

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of

Application of Theia Holdings A, Inc. for)	Call Sign S2986
Authority to Launch and Operate a Non-)	
Geostationary Satellite Orbit System in the)	File Nos. SAT-LOA-20161115-00121
Fixed-Satellite Service, Mobile-Satellite)	and SAT-AMD-_____
Service and Earth-Exploration Satellite Service)	

APPLICATION AMENDMENT

Theia Holdings A, Inc. (“Theia”), pursuant to Sections 301, 307, 308 and 309 of the Communications Act of 1934, as amended, and Section 25.116 and other relevant provisions of the Federal Communications Commission’s (“FCC” or “Commission”) rules, hereby amends its pending application for authority to launch and operate a non-geostationary satellite orbit (“NGSO”) system operating in certain Ku-band and Ka-band fixed-satellite service (“FSS”) and mobile-satellite service (“MSS”) spectrum, as well as certain Earth-exploration satellite service (“EESS”) bands.¹ Specifically, Theia seeks to include the 37.5-42.5 GHz (space-to-Earth) and the 47.2-50.2 and 50.4-51.4 GHz (Earth-to-space) bands (hereinafter, the “V-band”) in the Theia Satellite Network (“TSN”) for high capacity communication links between TSN spacecraft and a limited number of individually licensed gateway and gateway-like earth stations.

As described in the TSN Application, Theia seeks to launch and operate a global remote sensing and satellite communications system capable of obtaining, processing and delivering remote sensing analytics and broadband connectivity to a wide variety of consumer, enterprise and government users. The addition of V-band frequencies will enhance the performance and

¹ See Application of Theia Holdings A, Inc. for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service and Earth-Exploration Satellite Service, File No. File No. SAT-LOA-20161115-00121, Call Sign S2986 (“TSN Application”).

flexibility of the TSN to fulfill its core remote sensing and connectivity missions. Consistent with the Commission’s rules, Theia’s application amendment, including this narrative, waiver requests, FCC Form 312 and associated schedules and exhibits (collectively, the “Amendment”), provides only that information which is new or different from the information set forth in the original TSN Application, which is hereby incorporated by reference. As described herein and in the Application, grant of the TSN Application, as amended, will strongly serve the public interest.²

I. BACKGROUND

On July 15 2016, the Commission released a Public Notice announcing that it accepted for filing a petition from WorldVu Satellites Limited, d/b/a OneWeb, seeking to access the U.S. market using a Ku-band and Ka-band NGSO satellite constellation authorized by the United Kingdom; that Public Notice also initiated a processing round for additional applications and petitions for NGSO-like satellite systems operating in these frequencies.³ On November 1, 2016, the Commission released a Public Notice announcing that it had accepted for filing, in part, an NGSO satellite application from The Boeing Company that will operate in certain V-band frequencies; that Public Notice also initiated an overlapping processing round for additional applications and petitions for NGSO-like satellite systems operating in those frequencies.⁴

² To the extent this Amendment is deemed unacceptable for filing or would be considered a major amendment affecting the filing date of the TSN Application or Theia’s ability to participate in the Commission’s separate Ku-band/Ka-band NGSO processing round, Theia reserves the right to withdraw this Amendment, in whole or in part, to address such issues. In Section II.C.2., below, Theia seeks a waiver of Section 25.116(c) of the Commission’s rules, to the extent required to permit it to maintain its priority status in both processing rounds.

³ *See OneWeb Petition Accepted for Filing; Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 10.7-12.7 GHz, 14.0-14.5 GHz, 17.8-18.6 GHz, 18.8-19.3 GHz, 27.528.35 GHz, 28.35-29.1 GHz, and 29.5-30.0 GHz Bands*, IBFS File No. SAT-LOI-20160428-00041, Public Notice, DA 16-804, 31 FCC Rcd 7666 (Int. Bur., Sat. Pol. Br. 2016) (“*OneWeb Public Notice*”).

⁴ *See Boeing Applications Accepted for Filing in Part; Cut-off Established for Additional NGSO-like Satellite Applications or Petitions for Operations in the 37.5-40.0 GHz, 40.0-42.0*

On November 15, 2016, Theia filed the TSN Application with the Commission as part of the Ku-band/Ka-band NGSO processing round, pursuant to the *OneWeb Public Notice*. Except as set forth herein, all characteristics associated with operations in Ku-band, Ka-band and EESS frequencies (including basic satellite power requirements, spacecraft configuration, orbital debris and end-of-life characteristics, etc.) remain as originally described in the TSN Application.

In this Amendment, Theia seeks to augment the original TSN Application by adding V-band frequencies for limited gateway and high-capacity links using the spacecraft antennas originally dedicated for such links using Ka-band FSS spectrum. Thus, the links previously available for gateway/high-capacity operations in Ka-band only will now be able to operate using Ka-band or V-band frequencies. This operational flexibility and additional throughput will greatly enhance Theia's ability to deliver next-generation remote sensing analytics and information products to consumer, commercial and government users, but it will have only *de minimis* impact on the TSN satellite design. Moreover, Theia's limited V-band operations will be fully compatible with other V-band satellite systems and terrestrial 5G wireless operations.

II. DISCUSSION

Theia seeks to utilize the 37.5-42.5 GHz band (space-to-Earth), the 47.2-50.2 GHz band (Earth-to-space) and the 50.4-51.4 GHz band (Earth-to-space) in the TSN for a limited number of gateway and other high capacity links. The U.S. Table of Frequency Allocations, set forth in Section 2.106 of the Commission's rules, 47 C.F.R. § 2.106, identifies specific V-band spectrum allocations for non-Federal satellite and terrestrial operations, as well as for certain Federal military and research systems. Theia will operate the TSN in accordance with the Commission's

GHz, 47.2-50.2 GHz AND 50.4-51.4 GHz Bands, IBFS File No. SAT-LOA-20160622-00058, Public Notice, DA 16-1244, 31 FCC Rcd 11957 (Int. Bur., Sat. Pol. Br. 2016) ("*Boeing Public Notice*").

rules, including the Table of Frequency Allocations or, to the extent necessary, seeks limited waivers of the Commission's rules to permit its proposed operations in the V-band.

A. TSN Operations and Implementation

In the original TSN Application, Theia described the TSN constellation and operational elements, including the TSN satellites, Ku-band user terminals, Ka-band gateways, and network and satellite operations centers. It also described TSN operation and implementation issues. Except as set forth in the Amendment, the information provided with respect to those issues has not changed. In this Amendment, Theia provides summary of issues associated with its proposed addition of V-band NGSO operations to its original design.

Theia is also finalizing V-band NGSO satellite system Advanced Publication and Request for Coordination filings for submission to the International Telecommunication Union ("ITU"). Theia will coordinate with Commission staff regarding delivery of this information. In addition, consistent with Section 25.111(d) and (e) of the Commission's rules, along with the ITU materials, Theia will submit a declaration of unconditional acceptance of all consequent ITU cost-recovery charges in the Application docket and provide a paper copy of that declaration to the Commission.⁵

B. V-Band Spectrum Sharing

1. Uplink Operations

Theia seeks to operate a limited number of gateway and high-capacity links in a total of four (4) gigahertz of uplink spectrum: 47.2-50.2 and 50.4-51.4 GHz (Earth-to-space). Theia seeks to include these bands in the TSN satellite payload for use in the United States and around the world. Accordingly, to the extent the Commission does not authorize TSN to operate using

⁵ See 47 C.F.R. § 25.111(d)-(e).

any portion of these bands in the United States, Theia should be permitted to include the bands in its satellites and operate in those bands outside the United States subject to the regulatory requirements of foreign nations.

a. 47.2-50.2 GHz (Earth-to-space)

The U.S. Table of Frequency Allocations provides that the 47.2-50.2 GHz band is allocated on a co-primary basis to FSS (Earth-to-space), terrestrial fixed services (“FS”) and mobile services. The 48.2-50.2 GHz band segment is designated in the U.S. primarily for FSS uplink use. The only satellite systems licensed by the Commission in this band were the previously surrendered by Hughes Network Systems and Northrop Grumman.⁶ As discussed in the Technical Narrative, the TSN enables sharing with future V-band GSO or NGSO satellite networks.

The 47.2-50.2 GHz band was identified in the Further Notice of Proposed Rulemaking accompanying the Commission’s *Spectrum Frontiers Order* for consideration for the Upper Microwave Flexible Use Service (“UMFUS”).⁷ Theia notes that its limited use of the band for gateway and high-capacity links would be compatible with contemplated terrestrial uses of the band. In addition, Theia will comply with Commission rules that may be adopted governing such satellite access to the band, or seek appropriate waivers, if necessary. In this connection, Theia notes this band is critical for its proposed gateway and high-capacity earth station operations so FSS

⁶ See Public Notice, “Policy Branch Information Actions Taken,” DA 14-1821, 29 FCC Rcd 14861 (2014) at 2 (reporting surrender of Hughes Network Systems, LLC, Call Sign S2852, File No. SAT-LOA-20111223-00248) (Dec. 12, 2014); Public Notice, “Policy Branch Information Actions Taken,” Report No. SAT-00594, DA 09-674 (reporting surrender by Northrop Grumman Space & Mission Systems Corporation, Call Signs S2254, S2255, S2256, S2257, S2258, File Nos. SAT-LOA-19970904-00080, SAT-LOA-19970904-00081, SAT-LOA-19970904-00082, SAT-LOA-19970904-00083, SAT-LOA-19970904-00084 (rel. Apr. 3, 2009).

⁷ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89, 31 FCC Rcd 8014 (2016), at ¶ 408 (“*Spectrum Frontiers Order*”).

access to the band should be preserved. At a minimum, Theia should be permitted to operate in this band outside the United States in accordance with international FSS allocations and applicable regulatory requirements.

Theia understands that the only reported Federal users of this band are the National Science Foundation (“NSF”), NASA and the United States military agencies for radioastronomy observations and radar research and development. Theia will coordinate its limited gateway and gateway-like operations with these Federal operations and comply with other rules to fully protect these operations.

b. 50.4-51.4 GHz (Earth-to-space)

The U.S. Table of Frequency Allocations provides that the 50.4-51.4 GHz band is allocated on a primary basis for FSS (Earth-to-space), FS, mobile and MSS.⁸ The 50.4-51.4 GHz band, however, is not identified as available for FSS in Section 25.202(a)(1) of the Commission’s rules.⁹ Accordingly, elsewhere in this Amendment, Theia respectfully requests a waiver of Section 25.202(a)(1) to the extent necessary to permit its proposed NGSO operations in the uplink direction in the 50.4-51.4 GHz band, in accord with the U.S. Table of Frequency Allocations.

Theia notes that this band is identified in the Further Notice of Proposed Rulemaking accompanying the Commission’s *Spectrum Frontiers Order* for consideration for UMFUS.¹⁰ As with the 47.2-50.2 GHz band, Theia’s limited use of the 50.4-51.4 GHz band for gateway and high-capacity links would be compatible with contemplated terrestrial operations, and Theia will comply with Commission rules that may be adopted governing such satellite access to the band,

⁸ See United States Table of Frequency Allocations, 47 C.F.R. § 2.106.

⁹ See 47 C.F.R. § 2.202(a)(1).

¹⁰ *Spectrum Frontiers Order* at ¶ 373.

or seek appropriate waivers, if necessary. Theia also should be permitted to operate in this band outside the United States in accordance with foreign FSS allocations and regulatory requirements.

There are currently no non-Federal terrestrial or satellite networks licensed in this band. The only reported Federal users are NASA and the military agencies, which have previously reported using the 50.0-55.0 GHz band for radar research and development.¹¹ Theia will coordinate with these agencies as necessary to avoid interference to any such federal operations.

2. Downlink Operations

Theia seeks to operate a limited number of gateway and high-capacity links in a total of five (5) gigahertz of downlink spectrum: 37.5-42.5 GHz (space-to-Earth). Although Theia seeks only four gigahertz of uplink spectrum for these operations, access to additional V-band downlink spectrum is essential to carry the large amounts of data associated with the TSN's core remote sensing mission to the ground.

As with all proposed spectrum bands, Theia seeks to include these V-band downlink frequencies in the TSN satellite payload for use in the United States and around the world. To the extent the Commission does not authorize operations in certain bands in the United States, Theia should be permitted to include the bands in its satellites and operate internationally subject to the regulatory requirements of foreign nations.

a. 37.5-40.0 GHz (space-to-Earth)

The U.S. Table of Frequency Allocations provides that the 37.5-40.0 GHz band is allocated on a co-primary basis to FSS, FS and mobile services.¹² FSS operations in the band are subject to

¹¹ See *Federal Spectrum Use Summary, 30 MHz – 3000 GHz*, National Telecommunications and Information Administration, Office of Spectrum Management at 78 (Jun. 21, 2010), (available at https://www.ntia.doc.gov/files/ntia/Spectrum_Use_Summary_Master-06212010.pdf) (“*Federal Spectrum Use Summary*”).

¹² 47 C.F.R. § 2.106.

more stringent PFD limits in the 37.5-40.0 GHz band to accommodate terrestrial operation in the band, which limit FSS use to larger gateway-type earth stations.¹³ Although Theia's proposed high-capacity links would appear to satisfy this limitation, at an abundance of caution Theia seeks a waiver of this limitation elsewhere in this Amendment. In the 39.5-40.0 GHz band, there are Federal FSS (space-to-earth) and MSS (space-to-Earth) allocations (limited to military systems) and Theia will coordinate its operations to fully protect such operations.¹⁴

In the *Spectrum Frontiers Order*, the Commission adopted a wide range of new rules in Part 30 for UMFUS, including the 37.0-38.6 GHz and 38.6-40.0 GHz bands. The Part 30 provisions establish licensing rules for terrestrial access to these bands. Theia understands that certain elements of these rules are the subject of petitions for reconsideration, and given the pendency of the petitions for reconsideration and uncertainty regarding technical characteristics, it is difficult for Theia to address in detail sharing with future co-frequency terrestrial operations.

As discussed in the Technical Narrative, however, TSN downlink operations in these bands can comply with the most stringent PFD requirements to ensure there is no potential for interference into terrestrial systems and services. Nonetheless, Theia seeks a waiver of Part 30 and other Commission rules to permit operations on an unprotected, non-conforming use basis in the United States. Because these earth station receive operations cannot cause interference to terrestrial operations, and because Theia's gateway and high capacity earth stations have substantial sidelobe discrimination, are limited in number and will likely be located in rural areas,

¹³ See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, *Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band*, RM-11664, et al., Notice of Proposed Rulemaking, FCC 15-138, ¶ 38 (2015) ("*Spectrum Frontiers NPRM*"); *Spectrum Frontiers Order* at ¶ 74.

¹⁴ Theia notes that the 38.6-39.5 GHz band is not allocated for Federal use. See 47 CFR § 2.106 nn.US382, G117.

there would be no adverse impact on UMFUS deployment in these bands. Theia may further address licensing and sharing issues in these bands once the new rules are no longer subject to review.

In addition, the Commission should still authorize TSN operations in this downlink band outside the United States subject to compliance with applicable international and foreign regulations.

b. 40.0-42.0 GHz (space-to-Earth)

The 40.0-42.0 GHz band covers several sub-bands with a co-primary allocation for FSS and other services,¹⁵ and FSS operations are subject to clear-sky PFD levels 12 dB higher than the level allowed in the 37.5-40.0 GHz band.¹⁶ The 40.0-42.5 GHz band was identified in the Further Notice of Proposed Rulemaking accompanying the Commission's *Spectrum Frontiers Order* for consideration for UMFUS.¹⁷ Accordingly, there is substantial uncertainty with respect to the spectrum access rules that may apply to this band in the future. Nonetheless, Theia's limited use of this downlink band for gateway and gateway-like receive earth station operations would be compatible with contemplated terrestrial uses of the band.

Additionally, Theia will comply with Commission rules that may be adopted governing such satellite access to the band, or seek appropriate waivers, if necessary. At a minimum, Theia should be permitted to operate in this band outside the United States in accordance with international FSS allocations and applicable regulatory requirements.

¹⁵ In the 40.0-40.5 GHz band, MSS is co-primary with FSS; in the 40.5-41.0 GHz band, Broadcasting and BSS are co-primary with FSS; and in the 41.0-42.0 GHz band, Fixed, Mobile, Broadcasting, and BSS are co-primary with FSS.

¹⁶ *Spectrum Frontiers NPRM* at ¶ 125 (citing *V-Band Second Report and Order*, 18 FCC 25428, 25432 ¶¶ 8, 12-14 (2003)).

¹⁷ *Spectrum Frontiers Order & Further Notice* ¶ 400.

With respect to Federal use, the primary use of this band appears to consist of NASA and NSF programs for solar system exploration and radioastronomy, including the Very Large Baseline Array (“VLBA”), which operates receivers in the 41.0-45.0 GHz range.¹⁸ The 40.0-41.0 GHz sub-bands include an allocation for military FSS and MSS systems,¹⁹ but Theia has not identified any current Federal systems operating in this band. Theia will coordinate its limited earth station receive operations with Federal users and comply with applicable power limits to fully protect all Federal uses of the bands.

c. 42.0-42.5 GHz band (space-to-Earth)

The U.S. Table of Frequency Allocations provide that the 42.0-42.5 GHz band is allocated as a non-Federal only band for FS and mobile use on a co-primary basis. There is no FSS allocation in this band. Below, Theia respectfully requests a waiver to permit limited gateway and other high-capacity earth station receive operations in the United States on a non-conforming basis in the 42.0-42.5 GHz band. As discussed below, there is no potential for interference to terrestrial services from the TSN’s limited satellite downlink transmissions and Theia agrees to accept any harmful interference from these services while operating on a non-conforming, unprotected basis.

Regardless of the Commission’s decision on the requested waiver, Theia requests that the Commission include the 42.0-42.5 GHz band in Theia’s license for use outside the United States. This band has been allocated internationally for FSS use and Theia will operate in the band subject

¹⁸ *Federal Spectrum Use Summary* at 76-77; *Spectrum Frontiers NPRM* at ¶ 173 (noting that VLBA receivers include the 41.0-45.0 GHz band).

¹⁹ 47 C.F.R. § 2.106 n. G117; *see also Spectrum Frontiers NPRM* at ¶ 169 (discussing protection measures for Federal MSS and FSS downlink, but not identifying any specific Federal users).

to the frequency allocations and associated regulatory requirements of foreign nations in which the TSN may operate.

C. V-BAND WAIVER REQUESTS

In connection with this Amendment, for good cause shown, Theia hereby seeks certain waivers of the following rules:

- Sections 2.106 and 25.202(a)(1) to use the 42.0-42.5 GHz band for FSS;
- Section 25.202(a)(1) to use the 50.4-51.4 GHz Band for FSS;
- Section 25.202(a)(1) n.1 to use the 37.5-40.0 GHz band to serve individual customers;
- Section 25.208(r) to permit operation in the 37.5-40.0 GHz band at the higher ITU PFD limits;
- Section 25.156(d)(5) to permit consideration of this NGSO application after the Commission previously licensed a GSO system in these bands;
- Section 25.157(e) to permit sharing of V-Band spectrum among all NGSO system operators; and
- Section 25.116(c) to preserve Theia's status in the Ku-Band/Ka-Band processing round.

1. The Waiver Standard

Under the Commission's rules, the FCC may grant a waiver for "good cause shown."²⁰ More specifically, the Commission may exercise its discretion to waive a rule where special circumstances warrant a deviation from the general rule and such deviation would serve the public interest, or where the particular facts make strict compliance inconsistent with the public interest.²¹

²⁰ 47 C.F.R. § 1.3.

²¹ *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990); *WAIT Radio v. FCC*, 418 F.2d 1153, 1157, (D.C. Cir. 1969), *affirmed by WAIT Radio v. FCC*, 459 F.2d 1203 (D.C. Cir. 1972).

In making this analysis, the Commission may take into account consideration of hardship, equity, or more effective implementation of overall policy on an individual basis.²² Each of Theia's waiver requests meets that standard.

The U.S. Supreme Court has gone so far as to stipulate that it is the Commission's obligation to consider and grant waiver's, based on its responsibility to serve the "public interest, convenience, or necessity."²³ The Court reasoned that:

In each case that comes before it the Commission must still exercise an ultimate judgment whether the grant of a license would serve the "public interest, convenience, or necessity." If time and changing circumstances reveal that the "public interest" is not served by application of the Regulations, it must be assumed that the Commission will act in accordance with its statutory obligations.²⁴

The application of this directive has resulted in the "hard look" requirement, which encourages the Commission to consider the potential benefits of "new services." The United States Court of Appeals for the District of Columbia Circuit stated:

[A] general rule serving the public interest for a broad range of situations will not be rigidly applied where its application would not be in the public interest as, for example, where an applicant "proposes a new service that will not undermine the policy" served by the rule.²⁵

The reference to "new service" can be directly applied to Theia's proposed NGSO system and its request for waiver applicability.

²² *WAIT Radio*, 418 F.2d at 1159; *Northeast Cellular*, 897 F.2d at 1166.

²³ *National Broadcasting Co. v. U.S.*, 319 U.S. 190 (1943) (upholding the Commission's "chain broadcasting regulations," which prohibit exclusive arrangements between networks and radio stations, in part because the Commission may still grant waivers of the rules); *see also United States v. Storer Broadcasting Co.*, 351 U.S. 192, 205 (1956) (concluding that the Commission must grant a hearing to consider a justified request for waiver of its multiple ownership rules).

²⁴ *Id.*

²⁵ *Bellsouth Corp. v. FCC*, 162 F.3d 1215, 1224 (D.C. Cir. 1999) (*quoting WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969)) (concluding that the Commission adequately considered, before denying, a request for waiver of the FCC's commercial mobile radio spectrum cap limits).

Therefore, as set forth below, there is good cause to waive the rules identified by Theia. In particular, given the limited nature of Theia's proposed and strong policy reasons favoring grant, the requested waivers would serve the public interest without undermining the fundamental policies embodied in the rules.

2. Waiver Requests

a. Waiver of §§ 2.106 and 25.202(a)(1) to Use the 42.0-42.5 GHz Band for FSS

Sections 2.106 and 25.202(a)(1) of the Commission's rules identify the spectrum allocations that are available for use by FSS systems in the United States.²⁶ Neither identifies the 42.0-42.5 GHz band as available for FSS. The 42.0-42.5 GHz band is allocated for FSS in the ITU's International Table.

Theia seeks a waiver of Sections 2.106 and 25.202(a)(1) to permit it to use this band for individually licensed, gateway and gateway-like earth stations for downlinks from TSN spacecraft, consistent with the ITU Radio Regulations. Theia will rely on a small number of these earth stations to receive Earth observation data from the TSN. The earth stations will be limited in number because each TSN satellite has only two antennas that can support two small spot beams for V-band or Ka-band downlink communications. The large volume of Earth observation data the TSN will generate necessitates additional V-band downlink spectrum, including access to this band, to transmit these data to the terrestrial network or enterprise/government customers.

In the *Spectrum Frontiers Order*, at ¶¶ 367-68, the Commission deleted the existing allocations for broadcasting and BSS service in this band from the U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106, and declined to add an FSS allocation, citing the "ubiquitous nature"

²⁶ 47 C.F.R. §§ 2.106, 25.202(a)(1).

of broadcasting and BSS services and the attendant potential for interference with radioastronomy in the adjacent 42.5-43.5 GHz band, as well as future terrestrial 5G services.

The interference concerns associated with the ubiquity of broadcasting and BSS service are fully mitigated in this case because Theia plans only a small number of individually licensed earth stations at fixed locations, not a ubiquitous deployment. Because the gateway and gateway-like terminals have high discrimination, they can tolerate potential interference from terrestrial operations far better than small user terminals required for ubiquitous consumer services. Additionally, these larger earth stations can be sited in remote location and still perform their essential functions. Thus, Theia's limited, receive earth station operations in this band can be accommodated in the United States.

Furthermore, the TSN could operate successfully in accord with the PFD limits applicable to FSS operations in the 42.0-42.5 GHz band that were adopted to protect radioastronomy services in the adjacent 42.5-43.5 GHz band.²⁷ As a nonconforming use, the TSN would, of course, be subject to the requirement that it accept interference caused by conforming uses and not cause harmful interference to such uses.

In the Further Notice of Proposed Rulemaking accompanying the *Spectrum Frontiers Order*, at ¶ 403, the Commission proposed to authorize fixed and mobile service operations to operate in the 42 GHz band under the Part 30 UMFUS rules, as long as it could ensure protection for the adjacent channel radioastronomy services. Theia would accept the requested waiver conditioned on the outcome of this proceeding. It would thereafter operate in accord with any

²⁷ See *id.* (citing ITU-R Resolution 743). Resolution 743 resolves, *inter alia*, that an administration that plans to operate an NGSO FSS system in the 42.0-42.5 GHz band shall take all practicable steps to avoid exceeding the PFD value of -246 dB(W/m²) in any 500 kHz for any NGSO system in the 42.5-42.77 GHz band, for more than 2 percent of the time, at the site of a radioastronomy station registered as a single-dish radio telescope in Region 2.

future rules the Commission may develop governing FSS use of this band, or seek additional waivers, if necessary.

b. Waiver of § 25.202(a)(1) to Use the 50.4-51.4 GHz Band for FSS

The 50.4-51.4 GHz band is allocated on a primary basis for FSS (Earth-to-space) use in both the ITU's and the FCC's Table of Frequency Allocations, but it is not identified as available for FSS in Section 25.202(a)(1) of the Commission's rules. In the *Spectrum Frontiers Order*, at ¶ 421, the Commission acknowledged the existing allocation to FSS, and sought comment on how FSS operators would use this band. Good cause exists to waive Section 25.202(a)(1) of the Commission's rules to permit Theia to operate the TSN in the Earth-to-space direction in the 50.4-51.4 GHz band, pursuant to the existing primary allocation in Section 2.106.

Pursuant to ITU Resolution 159 (WRC-15), the ITU-R is currently studying the 50.4-51.4 GHz band for use by NGSO FSS systems.²⁸ Resolution 159 was adopted by WRC-15 based on a proposal and the leadership of the U.S. Administration and acknowledges the need for the implementation of new FSS technologies in higher spectrum bands. Resolution 159 observes that NGSO FSS systems are capable of providing “high-capacity and low-cost means of communication even to the most isolated regions of the world.”²⁹

Resolution 159 identifies a need for studies to ensure that NGSO FSS systems can protect passive Earth Exploration Satellite Services (“EESS”) in the adjacent 50.2-50.4 GHz band and radioastronomy services in the adjacent 51.4-54.25 GHz band. In particular, the Resolution notes

²⁸ Resolution 159 (WRC-15), Studies of technical, operational issues and regulatory provisions for non-geostationary fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/ROC0A00000C0006PDFE.pdf.

²⁹ *Id.*

that it may be necessary to update and amend ITU Resolution 750 (WRC-12) to ensure protection of the EESS (passive) in the frequency bands 36-37 GHz and 50.2-50.4 GHz from non-GSO FSS transmission.³⁰ The Resolution also identifies a need for studies on spectrum sharing between NGSO and GSO FSS systems throughout the V-band.

Theia would be able to operate a limited number of TSN individually licensed earth stations at fixed geographic points, as proposed herein, in such a manner as to protect EESS and radioastronomy operations in adjacent spectrum bands, as well as any terrestrial 5G uses adopted in the *Spectrum Frontiers* proceeding. As described in the attached Technical Narrative, it will also operate on a shared basis with other co-frequency GSO and NGSO systems. Therefore, good cause exists to waive Section 25.202(a)(1) to permit the TSN to operate in the Earth-to-space direction in the 50.4-51.4 GHz band. Theia would accept such waiver conditioned on the Commission's implementation of the outcome of the *Spectrum Frontiers* proceeding and ITU-R study process for Resolution 159 and its implementation by WRC-19.

c. Waiver of § 25.202(a)(1) n.1 to Use the 37.5-40.0 GHz Band to Serve Individual Customers

Section 25.202(a)(1) n.1 states that the use of the 37.5-40.0 GHz band “by the Fixed-Satellite Service is limited to individually licensed earth stations. Satellite earth station facilities in this band may not be ubiquitously deployed and may not be used to serve individual consumers.”³¹ Theia does not expect to serve individual *consumers* with its individually licensed

³⁰ *Id.* at ¶ 4.

³¹ The *Spectrum Frontiers Order*, ¶¶ 93, 105 n.272 (petitions for reconsideration pending), established a set of five criteria under which the Commission will consider applications for these individually-licensed earth stations. While Theia believes that those criteria are more conservative than necessary, it will require only a small number of earth stations, no more than one or two in the area covered by an individual TSN satellite, to operate, and therefore expects to be able to comply with the criteria as written, or as they may be modified by the Commission in the future.

earth stations, but it is possible that one or more earth stations operating in this band could be dedicated to an individual governmental or enterprise *customer*. Therefore, out of an abundance of caution, Theia requests a waiver of Section 25.202(a)(a), n.3, to the extent permitted to allow it to use an individually licensed earth station operating in this band to serve an individual customer.³²

Because it is possible that one or more of Theia’s individually licensed earth stations may serve only a single governmental or enterprise customer, and therefore could be said to “originate or terminate communications traffic” and be provided “for the exclusive use of [one] customer,” they would not meet the definition of an “NGSO FSS Gateway Earth Station” contained in 47 C.F.R. § 25.103. Because Theia believes that the Commission likely intended its use of the word “gateway” in the *Spectrum Frontiers Order* to be a shorthand reference for “individually licensed earth stations,” and not in the narrower sense of the Section 25.103 definition of “NGSO Gateway Earth Station,” Theia believes that no further waiver is necessary beyond that requested in the text above. Nevertheless, out of an abundance of caution, Theia’s waiver request provisionally encompasses authority to operate individually licensed earth stations to originate or terminate traffic for the exclusive use of a single customer.

³² Although Section 25.202(a)(1) n.1 appears sufficiently broad to encompass Commission approval of any individually licensed earth station, there is language in the *Spectrum Frontiers Order* that can be read to suggest that this band is limited to “gateway” operations. See, e.g. *Spectrum Frontiers Order* at ¶ 93, n.222 (“We adopt a new footnote, NG63, to the Allocation Table that reflects the existing limitation to gateway earth stations.”). New Footnote NG63 to the U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106, is not so limited, stating only that, “[i]n the band 37.5-40 GHz, earth station operations in the fixed-satellite service (space-to-Earth) shall not claim protection from stations in the fixed and mobile services, except where individually licensed earth stations are authorized pursuant to 47 CFR 25.136.” The word “gateway” is not used.

d. Waiver of § 25.208(r) to Permit Operation in the 37.5-40.0 GHz band at the Higher ITU PFD Limits

Section 25.208(r) of the Commission's rules includes PFD limits applicable to NGSO satellites operating in the 37.5-40.0 GHz band in clear sky conditions.³³ These limits are 12 dB more stringent than the PFD limits that exist in the ITU Radio Regulations for NGSO satellites.³⁴ The PFD limits are also 12 dB more stringent than those that were adopted by the FCC for satellite operations in the adjacent 40.0-42.0 GHz band.³⁵

Theia seeks a waiver of this rule, to permit the TSN to operate in the 37.5-40.0 GHz band at the higher PFD levels that exist in the ITU Radio Regulations for NGSO satellites. In the *Spectrum Frontiers Order*, at ¶ 497, the Commission concluded that the record in the proceeding was insufficient to permit the conclusion that satellite operations at this higher PFD level can coexist with terrestrial 5G use of this band, despite studies submitted by The Boeing Company demonstrating just that. The Commission instead chose to seek a more robust record, requesting further comment on the circumstances in which allowing FSS satellites in the 37.5-40 GHz band to operate at a higher PFD level than permitted under the existing rules would be consistent with terrestrial use of the 37.5-40.0 GHz band, *id.* at ¶ 499.

³³ See 47 C.F.R. § 25.208(r) (specifying a PFD limit of -117 dB(W/m²) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane).

³⁴ See ITU Radio Regulations, Article 21, Table 21-4 (specifying a PFD limit of -105 dB(W/m²) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane). Theia acknowledges that footnote 21.16.4 of Article 21 (Table 21-4) indicates that the PFD limits specified apply to NGSO systems with 99 or fewer satellites and that further study may be needed with respect to the application of the limits to systems with 100 or more satellites. Footnote 21.16.4 was adopted by WRC-2000 and has not been modified since. To the extent that further study is deemed necessary regarding the application of the ITU limits to larger NGSO systems, Theia is willing to actively participate in such studies.

³⁵ See 47 C.F.R. §25.208(s) and (t) (specifying a PFD limit of -105 dB(W/m²) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane).

Theia submits that the specific, limited use of this band proposed in this Amendment presents a considerably narrower set of issues than those before the Commission in the *Spectrum Frontiers* proceeding. In this case, Theia proposes limited use of this band at the higher PFD levels authorized by the ITU to communicate with a limited number of individually licensed earth stations, which will be located at fixed geographic points, not with ubiquitously deployed mobile terminals.

In any event, through the use of directional beams, incumbent terrestrial fixed service systems and future 5G systems can operate successfully in the 37.5-40.0 GHz band without experiencing harmful interference from satellite systems operating in the same spectrum employing space-to-Earth transmissions at the higher ITU PFD levels. Theia's judicious selection of individually licensed earth station locations in isolated areas may further mitigate this risk by minimizing the chance that a terrestrial service would be operating in close proximity to a directional beam from a TSN space station aimed at that fixed earth station.

e. Waiver of § 25.156(d)(5) to Permit Consideration of this NGSO Application after the Commission Previously Licensed a GSO System in these Bands

Section 25.156(d)(5) of the Commission's rules states that:

"In cases where the Commission has not adopted frequency-band specific service rules, the Commission will not consider NGSO-like applications after it has granted a GSO-like application, and it will not consider GSO-like applications after it has granted an NGSO-like application, unless and until the Commission establishes NGSO/GSO sharing criteria for that frequency band."

The Commission has not adopted NGSO/GSO sharing criteria for the V-band. Therefore, the above provision may be applicable to this Amendment.

As explained above, the Commission previously granted two satellite system licenses covering portions of the V-band to Northrop Grumman and Hughes Network Systems, but both authorizations were surrendered. Although Section 25.156(d)(5) of the Commission's rules does

not so state, it would be appropriate to assume that the above-quoted provision of the rule does not apply to satellite systems that were licensed, never built and the licenses were surrendered.

Out of an abundance of caution, Theia requests a waiver of the above-quoted requirements of Section 25.156(d)(5). Such a waiver is appropriate given the fact that no commercial satellite systems are currently operating in the V-band and therefore no incumbent satellite systems could be harmed by the grant of such a waiver.³⁶

**f. Wavier of § 25.157(e) to Permit Sharing of V-Band Spectrum
 Among All NGSO System Operators**

Section 25.157(e) of the Commission’s rules establishes default procedures for partitioning spectrum among multiple applicants in a single processing round. Section 25.157(e)(1) establishes as a default spectrum management procedure that, in cases where multiple NGSO FSS systems are granted licenses in the same processing round and insufficient spectrum is available to meet the needs of each licensee, the Commission will divide the available spectrum between them. Section 25.157(e)(2) establishes that, if a processing round results in the grant of licenses to only one or two NGSO FSS systems, each licensee will be assigned only one third of the available spectrum, leaving the remaining spectrum potentially fallow for later entrants. Finally, Section 25.157(e)(3) establishes that, if a processing round results in the grant of more than three licenses for NGSO FSS systems, each licensee will be assigned the lesser of either the amount of spectrum that it requested, or the amount of spectrum that would have been assigned to each licensee if the available spectrum were divided equally among the licensees. Each of these rules pre-dates the

³⁶ *The Boeing Company Application for Authority to Launch and Operate a Non-Geostationary Low Earth Orbit Satellite System in the Fixed Satellite Service*, IBFS File No. SAT-LOA-20160622-00058 (filed June 22, 2016), Application at 67.

development of modern, co-frequency spectrum sharing capabilities among multiple NGSO FSS satellite systems.

Theia requests a waiver of these rules because they are no longer necessary to prevent interference among NGSO constellations. Such is particularly the case with the TSN, which will use V-band frequencies only to transmit to a limited number of earth stations in fixed locations, making avoidance of in-line interference events considerably more straightforward than it would be in the case of ubiquitous or mobile terminals. Modern NGSO FSS systems can employ spectrum-sharing techniques to enable co-frequency spectrum-sharing with other NGSO FSS systems and thereby avoid the need for highly inefficient and counterproductive spectrum segmentation.

The spectrum-sharing capabilities of NGSO FSS systems have long been recognized by the Commission.³⁷ The Commission's International Bureau recently affirmed the importance of its "in-line avoidance" approach, indicating that the sharing requirement would be applied to NGSO FSS systems operating in additional spectrum bands.³⁸ Importantly, the "in-line avoidance" approach advocated by the Commission is in direct conflict with the band-segmentation approach embodied in Section 25.157(e), further justifying a waiver of the latter.

By permitting each NGSO FSS licensee to use the entire V-band on a shared basis with existing and future NGSO FSS systems, the Commission would ensure that spectrum is used in a highly efficient and intensive manner, both in the near-term and as future systems are developed.

³⁷ See generally *Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ku-Band*, IB Docket No. 01-96, Report and Order and Further Notice of Proposed Rulemaking, FCC 02-123, 17 FCC Rcd 7841 (2002), at ¶¶ 27-55 ("*Ku-Band NGSO Sharing Order*").

³⁸ See Public Notice, "International Bureau Provides Guidance Concerning Avoidance of In-Line Interference Events Among Ku-Band NGSO FSS Systems," DA 15-1197, 30 FCC Rcd 11534 (Int. Bur. 2015).

Importantly, such an approach would not preclude future entry by additional NGSO FSS systems. In fact, by ensuring long-term access to the entire V-band for future NGSO FSS systems, the Commission would enhance the business case for the operation of such systems and thereby help facilitate future options for consumers. Given these facts, good cause exists to grant a waiver of Section 25.157(e) of the Commission's rules.

g. Wavier of § 25.116(c) to Preserve Theia's Status in the Ku-Band/Ka-Band Processing Round

Section 25.116(c) of the Commission's rules, 47 C.F.R. § 25.116(c), states that, "[a]ny application for an NGSO-like satellite license within the meaning of § 25.157 will be considered to be a newly filed application if it is amended by a major amendment (as defined by paragraph (b) of this section) after a 'cut-off' date applicable to the application," except in circumstances not applicable here. Section 25.116(b) of the Commission's rules, 47 C.F.R. § 25.116(b), in turn, deems an amendment to be "major" if it, among other things, "increases the potential for interference, or changes the proposed frequencies or orbital locations to be used." Under Section 25.116(b), therefore, this Amendment is considered "major."

Theia requests a waiver of Section 25.116(c) to the extent required to ensure that this Amendment does not cause Theia's original TSN Application to be treated as "newly filed" in this processing round, and therefore late-filed in the Ku-band/Ka-Band processing round. Theia anticipated this issue and consulted with the International Bureau staff on the matter. Because NGSO-like applications for similar frequency bands must be considered in processing rounds, filing for the subject bands separately in each processing was procedurally advisable, if not required, by the rules. Further, because the V-band frequencies sought herein are fully integrated in the TSN, and application amendment is the appropriate vehicle to add the subject bands.

In addition, applications to use the V-band frequencies identified in the *Boeing Public Notice* were not yet due when the cutoff date for the *OneWeb Public Notice* passed. Indeed, the *Boeing Public Notice* was released on November 1, 2016, just two weeks before the November 15, 2016 cutoff date for Ku-band/Ka-band applications. Strict application of Section 25.116(c) in this case would disserve the public interest by substantially curtailing the Commission's ability to consider applications for systems that propose to use both bands, no matter how meritorious.

The Commission has seldom, if ever, created two overlapping processing rounds for NGSO systems operating on different frequency bands. But, by doing so, the Commission has created a unique and valuable opportunity to conduct its analysis of the applications filed under both processing rounds simultaneously, taking into account the public interest benefits offered by systems that proposed combined use of bands in both rounds.

Both the Ku-band/Ka-band proposal contained in the original TSN Application and the V-Band frequencies discussed in this Amendment are vital to the success of the TSN. Therefore, Theia requests that the Commission preserve the status obtained from the timely filing of the TSN Application in the Ku-band/Ka-band processing round, while also recognizing this Amendment as a timely filing in the V-band processing round. Theia believes that a waiver to consider applications that propose combined fully on their merits in conjunction with other applicants would better serve the public interest than strict adherence to Section 25.116(c).

III. PUBLIC INTEREST STATEMENT

Grant of the TSN Application, as amended, will serve the public interest by enhancing the operational flexibility and increasing the capacity of Theia's advanced remote sensing and communication NGSO system. By allowing Theia to operate in the V-Band, the Commission will enable a wide array of next-generation Earth observation services at higher data rates and lower latency. As discussed above, to the extent the Commission deems any portion of this amendment

to adversely affect processing of the original TSN Application, Theia reserves the right to withdraw this Amendment, in whole or in part, to address such issues.

In this Amendment, Theia has demonstrated compliance with applicable Commission rules and good cause for requested waivers to operate in certain V-band frequencies. On the uplink, Theia's gateway and high-capacity earth stations will be limited in number and able to protect any potentially co-frequency terrestrial operations from harmful interference. On the downlink, TSN earth station receive operations will not cause interference to other systems and services, and will not constrain their deployment. In fact, given the high-gain of the subject earth station receivers, Theia can operate on a non-conforming, unprotected basis in these bands. Noting that the Commission's rules in the V-band remain in flux, Theia reserves the right to seek such additional waivers and present such additional supporting information as may be appropriate in the context of future changes to the Commission's rules and policies.

Furthermore, in the TSN Application, Theia demonstrated the ability of the TSN to share spectrum with other NGSO systems. These spectrum sharing techniques apply equally to V-band operations, although sharing will be considerably easier because operations are limited to a small number of gateway and high-capacity earth stations. Thus, Theia believes that it will be able to coordinate its operations with other V-band NGSO licensees and protect future GSO operations.

Finally, in evaluating the Amendment, as with the proposal to use other spectrum set forth in the original TSN Application, the Commission should remain mindful that the TSN will operate globally and will be subject to the allocation rules and regulatory requirements of foreign nations in which it seeks to operate. Thus, regardless of the Commission's determinations regarding spectrum access in the United States, it should grant Theia authority to operate the TSN in accordance with international allocations and applicable foreign rules.

IV. CONCLUSION

Based on the foregoing, Theia respectfully requests that the Commission grant the TSN Application, as amended, for authority to launch and operate an NGSO remote sensing and communications system in Ku-band, Ka-band and V-band frequencies, as well as EESS frequencies, as described in the application materials associated with its proposed system.

Technical Certification

I, Joseph D. Fagnoli, hereby certify that I am the technically qualified person responsible for the preparation of the technical information contained in the Theia Holdings A, Inc.'s Amendment to Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth-Exploration Satellite Service, that I am familiar with Part 25 of the Commission's Rules (47 C.F.R. Part 25), and that I have either prepared or reviewed the technical information submitted in this application and found it to be complete and accurate to the best of my knowledge and belief.

/s/ Joseph D. Fagnoli
Joseph D. Fagnoli
Chief Technology Officer
Theia Holdings A, Inc.

March 1, 2017

Theia Part 25 Compliance Matrix
Amendment to File No. SAT-LOA-20161115-0012

Rule	Requirement	Application Citation
§ 25.110(b)	(b)(1) N/A (b)(2) Applications for space station licenses must be filed electronically on FCC Form 312 in accordance with the applicable provisions of part 1, subpart Y of this chapter and include all information required by § 25.114. (b)(3) N/A	<i>See</i> Amendment Form 312, Schedule S and associated materials.
§ 25.113(h)	(h) An operator of NGSO space stations under a blanket license granted by the Commission need not apply for license modification to operate technically identical in-orbit spare satellites in an authorized orbit....	Theia will comply.
§ 25.113(i)	(i) An operator of NGSO space stations under a blanket license granted by the Commission need not apply for license modification to deploy and operate technically identical replacement satellites in an authorized orbit....	Theia will comply.
§ 25.114(a)	(a) A license application filed pursuant to §25.110(b)(2) for a GSO space station or NGSO space station or space-station constellation must comprise a comprehensive proposal and must be submitted on FCC Form 312, Main Form and Schedule S, with attached exhibits required by paragraph (d) of this section.	<i>See</i> Amendment Form 312, Schedule S and associated materials.
§ 25.114(b)	Each application for a new or modified space station authorization must contain the formal waiver to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise (<i>see</i> 47 U.S.C. 304).	<i>See</i> Form 312
§ 25.114(c)	(1) Name, address, and telephone number of the applicant. (2) Name, address, and telephone number of the person(s), including counsel, to whom inquiries or correspondence should be directed. (3) Type of authorization requested (<i>e.g.</i> , launch authority, station license, modification of authorization). (4) See below. (5) N/A (6) For space stations in non-geostationary orbits: (i) The number of orbital planes and the number of space stations in each plane, (ii) The inclination of the orbital plane(s), (iii) The orbital period, (iv) The apogee, (v) The perigee, (vi) The argument(s) of perigee, (vii) Active service arc(s), (viii) Right ascension of the ascending node(s), and (ix) For each satellite in each orbital plane, the initial phase angle at the reference time. (7) The frequency bands, types of service, and coverage areas;	<i>See</i> Amendment Form 312, Schedule S and associated materials.

	<p>(8) Calculated maximum power flux density levels within each coverage area and energy dispersal bandwidths, if any, needed for compliance with §25.208, for the angles of arrival specified in the applicable paragraph(s) of §25.208;</p> <p>(9) [Reserved]</p> <p>(10) Estimated operational lifetime;</p> <p>(11) Whether the space station is to be operated on a common carrier basis;</p> <p>(12) [Reserved]</p> <p>(13) N/A</p>	
25.114(c)(4)	<p>(4)(i) For each space station transmitting and receiving antenna beam (including telemetry and tracking beams but not command beams), specify channel center frequencies and bandwidths and polarization plan. For command beams, specify each of the center frequencies within a 5 MHz range or a range of 2 percent of the assigned bandwidth, whichever is smaller, and the polarization plan. If the space station can vary channel bandwidth in a particular frequency band with on-board processing, specify only the range of frequencies in that band over which the beam can operate and the polarization plan.</p> <p>(ii) Specify maximum EIRP and maximum EIRP density for each space station transmitting antenna beam. If the satellite uses shapeable antenna beams, as defined in §25.103, specify instead maximum possible EIRP and maximum possible EIRP density within each shapeable beam's proposed coverage area. Provide this information for each frequency band in which the transmitting antenna would operate. For bands below 15 GHz, specify EIRP density in dBW/4 kHz; for bands at and above 15 GHz, specify EIRP density in dBW/MHz. If the EIRP density varies over time, specify the maximum possible EIRP density.</p> <p>(iii)-(iv) [Reserved]</p> <p>(v) For each space station receiving beam other than command beams, specify the gain-to-temperature ratio at beam peak. For receiving beams fed into transponders, also specify the minimum and maximum saturation flux density at beam peak. If the satellite uses shapeable beams, specify the minimum and maximum gain-to-temperature ratio within each shapeable beam's proposed coverage area, and for shapeable receiving beams fed into transponders, specify the minimum and maximum saturation power flux density within the 0 dB relative antenna gain isoline. Provide this information for each frequency band in which the receiving beam can operate. For command beams, specify the beam peak flux density at the command threshold;</p> <p>(vi)(A) N/A</p> <p>(B) For space stations in non-geostationary orbits, specify for each unique orbital plane the predicted antenna gain contour(s) for each transmit and receive antenna beam for one space station if all space stations are identical in the constellation. If individual space stations in the constellation have different antenna beam configurations, specify the predicted antenna gain contours for each transmit and receive beam for each space station type and orbit or orbital plane requested. The contours should be plotted on an area map with the beam</p>	<p><i>See Amendment Form 312, Schedule S and associated materials.</i></p>

	<p>depicted on the surface of the earth with the space stations' peak antenna gain pointed at nadir to a latitude and longitude within the proposed service area. The contour(s) should be plotted at 2 dB intervals down to 10 dB below the peak gain and at 5 dB intervals between 10 dB and 20 dB below the peak gain. For intersatellite links, specify the peak antenna gain and 3 dB beamwidth.</p> <p>(C) For space stations with shapeable antenna beams, specify the contours, as defined in paragraph (c)(4)(vi)(A) or (B) of this section, for the transmitting beam configuration that results in the highest EIRP density for the beams listed in paragraph (c)(4)(ii) of this section and for the receiving beam configuration with the smallest gain-to-temperature ratio and the highest required saturation power flux density for the beams listed in paragraph (c)(4)(v) of this section. If the shapeable beams are also steerable, include the contours that would result from moving the beam peak around the limit of the effective beam peak area and the 0 dB relative antenna gain isoline. The proposed maximum coverage area must be clearly specified.</p> <p>(D) For a space station with steerable beams that are not shapeable, specify the applicable contours, as defined in paragraph (c)(4)(vi)(A) or (c)(4)(vi)(B) of this section, with a description of a proposed coverage area for each steerable beam or provide the contour information described in paragraph (c)(4)(vi)(C) of this section for each steerable beam.</p> <p>(vii) N/A</p>	
§ 25.114(d)	<p>(d)(1) Overall description of system facilities, operations and services and explanation of how uplink frequency bands would be connected to downlink frequency bands.</p> <p>(2)-(5) [Reserved].</p> <p>(6) Public interest considerations in support of grant.</p> <p>(7) Applicants for authorizations for space stations in the Fixed-Satellite Service must also include the information specified in §25.140(a).</p> <p>(8) N/A</p> <p>(9) N/A</p> <p>(10) N/A</p> <p>(11) N/A</p> <p>(12) Applications for authorizations in the non-geostationary orbit Fixed-Satellite Service in the 10.7-14.5 GHz bands must also provide all information specified in §25.146.</p> <p>(13) N/A</p> <p>(14) A description of the design and operational strategies that will be used to mitigate orbital debris.</p> <p>(15) N/A</p> <p>(16) N/A</p> <p>(17) N/A</p> <p>(18) N/A</p>	<p><i>See File No. SAT-LOA-20161115-0012, Technical Narrative.</i></p> <p><i>See Amendment Form 312, Schedule S and associated materials.</i></p>

§ 25.116(a)	(a) Unless otherwise specified, any pending application may be amended until designated for hearing, a public notice is issued stating that a substantive disposition of the application is to be considered at a forthcoming Commission meeting, or a final order disposing of the matter is adopted by the Commission.	Theia complies.
§ 25.116(b)	<p>(b) Major amendments submitted pursuant to paragraph (a) of this section are subject to the public notice requirements of § 25.151. An amendment will be deemed to be a major amendment under the following circumstances:</p> <p>(1) If the amendment increases the potential for interference, or changes the proposed frequencies or orbital locations to be used.</p> <p>(2) If the amendment would convert the proposal into an action that may have a significant environmental effect under § 1.1307 of this chapter.</p> <p>(3) [Reserved]</p> <p>(4) If the amendment, or the cumulative effect of the amendment, is determined by the Commission otherwise to be substantial pursuant to section 309 of the Communications Act.</p> <p>(5) Amendments to “defective” space station applications, within the meaning of § 25.112 will not be considered.</p>	<i>See Amendment Legal Narrative.</i>
§ 25.116(c)	<p>(c) Any application for an NGSO-like satellite license within the meaning of § 25.157 will be considered to be a newly filed application if it is amended by a major amendment (as defined by paragraph (b) of this section) after a “cut-off” date applicable to the application, except under the following circumstances:</p> <p>(1) The amendment resolves frequency conflicts with authorized stations or other pending applications but does not create new or increased frequency conflicts;</p> <p>(2) The amendment reflects only a change in ownership or control found by the Commission to be in the public interest and, for which a requested exemption from a “cut-off” date is granted;</p> <p>(3) The amendment corrects typographical, transcription, or similar clerical errors which are clearly demonstrated to be mistakes by reference to other parts of the application, and whose discovery does not create new or increased frequency conflicts; or</p> <p>(4) The amendment does not create new or increased frequency conflicts, and is demonstrably necessitated by events which the applicant could not have reasonably foreseen at the time of filing.</p>	<i>See Amendment Narrative. Theia requests a waiver of § 25.116(c) in the Legal Narrative.</i>

§ 25.116(e)	(e) Any amendment to an application shall be filed electronically through the International Bureau Filing System (IBFS) in accordance with the applicable provisions of part 1, subpart Y of this chapter. Amendments to space station applications must be filed on Form 312 and Schedule S. Amendments to earth station applications must be filed on Form 312 and Schedule B.	<i>See</i> Amendment Form 312 and Schedule S.
§ 25.136(a)	(a) FSS is secondary to the Upper Microwave Flexible Use Service in the 27.5-28.35 GHz band. Notwithstanding that secondary status, an earth station in the 27.5-28.35 GHz band that meets one of the criteria listed below may operate consistent with the terms of its authorization without providing any additional interference protection to stations in the Upper Microwave Flexible Use Service:.....	<i>N/A</i>
§ 25.136(b)	(b) Applications for earth stations in the 37.5-40 GHz band shall provide an exhibit describing the zone within which the earth station will require protection from transmissions of Upper Microwave Flexible Use Service licensees.....	<i>N/A</i>
§ 25.136(c)	(c) The protection zone (as defined in paragraph (b) of this section) shall comply with the following criteria. The applicant shall demonstrate compliance with all of the following criteria in its application:.....	<i>N/A</i>
§ 25.136(d)	(d) If an earth station applicant or licensee in the 27.5-28.35 GHz or 37.5-40 GHz bands enters into an agreement with an UMFUS licensee....	<i>N/A</i>
§ 25.156(a)	(a) Applications for a radio station authorization, or for modification or renewal of an authorization, will be granted if, upon examination of the application, any pleadings or objections filed, and upon consideration of such other matters as it may officially notice, the Commission finds that the applicant is legally, technically, and otherwise qualified, that the proposed facilities and operations comply with all applicable rules, regulations, and policies, and that grant of the application will serve the public interest, convenience and necessity.	<i>See</i> File No. SAT-LOA-20161115-0012 Form 312, Schedule B, Schedule S and associated application materials; <i>Legal Narrative</i> .
§ 25.156(d)	(d)(1) Applications for NGSO-like satellite operation will be considered pursuant to the procedures set forth in §25.157, except as provided in §25.157(b). (2) <i>N/A</i> (3) Applications for both NGSO-like satellite operation and GSO-like satellite operation in two or more service bands will be treated as separate applications for each service band, and each service band request will be considered pursuant to §25.157 or §25.158, as appropriate.	File No. SAT-LOA-20161115-0012, <i>Legal Narrative</i> .

	<p>(4) Applications for feeder-link authority or inter-satellite link authority will be treated like an application separate from its associated service band. Each feeder-link request or inter-satellite link request will be considered pursuant to the procedure for applications for GSO-like operation or NGSO-like operation, as applicable.</p> <p>(5) In cases where the Commission has not adopted frequency-band specific service rules, the Commission will not consider applications for NGSO-like satellite operation after it has granted an application for GSO-like operation in the same frequency band, and it will not consider applications for GSO-like operation after it has granted an application for NGSO-like operation in the same band, unless and until the Commission establishes NGSO/GSO sharing criteria for that frequency band. In the event that the Commission receives applications for NGSO-like operation and applications for GSO-like operation at the same time, and the Commission has not adopted sharing criteria in that band, the Commission will divide the spectrum between GSO-like and NGSO-like licensees based on the proportion of qualified GSO-like and NGSO-like applicants.</p> <p>(6) N/A</p>	
<p>§ 25.157(c)</p>	<p>(c) Each application for NGSO-like satellite operation that is acceptable for filing under §25.112, except replacement applications described in paragraph (b) of this section, will be reviewed to determine whether it is a “competing application,” <i>i.e.</i>, filed in response to a public notice initiating a processing round, or a “lead application,” <i>i.e.</i>, all other applications for NGSO-like satellite operation.</p>	<p><i>Id.</i></p>
<p>§ 25.157(e)</p>	<p>(e)(1) In the event that there is insufficient spectrum in the frequency band available to accommodate all the qualified applicants in a processing round, the available spectrum will be divided equally among the licensees whose applications are granted pursuant to paragraph (d) of this section, except as set forth in paragraph (e)(2) or (e)(3) of this section.</p> <p>(2) In cases where there are only one or two applications in a processing round granted pursuant to paragraph (d) of this section, each applicant will be assigned $\frac{1}{3}$ of the available spectrum, and the remaining spectrum will be made available to other licensees in an additional processing round pursuant to paragraph (c) of this section.</p> <p>(3) In cases where there are three or more applications in a processing round granted pursuant to paragraph (d) of this section, and one or more applicants apply for less spectrum than they would be warranted under paragraph (e)(1) of this section, those applicants will be assigned the bandwidth amount they requested in their applications. In those cases, the remaining qualified applicants will be assigned the lesser of the amount of spectrum they requested in their applications and the amount spectrum that they would be assigned if the available spectrum were divided equally among the remaining qualified applicants.</p>	<p><i>Id.</i></p>

<p>§ 25.164</p>	<p>(a) N/A</p> <p>(b) The recipient of an initial license for an NGSO satellite system, other than a DBS or SDARS satellite system, granted on or after September 11, 2003, must launch the space stations, place them in the assigned orbits, and operate them in accordance with the station authorization no later than six years after the grant of the license, unless a different schedule is established by Title 47, Chapter I, or the Commission.</p> <p>(c) – (e) [Reserved]</p> <p>(f) A licensee subject to the requirements in paragraph (a) or (b) of this section must either demonstrate compliance with the applicable requirement or notify the Commission in writing that the requirement was not met, within 15 days after the specified deadline. Compliance with a milestone requirement in paragraph (a) or (b) of this section may be demonstrated by certifying pursuant to §25.121(d) that the space station(s) in question, has, or have, been launched and placed in the authorized orbital location or non-geostationary orbit(s) and that in-orbit operation of the space station or stations has been tested and found to be consistent with the terms of the authorization.</p> <p>(g) N/A</p> <p>(h) N/A</p>	<p><i>See File No. SAT-LOA-20161115-0012, Technical Narrative.</i></p>
<p>§ 25.165(a)</p>	<p>(a) For all space station licenses issued after September 20, 2004, other than licenses for DBS space stations, SDARS space stations, and replacement space stations as defined in paragraph (e) of this section, the licensee must post a bond within 30 days of the grant of its license. Failure to post a bond will render the license null and void automatically.</p> <p>(1) An NGSO licensee must have on file a surety bond requiring payment in the event of default as defined in paragraph (c) of this section, in an amount, at a minimum, determined according to the following formula, with the resulting dollar amount rounded to the nearest \$10,000: $A = \\$1,000,000 + \\$4,000,000 * D/2192$, where A is the amount to be paid and D is the lesser of 2192 or the number of days that elapsed from the date of license grant until the date when the license was surrendered.</p> <p>(2) N/A</p> <p>(3) N/A</p>	<p>Theia will comply.</p>
<p>§ 25.202</p>	<p>Frequencies, Frequency Tolerance and Emission Limits.</p>	<p><i>See Amendment Form 312, Schedule S and associated materials.</i></p>

<p>§ 25.207</p>	<p>(a)-(b) [Reserved]</p> <p>(c) Space stations shall be made capable of ceasing radio emissions by the use of appropriate devices (battery life, timing devices, ground command, etc.) that will ensure definite cessation of emissions.</p> <p>(d)-(e) [Reserved]</p> <p>(f) All space stations in the Fixed-Satellite Service operating in any portion of the 3600-4200 MHz, 5091-5250 MHz, 5850-7025 MHz, 10.7-12.7 GHz, 12.75-13.25 GHz, 13.75-14.5 GHz, 15.43-15.63 GHz, 18.3-20.2 GHz, 24.75-25.25 GHz, or 27.5-30.0 GHz bands, including feeder links for other space services, and in the Broadcasting-Satellite Service in the 17.3-17.8 GHz band (space-to-Earth), shall employ state-of-the-art full frequency reuse, either through the use of orthogonal polarizations within the same beam and/or the use of spatially independent beams. This requirement does not apply to telemetry, tracking, and command operation.</p> <p>(g)-(h) [Reserved]</p> <p>(i) N/A</p> <p>(j) N/A</p>	<p><i>See File No. SAT-LOA-20161115-0012, Technical Narrative.</i></p> <p><i>See Amendment Form 312, Schedule S and associated materials.</i></p>
<p>§ 25.208</p>	<p>Applicable power-flux density limits</p>	<p><i>See Amendment Technical Narrative.</i></p>
<p>§ 25.210(f)</p>	<p>(f) All space stations in the Fixed-Satellite Service operating in any portion of the 3600-4200 MHz, 5091-5250 MHz, 5850-7025 MHz, 10.7-12.7 GHz, 12.75-13.25 GHz, 13.75-14.5 GHz, 15.43-15.63 GHz, 18.3-20.2 GHz, 24.75-25.25 GHz, or 27.5-30.0 GHz bands, including feeder links for other space services, and in the Broadcasting-Satellite Service in the 17.3-17.8 GHz band (space-to-Earth), shall employ state-of-the-art full frequency reuse, either through the use of orthogonal polarizations within the same beam and/or the use of spatially independent beams. This requirement does not apply to telemetry, tracking, and command operation.</p>	<p><i>See File No. SAT-LOA-20161115-0012, Technical Narrative.</i></p>
<p>§ 25.271</p>	<p>(a) The licensee of a facility licensed under this part is responsible for the proper operation and maintenance of the station.</p> <p>(b) N/A</p> <p>(c) N/A</p> <p>(d) The licensee shall insure that the licensed facilities are properly secured against unauthorized access or use whenever an operator is not present at the transmitter.</p> <p>(e) The licensee of an NGSO FSS system operating in the 10.7-14.5 GHz bands shall maintain an electronic web site bulletin board to list the satellite ephemeris data, for each satellite in the constellation, using the North American Aerospace Defense Command (NORAD) two-line orbital element format. The orbital elements shall be updated at least once every three days.</p> <p>(f) N/A</p> <p>(g) N/A</p>	<p>Theia will comply.</p>

<p>§ 25.272</p>	<p>(a) Each space station licensee in the Fixed-Satellite Service shall establish a satellite network control center which will have the responsibility to do the following:</p> <p>(1) Monitor space-to-Earth transmissions in its system (thus indirectly monitoring uplink earth station transmissions in its system) and</p> <p>(2) Coordinate transmissions in its satellite system with those of other systems to prevent harmful interference incidents or, in the event of a harmful interference incident, to identify the source of the interference and correct the problem promptly.</p> <p>(b) [Reserved]</p> <p>(c) N/A</p> <p>(d)(1) – (4) N/A</p> <p>(d)(5) The space station licensee may delegate the responsibility and duties of the satellite network control center to a technically qualified user or group of users, but the space station licensee shall remain ultimately responsible for the performance of those duties.</p>	<p><i>See File No. SAT-LOA-20161115-0012, Technical Narrative.</i></p>
<p>§ 25.273</p>	<p>(a) No person shall:</p> <p>(1) Transmit to a satellite unless the specific transmission is first authorized by the satellite network control center;</p> <p>(2) Conduct transmissions over a transponder unless the operator is authorized to transmit at that time by the satellite licensee or the satellite licensee's successor in interest; or</p> <p>(3) Transmit in any manner that causes unacceptable interference to the authorized transmission of another licensee.</p> <p>(b) Satellite operators shall provide upon request by the Commission and by earth station licensees authorized to transmit on their satellites relevant information needed to avoid unacceptable interference to other users, including the polarization angles for proper illumination of a given transponder.</p> <p>(c) Space station licensees are responsible for maintaining complete and accurate technical details of current and planned transmissions over their satellites, and shall require that authorized users of transponders on their satellites, whether by tariff or contract, provide any necessary technical information in this regard including that required by §25.272. Based on this information, space station licensees shall exchange among themselves general technical information concerning current and planned transmission parameters as needed to identify and promptly resolve any potential cases of unacceptable interference between their satellite systems.</p> <p>(d) N/A</p>	<p>Theia will comply.</p>
<p>§ 25.275(b)</p>	<p>(b) When authorized frequency bands are specified in the station authorization, the licensee is authorized to transmit any number of r.f. carriers on any discrete frequencies within an authorized frequency band in accordance with the other terms and conditions of the authorization and the requirements of this part. Specific r.f. carrier frequencies within the authorized frequency band shall be selected by the licensee to avoid unacceptable levels of interference being caused to other earth, space or terrestrial stations. Any coordination agreements, both domestic and international, concerning specific frequency usage constraints, including non-use of any particular frequencies within the frequency bands listed in the station authorization, are considered to be conditions of the station authorization.</p>	<p>Theia will comply.</p>

§ 25.278	Licensees of non-geostationary satellite systems that use frequency bands allocated to the Fixed-Satellite Service for their feeder link operations shall coordinate their operations with licensees of geostationary Fixed-Satellite Service systems licensed by the Commission for operation in the same frequency bands. Licensees of geostationary Fixed-Satellite Service systems in the frequency bands that are licensed to non-geostationary satellite systems for feeder link operations shall coordinate their operations with the licensees of such non-geostationary satellite systems.	They will comply.
§ 25.283	(a) N/A (b) N/A (c) Upon completion of any relocation authorized by paragraph (b) of this section, or any relocation at end-of-life specified in an authorization, or upon a spacecraft otherwise completing its authorized mission, a space station licensee shall ensure, unless prevented by technical failures beyond its control, that stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, or other appropriate measures. (d) N/A	<i>See File No. SAT-LOA-20161115-0012, Legal Narrative.</i>