of limitations in the Schedule S software and Umbra's implementation of a workaround to allow entry of the required information in the Schedule S, the Commission previously granted Umbra a similar waiver of Section 25.114(c).³⁹

- Umbra's TT&C transmitter has a maximum transmit EIRP of -8.4 dBW. However, the Schedule S data field will not accept a number less than zero. Umbra entered zero to satisfy the Schedule S form requirement.
- Umbra's SAR transmitter does not utilize greater than 600 MHz to image under 20 degrees. However, the Schedule S data field requires a maximum PFD value for the 0–5 degrees and 5–10 degrees fields. Umbra entered -200 and -93.9 dBW/m²/4 kHz band, respectively, in the Schedule S.
- Umbra's SAR transmitter is capable of both vertical (V) and horizontal (H) polarization. However, the Schedule S data field allows only one entry. Umbra entered "V," which is the nominal operation.

For the reasons above, Umbra requests, to the extent necessary, a waiver of these aspects of the Schedule S.

³⁸ 47 C.F.R. § 25.114(c).

³⁹ See *supra* note 3.

V. OTHER MATTERS

A. NOAA AUTHORIZATION

Umbra holds a NOAA license to operate a private remote sensing space system, which includes the Block 3 Tranche 1 satellites.

B. ITU COMPLIANCE

Block 3 Tranche 1 satellites will operate under USASAT-30P. Umbra is preparing a modification to its ITU filing and agrees to timely provide the Commission with the appropriate electronic files for submission to the ITU.

VI. CONCLUSION

For the reasons stated above, Umbra requests that the Commission expeditiously grant this application.

Respectfully submitted,

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