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In the Matter of	)	
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Umbra Lab, Inc.,	)	File No.: SAT-LOA-2023 ____ - ____
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Application for Authority to Launch and	)	
Operate a Non-Geostationary Satellite Orbit	)	
System in the Earth Exploration-Satellite	)	
Service	)	

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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.: SAT-LOA-2023 ____ - ____

APPLICATION

Umbra Lab, Inc. (“Umbra”) requests authority to launch and operate a constellation of two (2) synthetic aperture radar (“SAR”) microsatellites in low-Earth, non-geostationary orbit (“NGSO”) for provision of Earth-Exploration Satellite Service (“EESS”) (the “Umbra Block Two Constellation”). A completed Form 312, Schedule S, Technical Attachment, orbital debris assessment report (“ODAR”), Interference Analysis for the Umbra Block Two Constellation, and this narrative are included with this application (the “Application”). This Application is submitted under the Commission’s streamlined licensing procedures governing small satellites.¹

I. BACKGROUND AND SYSTEM DESCRIPTION

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. Umbra has developed proprietary technology, including its patented foldable antenna,² which enables unique capabilities. With the help of its SAR microsatellites, 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

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

² U.S. Patent No. 10,847,893 (issued Nov. 24, 2020).

customers increasingly seek to procure Umbra’s spaceborne SAR imagery and, consequently, Umbra seeks to continue growing its commercial operations.

The Commission previously granted Umbra an authorization to launch and operate six satellites (the “Umbra Block One Constellation”)³ and on January 3, 2023, Umbra successfully launched the fourth and fifth satellites, with the sixth satellite scheduled for launch in April 2023. This Application seeks to supplement that authorized system. The satellites in the Umbra Block Two Constellation will have virtually the same radiofrequency and orbital characteristics as those in the previously granted License.⁴ To enable Umbra’s commercial operations and to meet upcoming launch milestones, Umbra respectfully requests that the Commission grant this authorization request expeditiously.

A. Space Segment

The Umbra Block Two Constellation space segment consists of two (2) Evolved Expendable Launch Vehicle Secondary Payload Adapter (“ESPA”) class satellites. The deployed satellite features a large circular reflector which serves as the primary SAR payload antenna. The satellite mass at launch is less than 100 kg, which includes the satellite’s propulsion system that employs water as the propellant for orbit maintenance and collision avoidance.

B. Orbital Information

SpaceX, the rideshare launch provider, has confirmed that the satellites will be inserted into orbit between 480 km to 520 km altitude at an inclination of SSO +/- 0.1. Umbra will then maneuver the satellites to a target nominal mean equatorial altitude of 535 km, with a mean orbital range between 505 km to 565 km (*i.e.*, 535 ± 30 km). During mission life, Umbra may relocate its Block Two satellites within the 505 km to 565 km orbital range to reduce conjunction probabilities and to accommodate requests from customers.⁵ The orbital altitude range requested in this Application is slightly higher than the orbital altitude range in the previously granted License.⁶ Umbra seeks a higher operational altitude for its satellites due to the relatively strong solar environment resulting in decreased fuel margins over the planned mission

³ See Stamp Grant, Umbra Lab, Inc., IBFS File No. SAT-MOD-20220627-00065; SAT-AMD-20220926-00127 (granted Dec. 1, 2022) (the “License”).

⁴ *Id.* All satellites in the Umbra Block Two Constellation will be materially the same with respect to relevant FCC technical parameters, *e.g.*, radio frequency and orbital debris.

⁵ See, *e.g.*, Stamp Grant, Capella Space Corp., IBFS File No. SAT-LOA-20200914-00108 (granted Dec. 17, 2020) (granting applicant authority to operate within the 525 ± 50 km range).

⁶ See generally *supra* note 3 (granting Umbra Block One Constellation operational altitude of 517 ± 30 km).

lifetime. While Umbra plans to operate the satellites within the altitude range described above prior to performing the post-mission disposal (“PMD”) maneuver, Umbra may continue to leverage the SAR-sensing capabilities of these systems throughout the deorbiting process to a mean altitude of no lower than 450 km.

Table 1 below summarizes the nominal orbital parameters. Umbra will inform the Commission if it anticipates any material changes to these characteristics.

Table 1. Orbital Parameters

Satellite Number	07	08
Orbital Plane Number	coplanar	coplanar
Tx Duty Cycle S-Band (in view, as needed)	96%	96%
Tx Duty Cycle X-Band (in view, as needed)	100%	100%
Operating Alt. Range (km)	535 ± 30 km	535 ± 30 km
Inclination (degree)	97.4 ± 0.1	97.4 ± 0.1
Eccentricity	Less than 0.004	Less than 0.004
Sun Sync	Yes	Yes
LTAN (RAAN)*	11:30 + 60 min	11:30 + 60 min
Launch Date	October 2023	October 2023
Mean Anomaly (deg)	0	0.3
Active Service Arc	Full Orbit	Full Orbit
Orbital Period (sec)	5689 ± 37	5689 ± 37

*Right ascension of the ascending node (“RAAN”) values are representative.⁷

C. Spectrum

Umbra requests authority to use the frequencies listed in Table 2 below for its communication links. Umbra plans to launch the satellites as a pair in close enough proximity to potentially cause self-interference. Therefore, to facilitate simultaneous communications with these paired satellites, Umbra requests a “Band 1” and “Band 2” to accommodate both left- and right-hand circular polarization (“LHCP”

⁷ See Exhibit A - Technical Attachment (“Technical Attachment”), Section 2.1 (discussion of representative RAAN values).

and “RHCP”, respectively).⁸ Except for the additional polarization use, the S-band and X-band communication frequency use is the same as the previously authorized Block One Constellation.⁹

Table 2. Frequencies of Operation

Link Name	Band (MHz)	Center Frequency (MHz)¹⁰	Bandwidth (MHz)	Polarization
Mission Data Downlink Band 1	8025–8400	8150	250	RHCP
Mission Data Downlink Band 2	8025–8400	8150	250	LHCP
EESS (Active) Band 1	9200–10400	9800	1200	VV/HH (selectable)
EESS (Active) Band 2	9300–9900	9600	600	VV/HH (selectable)
TT&C Downlink Band 1	2200–2290	2254	0.1	RHCP
TT&C Downlink Band 2	2200–2290	2254	0.1	LHCP
TT&C Uplink Band 1	2025–2110	2080	0.1	RHCP
TT&C Uplink Band 2	2025–2110	2080	0.1	LHCP

The Umbra Block Two Constellation is designed to avoid any harmful interference with other satellite systems, including other EESS systems and protected terrestrial systems. Transmissions will meet all applicable power flux-density (“PFD”) and other coexistence requirements even in a worst-case scenario.¹¹ Despite the on-demand nature of Umbra’s service, its payload and sensing transmissions occur at relatively low duty cycle further minimizing the probability of a worst-case geometric configuration while these systems are active. In addition, Umbra utilizes a Geographic Exclusion Zone (“GEZ”) capability to further avoid any possible interference issues as needed. Umbra previously conducted an extensive analysis of non-interference for wide-band SAR operations and was granted a waiver of the U.S. Table of Frequency Allocations for those operations under the License.¹² In this Application, Umbra requests similar waivers for the operation of its SAR system.¹³

⁸ Self-interference to a single ground site is possible when the paired satellites are within 260 km of each other along track. Umbra is under contract with the U.S. Government to conduct a months-long demonstration following launch of these satellites, which will temporarily bring the satellites within this range and thereby necessitating this request to update our communications frequency plan to include RHCP and LHCP polarizations.

⁹ See *supra* note 3.

¹⁰ The center frequencies for the TT&C and data links are representative and may change based on coordination with Federal operators and other users.

¹¹ See Technical Attachment, Section 5.

¹² See *supra* note 3, Condition #3.

¹³ See *infra* Section IV.A; see also Exhibit C – Interference Analysis for the Umbra Block Two Constellation (“Interference Analysis”).

D. Ground Segment

The ground segment consists of commercial ground stations provided by Kongsberg Satellite Services (“KSAT”), Amazon Web Services (“AWS”), and ATLAS Space Operations, Inc. (“ATLAS”) Ground Stations (collectively “Commercial Remote Ground Terminals” or “Commercial RGTs”), for both payload and telemetry, tracking, and command (“TT&C”) communications. In addition to the appreciable cost incentive, utilizing Commercial RGTs offers an innovative and highly efficient means of acquiring, storing, and processing downlinked data. Commercial RGTs work with Umbra, national regulatory authorities, and international regulatory authorities to obtain all necessary licenses for station operations and transmission approval. The Commercial RGTs' locations are provided in the Technical Attachment.¹⁴ Umbra may also communicate with Federal ground stations, as requested by its Federal government customers.¹⁵

Mission control of the Umbra Block Two Constellation will be located at Umbra’s headquarters in Santa Barbara, California with a mobile backup. In accordance with its NOAA license, Umbra maintains a 24/7/365 operations hotline and on-call staff, which can act upon any interference-related requests. Constant constellation monitoring via automated and human systems allows for quick response to technical or regulatory questions or concerns.

E. Launch Schedule

The satellites are scheduled for a rideshare launch on SpaceX Transporter-9 in Q4 of 2023. Umbra will actively deorbit the satellites within the six-year license term¹⁶ to ensure that the total in-orbit lifetime of each satellite is six years or less as required under the streamlined Part 25 license rules.¹⁷

¹⁴ See Technical Attachment, Section 2.4.

¹⁵ See *infra* Sections III.A.3 and IV.A.

¹⁶ 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).

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

II. SMALL SATELLITE CERTIFICATIONS

Consistent with the requirements for streamlined treatment under Section 25.122,¹⁸ 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.¹⁹ Additionally, the space stations will maintain a propulsion system and have the ability to make collision avoidance and deorbit maneuvers using propulsion.²⁰
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 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.

¹⁸ 47 C.F.R. § 25.122(c).

¹⁹ The Block Two satellites will be deployed at altitudes between 480 km and 520 km. *See supra* Section I.B.

²⁰ 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 Two satellites will satisfy both of these requirements.

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.²¹

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.²²

III. SPECTRUM USE AND 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 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.”²³ In *SmallSat R&O*, the Commission provided examples of types of systems that would meet these requirements, including EESS systems.²⁴

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 pre-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.²⁵

²¹ The Commission added criteria for orbital debris mitigation, which has not yet been published in the Federal Register. Nonetheless, Umbra meets these additional requirements. See *Mitigation of Orbital Debris in the New Space Age, Report and Order and Further Notice of Proposed Rulemaking*, FCC 20-54, 35 FCC Rcd 4156 (5), (Appendix A, Final Rules (2020)).

²² *Id.*

²³ *SmallSat R&O* ¶ 81.

²⁴ *Id.* ¶ 107.

²⁵ See Technical Attachment, Sections 4-9.

A. Communications and Telemetry, Tracking, and Command Links

Spectrum sharing in the proposed S-band and X-band frequencies is possible because the Umbra satellites and satellites in other similar systems transmit and receive only in short periods of time while visible to a receiving or transmitting Earth station. For harmful interference to occur, satellites 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 can be avoided by commercial operator(s) of the Earth station coordinating the satellite transmissions so that they do not occur simultaneously. Additionally, orbital parameters can also be adjusted such that phasing of the contacts can be offset over time. Umbra's satellites are equipped with propulsion systems which will allow additional maneuverability and phasing throughout their operations. Accordingly, there is no mutual exclusivity between Umbra satellites and other NGSO EESS systems using the same frequency bands.

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.²⁶ The Umbra Block Two Constellation 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.²⁷ Except for the additional polarization use, the X-band frequency use is the same as the Block One satellites.²⁸

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 interference to authorized Federal and non-Federal operations.²⁹ Because the Umbra Block Two Constellation is an EESS system, use of this band is consistent with the U.S. Table of Frequency Allocations. Except for the additional polarization use, the S-band frequency use is the same as the Block One satellites.³⁰

²⁶ See 47 C.F.R. § 2.106 n.US258.

²⁷ See Technical Attachment, Sections 5.2, 5.4, and 6.2–6.5.

²⁸ See *supra* note 3.

²⁹ See 47 C.F.R. § 2.106 n.US347.

³⁰ See *supra* note 3.

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.³¹ In the U.S., this band is allocated only for Federal use.³² 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.³³ Nonetheless, because this band is allocated only for Federal use in the U.S., in an abundance of caution, Umbra requests a waiver, to the extent necessary, to permit the proposed spectrum use.³⁴ The interference analysis for this band is provided in the Technical Attachment.³⁵

B. X-Band Radar (9200–10400 MHz)

The Block Two satellites generate brief pulses using a very high directivity antenna – thus minimizing both the active time as well as the affected areas on the ground. Umbra plans to utilize two alternative frequency channels for its SAR payload. The SAR utilizes linear polarization and can operate at HH or VV. As described in the table below, the Umbra X-band radar beam will have a maximum EIRP of 78.2 dBW utilizing one of two alternative frequencies centered at 9600 MHz and 9800 MHz with bandwidths of 600 MHz and 1200 MHz respectively. The proposed X-Band frequency use is the same as the previously authorized Block One satellites.³⁶

Table 3. X-Band SAR Transmission Characteristics

Frequency Range	9200–10400 MHz
Bandwidth	600 MHz 1200 MHz
Center Frequency	9600 MHz 9800 MHz
EIRP	≤ 78.2 dBW
Polarization	HH, VV (selectable)

³¹ 47 C.F.R. § 2.106 nn.5.392, US96.

³² *Id.* at nn.5.392, US303.

³³ *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.

³⁴ *See infra* Section IV.A. (requesting waiver of the U.S. Table of Frequency Allocations for use of this frequency in the U.S.).

³⁵ *See* Technical Attachment, Sections 5.1 and 6.1

³⁶ *See supra* note 3, Conditions #5, #7, and #9.

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.³⁷ Internationally, the band is allocated for EESS (active) on a primary basis, subject to certain conditions.³⁸ 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.

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,³⁹ 9900–10000 MHz,⁴⁰ and 10000–10400 MHz⁴¹) are allocated internationally to EESS (active) by the ITU, subject to certain conditions.⁴² The FCC, however, has not adopted this allocation in the U.S. Table of Frequency Allocations.⁴³ 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,⁴⁴ and Exhibit C, Umbra’s use of the above X-band frequencies is consistent with international allocations and will not cause harmful interference to other authorized operations.

IV. WAIVER REQUESTS

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.⁴⁵ Generally, the Commission

³⁷ See 47 C.F.R. § 2.106 nn.5.476A, US476A.

³⁸ See, e.g., ITU Radio Regulations, Vol. 1: Articles, Art. 5, at 121–139 nn.5.427, 5.475A, 5.475B, 5.476A (2020).

³⁹ 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.

⁴⁰ 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.

⁴¹ *Id.*

⁴² See 47 C.F.R. § 2.106 nn.5.474A, 5.474B, 5.474C, 5.474D.

⁴³ See *infra* Section IV.A (requesting waiver of the U.S. Table of Frequency Allocations for use of these frequencies for EESS (active)).

⁴⁴ See Technical Attachment, Sections 5.3, 5.6, and 6.6–6.7.

⁴⁵ *Ne. Cellular Tel. Co., L.P. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

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.⁴⁶ Umbra submits that good cause exists to waive the following rules.

A. U.S. Table of Frequency Allocations

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 basis⁴⁷ and Umbra seeks to provide an EESS (active) service. The Umbra Block Two Constellation complies with these international requirements and will not cause harmful interference to other authorized operations.⁴⁸ 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, thereby granting Umbra this waiver under the License.⁴⁹ For this Application, Umbra submits an updated Interference Analysis in Exhibit C, accounting for the proposed and total constellation size, which similarly demonstrates that the Umbra Block Two Constellation must operate in these bands to protect other Federal and non-Federal operations. Additionally, Umbra will coordinate operations in this band to minimize potential interference. For these reasons and those provided in the Technical Attachment and Interference Analysis, Umbra submits that this waiver is justified.

Umbra also requests waiver of the U.S. Table of Frequency Allocations, to the extent necessary, to permit use of the 2200–2290 MHz S-Band downlink in the U.S. with Federal operators. As previously stated, the 2200–2290 MHz band is allocated to EESS (space-to-Earth) and Space Operations (space-to-Earth), among other services, in all ITU regions, but in the U.S., the band is allocated only for Federal use. Umbra will use the S-band downlink to communicate with Federal ground stations (and with non-U.S., commercial ground stations).⁵⁰ Umbra requests, to the extent necessary, a waiver to permit the proposed spectrum use. Grant of the waiver will allow Umbra to better serve its Federal government customers by providing decreased latency via direct communications with the Federal ground stations. The proposed

⁴⁶ *Id.*; see also *WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969).

⁴⁷ ITU Radio Regulations, Vol. 1: Articles, Art. 5, at 138 nn.5.474A, 5.474B, 5.474C, 5.474D (2020).

⁴⁸ See Technical Attachment, Sections 5.3, 5.5-5.6, and 6.6-6.7.; see also Interference Analysis.

⁴⁹ See *supra* note 3, Condition #3.

⁵⁰ See Technical Attachment, Section 2.4 (identifying proposed ground station locations and frequency use).

spectrum use and waiver will be pre-coordinated with Federal spectrum managers to ensure that there are no objections, and Umbra will update the Commission regarding those discussions.

The Umbra Block Two Constellation complies with the international technical requirements and will not cause harmful interference to other authorized operations.⁵¹ For these reasons and those provided in the Technical Attachment,⁵² Umbra submits that this waiver is justified.

B. 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.⁵³ 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) based upon a finding that such waiver was warranted.⁵⁴

- Umbra's TT&C transmitter has a maximum transmit EIRP of -9 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 image under 10 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 -92 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.

⁵¹ See *infra* Section III.A (general discussion of spectrum sharing and avoidance of harmful interference); see also Technical Attachment, Section 6.1 (interference analysis of S-band downlink in the 2200-2290 MHz band).

⁵² See *id.*

⁵³ 47 C.F.R. § 25.114(c).

⁵⁴ Stamp Grant, Umbra Lab, Inc., IBFS File No. SAT-LOA-20210616-00080, Condition #3 (granted March 28, 2022).

V. GRANT OF THE APPLICATION IS IN THE PUBLIC INTEREST

Together with its Block One satellites, Umbra's Block Two satellites will significantly increase the available supply of high fidelity, timely SAR data for diverse applications such as climate science, precision agriculture, property and casualty insurance, search and rescue, and national defense, to name a few.

Umbra anticipates military intelligence gathering will be a foundational application for data produced from the constellation from the onset. Increased availability of Umbra data from the Block Two Constellation will help meet significant U.S. government demand for national security missions, including maritime surveillance, disaster response, asset monitoring, and foundational feature mapping. However, the broader implication of a favorable decision by the Commission to grant this Application is commercial. Umbra data can achieve the highest spatial resolution available on the commercial market in certain modes. Moreover, the combination of superior collection reliability and groundbreaking spatial resolution of the Umbra Block Two Constellation will provide Umbra's customers with access to extremely high fidelity, high-revisit rate collections at exceedingly affordable rates.

A swift approval by the Commission would serve the public interest by further accelerating the growth of this domestic commercial SAR industry. If the U.S. does not authorize domestic businesses to use these frequencies, foreign companies will fill the void in the global commercial market to the detriment of U.S. economic and national security interests. The sooner the U.S. can foster a healthy commercial SAR ecosystem, the sooner the value of this data will be manifested by companies, non-profits, researchers, and government agencies working on important applications for SAR data. A timely grant of this Application will allow Umbra to launch the pair of Block Two Constellation satellites as planned in Q4 of 2023, providing substantial benefit to the varied types of government and commercial customers identified above. Accordingly, expeditious grant of this Application is in the public interest.

VI. OTHER MATTERS

A. Related FCC Authorizations

Umbra was issued an experimental radio authorization under Call Sign WL2XBR on February 9, 2021.⁵⁵ Umbra also received a Part 25 commercial license under SAT-LOA-20210616-00080

⁵⁵ FCC Experimental Radio Station Construction Permit and License, File No. 0424-EX-CN-2020 (granted Feb. 9, 2021).

on March 28, 2022⁵⁶, as amended.

B. NOAA Authorization

Umbra holds a NOAA license to operate a private remote sensing space system.⁵⁷

C. ITU Compliance

The Umbra Block Two Constellation 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.

VII. CONCLUSION

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

Respectfully submitted,

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⁵⁶ Stamp Grant, Umbra Lab, Inc., IBFS File No. SAT-LOA-20210616-00080 (granted March 28, 2022); *see also supra* note 3.

⁵⁷ *See* <https://www.nesdis.noaa.gov/CRSRA/noaaLicensees.html> (last visited March 9, 2023).