Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
Loft Orbital Solutions Inc.	)	File No. _____
	)	
Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Earth-Exploration Satellite Service	)	Call Sign: _____

APPLICATION

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APPLICATION

Loft Orbital Solutions Inc. ("Loft Orbital") requests authority to launch and operate a single microsatellite, YAM-3, in low-Earth, non-geostationary ("NGSO") orbit, pursuant to the Federal Communications Commission ("FCC" or "Commission") streamlined small satellite rules.[1] Loft Orbital is one of the first commercial service providers flying payloads on behalf of customers. By standardizing the accommodation and operation of payloads and handling the end-to-end mission on the customers' behalf, Loft Orbital reduces the time, cost, and complexity for organizations to access space. Specifically, Loft Orbital procures, deploys, and operates space infrastructure on behalf of its customers, enabling them to focus financial and human capital resources on developing novel payload technologies as well as new techniques for exploiting space-based data and services. Ultimately, Loft Orbital intends for its offering to unlock greater utility that can be derived from low-Earth orbit ("LEO") across commercial and governmental applications. Furthermore, by ridesharing multiple payloads belonging to different customers on the same spacecraft, Loft Orbital hopes to reduce the number of satellites that

[1] *See, e.g.*, 47 C.F.R. § 25.122; *see also Streamlining Licensing Procedures for Small Satellites, Report and Order*, 34 FCC Rcd 13077 (2019) ("*Streamlined Processing Order*"); *Streamlining Licensing Procedures for Small Satellites*, 85 FR 43711 (2020).

would have been launched if each customer had procured its own spacecraft. It is Loft Orbital's belief that this new model will reduce the administrative burden on the FCC and other regulatory bodies as well as reduce space debris. For all of these reasons, Loft Orbital submits that grant of this application is in the public interest.

I. BACKGROUND AND SYSTEM DESCRIPTION

Loft Orbital is a San Francisco, California-based company incorporated in Delaware in January 2017. Loft Orbital's business objective is to provide customers with the experience of rapid and turnkey access to space by handling the procurement, payload integration, deployment, and operations of the spacecraft on behalf of its customers. To facilitate this model, Loft Orbital in most cases will be responsible for regulatory compliance and licensing of the satellite mission, in addition to securing insurance and mission financing.[2] It is Loft Orbital's long-term goal to serve as an aggregation platform for LEO payloads and in so doing reduce the need for entities to launch their own spacecraft or obtain the associated regulatory licenses, simplifying the process for deploying new and innovative satellite services and reducing administrative burdens and workloads.

Loft Orbital outsources the manufacturing and development of the microsatellite buses used in its missions and develops, in-house, a universal payload adapter and a mission operations system that enable seamless integration and operation of multiple payloads. Payloads flown by Loft Orbital may be furnished by the customer, procured from a third party on behalf of the customer, or developed in-house by Loft Orbital.

[2] To be clear, Loft Orbital owns and controls the YAM-3 satellite. Specifically, Loft Orbital regulates the power to and can shut off a payload and has the technical capability and contractual right to accept or reject payload tasking requests by customers.

Loft Orbital's universal adapter, the "Payload Hub," is a standard product used on each mission to accommodate customer payloads. The Payload Hub serves as a mechanical and thermal interface as well as a data and power interface that decouples the onboard payloads from the satellite bus. This approach enables Loft Orbital to use a common, generic satellite bus for each mission, despite a variable payload configuration. The Payload Hub can either "rideshare" multiple payloads or fly a single payload as a dedicated mission. It is also payload-agnostic, as it supports a wide range of common interface types and protocols. As such, the Payload Hub can accommodate a wide range of payload types including imagers, RF payloads, technology demonstrations, and weather and scientific payloads.

The exact payload configuration on each Loft Orbital mission is driven by customer demand. Loft Orbital designates each mission in its fleet as "Yet Another Mission" or "YAM," with an ascending numerical designation.[3]

Loft Orbital respectfully requests that the FCC grant this application in time to allow Loft Orbital to launch YAM-3 by June 2021, which is the earliest predicted launch window.

A. Space Segment

As discussed in more detail in Sections 3, 5, and 6 of the Technical Annex, YAM-3 will use UHF frequencies (400.15-401 MHz and 401-402 MHz) for backup telemetry, tracking, and command ("TT&C") downlinks and (449.75-450.25 MHz) for backup TT&C uplinks,[4] S-band

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[3] *See, e.g.*, Applications of Loft Orbital, IBFS File Nos. SAT-LOA-20190807-00072 and SAT-AMD-20200527-00063 (filed Aug. 7, 2019 and May 27, 2020) (requesting authority for the YAM-2 satellite).

[4] Back-up TT&C communications shall only be employed in the event of the inability to use the primary TT&C links in the 2025-2110 MHz and 8025-8400 MHz bands, such as when the satellite is tumbling, and for occasional testing to ensure the operational capability of the back-up TT&C system.

frequencies (2025-2110 MHz) for primary data and TT&C uplinks, and X-band frequencies (8025-8400 MHz) for primary data and TT&C downlinks.

Additionally, the YAM-3 satellite will use a space-hardened Globalstar modem, the GSP-1720, for a space-to-space intersatellite link ("ISL") that utilizes the Globalstar constellation and operates only on Globalstar-authorized and assigned frequencies. Specifically, this intersatellite link transmits in the L-band on Globalstar channels 5 and 6 (*i.e.*, 1615.65 MHz and 1616.88 MHz center frequencies; and 1.23 MHz bandwidth) and receives in the S-band (*i.e.*, 2489.31 MHz and 2490.54 MHz center frequencies).

The YAM-3 satellite will have a receive-only payload that concurrently receives Global Positioning System ("GPS") navigational signals and L-band data signals in the 1535-1559 MHz band from authorized and coordinated Inmarsat plc ("Inmarsat") satellites.[5] The L-band data signal provides satellite navigation correction data, augmenting the accuracy of Loft Orbital's location assessment.

Loft Orbital will operate the following payloads onboard YAM-3 on behalf of its customers.[6]

- Two RGB imaging sensors;[7]
- An Internet-of-Things ("IoT") payload that transmits in the 400.05-400.15 MHz band and receives in the 864-925 MHz band ("UHF IoT Payload");[8] and

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[5] Specifically, the YAM-3 satellite will receive transmissions from the following Inmarsat satellites: 3F1, 4F2, 3F3, AF1, 4F3, 3F5, and 4F1. Loft Orbital understands that these Inmarsat satellites are authorized by the United Kingdom.

[6] *See supra* note 2. Pursuant to guidance from FCC staff, Loft Orbital will license all radiofrequency payloads onboard YAM-3.

[7] Loft Orbital has a commercial remote sensing license from the National Oceanic and Atmospheric Administration and intends to modify that license, as necessary, to ensure that the YAM-3 imaging sensors are covered. *See* 15 C.F.R. Part 960.

- An experimental IoT payload that transmits and receives in the 2400-2483.5 MHz band ("S-band IoT Payload").

The YAM-3 satellite will be commissioned after ejection from its launch vehicle. Extensive telemetry capability exists onboard each spacecraft, and it is possible to control each spacecraft via ground command, including extensive adjustments to the flight software. Non-real-time (scheduled) commanding is also used to fulfill the concept of operations as required by Loft Orbital's customers. YAM-3 will not have a propulsion system for orbit adjustment or decommissioning purposes. However, it can perform station-keeping and collision avoidance maneuvers using differential drag techniques.

B. Ground Segment

The Mission Operations Center ("MOC") for YAM-3 will be located in Loft Orbital's San Francisco, California headquarters. The MOC will provide monitoring, control, and on-call engineering support around the clock and includes a team of full-time engineering support staff. Loft Orbital will operate YAM-3 using an in-house developed Mission Control System called Cockpit. Cockpit is secure, cloud-hosted ground software that accepts tasking requests from customers to create a spacecraft tasking schedule, which is uplinked to the YAM-3 satellite.

Loft Orbital will use the Kongsberg Satellite Services ground station network at Svalbard, Norway and Troll, Antartica.[9] The company may expand its future ground station network to include stations inside and/or outside the United States for the purposes of increasing

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[8] As discussed with FCC staff, the UHF IoT payload will operate under a French administration International Telecommunication Union ("ITU") filing, F-SAT-NG-8, and also will be licensed separately by the French administration. Loft Orbital understands that the grant of the application will reflect that the FCC has no objection to the customer of the payload submitting an ITU notification bringing into use the French administration ITU filing with respect to the 400.05-400.15 MHz band.

[9] *See* Exhibit B, Technical Annex § 17.

opportunities for data transmissions. The company will also coordinate all non-U.S. ground stations with Federal operators in the relevant bands prior to operating any such stations and requests authority for such communications subject to coordination with relevant Federal operators.[10]

C. Launch Schedule and Orbital Information

YAM-3 will be launched as a secondary payload and will have the following orbital parameters:

- Minimum Circular Altitude: 500 km
- Maximum Circular Altitude: 535 km
- Target Deployment Circular Altitude: 525 km
- Orbit Type: sun-synchronous
- Inclination: 97.6 degrees

Loft Orbital has manifested YAM-3 on a Falcon 9 that is scheduled for launch in June 2021.

II. APPLICATION OF STREAMLINED RULES

Section 25.122 of the Commission's rules states that applicants filing under the streamlined rules must certify that they meet certain criteria.[11] The following table identifies the streamlined rules criteria and confirms that YAM-3 meets the criteria.

47 C.F.R. § 25.122(c) Criteria	Loft Orbital Compliance
(1) The space station(s) will operate only in non-	YAM-3 will be deployed into a sun-

[10] *See, e.g.*, Stamp Grant, Planet Labs Inc., IBFS No. SAT-MOD-20170713-00103, at Condition 7 (granted Jul. 19, 2018) ("Transmissions of ... data in the 8025-8400 MHz frequency band many only be made to earth stations coordinated with National Aeronautics and Space Administration (NASA). Planet shall provide the FCC the list of coordinated earth stations.").

[11] *See* 47 C.F.R. § 25.122. The Commission recently added criteria for orbital debris mitigation. *See Mitigation of Orbital Debris in the New Space Age*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156 (2020) (Appendix A). Although not yet effective, Loft Orbital will comply with the new requirements, as detailed in this section.

47 C.F.R. § 25.122(c) Criteria	Loft Orbital Compliance
geostationary orbit.	synchronous circular orbit at a target altitude of 525 km.[12]
(2) The total in-orbit lifetime for any individual space station will be six years or less.	YAM-3 is expected to have a total in-orbit lifetime of 4.06 years at the target altitude.[13]
(3) The space station(s): (i) Will be deployed at an orbital altitude of 600 kilometers or below; or (ii) Will maintain a propulsion system and have the ability to make collision avoidance and deorbit maneuvers using propulsion.	YAM-3 will be deployed to a target altitude 525 km, and no higher than 535 km.[14]
(4) Each space station will be identifiable by a unique signal-based telemetry marker distinguishing it from other space stations or space objects.	YAM-3 will have unique transmitting telemetry channels, allowing the satellite to be identifiable during commissioning and in-orbit activities.[15]
(5) The space station(s) will release no operational debris.	YAM-3 will not release any operational debris.[16]
(6) The space station operator has assessed and limited the probability of accidental explosions, including those resulting from the conversion of energy sources on board the space station(s) into energy that fragments the spacecraft.	Loft Orbital has assessed and limited the probability of accidental explosions, including those resulting from the conversion of energy sources on board YAM-3 into energy that fragments the spacecraft.[17]
(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 NASA software or other higher fidelity model.	The probability of collision between YAM-3 and other large objects is 0.0000038478, as calculated by the NASA Debris Assessment Software ("DAS").[18]
(8) The space station(s) 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	YAM-3 will be disposed of through atmospheric re-entry.[19] The probability of human casualty from portions of the spacecraft surviving re-entry and reaching the surface of the Earth is zero

[12] *See* Exhibit C, Orbital Debris Assessment Report ("ODAR") § 1.

[13] *See id.* § 6.

[14] *See id.* § 1.

[15] *See* Technical Annex § 5.

[16] *See id.* § 18; ODAR § 3.

[17] *See* ODAR § 4.

[18] *See id.* § 5.

[19] *See id.* § 6.

47 C.F.R. § 25.122(c) Criteria	Loft Orbital Compliance
software or higher fidelity models.	as calculated using current NASA DAS.[20]
(9) Operation of the space station(s) will be compatible with existing operations in the authorized frequency band(s). Operations will not materially constrain future space station entrants from using the authorized frequency band(s).	Operation of YAM-3 will be compatible with existing and future operators in the authorized frequency bands, as discussed below.[21]
(10) The space station(s) can be commanded by command originating from the ground to immediately cease transmissions and the licensee will have the capability to eliminate harmful interference when required under the terms of the license or other applicable regulations.	YAM-3 can be commanded by the MOC at any time to immediately cease transmissions and to eliminate harmful interference.[22]
(11) Each space station is 10 cm or larger in its smallest dimension.	YAM-3's smallest dimension is approximately 66.5 cm.[23]
(12) Each space station will have a mass of 180 kg or less, including any propellant.	YAM-3 will weigh approximately 83 kg.[24]
(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.	YAM-3 will be disposed of by atmospheric entry and does not require a specific spacecraft orientation and drag state to meet the disposal requirements. Therefore, there is no risk that a collision with small debris or meteoroids would cause loss of control and prevent disposal.[25]
(14) Upon receipt of a space situational awareness conjunction warning, the licensee or operator will review and take all possible steps to assess the collision risk, and will 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	Loft Orbital will review conjunction warnings, coordinate physical operations of YAM-3 with any operator using similar orbits, and, if necessary, mitigate collision risks to minimize operational impacts.[26]

[20] *See id.* § 7.

[21] *See infra* § II.A-II.D.

[22] *See supra* § I.B; Technical Annex § 10.

[23] *See* ODAR § 2.

[24] *See id.*

[25] *See id.* § 5.

[26] *See* Technical Annex § 18.

47 C.F.R. § 25.122(c) Criteria	Loft Orbital Compliance
and other appropriate operational information with any such operator; and modifying space station attitude and/or operations.	

The Commission has categorically exempted systems operating under the streamlined rules from the Part 25 processing round and default service requirements. Excluding these systems is sensible because small satellite systems eligible for streamlined processing are "designed to serve [their] purpose within a limited, relatively short period of time [and] have more limited frequency use characteristics than more traditional operations licensed under part 25."[27] 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."[28] Loft Orbit 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.[29]

In the *Streamlined Processing Order*, the Commission provided examples of applications that may satisfy the required description requirement. Potentially acceptable scenarios include those where the satellite operator possesses "a limited number of earth stations and downlinks during relatively short periods of time, with the ability to effectively schedule transmissions such

[27] *Streamlined Processing Order* ¶ 80.

[28] *Id.* ¶ 81.

[29] Loft Orbital's statement is not applicable to the Inmarsat and Globalstar frequencies, which are used pursuant to commercial arrangements with those authorized satellite service providers.

that future satellite entrants can be accommodated."[30] As detailed in the following sub-sections, YAM-3's activities will not materially constrain current and future co-frequency systems.

A. S-Band/X-Band EESS

YAM-3 meets the definition of an EESS satellite because it will observe and record data originating from or surrounding the Earth and downlink such data to Earth stations that are part of the satellite network, like other EESS systems. Loft Orbital expects that the data associated with the imager and camera onboard YAM-3 will comprise more than 95% of the data downlinked. The other data transmissions will be associated with other payloads. For example, Loft Orbital expects that less than approximately 5% of the data downlinked by YAM-3, *i.e.*, a *de minimis* amount, will be associated with the data from the IoT payloads. And even then, much of the IoT data will be sensor data, *e.g.*, temperature, rainfall, wind, soil conditions, etc.,[31] collected from terrestrial sensors.

Spectrum sharing in the proposed EESS frequencies, S-band and X-band, will be possible because YAM-3 and satellites in other similar systems transmit/receive only in short periods of time while visible to a receiving/transmitting earth station. For harmful interference to occur, satellites belonging to the 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 the satellite transmissions so that they do not occur simultaneously. Accordingly, there is no mutual exclusivity between YAM-3 and other NGSO EESS systems using the same frequency band.

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[30] *Id.* ¶ 81.

[31] *See, e.g.*, *Agriculture*, Sigfox, https://www.sigfox.com/en/agriculture (last viewed Jul. 23, 2019). As discussed below, the S-Band IoT Payload is an experimental payload, which will be used only for testing.

Loft Orbital will also comply with technical requirements in Part 2 of the Commission's rules and applicable ITU rules and complete coordination with the Federal operators as required.[32]

B. UHF Space Operations

Loft Orbital requests to use the 400.15-401 MHz, 401-402 MHz, and 449.75-450.25 MHz bands for TT&C, consistent with the Space Operations Service frequency band allocations.[33] The Commission noted in the *Streamlined Processing Order* that the Space Operations Service bands have accommodated both commercial and Federal small satellite operations on a non-exclusive basis.[34] Moreover, here Loft Orbital will use these frequencies only for back-up TT&C purposes.[35] Loft Orbital will comply with technical requirements in Part 2 of the Commission's rules and applicable ITU rules and complete any necessary coordination with the Federal operators. Accordingly, such limited use will not exclude other operators from use of these bands.

C. UHF IoT Payload

1. 400.05-400.15 MHz

The IoT Payload uses the 400.05-400.15 MHz band for downlink beacon transmissions of precise frequency and/or accurate time information to enhance the performance of terrestrial IoT systems. The beacon signal will be represented by a set of non-modulated "tones" at

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[32] *See Space Imaging Order* ¶¶ 26-31; *DigitalGlobe, Inc.*, Order and Authorization, 20 FCC Rcd 15696 ¶¶ 1, 15 (2005); *see also* Planet Labs Stamp Grant; Skybox Imaging Stamp Grant; Stamp Grant, Spire Global Inc., IBFS File No. SAT-LOA-20151123-00078 (granted in part Mar. 18, 2016).

[33] *See* 47 C.F.R. § 2.106 nn.5.286 and US87.

[34] *See Streamlined Processing Order* ¶ 107. Sharing frequencies under the streamlined process is possible when operators can "effectively schedule" or coordinate their activities, which are limited in number and duration of the transmissions, so that future entrants can be accommodated. *See id.* ¶¶ 81, 107.

[35] *See supra* Part I.A and n.4.

reference frequencies or by a modulated signal containing accurate time information with a bandwidth of up to 50 kHz. The signals will also indicate service information such as a status of the IoT Payload. Specific waveforms and functionality, which should be compatible with the partnering IoT systems, are currently under development.[36] Finalized signal configurations could be directly uploaded to the IoT Payload after its deployment on orbit because it uses a software defined radio. The IoT Payload will also be equipped with a GPS receiver that will obtain highly accurate time signals from GPS satellites, which then may be retransmitted in the beacon. To comply with ITU Radio Regulations footnote 5.261, all beacon emissions will be confined in a band within +/- 25 kHz of 400.1 MHz.[37]

Transmission of precise frequency and/or accurate time information could allow position determination for the low-cost IoT terminals not equipped with GPS receivers. Because the signal transmitted from the IoT Payload is received essentially simultaneously by devices and base stations within the satellite footprint, it enhances calibration and more efficient interaction within the IoT network. These frequency and/or accurate time information signals also will be available to the public on an unrestricted basis.

This proposed use is consistent with the Standard Frequency and Time Signal-Satellite Service allocated for the band in the ITU and U.S. Table of Frequency Allocations. The service is defined as a "radiocommunication service for scientific, technical and other purposes, providing the transmission of specified frequencies, time signals, or both, of stated high

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[36] Initially, the UHF beacon signal will be a programmable I/Q sampled waveform that lasts for 1s and is transmitted every 5s. *See* Technical Annex §§ 2, 6.6.

[37] *See* 47 C.F.R. § 2.106 n.5.261.

precision, intended for general reception."[38] The IoT Payload downlink transmission satisfies each element of the definition. It is intended for technical and other purposes (IoT network optimization); transmits specified frequencies, time signals, or both; possesses high-precision time and frequency transmissions (targeted deviation is less than 0.1 parts per billion, or ppb, for the frequency and 1 millisecond for the time signals); and may be received by the general public on an unrestricted basis (*i.e.*, by IoT network receivers throughout the coverage area rather than individual receive stations). For these reasons, the proposed use of this band is consistent with the streamlined processing rules.

2. 864-925 MHz

The IoT Payload will receive signals in the frequency band 864-925 MHz and store the digitized data into memory for subsequent data processing.[39] The proposed reception of such short-range device ("SRD") transmissions, by its nature, is consistent with the U.S. and ITU Table of Frequency Allocations and will not cause harmful interference to other authorized services. Although there is no defined radio service for SRD transmissions in the 864-925 MHz band,[40] the ITU acknowledges that national administrations, at their discretion, may authorize SRDs for a wide variety of uses in their respective countries using frequencies within this band.[41]

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[38] *See* ITU Radio Regulations Nos. 1.53-1.54.

[39] *See* Technical Annex §§ 2, 6.6.

[40] This frequency range includes various allocations including, but not limited to, the Fixed, Mobile, and Land Mobile services, none of which are applicable to SRD transmissions.

[41] *See* Report ITU-R SM.2153 at 6 (noting the use of SRDs "is continuously evolving to reflect the many changes that are taking place in the radio environment; particularly in the field of technology"); *see also* ITU, Global harmonization of short-range devices categories, Recommendation ITU-R SM.2103-0 at 1 (Sept. 2017), https://bit.ly/2pWNDLX ("[T]here is an increasing demand for and use of SRDs for a wide variety of applications throughout the world[.]"); CEPT, Relating to the use of Short Range Devices (SRD), Recommendation CEPT/ERC/REC 70-03 at 6-14 (last updated Jun. 7, 2019), https://bit.ly/2zXOgKb.

In the United States, the SRDs will operate consistent with the FCC's Part 15 regulations governing unlicensed devices.[42] In other countries, the customer's partners will be responsible for ensuring that the transmission of an SRD signal is permitted by relevant national administrations. Further, under the operating technical parameters established by many national administrations, SRD transmissions cannot cause harmful interference to other services and cannot preclude any other party from also transmitting or receiving in the same bands.[43] Accordingly, the proposed use of the band is consistent with the streamlined processing rules, and Loft Orbital submits that it should be authorized to receive transmissions in this band, as discussed above.[44]

D. S-band IoT Payload

The S-band IoT Payload is an experimental IoT payload that will both transmit and receive signals in the 2400-2483.5 MHz band. The experiment is intended to facilitate the development of Doppler Multichannel Spread Spectrum technology.[45] The S-band IoT Payload will collect performance data regarding two-way satellite communications in this band and will support development of algorithms that will inform system designs. Specifically, the experiment will facilitate assessment of uplink/downlink link budget and system algorithms, scattering and

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[42] *See* 47 C.F.R. Part 15.

[43] *See, e.g.*, Report ITU-R SM.2153 at 6 ("If an SRD does cause interference to authorized radiocommunications, even if the device complies with all of the technical standards and equipment authorization requirements in the national rules, then its operator will be required to cease operation.").

[44] To the extent necessary, however, Loft Orbital requests waiver of the applicable FCC regulations. *See infra* § III.A.5 (seeking waiver of the U.S. Table of Frequency Allocations to receive transmissions from authorized SRDs operating in the 864-925 MHz band).

[45] *See* Totum, https://totumlabs.com/ (last visited Aug. 20, 2020).

atmospheric scintillation effects of the link, day-time versus night-time effects on noise floor levels in the band, and satellite antenna radiation pattern effectiveness and predictions.

Totum Labs, Inc. ("Totum"), the customer of this payload, is separately seeking a Part 5 authorization to operate a single ground terminal ("Endpoint"), located in San Diego, California, with YAM-3 for experimental purposes.[46] Test transmissions will occur in two sessions daily (0.5 hours each) over San Diego, CA (horizon-to-horizon coverage).[47]

Because of the limited operations for test purposes, as discussed more in Totum's Part 5 application, the proposed use of this band will not cause harmful interference to other services and will not preclude any other party from also transmitting or receiving in the same bands. Accordingly, the proposed use of the band is consistent with the streamlined processing rules.[48]

III. WAIVER REQUESTS

The Commission may waive any of its rules if there is "good cause" to do so.[49] 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.[50] Generally, the Commission will grant a waiver of its rules in a particular case if the

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[46] *See* Application of Totum, ELS File No. 0391-EX-CN-2020 (filed May 4, 2020) ("Totum Application"). The experimental docket will provide analysis showing that harmful interference will not occur.

[47] As development progresses, Totum may conduct experiments with Endpoints in Germany and Sweden and would seek the appropriate regulatory authorizations in those countries prior to operations.

[48] To the extent necessary, Loft Orbital requests waiver of the applicable FCC regulations, as discussed below. *See infra* § III.A.5 (seeking waiver of the U.S. Table of Frequency Allocations for use of the 2400-2483.5 MHz band).

[49] *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).

[50] *See Northeast Cellular*, 897 F.2d at 1166.

relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[51] Loft Orbital submits that good cause exists to waive the following rules.

A. U.S. Table of Frequency Allocations

1. 2025-2110 MHz (Earth-to-Space) TT&C Uplink

This band is allocated to EESS subject to conditions as may be applied on a case-by-case basis and the limitation that any use may not cause harmful interference to authorized Federal and non-Federal operations.[52] As discussed above, Loft Orbital's proposed services meet the definition of EESS, and use of this band can and will be coordinated ensuring that operations will not cause harmful interference. Accordingly, the YAM-3 satellite may use this frequency band consistent with the U.S. Table of Frequency Allocations. Nonetheless, to the extent necessary, Loft Orbital requests a waiver of the U.S. Table of Frequency Allocations in the event the Commission concludes that the YAM-3 satellite is not an EESS system.

2. 8025-8400 MHz (Space-to-Earth) Data Downlink

This band is allocated to EESS on a primary basis on a case-by-case basis.[53] As discussed above, Loft Orbital's proposed services meet the definition of EESS, and use of this band can and will be coordinated ensuring that operations will not cause harmful interference. Accordingly, the YAM-3 satellite may use this frequency band consistent with the U.S. Table of Frequency Allocations. Nonetheless, to the extent necessary, Loft Orbital requests a waiver of

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[51] *See WAIT Radio*, 418 F.2d at 1157.

[52] *See* 47 C.F.R. § 2.106 n.US347.

[53] *See* 47 C.F.R. § 2.106 n.US258. Loft Orbital intends to use the 8025-8400 MHz frequencies primarily for data downlinks but may on occasion also use these downlinks for TT&C downlinks, as permitted under the FCC's rules.

the U.S. Table of Frequency Allocations in the event the Commission concludes that the YAM-3 satellite is not an EESS system.

3. 1535-1559 MHz (Space-to-Space) Data Signals (Inmarsat Frequencies)

Loft Orbital requests a waiver of the U.S. Table of Frequency Allocations to receive L-band data signals from authorized and coordinated Inmarsat satellites.[54] The signals fall within the 1535-1559 MHz band, which is allocated for the Mobile-Satellite Service ("MSS") (space-to-Earth).[55]

The L-band data signal provides satellite navigation correction data, augmenting the accuracy of Loft Orbital's location assessment. It decreases the number of false positive conjunction alerts and enhances space situational awareness, imagery analysis, and geolocation applications. Additionally, reception of the signal cannot cause interference to other authorized systems. The YAM-3 satellite will be receiving the L-band transmission from higher altitude GEO satellites that are already authorized to transmit to earth stations. Accordingly, receipt of that signal in space will not cause any interference.[56] For the above reasons, grant of the waiver is justified.

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[54] *See supra* note 5.

[55] *See* 47 C.F.R. §§ 2.102(a), 2.106.

[56] *See, e.g., Iridium Constellation LLC Application for Modification of License to Authorize a Second-Generation NGSO MSS Constellation*, Order and Authorization, 31 FCC Rcd 8675 ¶ 26 (2016). The Commission also has previously authorized earth stations licensed in the United States for communications with Inmarsat satellites for similar types of location accuracy services. *See, e.g.,* Stamp Grant, Deere & Company, IBFS File No. SES-LIC-20130422-00340 (granted Feb. 9, 2016).

4. 1615.65 MHz, 1616.88 MHz, 2489.31 MHz, and 2490.54 MHz (Space-to-Space) Intersatellite Links (Globalstar Frequencies)

Loft Orbital requests a waiver of the U.S. Table of Frequency Allocations to use certain specific Globalstar frequencies for intersatellite service.[57] The YAM-3 satellite will have a conventional (but, space-hardened) GSP-1720 Modem (FCC type-approved) operating as a satellite transceiver. The transceiver will operate on Globalstar-authorized and assigned channels 5 and 6 (centered at 1615.65 MHz and 1616.88 MHz and having a bandwidth of 1.23 MHz) and will be dynamically assigned a corresponding frequency channel in the forward (command link) direction at the 2489.31 MHz and 2490.54 MHz center frequencies.

The two Globalstar channels operate in the 1613.8-1626.5 MHz band,[58] which is allocated for MSS (Earth-to-space) on a primary basis.[59] The band is also allocated to Aeronautical Radionavigation on a primary basis and Radiodetermination-Satellite Service ("RDSS") (Earth-to-space) on a primary basis. The forward links operate in the 2483.5-2495 MHz band, which is allocated for MSS (space-to-Earth) and RDSS (space-to-Earth) on a primary basis.

The Globalstar modem will be used in limited, time-sensitive scenarios as part of Loft Orbital's service to its customers. Loft Orbital anticipates using the Globalstar modem to send very short text messages based on analytics from one or more of the customer payloads. In the special situations in which the analytics trigger a pre-established alert, such as a leaking oil pipeline, Loft Orbital would send a message using the Globalstar modem rather than waiting for

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[57] *See* 47 C.F.R. §§ 2.102(a), 2.106.

[58] Iridium Constellation LLC ("Iridium") also operates in this MSS band. Loft Orbital, however, will not operate on any Iridium authorized and assigned frequencies.

[59] Although not applicable here, the band is also allocated for MSS (space-to-Earth).

the satellite to pass over an earth station, greatly increasing the responsiveness of the Loft Orbital system. Moreover, as discussed in the Technical Annex, use of these frequencies for intersatellite service will not cause harmful interference to other authorized operations, including that of Iridium.[60] For these reasons, grant of this waiver is justified and serves the public interest.

5. 864-925 MHz (Earth-to-Space) UHF IoT Payload Uplink

To the extent necessary, Loft Orbital requests a waiver of the U.S. Table of Frequency Allocations to receive transmissions in the 864-925 MHz band from authorized SRDs.[61] The operation of authorized SRDs will comply with applicable regulations implemented by the relevant national administration. For example, in the United States the devices will comply with the FCC's Part 15 regulations regarding unlicensed devices. As another example, in Brazil, SRDs will conform to SRD regulations implemented by the Brazilian administration including, for example, field strength limits, use restrictions, and frequency channel restrictions.[62] In each case, the relevant administration has already determined that SRD operations, consistent with established operating technical parameters, will not cause harmful interference to other authorized services.[63] For the above reasons, grant of the waiver request is justified.

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[60] *See* Technical Annex at § 13; *see also* Reply of Iridium, IBFS File Nos. SAT-LOA-20190807-00072 and SAT-AMD-20200527-00063 (filed Aug. 20, 2020) (acknowledging that use of the GSP-1720 modem on Globalstar channels 5 and 6 for ISL operations would not cause harmful interference to Iridium).

[61] *See* 47 C.F.R. §§ 2.102(a), 2.106.

[62] *See* Report ITU-R SM.2153, Attachment 6 to Annex 2.

[63] Moreover, SRDs generally operate on a non-interference and unprotected basis. *See supra* § II.C.2.

6. 2400-2483.5 MHz (Space-to-Earth) S-band IoT Payload Downlink

To the extent necessary, Loft Orbital requests a waiver of the U.S. Table of Frequency Allocations to transmit (space-to-Earth) IoT signals in 2400-2483.5 MHz.[64] The band is allocated for non-Federal licensed operations in the Amateur, Fixed, and Mobile services on a primary basis[65] and unlicensed and ISM operations.[66]

As discussed in the Technical Annex, operations in this band would be below the noise floor. Accordingly, the proposed use of the band will not cause interference to authorized users in the band.

7. 2400-2483.5 MHz (Earth-to-Space) S-band IoT Payload Uplink

To the extent necessary, Loft Orbital requests a waiver of the U.S. Table of Frequency Allocations to receive (Earth-to-space) IoT signals in 2400-2483.5 MHz. The band is allocated for non-Federal licensed operations in the Amateur, Fixed, and Mobile services on a primary basis[67] and unlicensed and ISM operations.[68] As discussed above, there would be only infrequent use of this band at a single location in the U.S. for test purposes.[69] Accordingly, the proposed use of the band will not cause interference to authorized users in the band.

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[64] *See* 47 C.F.R. §§ 2.102(a), 2.106.

[65] These services' possess varying status (primary, secondary, or none) throughout the band. *See* 47 C.F.R. § 2.106.

[66] *See id.* § 2.106 and n.5.150; *id.* Parts 15 and 18.

[67] These services' possess varying status (primary, secondary, or none) throughout the band. *See* 47 C.F.R. § 2.106.

[68] *See id.* § 2.106 and n.5.150; *id.* Parts 15 and 18.

[69] *See supra* Part II.D; Totum Application.

IV. ITU COMPLIANCE

Loft Orbital has prepared the ITU Advance Publication Information submission for its proposed system, USASAT-30L, and is contemporaneously providing this information to the Commission under separate cover. Attached to this application is Loft Orbital's signed ITU cost recovery letter.[70]

V. CONCLUSION

For the reasons stated above, Loft Orbital submits that the public interest would be served by expeditious grant of the application.

Respectfully submitted,

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Dated: September 7, 2020

[70] *See* Exhibit D, ITU Cost Recovery Letter.

ATTACHMENT
Certification of Compliance with Part 25 Streamlined Rules

I hereby certify that the satellite system described in the associated application meets the criteria for streamlined processing established under *Streamlining Licensing Procedures for Small Satellites*, Report and Order, 34 FCC Rcd 13077 (2019).

/s/ Alex Greenberg

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