

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, DC 20554

In the Matter of )  
 )  
LeoSat MA, Inc. ) SAT-PDR-20161115-00112  
 ) Call Sign S2979  
 )  
 )  
NGSO-Like Satellite Applications and Petitions for )  
U.S. Market Access in the 12.75-13.25 GHz, 13.85- ) DA 17-524  
14.0 GHz, 18.6-18.6 GHz, 19.3-20.2 GHz, and 29.1- )  
29.5 GHz bands )  
 )

**OPPOSITION AND RESPONSE OF LEOSAT MA, INC.**

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July 7, 2017

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## EXECUTIVE SUMMARY

LeoSat MA, Inc. (“LeoSat”) submits this Reply and Opposition to comments and petitions to deny filed in this processing round in connection with LeoSat’s Petition for Declaratory Ruling (“PDR”). LeoSat’s PDR seeks U.S. market access for LeoSat’s proposed Ka-band fixed-satellite Service (“FSS”) non-geostationary (“NGSO”) 78-satellite system, which will provide innovative broadband enterprise communications solutions.

The majority of the substantive issues that were raised by the commenters already are under consideration in the pending NGSO FSS rulemaking proceeding in which the Federal Communications Commission (“Commission”) has proposed update its satellite rules to accommodate a new generation of NGSO constellations. These issues are more appropriately addressed in that broadly applicable rulemaking rather than through *ad hoc* conditions imposed on the grant of individual applications in this processing round. Indeed, the pending rulemaking is the appropriate vehicle to adopt requirements governing spectrum sharing between NGSO systems.

This includes consideration of what mechanism should be used to avoid and resolve in-line interference and what role International Telecommunications Union priority and coordination obligations should play. Similarly, the rulemaking proceeding also is the appropriate vehicle to address ITU Article 22 equivalent power-flux density (“EPFD”) requirements, as well as EPFD requirements to address aggregate interference from NGSO constellations into GSO operations. LeoSat agrees with the commenters who asserted that the Commission should condition its grant of applications in this processing round on compliance with any rules that the Commission adopts in the pending NGSO rulemaking proceeding.

Certain commenters additionally requested that LeoSat's PDR and other applications in this processing round be subject to other conditions. LeoSat does not oppose grant of its PDR being conditioned on compliance with orbital debris mitigation requirements prior to LeoSat entering the U.S. market. LeoSat also does not object to being subjected to the majority of the conditions that were imposed on O3b Limited's U.S. market access grant, although certain O3b conditions are inapplicable to LeoSat. Finally, for the reasons set forth herein, LeoSat requests that the Commission dismiss the petitions to deny filed by Telesat Canada and ViaSat, Inc.

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**OPPOSITION AND RESPONSE OF LEOSAT MA, INC.**

**I. INTRODUCTION**

LeoSat MA, Inc. (“LeoSat”) submits this Opposition and Response to the comments and petitions to deny that were filed in connection with LeoSat’s Petition for Declaratory Ruling (“PDR”). LeoSat’s PDR seeks U.S. market access to provide new broadband fixed-satellite services (“FSS”) to the United States using its Ka-band low-Earth orbit (“LEO”), non-geostationary orbit (“NGSO”) satellite system.<sup>1</sup> On May 26, 2017, the Federal Communications Commission (“FCC” or “Commission”) released a public notice accepting ten NGSO applications for filing, including LeoSat’s PDR.<sup>2</sup> Five parties filed comments and two parties filed petitions to deny in connection with LeoSat’s PDR (collectively “Commenters”).<sup>3</sup>

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<sup>1</sup> LeoSat MA, Inc., Petition for Declaratory Ruling to Permit U.S. Market for the LeoSat Ka-Band Low-Earth Orbit Satellite System, Call Sign S2979, IBFS File No. SAT-PDR-20161115-00112 (filed Nov. 15, 2016) (“PDR”).

<sup>2</sup> See *Satellite Policy Branch Information, Applications Accepted for Filing, Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 12.75-13.25*

## II. BACKGROUND REGARDING LEOSAT'S PDR

LeoSat filed a PDR with the Commission on November 15, 2016 seeking U.S. market access for its proposed constellation of 78 high-throughput, Ka-band LEO satellites (plus six in-orbit spares) operating at an altitude of 1400 kilometers (“LeoSat System”). The LeoSat System will provide premises-to-premises enterprise communications solutions, broadband Internet connectivity, 5G/4G cellular backhaul, video content delivery, oil field services and operations, and maritime communications. Each LeoSat satellite will contain ten steerable user antennas capable of providing 50 Mbps to 1.2 Gbps of full-duplex connectivity per link to user terminals, as well as two steerable gateway/enterprise user antennas that are capable of individually providing throughput of 5.2 Gbps for an aggregate throughput of up to 10 Gbps. The LeoSat System’s innovative satellite architecture, which was designed by Thales Alenia Space (“TAS”), transfers data between satellites using inter-satellite laser links, which can be configured into a star or mesh network configuration.

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*GHz, 13.85-14.0 GHz, 18.6-18.8 GHz, 19.3-20.2 GHz, and 29.1-29.5 GHz Bands*, Public Notice, 32 FCC Rcd 4180 (2017). The Commission requested that parties file comments or petitions in response to those applications by June 26, 2017 and file reply comments by July, 7, 2017.

<sup>3</sup> Comments of Hughes Network Systems, LLC, IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“Hughes Comments”); Comments of SES S.A. and O3b Limited, IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“SES/O3b Comments”); Comments of Space Exploration Technologies Corp., IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“SpaceX Comments”); Comments of Space Norway AS, IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“Space Norway Comments”); Comments of Spire Global, Inc., IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“Spire Global Comments”); Petition to Deny of Telesat Canada, IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“Telesat Petition”); Petition to Deny or Impose Conditions of ViaSat, Inc., IBFS File No. SAT-PDR-20161115-00112 (filed June 26, 2017) (“ViaSat Petition”).

The Commission requested additional information about LeoSat’s PDR on March 15, 2017,<sup>4</sup> and LeoSat responded to the Commission’s request on May 15, 2017 (“LeoSat Response”).<sup>5</sup> In the LeoSat Response, LeoSat stated that it intends to file a satellite license application for the LeoSat System with the Netherlands satellite regulatory authority, Radiocommunications Agency Netherlands (“RA”),<sup>6</sup> rather than the French regulatory authority as LeoSat initially had contemplated. In addition, LeoSat provided the results of an equivalent power-flux density (“EPFD”) analysis generated using software compliant with ITU-R Recommendation S.1503-2 of the International Telecommunication Union (“ITU”).<sup>7</sup> LeoSat also provided in the LeoSat Response additional details regarding LeoSat’s orbital debris mitigation plan.<sup>8</sup> However, LeoSat’s orbital debris mitigation plan will not be finalized until LeoSat completes the final design phase for the LeoSat System in collaboration with TAS in early 2018. Consequently, LeoSat requested for the Commission to grant the PDR conditioned on (i) LeoSat’s full compliance with the Commission’s orbital debris mitigation requirements or

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<sup>4</sup> Letter from Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, to Joseph C. Anders, Founder and President, LeoSat MA, Inc., IBFS File No. SAT-LOI-20161115-00112 (Mar. 15, 2017).

<sup>5</sup> Letter from Phillip R. Marchesiello & Lynne M. Montgomery, Counsel to LeoSat MA, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, IBFS File No. SAT-LOI-20161115-00112, at 2, 4-6 (filed May 15, 2017) (“LeoSat Response”).

<sup>6</sup> *Id.* at 2; *see also* Letter from Phillip R. Marchesiello & Lynne M. Montgomery, Counsel to LeoSat MA, Inc., to Jose P. Albuquerque, Chief, Satellite Division, International Bureau, FCC, IBFS File No. SAT-LOI-20161115-00112 (dated May 22, 2017) (“RA Letter”) (forwarding to the FCC a letter from the RA confirming that LeoSat met with RA “to discuss authorizing the operation of LeoSat’s 78-satellite Ka-band low-Earth orbit ... non-geostationary Constellation ...”).

<sup>7</sup> *See* LeoSat Response at 2-3; Results of ITU Software EPFD Analysis at 5-8 (“LeoSat EPFD Analysis”) (Attachment A to LeoSat Response).

<sup>8</sup> *See LeoSat Response* at 4-11.

(ii) a Commission determination that the RA provides direct and effective regulatory oversight of orbital debris mitigation.<sup>9</sup>

### **III. ISSUES RAISED BY COMMENTERS THAT ARE BEING ADDRESSED IN THE NGSO FSS RULEMAKING SHOULD BE RESOLVED IN THAT PROCEEDING**

Almost all of the substantive matters raised by Commenters regarding LeoSat’s PDR currently are being addressed in the Commission’s pending FSS NGSO rulemaking (“NGSO NPRM”) proceeding (“NPRM Proceeding”).<sup>10</sup> In the NPRM Proceeding, the Commission has proposed to update, clarify, and streamline its satellite rules to account for the planned new generation of large NGSO satellite constellations, including those proposed by the applicants in this processing round (“Applicants”). The Commission will promulgate new rules in the NPRM Proceeding to establish a generally applicable regulatory framework, and these rules will resolve most of the substantive issues raised by Commenters in connection with the LeoSat PDR and other applications. Consequently, the NPRM Proceeding, rather than this processing round, is the appropriate regulatory vehicle to address issues that are of broad applicability to the Applicants and other NGSO FSS operators and future applicants. Moreover, all of the Applicants had an opportunity to participate in the NPRM Proceeding and most did so.

Therefore, the Commission should condition grant of each application in this processing round on compliance with the rules that the Commission adopts in the NPRM Proceeding as

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<sup>9</sup> *See id.* at 5.

<sup>10</sup> *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Notice of Proposed Rulemaking, 31 FCC Rcd 13651, 13655 ¶ 9 (2016) (“NGSO NPRM”); *see also* Comments of LeoSat MA, Inc., IB Docket No. 16-408 (filed Feb. 27, 2017) (“LeoSat Comments”); Reply Comments of LeoSat MA, Inc., IB Docket No. 16-408 (filed Apr. 10, 2017) (“LeoSat Reply Comments”).

requested by several Commenters.<sup>11</sup> The Commission took exactly this approach when it granted the OneWeb application.<sup>12</sup> According to the Commission,

We ... condition grant of the OneWeb Petition on the outcome of any rulemaking proceedings, which includes [the NPRM Proceeding].... [W]e note that grant of the OneWeb Petition will not prejudice any decision, including a contrary action, in the [NPRM Proceeding]. Rather, decisions of general applicability in the [NPRM Proceeding] will be based on the totality of comments and proposals in that proceeding, including OneWeb's.<sup>13</sup>

LeoSat supports this approach and anticipates that the Commission will impose this condition on its grant of LeoSat's PDR. To the extent, however, that a Commenter requests the imposition of an *ad hoc* condition specific to LeoSat that relates to a substantive matter at issue in the NPRM Proceeding, the Commission should deny the Commenter's request and instead should address the issue in the context of the NPRM Proceeding.

A. *SPECTRUM SHARING REQUIREMENTS ARE APPROPRIATELY IMPOSED BY RULE IN THE NPRM PROCEEDING RATHER THAN THROUGH AD HOC LICENSE CONDITIONS*

A primary focus of the NGSO NPRM is spectrum sharing. The NGSO NPRM requests comments on a variety of issues related to the manner in which available spectrum in covered

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<sup>11</sup> See, e.g., ViaSat Petition at 3, 9-10; Telesat Petition at 4; SES/O3b Comments at 9; SpaceX Comments at 6; Spire Global Comments at 5, 7. Facilitating this approach, when the Commission initiated this processing round, the Commission expressly stated that "Applicants ... will be afforded an opportunity to amend their requests, if necessary, to conform to any requirements or policies that may be subsequently adopted concerning NGSO-like satellite operation in these bands." See *Satellite Policy Branch Information, OneWeb Petition Accepted for Filing, IBFS File No. SAT-LOI-20160428-00041, Cut-Off Established for Additional NGSO-Like Satellite Applications of Petitions for Operation in the 10.7-12.7 GHz, 14.0-14.5 GHz, 17.8-18.6 GHz, 18.8-19.3 GHz, 27.5-28.35 GHz, 28.35-29.1 GHz, and 29.5-30.0 GHz Bands*, Public Notice, 31 FCC Rcd 7666 (IB 2016).

<sup>12</sup> *WorldVu Satellites Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, FCC 17-77, ¶ 26 (rel. June 23, 2017) ("*OneWeb Order*"). ("This grant of U.S. market access and any earth station licenses granted in the future are subject to modification to bring them into conformance with any rules or policies adopted by the Commission in the future.").

<sup>13</sup> *Id.* ¶ 12 (citations omitted).

bands should be shared between multiple Applicants seeking access to such spectrum.<sup>14</sup> LeoSat will comply with the spectrum sharing and coordination approach that the Commission ultimately adopts in the NPRM Proceeding, but the Commission should not impose additional or different *ad hoc* spectrum sharing or coordination requirements on individual Applicants as conditions to the grant of their respective applications.

**1. THE LEOSAT SYSTEM WILL USE TECHNOLOGIES IDEALLY SUITED TO FACILITATE SPECTRUM SHARING**

As several Commenters noted, avoiding in-line interference events is preferable to a spectrum sharing approach where the available frequency band is divided among the NGSO operators.<sup>15</sup> In addition, the Commission concluded in the *OneWeb Order* that sharing will be possible between OneWeb’s proposed constellation and the other Applicants’ proposed NGSO FSS systems.<sup>16</sup> This includes the LeoSat System, which incorporates multiple features designed to ensure that LeoSat’s constellation is spectrally efficient and capable of coexisting with other NGSO networks by avoiding in-line interference events. These include the following:

- *Satellite Diversity*. Simple satellite diversity will allow LeoSat to avoid in-line interference events. Multiple satellites will be visible to earth stations at any given time, which will enable the LeoSat System to select satellites for communications that have

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<sup>14</sup> *NGSO NPRM*, 31 FCC Rcd at 13660-61 ¶¶ 22-26 (proposing to extend with certain revisions the FCC’s in-line interference to all NGSO FSS allocations subject to the NGSO NPRM rather than imposing band splitting requirements on these allocation); *id.* at 13662-63 ¶¶ 28-30 (seeking comment regarding imposing earth station e.i.r.p. density limits to facilitate NGSO FSS spectrum sharing).

<sup>15</sup> *See, e.g.*, Space Norway Comments at 3; Telesat Petition at 2.

<sup>16</sup> *OneWeb Order* ¶ 18 (“Based on our technical review of the OneWeb Petition and of other applications and petitions that were submitted in the OneWeb processing round, we conclude that sharing will be possible between the OneWeb system and other proposed NGSO FSS systems in all of the bands requested by OneWeb.”).

maximum angular separation from other NGSO satellites, thereby minimizing in-line interference events.

- *Inter-Satellite Laser Links.* Enhancing the benefits of satellite diversity, the LeoSat System will use inter-satellite laser links to enable communications to be routed between multiple LeoSat satellites before being transmitted back to earth stations. This will enable LeoSat to select a satellite for downlink transmissions that avoids in-line interference.
- *Frequency Avoidance.* The LeoSat System has been designed to operate across a wide variety of Ka-band spectrum, thereby maximizing the ability of the system to utilize frequency avoidance when necessary to avoid in-line interference.
- *Power Control and Adaptive Coding.* The LeoSat System will implement power control and adaptive coding to mitigate transmission distance variations and atmospheric propagation effects. These features also are intended to allow the LeoSat System to partially compensate for increased interference over the short term during in-line events.
- *Narrow, Highly Steerable Beams.* Each of the twelve transmit/receive steerable beams on each LeoSat satellite will be directive or very directive and a portion of the beams will have a narrow aperture of approximately  $4.1^\circ$ , which will enable geographic separation at the Earth's surface. The minimum transmission gain of the steerable beams will be 29.57 dBi and the maximum gain will be 34.78 dBi.
- *Low Side Lobes.* LeoSat's satellites' antennas have low side lobes to ensure their compatibility with geosynchronous ("GSO") networks and facilitate coordination with other NGSO systems.

- Directional Earth Stations. As with the OneWeb System, the LeoSat System will employ directional earth stations, which further facilitates avoidance of in-line interference.<sup>17</sup>
- Premises-to-Premises Communications. The LeoSat System only transmits when users are utilizing LeoSat’s satellite service.<sup>18</sup> As a result, the LeoSat System will not blanket the earth with a radiofrequency signal, and many of LeoSat’s satellites may not be transmitting to Earth at any given time.

For these reasons, LeoSat is confident that it will be able to operate in compliance with the spectrum sharing conditions that the Commission imposed in the *OneWeb Order*,<sup>19</sup> as well as any other spectrum sharing and coordination requirements that Commission adopts in the NPRM Proceeding.<sup>20</sup> LeoSat is committed, both in the design of the LeoSat System and in coordination

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<sup>17</sup> See Technical Annex to Supplement Schedule S at 6 § 2.2 (“LeoSat Technical Annex”) (Attachment A to PDR) (describing the “mechanically steerable parabolic reflector antennas, electronically steerable phased array antennas or other beam-steering technology” that will be utilized by the LeoSat System’s user earth terminals); see also *OneWeb Order* ¶ 18 (explaining that OneWeb’s earth station’s directional antennas will “permit[] avoidance of in-line interference” events).

<sup>18</sup> The number of LeoSat satellites converging in the polar regions as a result of the LeoSat System’s polar orbital planes should not increase the number of in-line interference events in these regions or hamper coordination efforts with other NGSO FSS operators because most LeoSat satellites will not be transmitting to Earth most of the time over polar regions. See SpaceX Comments at 3-4. Instead, the likelihood of in-line interference events between the LeoSat System and other NGSO FSS operators in the polar regions will be determined based on market demand in these regions. There are likely to be relatively few earth stations operating in the polar regions at any one time, while numerous LeoSat satellites will be available for selection of non-in-line operation.

<sup>19</sup> The *OneWeb Order* requires OneWeb to comply with the in-line interference method specified in 47 C.F.R. § 25.261(b)-(d). See *OneWeb Order* ¶¶ 23(k), 29.

<sup>20</sup> SpaceX’s assertions regarding the compatibility of the LeoSat System and SpaceX’s proposed constellation are too pessimistic. See SpaceX Comments at 4-6. First, an appropriate compatibility study between the two constellations should be dynamic—the I/N value should be linked with a given probability. Second, the terminal e.i.r.p. mask provided by SpaceX is an envelope of all the LeoSat earth stations. Feeder link earth stations and user terminals are

efforts with other Applicants, to promote the efficient use of the Ka-band consistent with the public interest. Consequently, the Commission should not impose any additional spectrum sharing requirements on the LeoSat System that are not generally imposed on all Applicants through the NPRM Proceeding.<sup>21</sup>

**2. THE COMMISSION SHOULD DETERMINE IN THE NPRM PROCEEDING THAT NGSO OPERATORS ARE SUBJECT TO ITU COORDINATION REQUIREMENTS**

In its PDR, LeoSat requested the Commission to “condition any grant ... in this processing round upon compliance with (i) international coordination obligations and (ii) a requirement to cease U.S. service immediately upon launch and operation of a non-U.S.-licensed system with ITU date priority, in the absence of successful coordination with such system.”<sup>22</sup> This request is consistent with Commission policy, which holds that “[a]bsent ... coordination, a U.S.-licensed satellite making use of an ITU filing with a later protection date would be required to cease service to the U.S. market immediately upon launch and operation of a non-U.S.-licensed satellite with an earlier protection date, or be subject to further conditions.”<sup>23</sup> However, LeoSat made this request prior to the issuance by the Commission of the *NGSO NPRM*. An NGSO operator’s obligation to comply with ITU coordination requirement has been thoroughly addressed by commenters in the NPRM Proceeding. LeoSat therefore believes that this issue is best addressed by the Commission in a generally applicable manner in that proceeding.

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defined in this envelope. This envelope also includes allowance for uplink power control. Third, the assessment made by SpaceX considers an in-line event occurring at zenith, which is a worst-case scenario. LeoSat intends to discuss each of these inappropriate assumptions with SpaceX representatives during future coordination meetings between the Applicants.

<sup>21</sup> See SpaceX Comments at 6.

<sup>22</sup> PDR at 13.

<sup>23</sup> See *Amendment of the Commission’s Space Station Licensing Rules and Policies*, Second Order on Reconsideration, 31 FCC Rcd 9398, 9410 ¶ 32 (2016).

Consequently, the Commission should not adopt conditions in this processing round based on the assertion by certain Commenters that ITU filing date priority should not be a determining factor in how spectrum is to be shared among the NGSO constellations.<sup>24</sup> To the extent that the Commission deems it appropriate to impose conditions on Applicants in this processing round related to international coordination obligations, such conditions should be consistent with the condition imposed in the *OneWeb Order*, in which the Commission mandated that

[c]ommunications between U.S.-licensed earth stations and OneWeb space stations must comport with all existing and future space station coordination agreements reached between the United Kingdom and other administrations. In the absence of a coordination agreement, such communications must comport with applicable provisions of the ITU Radio Regulations.<sup>25</sup>

Ultimately, LeoSat believes that coordination agreements are the preferred method to assure coexistence between NGSO networks, and LeoSat is confident that the design of the LeoSat System will enable LeoSat successfully to coordinate with other Applicants. Nevertheless, ITU priority and ITU coordination obligations serve as an important backstop to ensure the resolution of interference and protection matters in situations in which coordination agreements do not exist.

### **3. THE COMMISSION SHOULD DISMISS TELESAT CANADA’S PETITION TO DENY**

The only argument asserted by Telesat Canada (“Telesat”) in its petition to deny LeoSat’s PDR is that the frequencies that will be used by the LeoSat System overlap the frequencies for which Innovation, Science, and Economic Development Canada (“ISED”) has authorized Telesat

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<sup>24</sup> See SES-O3b Comments at 6-7; SpaceX Comments at 6.

<sup>25</sup> *OneWeb Order* ¶ 23(a).

to use for its satellite network.<sup>26</sup> The sole relief sought by Telesat is the imposition by the Commission of two conditions on grant of LeoSat’s PDR. Telesat filed a very similar petition to deny against OneWeb’s application in this processing round.<sup>27</sup> In that petition to deny, Telesat requested the Commission to condition its grant of the OneWeb application on international coordination based on ITU priority.<sup>28</sup> With OneWeb’s consent, the Commission imposed such a condition in the *OneWeb Order*<sup>29</sup> and dismissed Telesat’s petition to deny.<sup>30</sup> In the Telesat Petition against LeoSat’s PDR, Telesat also requested the Commission to condition grant of the PDR on the outcome of the NPRM Proceeding.<sup>31</sup> As set forth above, LeoSat will agree to both of these conditions. Accordingly, the Commission should dismiss the Telesat Petition just as it dismissed Telesat’s petition to deny the OneWeb application.

**B. THE COMMISSION SHOULD ADDRESS IN THE NPRM PROCEEDING EPFD REQUIREMENTS TO PROTECT GSO SYSTEMS**

**1. ARTICLE 22 EPFD REQUIREMENTS SHOULD BE IMPOSED ON APPLICANTS THROUGH THE NPRM PROCEEDING**

In its *NGSO NPRM*, the Commission proposed to create a new secondary FSS allocation in the 17.8-18.3 GHz band. NGSO networks licensed in this band would be required to operate

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<sup>26</sup> Telesat Petition at 1-2.

<sup>27</sup> Petition to Deny of Telesat Canada, IBFS File No. SAT-LOI-20160428-00041 (filed Aug. 15, 2016).

<sup>28</sup> *See id.* at 5; Telesat Petition at 4.

<sup>29</sup> *See OneWeb Order* ¶¶ 9 & nn. 33-35, 23(a) (“Communications between U.S.-licensed earth stations and OneWeb space stations must comport with all existing and future space station coordination agreements reached between the United Kingdom and other administrations. In the absence of a coordination agreement, such communications must comport with applicable provisions of the ITU Radio Regulations.”).

<sup>30</sup> *Id.* ¶ 33.

<sup>31</sup> Telesat Petition at 4.

on an unprotected, non-interference basis with respect to GSO FSS networks.<sup>32</sup> Further, the Commission recently authorized OneWeb to operate in the band on a non-interference basis.<sup>33</sup> Certain Commenters request the Commission to require Applicants to meet the EPFD requirements set forth in Article 22 of the ITU Radio Regulations to protect GSO operations in this band.<sup>34</sup> LeoSat has demonstrated that it will comply with Article 22 and has endorsed the Commission’s adoption of the Article 22 requirements in the NPRM Proceeding.<sup>35</sup> Although the Commission can and should address these Commenters’ requests merely by requiring Applicants to comply with the rules (including the EPFD rules) established by the Commission in the NPRM Proceeding, LeoSat does not oppose the imposition of a condition on grant of the PDR consistent with the EPFD condition imposed by the Commission in the *OneWeb Order*.<sup>36</sup>

**2. AGGREGATE EPFD REQUIREMENTS ARE APPROPRIATELY IMPOSED ON APPLICANTS THROUGH ADOPTION OF GENERALLY APPLICABLE RULES IN THE NPRM PROCEEDING**

Certain Commenters expressed concern about the potential for *aggregate* interference to GSO systems from multiple NGSO systems, but these Commenters did not provide clear and

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<sup>32</sup> *NGSO NPRM*, 31 FCC Rcd at 13655 ¶ 9. The FCC noted that both NGSO FSS and GSO FSS systems have been successfully authorized to operate in this band by waiver on an unprotected, non-interference basis. In addition, the FCC proposed to limit this new allocation to individually licensed earth stations, which are likely to be able to operate successfully on an unprotected basis. *Id.*

<sup>33</sup> *OneWeb Order* ¶ 23(f).

<sup>34</sup> *See* ViaSat Petition at 5-10 (finding that Article 22 is a sufficient single entry EPFD requirement); Hughes Comments at 3 (requesting the FCC to “adopt [the ITU Article 22 and Article 76 requirements as] rules in its *NGSO NPRM* proceeding or at a minimum, condition each license accordingly”); SES-O3b Comments at 9 (proposing condition 4, which requires compliance with “applicable PFD and EPFD limits”).

<sup>35</sup> LeoSat EPFD Analysis at 1-2; LeoSat Comments at 4, 8-10; LeoSat Reply Comments at 8.

<sup>36</sup> Specifically, the Commission required OneWeb to comply with the applicable PFD limits in Article 21 of the ITU Radio Regulations and 47 CFR § 25.208(c), as well as the EPFD requirements in Article 22 of the ITU Radio Regulations. *See OneWeb Order* ¶ 23.

implementable proposals to address such concerns. However, each addressed this issue in its *NGSO NPRM* comments,<sup>37</sup> and this matter therefore is before the Commission in that context. Consequently, the Commission should address this issue in the rules adopted in the NGSO Proceeding, rather than imposing an aggregate EPFD condition individually on each application in this processing round.

Hughes requested the Commission to require Applicants to meet aggregate EPFD requirements set forth in Resolution 76 of the ITU Radio Regulations.<sup>38</sup> However, Resolution 76 was designed to address aggregate EPFD, and the single-entry EPFD limits in Article 22 were derived from such aggregate limits assuming 3.5 NGSO systems.<sup>39</sup> At this stage, the number of NGSO systems which will be ultimately operated in each relevant frequency band is unknown. Additionally, as shown in the PDR Technical Attachment, LeoSat is able to meet the single-entry EPFD limit with an additional margin to spare. On that basis, it is likely that more than 3.5 systems could be accommodated while still meeting the aggregate EPFD limit of Resolution 76.

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<sup>37</sup> See Comments of Inmarsat, IB Docket No. 16-408, at 4, 8-9 (filed Feb. 27, 2017); LeoSat Comments at 6; Comments of Lockheed Martin Corporation, IB Docket No. 16-408, at 2 (filed Feb. 27, 2017); Comments of SES S.A. and O3b Limited, IB Docket No. 16-408, at 13 (filed Feb. 27, 2017); Comments of Space Exploration Technologies Corp., IB Docket No. 16-408, at 5 (filed Feb. 27, 2017); Comments of Space Norway AS, IB Docket No. 16-408, at 3, 6 (filed Feb. 27, 2017) (“Space Norway NGSO Comments”); Comments of ViaSat, Inc., IB Docket No. 16-408, at 11 (filed Feb. 27, 2017); Reply Comments of the Boeing Company, IB Docket No. 16-408, at 3-4 (filed Apr. 10, 2017); Reply Comments of EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC, IB Docket No. 16-408, at 2, 8 (filed Apr. 10, 2017); Reply Comments of Inmarsat Inc., IB Docket No. 16-408, at 2, 5-6 (filed Apr. 10, 2017); LeoSat Reply Comments at 8-9; Reply Comments of SES S.A. and O3b Limited, IB Docket No. 16-408, at 6 (filed Apr. 10, 2017); Reply Comments of Telesat Canada, IB Docket No. 16-408, at 13 (filed Apr. 10, 2017); Reply Comments of ViaSat, Inc., IB Docket No. 14-608, at 6, 9 (filed Apr. 10, 2017).

<sup>38</sup> Hughes Comments at 3.

<sup>39</sup> See International Telecommunication Union, *World Telecommunication Standardization Assembly: Resolution 76 – Studies related to conformance and interoperability testing, assistance to developing countries, and a possible future ITU Mark programme* (Nov. 2012).

Compliance with Resolution 76 limits could be assessed once systems reach an operational stage. Resolution 76 applies to notifying administrations of NGSO satellites systems, and LeoSat will be subject to the requirements of this Resolution through its notifying administration, as will the other Applicants.

ViaSat requested the Commission to impose a vague blanket aggregate interference prohibition requirement on NGSO operators and to determine that NGSO operators should be held jointly and severally responsible for harmful interference to GSO systems.<sup>40</sup> ViaSat is unclear regarding how this condition would be implemented or enforced. In addition, it is fundamentally inequitable to hold all NGSO operators jointly and severally responsible irrespective of their actual, relative contribution to any harmful interference. SES/O3b vaguely requests the Commission to “incorporate aggregate EPFD compliance requirements” in the grant of processing round applicants, but SES/O3b is unclear regarding what those requirements should be.<sup>41</sup>

The Commission addressed aggregate EPFD requirements in the *OneWeb Order* by requiring OneWeb to “cooperate with other NGSO FSS operators in order to ensure that all authorized operations jointly comport with the applicable limits for aggregate EPFD in the space-to-Earth direction (EPFD<sub>down</sub>) contained in 47 CFR § 25.208(h), (m), as well as in Resolution 76 of the ITU Radio Regulations.”<sup>42</sup> It is not clear how such a cooperation requirement will be implemented or enforced by the Commission. Nevertheless, however,

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<sup>40</sup> ViaSat Petition at 9. Although ViaSat seeks for the Commission to impose more specific conditions on other Applicants, this is the only request in the ViaSat Petition related to LeoSat. Accordingly, because the Commission should not take the action requested by ViaSat, the ViaSat Petition should be dismissed as it applies to LeoSat’s PDR.

<sup>41</sup> SES/O3b Comments at 5-6.

<sup>42</sup> *OneWeb Order* ¶ 25(a).

LeoSat does not object to the imposition of the same requirement on grant of its PDR as an interim step until appropriate aggregate EPFD requirements are adopted by the Commission in the NPRM Proceeding.

**3. SPACE NORWAY’S PROPOSED ARCTIC SATELLITE BROADBAND MISSION (“ASBM”) SHOULD NOT BE TREATED AS A GSO SYSTEM FOR PURPOSES OF EPFD REQUIREMENTS**

In its comments, Space Norway seeks a heightened level of Commission-mandated interference protection for its proposed ASBM system. Specifically, Space Norway requests for its NGSO system to be treated as if it were a GSO system for purposes of the application of the Commission’s EPFD requirements.<sup>43</sup> Space Norway asserts that the ASBM system is more similar to a GSO system than to other NGSO constellations due to the ASBM system’s highly elliptical orbit.<sup>44</sup> The Commission should deny Space Norway’s request.

As an initial matter, Space Norway’s request for special interference protection is inconsistent with the Commission’s basic processing round policies, which holds that all applications filed in a processing round should be treated equally for purposes of domestic licensing priority.<sup>45</sup> Further, the Commission’s rules historically only have distinguished between GSO and NGSO systems and have not recognized subcategories of NGSO systems.<sup>46</sup>

The Commission should not reverse this longstanding policy now. However, if the Commission

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<sup>43</sup> Space Norway Comments at 3-4. Space Norway made this same argument in its comments in response to the *NGSO NPRM*. See Space Norway NGSO Comments at 9-12.

<sup>44</sup> Space Norway Comments at 2 (“The ASBM would be more similar to a geostationary orbit (“GSO”) system than to other NGSO constellations....”).

<sup>45</sup> See, e.g., *Amendment of the Commission’s Space Station Licensing Rules and Policies; Mitigation of Orbital Debris*, First Report and Order and Further Notice of Proposed Rulemaking in IB Docket No. 02-34, and First Report and Order in IB Docket No. 02-54, 18 FCC Rcd 10760, 10783 ¶ 48 (2003).

<sup>46</sup> See, e.g., 47 C.F.R. § 25.157(a) (defining “NGSO-like satellite operation” to mean “[o]peration of *any* NGSO satellite system” without differentiation based on the orbit of particular NGSO systems) (emphasis added).

intends to consider doing so, which the Commission should not, the Commission only should undertake this action through a rulemaking proceeding of general applicability, rather than through *ad hoc* conditions imposed on particular applications in this adjudicatory processing round.

Given the level of satellite diversity that LeoSat will have in the northern polar region, LeoSat is confident that it will be able to successfully coordinate with Space Norway pursuant to the ITU's coordination procedures. But the Commission should not attempt to intervene in the international coordination responsibilities of these two foreign-licensed systems through license conditions imposed in this processing round.<sup>47</sup>

#### **IV. LEOSAT DOES NOT OPPOSE GRANT OF ITS PDR BEING CONDITIONED ON COMPLIANCE WITH ORBITAL DEBRIS MITIGATION REQUIREMENTS**

LeoSat has not yet completed the final design phase for the LeoSat System and does not expect to do so until early 2018. As a result, LeoSat has not yet finalized its orbital debris mitigation plan. LeoSat provided the Commission in the PDR and the LeoSat Response with as much information as possible at this stage regarding the orbital debris mitigation plan for the LeoSat System, including the options that LeoSat is considering for deorbiting its satellites.<sup>48</sup> Further, LeoSat committed to ultimately comply with both the orbital debris requirements set forth in Section 25.114(d)(14)(i)-(iv) of the Commission's rules,<sup>49</sup> as well as the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space and the Inter-Agency Debris Coordination ("IADC") Space Debris Mitigation Guidelines, ITU

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<sup>47</sup> LeoSat and Space Norway's operations are subject to procedures set out in ITU Radio Regulations Nos. 9.12 and 9.11A, which require coordination with other NGSO FSS networks based upon ITU date priority of the associated ITU filings. ITU Radio Regulations Articles at 199 §§ 9.12 and 9.11A (2016).

<sup>48</sup> See LeoSat Technical Annex at 23-24 § 9; LeoSat Response at 3-10.

<sup>49</sup> 47 C.F.R. § 25.114(d)(14)(v).

Recommendation ITU-R S.1003 (“IADC Guidelines”), both of which will be required by the RA.<sup>50</sup>

Until such time as LeoSat’s orbital debris mitigation plan is finalized, and consistent with Commission precedent,<sup>51</sup> LeoSat requested the Commission to grant its PDR with a condition that requires, prior to LeoSat’s U.S. market access, either (i) for LeoSat to demonstrate that its orbital debris mitigation plan fully complies with applicable Commission requirements or (ii) for the Commission to determine that the RA provides “direct and effective regulatory oversight” of orbital debris mitigation.<sup>52</sup> Spire Global requests that the Commission impose this condition on grant of each Applicant’s application, including the PDR.<sup>53</sup> In light of LeoSat’s requested conditional grant, LeoSat has no objection to this request. In addition, Spire Global requests Applicants proposing LEO systems to agree to comply with any future Commission orbital debris mitigation rules.<sup>54</sup> To the extent that the Commission (or the RA or IADC) change their approach to orbital debris mitigation in the future through a generally applicable rulemaking, LeoSat will comply with any such new requirements to the extent that the LeoSat System is not grandfathered.

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<sup>50</sup> See LeoSat Response at 4; RA Letter.

<sup>51</sup> See LeoSat Response at 5-6 (citing instances in which the Commission imposed substantially similar conditions on satellite applicants).

<sup>52</sup> See *id.* at 5. In the alternative, if the Commission declines to grant such a conditional approval, LeoSat requests the Commission to delay acting on the PDR until LeoSat has completed the final design of its system and demonstrated compliance with the Commission’s requirements. *Id.* at 6 n.17.

<sup>53</sup> See Spire Global Comments at 5. Spire Global also requests that five of the Applicants, including LeoSat, provide additional information regarding the transit of their satellites across 400-650 kilometers, where Spire Global and Planet Labs Inc. collectively expect to have 375 operational satellites. *Id.* at 3-4. Any such additional information will be of little benefit to Spire Global because its space stations will be unable to perform any type of collision avoidance maneuvers.

<sup>54</sup> *Id.* at 5.

SpaceX, which proposes to launch into orbit over 4,425 separate space stations,<sup>55</sup> expresses concern<sup>56</sup> about LeoSat’s two anticipated options for disposal of its 78 satellites: (i) a higher orbit with a perigee altitude higher than 2000 kilometers that will remain stable for more than 100 years or (ii) a lower orbit that will lead to a predicted orbital lifetime of less than 25 years until atmospheric reentry occurs as a result of natural orbital decay processes.<sup>57</sup> SpaceX fails to take into account the complex financial and operational tradeoffs, including fuel weight, satellite mass and available launch capacity, that are involved in developing a deorbiting plan. Further, SpaceX does not request any particular Commission action in connection with its expressed concern, and it fails to assert any authority that prohibits either of LeoSat’s anticipated approaches. In fact, both approaches are envisioned by the Commission and under the IADC Guidelines.<sup>58</sup>

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<sup>55</sup> Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, IBFS File No. SAT-LOA-20161115-00118 (filed Nov. 15, 2016).

<sup>56</sup> See SpaceX Comments at 7-8.

<sup>57</sup> See LeoSat Response at 7.

<sup>58</sup> See *Migration of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 19038-39 ¶ 84 (2004) (“[W]e intend to examine [orbital debris mitigation] disclosures to determine, for spacecraft with orbits either wholly within, or passing through, the LEO region, whether the spacecraft will be disposed of at end of life either through immediate atmospheric re-entry, through the placement of a spacecraft into an orbit from which it will re-enter the Earth’s atmosphere within 25 years, or through boosting the spacecraft into an orbit with a perigee above the LEO region. As a general matter, these methods of post-mission disposal suggest that the space station will operate consistent with the public interest.”) (citations omitted); IADC Guidelines, at 6 § 3.3.2 (identifying orbits with an altitude of *up to* 2,000 kilometers as a protected region), IADC Guidelines, at 9-10 § 5.3.2 (“A spacecraft or orbital stage should be left in an orbit in which, using an accepted nominal projection for solar activity, atmospheric drag will limit the orbital lifetime after completion of operations. ... This IADC and some other studies and a number of existing national guidelines have found 25 years to be a reasonable and appropriate lifetime limit.”).

## V. LEOSAT DOES NOT OBJECT TO MOST OF THE CONDITIONS IMPOSED ON O3B BY THE COMMISSION

LeoSat does not oppose the Commission conditioning grant of LeoSat's PDR in a nondiscriminatory manner on most conditions that the Commission imposed on O3b<sup>59</sup> to the extent that the conditions were applied to OneWeb in the *OneWeb Order*.<sup>60</sup> Specifically, LeoSat does not oppose the application to the LeoSat System of the preamble and conditions one through nine set forth in the O3b Market Access Grant provided that these conditions are applied in the same manner and to the same extent to OneWeb and the other Applicants in this processing round.<sup>61</sup>

Conditions 10 and 12, however, deal with spectrum sharing issues that are currently under consideration in the NPRM Proceeding.<sup>62</sup> Consequently, the Commission should require compliance with the requirements adopted in the NPRM Proceeding rather than applying these O3b conditions to Applicants.

In addition, condition 15 in the O3b Market Access Grant only is relevant if the Commission determines that an applicant is and will be subject to direct and effective regulation concerning orbital debris mitigation by its satellite licensing administration. Thus, this condition

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<sup>59</sup> See *O3b Limited*, IBFS File Nos. SAT-LOI-20141029-00118 & SAT-AMD-20150115-00004, grant-stamped Jan. 22, 2015, corrected and re-issued June 2, 2015 ("O3b Market Access Grant").

<sup>60</sup> See SES/O3b Comments at 8-10. SES/O3b requested that the preamble to the O3b Market Access Grant and conditions 1-12 and condition 15 be included in a grant of LeoSat's PDR. *Id.*

<sup>61</sup> *Id.*

<sup>62</sup> Condition 10 requires O3b to comply with the spectrum sharing methods in the 18.8-19.3 GHz and 28.6-29.1 GHz bands established by the Commission in *Establishment of Policies and Service Rules for the Non-Geostationary Orbit, Fixed Satellite Service in the Ka-band*, Report and Order, 18 FCC Rcd 14708 (2003) and 47 C.F.R. § 25.261. Condition 12 grants O3b's request for waiver of Sections 25.137(c) and 25.157 of the Commission's rules, 47 C.F.R. §§ 25.137(c), 25.157, and requires O3b to use satellite diversity to enable spectrum sharing at low to medium latitudes and to employ a band segmentation approach at higher latitudes. See O3b Market Access Grant at 3.

only should be applicable to LeoSat to the extent that the Commission ultimately determines that the RA provides “direct and effective regulatory oversight” of orbital debris mitigation.<sup>63</sup> If LeoSat instead demonstrates that its orbital debris mitigation plan complies with the Commission’s requirements, this condition should not be imposed on LeoSat.

Finally, LeoSat requests that the Commission refrain from applying to LeoSat condition 11 in the O3b Market Access Grant. Condition 11 specifies the constellation changes that O3b can make without first notifying the Commission and seeking a modification of its authorization.<sup>64</sup> This condition was applied to O3b’s middle-earth orbit satellites, which are equally spaced over the equator. By contrast, LeoSat has proposed a global constellation of LEO satellites that are constantly in motion in six polar orbits. Consequently, condition 11 is not appropriately applied to the LeoSat System. In addition, the Commission did not apply this condition to OneWeb in the *OneWeb Order*.

## **VI. CONCLUSION**

The LeoSat System will provide an innovative new enterprise-level satellite broadband service to U.S. and international companies. As set forth in the PDR and LeoSat Response, the LeoSat System will comply with all Commission rules and is designed to coexist with other NGSO systems. Further, LeoSat is prepared to comply with any new requirements imposed on NGSO systems in the pending NPRM Proceeding. However, the Commission should not adopt in this processing round *ad hoc* license conditions relating to matters already being addressed in the NPRM Proceeding as requested by certain Commenters. In addition, LeoSat respectfully

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<sup>63</sup> LeoSat requested that the PDR be granted with a condition that prior to actual access to the U.S. market either (i) LeoSat demonstrates that its orbital debris mitigation plan fully complies with applicable Commission requirements *or* (ii) the Commission determines that the RA provides “direct and effective regulatory oversight” of orbital debris mitigation. *See* LeoSat Response at 5.

<sup>64</sup> *See* Cite O3b Market Access Grant at 3.

requests the Commission to deny or dismiss the petitions to deny filed by Telesat and ViaSat for the reasons set forth herein.

Respectfully submitted,

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July 7, 2017

## CERTIFICATE OF SERVICE

I, Lynne M. Montgomery, hereby certify under penalty of perjury that the foregoing Opposition and Response was served this 7th day of July, 2017, by electronic mail to the following:

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