

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

In the Matter of	)	
	)	
AUDACY CORPORATION	)	SAT-LOA-20161115-00117
	)	
THEIA HOLDINGS A, INC.	)	SAT-AMD-20170301-00029
	)	
VIA SAT, INC.	)	SAT-PDR-20161115-00120
	)	
WORLDVU SATELLITES LIMITED	)	SAT-LOI-20170301-00031
	)	

**COMMENTS OF SPACE EXPLORATION HOLDINGS, LLC**

William M. Wiltshire  
Paul Caritj  
HARRIS, WILTSHIRE & GRANNIS LLP  
1919 M Street, N.W.  
Suite 800  
Washington, DC 20036  
202-730-1300 tel  
202-730-1301 fax

*Counsel to SpaceX*

Tim Hughes  
Senior Vice President, Global Business and  
Government Affairs  
Patricia Cooper  
Vice President, Satellite Government  
Affairs  
SPACE EXPLORATION TECHNOLOGIES CORP.  
1030 15<sup>th</sup> Street, N.W.  
Suite 220E  
Washington, DC 20005  
202-649-2700 tel  
202-649-2701 fax

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## TABLE OF CONTENTS

<b>I.</b>	<b>INTRODUCTION AND SUMMARY .....</b>	<b>1</b>
<b>II.</b>	<b>ONEWEB’S V-BAND SYSTEM DESIGN REPRESENTS AN IMPROVEMENT OVER ITS KU/KA CONSTELLATION, BUT STILL RAISES INTERFERENCE CONCERNS .....</b>	<b>1</b>
	A. OneWeb’s Deployment Plans Should be Clarified .....	2
	B. OneWeb Should Explain Why It Plans to Use Efficient, Steerable Beams for Only Its V-Band User Links .....	4
	C. OneWeb’s Small Number of U.S. Earth Stations Will Unnecessarily Create Additional In-Line Events.....	5
	D. OneWeb Should Provide Real-Time Pointing Data to Minimize Wasted Spectrum Due to ‘False’ In-Line Events.....	8
<b>III.</b>	<b>VIASAT’S MEO SATELLITES COULD SHARE SPECTRUM EFFICIENTLY, BUT MORE INFORMATION IS NEEDED.....</b>	<b>10</b>
	A. ViaSat Should Share Real-Time Pointing Data to Ensure Spectrum is Used Efficiently.....	10
	B. ViaSat Should Provide Additional Information Regarding Uplink Power .....	12
	C. The Commission Should Confirm that ViaSat’s MEO-GSO Links Will Not Receive Protection outside the GSO Arc .....	13
<b>IV.</b>	<b>AUDACY SHOULD CLARIFY THE PURPOSE OF ITS “OFF-NOMINAL” COMMUNICATIONS BEAMS AND MUST BE PREPARED TO COORDINATE WITH OTHER OPERATORS TO AVOID IN-LINE INTERFERENCE .....</b>	<b>13</b>
<b>V.</b>	<b>MORE INFORMATION IS NEEDED TO ASSESS THE INTERFERENCE RISK POSED BY THE THEIA SYSTEM.....</b>	<b>15</b>
<b>VI.</b>	<b>THE COMMISSION SHOULD GRANT REQUESTS FOR WAIVERS TO OPERATE IN THE 50.4-51.4 GHZ, AND 51.4-52.4 GHZ BANDS.....</b>	<b>16</b>
<b>VII.</b>	<b>CONCLUSION .....</b>	<b>17</b>

## **I. INTRODUCTION AND SUMMARY**

Space Exploration Holdings, LLC (“SpaceX”) hereby comments on the above-captioned license applications and requests for authority to serve the U.S. market using non-geostationary orbit (“NGSO”) Fixed-Satellite Service (“FSS”) systems operating in certain V-band spectrum. Although the V-band represents a new frontier for wireless operations, it is clear that use of this spectrum is poised to accelerate rapidly. Both GSO and NGSO operators have demonstrated significant interest in deploying satellite systems in this band, while terrestrial operators seek to deploy 5G networks using this spectrum as well. Thus, it is time for the Commission to set expectations for spectrum sharing among all users of the band, and to create incentives that encourage more efficient and equitable sharing among all interested parties.

Accordingly, the Commission should seek additional information about the sharing capabilities of the NGSO systems proposed by OneWeb, ViaSat, Audacy, and Theia, applying license conditions when necessary to ensure that valuable spectrum is not wasted through inefficient system design or poor information sharing. It should also grant waivers as necessary to ensure that NGSO operators have access to as much spectrum as possible to do their part to address the digital divide in the United States and across the globe.

## **II. ONEWEB’S V-BAND SYSTEM DESIGN REPRESENTS AN IMPROVEMENT OVER ITS KU/KA CONSTELLATION, BUT STILL RAISES INTERFERENCE CONCERNS**

OneWeb’s proposed V-band system would consist of one 720-satellite low-Earth orbit (“LEO”) constellation, and a second 1,280-satellite medium-Earth orbit (“MEO”) constellation.<sup>1</sup>

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<sup>1</sup> Petition for Declaratory Ruling, IBFS File No. SAT-LOI-20170301-00031, OneWeb Non-Geostationary Satellite System V-Band Component at 1-2 (Mar. 1 2017) (“OneWeb Application”).

Each of these satellites will employ 20 circular user beams, which can be steered throughout the satellite's footprint. Each satellite will have two gateway antennas with which it will communicate with one of four gateway earth stations within the United States.<sup>2</sup> OneWeb indicates that the V-band payload on the 720 LEO satellites will "share the same spacecraft bus" as the Ku/Ka payload previously authorized, but will be operationally distinct.<sup>3</sup>

#### **A. OneWeb's Deployment Plans Should be Clarified**

There remains much the Commission does not know about OneWeb's plans for the operation and deployment of its NGSO system. For example, OneWeb has sought authorization to provide service in the U.S. using a V-band NGSO system in addition to its recently authorized Ku/Ka-band system. But OneWeb has not indicated whether both bands will be included on some or all of the initial 720 LEO satellites deployed. Among other things, OneWeb should explain how it intends to deploy in both bands, whether it will have to replace an initial wave of Ku/Ka-band satellites with a new generation of V-band equipped satellites, and if so, how it intends to manage the significant coordination, collision avoidance, and disposal management challenges that such a rapid turn-over would require. In this processing round, the Commission has specifically requested "more information about the relationship between [an applicant's] proposed V-band and Ka-band constellations, including whether the V-band NGSO constellation will be composed of entirely new satellites, or if [the applicant] intends to host V-band payloads on the satellites of its Ka-band NGSO constellation."<sup>4</sup> The Commission should insist that OneWeb

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<sup>2</sup> *Id.* at 8.

<sup>3</sup> *Id.* at 2. *See also WorldVu Satellites Limited*, FCC 17-77 (rel. June 23, 2017) (authorizing NGSO operations in certain portions of the Ku- and Ka-bands).

<sup>4</sup> Letter from Jose Albuquerque to Elisabeth Neasmith, IBFS File No. SAT-LOI-20170301-00023, at 1 (June 22, 2017).

provide the same information. More generally, OneWeb should explain how it intends to deploy a total of 2,000 V-band LEO/MEO satellites within the six-year deployment window (of which OneWeb has not sought a waiver).

Likewise, the Commission still knows little about OneWeb's orbital debris mitigation plans. Although OneWeb submitted a high-level description of its plans in connection with its Ku/Ka-band system, it has provided no further information in connection with its V-band application, and no information at all with respect to the 1,280 MEO satellites it seeks to add as a part of this application. Notably, the Commission has asked several important and challenging questions of other NGSO system applicants, such as analyses of collision risk assuming varying levels of satellite reliability, risk of collision during satellites' passive disposal phase, risk of human casualty, and the number of avoidance maneuvers likely to be required of the International Space Station.<sup>5</sup> The Commission has asked these questions of both domestic license applicants and operators seeking U.S. market access which have claimed that they are subject to the direct and effective oversight of another licensing authority. In the latter case, the Commission has asked the same or closely similar questions "to assist in its assessment of whether [the applicant] has demonstrated that it is subject to direct and effective regulatory oversight."<sup>6</sup> OneWeb, however, has not been asked or provided answers to such questions. In the interest of both space safety and equal treatment of applicants, the Commission should require that OneWeb provide such information as well prior to any action on its application.

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<sup>5</sup> *See, e.g., id.* at 2-3

<sup>6</sup> *See, e.g., id.* The Commission asked similar questions of non-U.S. applicants in the ongoing Ku/Ka-band NGSO processing round. *See, e.g.,* Letter from Jose P. Albuquerque to Joseph C. Anders, IBFS File No. SAT-PDR-20161115-00112, at 1-2 (Mar. 15, 2017); Jose P. Albuquerque to Elisabeth Neasmith, IBFS File No. SAT-PDR-20161115-00108, at 1-3 (Mar. 15, 2017); Jose P. Albuquerque to Nicholas G. Spina, IBFS File No. SAT-PDR-20161115-00114, at 2-3 (Mar. 21, 2017).

Moreover, although OneWeb has applied for market access for a system with 720 LEO satellites, OneWeb’s public statements indicate that it plans to “add[] 2,000 satellites at different altitudes in low Earth orbit.”<sup>7</sup> While the Commission should permit expansions of authorized systems under certain circumstances, there is simply no precedent for such a dramatic enlargement. The Commission should ensure that an operator seeking to make such a dramatic modification is able to demonstrate that the change does not increase the risk of interference that a system poses to other operators, or increase the potential for collision or orbital debris.

OneWeb has not begun to provide the information needed to make such a showing. OneWeb has not indicated what frequency bands these planned satellites would use, when they would be launched, or what steps it will take to ensure that the enlarged system would not create dangers for other operators. But clearly the addition of 2,000 additional LEO satellites would dramatically change the interference and coordination characteristics of OneWeb’s proposed NGSO system. OneWeb should therefore provide updated information about its current deployment plans.

**B. OneWeb Should Explain Why It Plans to Use Efficient, Steerable Beams for Only Its V-Band User Links**

OneWeb’s V-band user beams are strikingly different from its Ku-band user beams. In Ku-band, the beams are fixed and can only be steered by pitching the entire satellite to point away from the GSO arc.<sup>8</sup> By contrast, the V-band system has steerable beams, using the very phased array technology that OneWeb previously criticized as less efficient and less “elegant” than the

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<sup>7</sup> Tereza Pultarova, *OneWeb Weighing 2,000 More Satellites*, SPACENEWS (Feb. 24, 2017), available at <http://spacenews.com/oneweb-weighing-2000-more-satellites/>.

<sup>8</sup> Application of WorldVu Satellites Limited, IBFS File No. SAT-LOI-20160428-00041, Attachment A at 7 n. 5 (Apr. 28, 2016).

pitch maneuver used by its Ku/Ka-band system.<sup>9</sup> Nonetheless, SpaceX agrees that OneWeb's flexible V-band user link design is, in fact, more efficient than the Ku-band design, and will offer much improved capabilities for sharing by more efficiently directing energy only at active users.

It is unclear, however, why OneWeb continues to propose to operate a Ku/Ka-band system without steerable user beams when it appears that it intends to operate steerable, phased array V-band antennas on the very same satellite bus. There is no reason to believe that OneWeb would derive any benefit from transmitting data to vast areas of the Earth where it has no active users, as it would using the Ku-band user beams it has proposed. And as SpaceX pointed out in its comments on OneWeb's Ku/Ka-band system, steerable user beams will enable OneWeb to minimize in-line events with other operators, allowing it to coordinate more effectively with other NGSO system operators and improving overall spectral efficiency.<sup>10</sup> The potential gains of such an improvement are especially dramatic given the very large size of OneWeb's currently planned Ku-band user beams. The Commission should ask OneWeb to explain why it chose not use this more advanced technology for both V-band and Ku-band operations, artificially limiting its improved coordination capabilities only to operations in the V-band.

### **C. OneWeb's Small Number of U.S. Gateway Earth Stations Will Unnecessarily Create Additional In-Line Events**

Unfortunately, however, OneWeb's proposed V-band system raises its own interference and coordination concerns. OneWeb proposes to locate only four gateway earth stations in the U.S. As an initial matter, it is unclear whether OneWeb's beams, as they converge on these few

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<sup>9</sup> Opposition and Response of WorldVu Satellites Limited, IBFS File No. SAT-LOI-20160428-00041, at 8 (Aug 25, 2016).

<sup>10</sup> Comments of Space Exploration Technologies Corp., IBFS File No. SAT-LOI-20160428-00041, at 12-14 (Aug. 15, 2016).

gateway earth stations, will be able to sufficiently mitigate their collective adjacent-channel interference to allow transmissions by other NGSO system operators during band-splitting events.

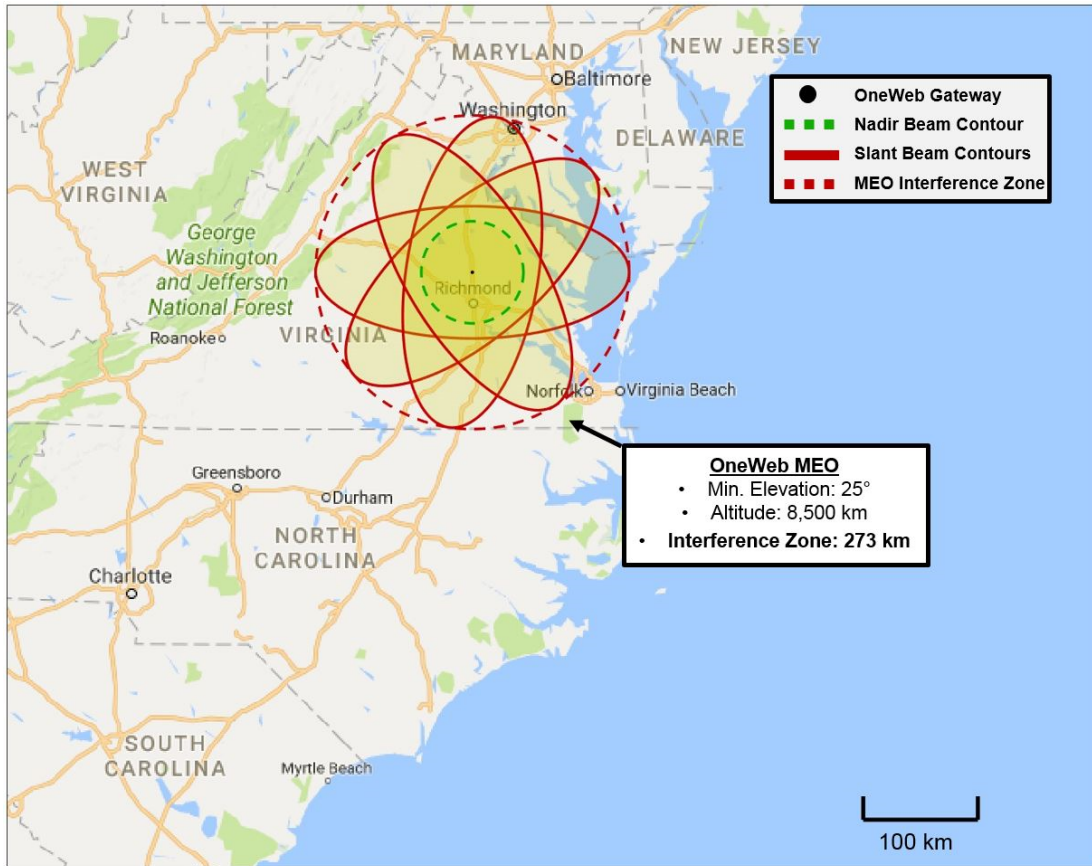
In addition, relying on so few gateways will require OneWeb satellites to steer their gateway beams at very high steering angles—15 and 25 degrees for its LEO and MEO constellations respectively, according to OneWeb’s application.<sup>11</sup> These high steering angles, in turn, will result in significant spreading of the gateway beams, increasing the number of in-line events with other NGSO systems and accordingly increasing the interference burden on all NGSO operators.

The gateway beams on OneWeb’s MEO satellites, for example, will have a diameter on the surface of the Earth at nadir of 89 km, and thus will affect an area of approximately 6,200 km<sup>2</sup>. However, as shown in Figure 1, at the 25 degree steering angle necessary to maintain a link to one of the four OneWeb U.S. earth stations, this beam will spread to 273 km along its major axis, resulting in a circular zone of potential interference with a radius of 136.5 km—or an area of more than 58,500 km<sup>2</sup>.

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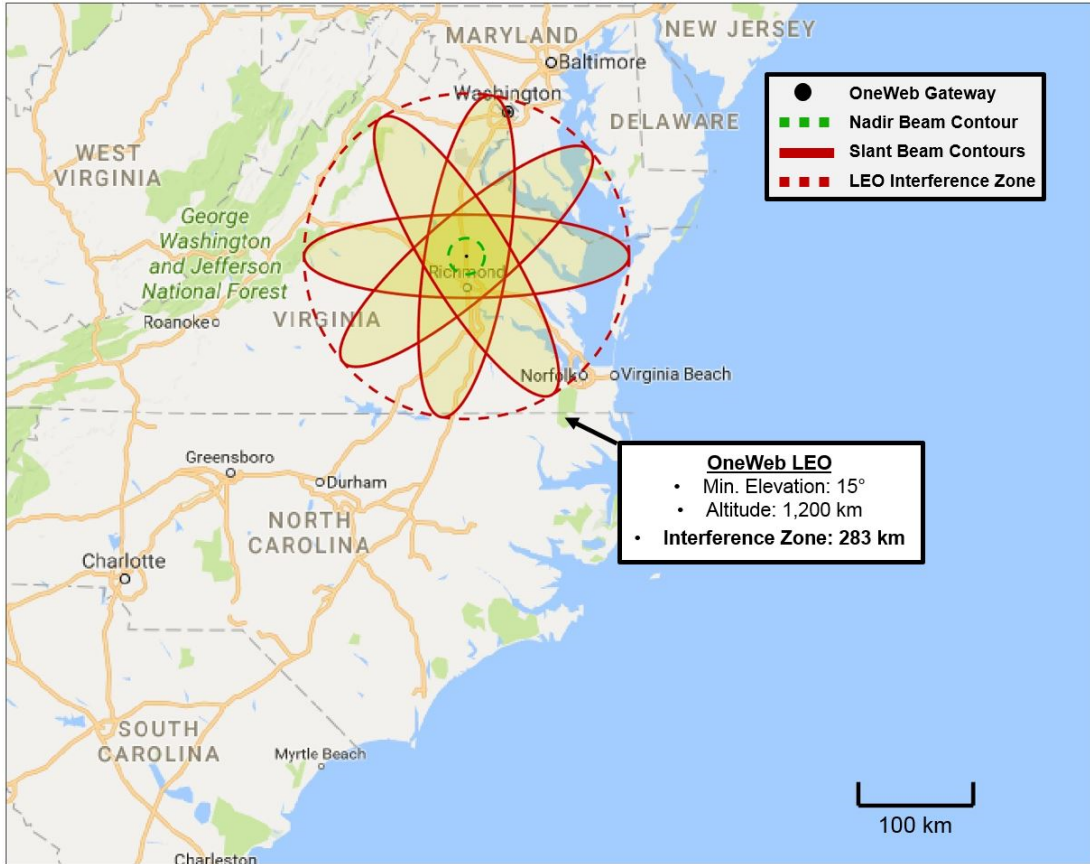
<sup>11</sup> OneWeb Application at 7 n.6.





**Figure 1. Potential Interference Zone for OneWeb MEO Gateway at Maximum Slant**

As shown in Figure 2, OneWeb’s LEO gateway beams present nearly identical challenges, with a beamwidth of 31 km at nadir but 283 km at maximum slant, potentially causing interference in an area or more than 62,900 km<sup>2</sup>.



**Figure 2. Potential Interference Zone for OneWeb LEO Gateway at Maximum Slant**

Thus, by choosing to deploy only four gateway earth stations in the U.S., OneWeb has significantly increased the interference potential of its gateway beams, diminishing the overall utility of the band both for themselves and other NGSO system operators.

**D. OneWeb Should Provide Real-Time Pointing Data to Minimize Wasted Spectrum Due to ‘False’ In-Line Events**

In addition, the very large footprints of OneWeb’s MEO satellites raise potential concerns. Although OneWeb’s steerable beams could theoretically facilitate spectrum sharing, this will only be effective if OneWeb provides real-time pointing data to allow other operators to identify true in-line events. Under the Commission’s avoidance of in-line events spectrum sharing regime, band splitting or other coordination measures would only be necessary to prevent harmful

interference when the satellite of another NGSO system is in-line with a OneWeb satellite.<sup>12</sup> Because OneWeb’s MEO footprint is considerably larger than the total area that it will actively serve at any given time, other NGSO operators will have no way of knowing whether OneWeb is actually operating in a given portion of its footprint unless OneWeb supplies them the operational steering angles of its beams. Without this information, other operators will have to split the spectrum or take other measures to ensure they do not cause or experience in-line interference, even though (unbeknownst to them) no such interference would actually have occurred. Such an outcome would be extremely wasteful of valuable spectrum. However, OneWeb’s MEO altitude will also make the necessary information sharing less challenging. Its MEO beams will move far more slowly relative to the surface of the Earth than will LEO beams, require pointing data to be updated at a manageable rate. If, as OneWeb has indicated, V-band beams will be concentrated on urban and other high-demand areas, this should result in pointing data that is even more stable and predictable and therefore easier to share.

Accordingly, the Commission should condition any authorization for the OneWeb V-band system with a requirement that OneWeb share with other NGSO system operators real-time beam pointing information.<sup>13</sup> To the extent OneWeb intends to use its “progressive pitch” maneuver, satellite pitch information will also be needed to determine the location of active beams.

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<sup>12</sup> Although this regime currently applies only in certain portions of the Ku-band, the Commission has proposed to extend it to additional bands as well. See *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, 31 FCC Rcd. 13651 (2016) (“NGSO NPRM”).

<sup>13</sup> This condition should be applied to any other MEO or HEO system where satellite footprint size significantly exceeds the area actually served by a satellite at a given time, in order to minimize unneeded spectrum splitting and maximize spectrum utilization.

### **III. VIASAT'S MEO SATELLITES COULD SHARE SPECTRUM EFFICIENTLY, BUT MORE INFORMATION IS NEEDED**

ViaSat proposes to operate a constellation of 24 MEO satellites, each with 32 V-band beams. Combined with ViaSat's proposed Ku/Ka-band operations, the ViaSat system will employ 960 total spot beams to provide service throughout the world.<sup>14</sup>

#### **A. ViaSat Should Share Real-Time Pointing Data to Ensure Spectrum is Used Efficiently**

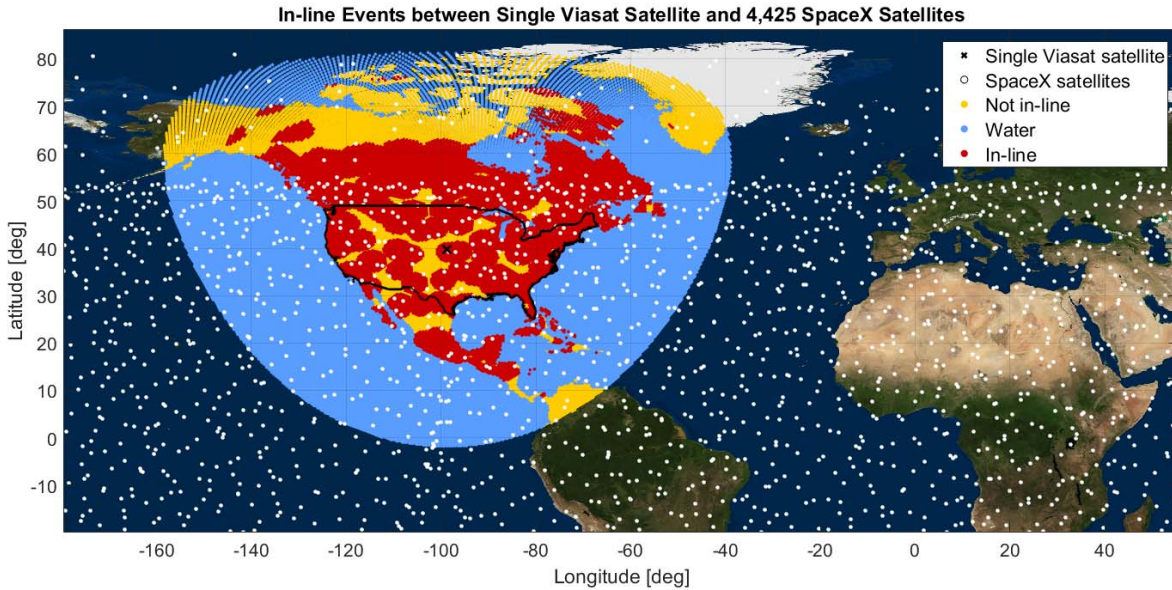
SpaceX applauds ViaSat's use of narrow steerable beams. This aspect of ViaSat's system design will help to facilitate spectrum sharing, and is especially valuable in a MEO system, whose wide beams—after accounting for spreading—would otherwise present serious coordination challenges.

However, for the reasons discussed above, it will not be possible to fully leverage this potential efficiency unless ViaSat shares real-time pointing data with other NGSO operators so as to minimize the potential impact of false in-line events. Although ViaSat's spot beams are narrow, each satellite's beams can be steered across a footprint significantly larger than North America. Without real-time steering information, therefore, other operators will be unable to determine when they pass through and seek to serve an earth station within an active ViaSat spot beam, as opposed to a portion of the ViaSat footprint that is not actively being served. If other operators cannot distinguish between these false in-line events and true ones, they may be required to take a conservative approach and employ spectrum splitting or other coordination measures even when

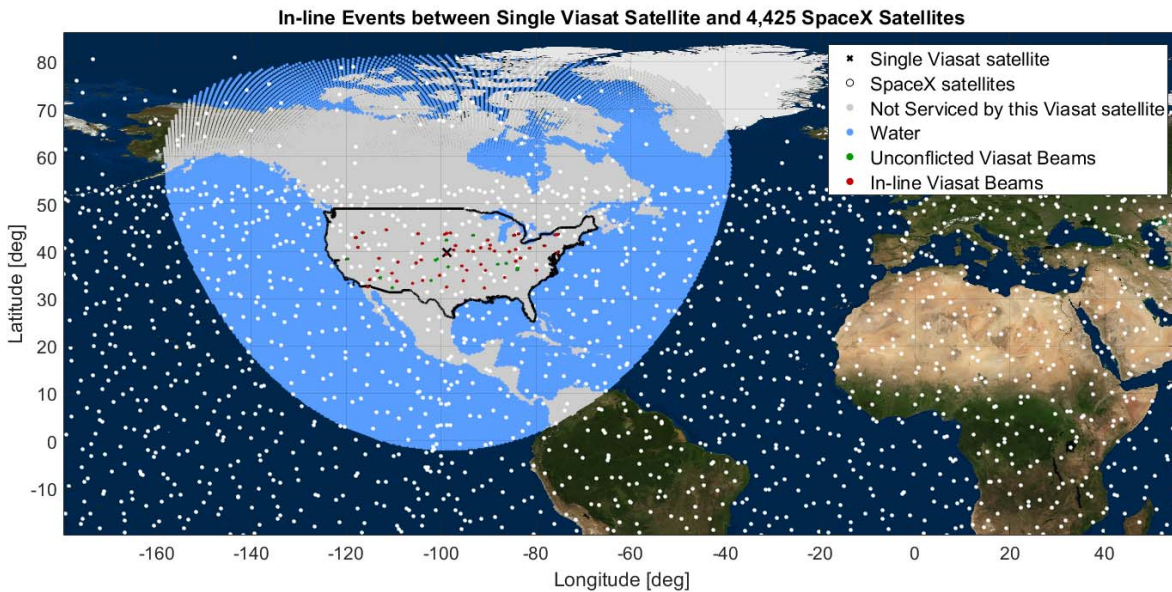
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<sup>14</sup> See generally Petition for Declaratory Ruling, IBFS File No. SAT-PDR-20161115-00120, at 1-4 (Nov. 15, 2016) ("ViaSat Application").

there is no real risk of in-line interference. The potential improvement in spectrum usage achievable through information sharing is illustrated in Figures 3 and 4 below, which show the



**Figure 3. Potential In-Line Events Without Information Sharing**



**Figure 4. Potential In-Line Events Using Information Sharing**

area potentially subject to in-line events across a ViaSat satellite's footprint as compared to such events determined using beam steering information.

As with OneWeb, ViaSat's altitude will simplify the information sharing task considerably. Its MEO beams will move far more slowly relative to the surface of the Earth than would LEO beams, require pointing data to be updated at a manageable rate that can be processed in real-time by other NGSO system operators. The Commission should therefore condition any authorization for the ViaSat V-band system with a requirement that ViaSat share with other NGSO system operators real-time pointing information.<sup>15</sup>

### **B. ViaSat Should Provide Additional Information Regarding Uplink Power**

As SpaceX has explained in its Comments on ViaSat's and other operators' Ku/Ka-band systems, MEO uplink transmissions may present a significant risk of harmful interference to LEO satellites.<sup>16</sup> Due to the large differences in uplink transmission EIRP in LEO versus MEO systems, there is a significant risk that MEO uplink signals will reach LEO satellite antennas at extremely high EIRP levels relative to the LEO's desired signal level. This would result in desense (*i.e.*, increase in  $\Delta T/T$ ) of the LEO receiver—even, potentially, when the LEO receive antenna is steered well away from the transmission path of the interfering earth station.

ViaSat's V-band application, however, does not appear to disclose the intended transmit power of its consumer and enterprise user terminals, making it impossible to judge the true interference risk of ViaSat's V-band uplinks. ViaSat should provide this information to facilitate a complete interference analysis before the Commission acts on its application.

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<sup>15</sup> ViaSat's system design, which relies on an adaptive channelizer to route uplink traffic into the appropriate downlink channels, also raises questions about whether ViaSat will be able to achieve sufficient adjacent-channel performance to facilitate band splitting. *See* ViaSat Application, Technical Appendix at 5. The Commission should ensure that ViaSat and all other applicants are able to achieve the necessary performance standards to ensure that they will not cause harmful adjacent-channel interference during band-splitting events.

<sup>16</sup> *See, e.g.*, Comments of Space Exploration Technologies Corp., IBFS File No. SAT-PDR-20161115-00120, at 2 (June 26, 2017).

**C. The Commission Should Confirm that ViaSat’s MEO-GSO Links Will Not Receive Protection outside the GSO Arc**

ViaSat proposes to operate inter-satellite links between its MEO and GSO satellites. While this arrangement does not necessarily present interference concerns for other NGSO system operators, the Commission should clarify that these proposed links are entitled to no special interference protections beyond the equivalent power flux-density (“EPFD”) limits that protect GSO operations. These limits generally protect GSO satellites operating within the GSO arc. They do not, however, provide any sort of protection for these inter-satellite links that involve a ViaSat MEO operating outside that region of space. Instead, these NGSO operations will be subject to the same coexistence regime as other NGSO operations, including the need to coordinate with other operators to resolve any potential interference.

**IV. AUDACY SHOULD CLARIFY THE PURPOSE OF ITS “OFF-NOMINAL” COMMUNICATIONS BEAMS AND MUST BE PREPARED TO COORDINATE WITH OTHER OPERATORS TO AVOID IN-LINE INTERFERENCE**

Audacy has applied for authorization to use 500 MHz of V-band spectrum for primary uplink and downlink operations of its NGSO satellite system. It also requests authority to use another 500 MHz of spectrum in each direction for TT&C links in “off-nominal, emergency situations.”<sup>17</sup> Audacy specifically states that this latter spectrum band “will not be used to provide service coverage.”<sup>18</sup>

Audacy should clarify the purpose of these “off-nominal” beams. Puzzlingly, although Audacy indicates that these links will only be used for emergency TT&C, 500 MHz of additional spectrum for this purpose appears entirely disproportionate in light of the significant amount of V-

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<sup>17</sup> Audacy Corporation Application, IBFS File No. SAT-LOA-20161115-00117, at 44 (Nov. 15, 2016) (“Audacy Application”).

<sup>18</sup> *Id.*

band spectrum Audacy also seeks to use to provide communications services. In fact, the spectrum blocks requested for these emergency TT&C beams are the same size as those requested for feeder links.

If these beams are to be used for significant periods of time, outside of true emergencies, or to transmit more than limited TT&C data, they present significant interference concerns. For example, Audacy indicates that these links will use omni-directional antennas.<sup>19</sup> Moreover, although Audacy's narrative describes these antennas as 'low gain,' Audacy's Schedule S and attached gain contour information indicate that these links will operate at 19.5 dBW EIRP with 10.0 dBi antenna gain. This combination would appear likely to result in a violation of the Commission's EPFD limits, which are especially stringent in the 19.7-20.2 GHz band in which it proposes to conduct these off-nominal operations. The Commission should seek additional information about these links, and why these operations could not be performed using conventional TT&C channels within Audacy's V-band spectrum.

In addition, Audacy has suggested that its license should reflect the "low probability that a[n] [Audacy] satellite or gateway earth stations will become a source of harmful interference."<sup>20</sup> It is unclear which conditions Audacy contends might be inappropriate as applied to its system. The only condition Audacy identifies specifically is ViaSat's proposal to hold NGSO operators "jointly and severally liable"<sup>21</sup> for interference to GSO systems, which SpaceX agrees is not an appropriate condition for *any* NGSO system license.<sup>22</sup> However, there would be no justification

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<sup>19</sup> *Id.* at 62.

<sup>20</sup> Opposition and Response of Audacy Corporation, IBFS File No. SAT-LOA-20161115-00117, at 8 (July 7, 2017).

<sup>21</sup> *Id.* at iii.

<sup>22</sup> *See* Consolidated Reply of Space Exploration Holdings, LLC, IBFS File Nos. SAT-LOA-20161115-00117, *et al.*, at 9 (July 14, 2017).



to exempt Audacy from any band-wide coexistence and spectrum sharing requirements, including any requirement to either coordinate to avoid in-line interference or implement a default spectrum splitting solution. This approach naturally addresses Audacy’s concern, as it imposes coordination burdens that are generally proportionate to a system’s interference potential.

Finally, SpaceX supports Audacy’s requested waiver of the power flux-density (“PFD”) limits in the 37.5 to 40.0 GHz band.<sup>23</sup> SpaceX generally agrees that NGSO operators in this band should be allowed to operate within the international PFD limit established under the ITU’s rules, which is 12 dB higher than the corresponding limit in the Commission’s rules,<sup>24</sup> as that would enable more efficient use of this spectrum by NGSO systems to provide high-quality broadband services to Americans in underserved areas. Moreover, the minor deviations Audacy requests from the Commission’s limits in this band, for certain angles of arrival and under limited circumstances, will generally facilitate deployment of a higher performance system. Simultaneously, because it will comply with applicable ITU limits, this additional flexibility will not increase the risk of harmful interference to other licensed operations.

**V. MORE INFORMATION IS NEEDED TO ASSESS THE INTERFERENCE RISK POSED BY THE THEIA SYSTEM**

Theia’s proposed V-band system lacks at least two important details needed to determine the interference risk that it poses. First, Theia requests a waiver of the Commission’s PFD limits applicable to operations in the 37.5-40.0 GHz band to account for rain fade.<sup>25</sup> As stated above, SpaceX generally agrees that the public interest in efficient use of spectrum to provide high-quality

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<sup>23</sup> Audacy Application at 56-57.

<sup>24</sup> Compare ITU Radio Regulations, Article 21, Table 21-4 with 47 C.F.R. § 25.208(r)(1).

<sup>25</sup> See Application Amendment, IBFS File No. SAT-AMD-20170301-00029, Technical Narrative at 21 (Mar. 1, 2017) (“Theia Application”).

broadband services would be served by allowing NGSO operators in this band to operate within the international PFD limit rather than the Commission's more restrictive limit. However, additional information about the magnitude of Theia's requested power increase, and the conditions under which it will occur, will be necessary to analyze the risk of interference that the Theia system poses, and to develop coordination plans.

Similarly, Theia's application provides little information about its intended number and location of gateway earth stations. As SpaceX's comments on OneWeb's proposed system demonstrate, these characteristics can have a significant effect on a system's interference potential. Information about the location and number of Theia earth stations is, therefore, crucial if other operators are to form a complete picture of the interference potential of Theia's proposed NGSO system.

#### **VI. THE COMMISSION SHOULD GRANT REQUESTS FOR WAIVERS TO OPERATE IN THE 50.4-51.4 GHz AND 51.4-52.4 GHz BANDS<sup>26</sup>**

OneWeb, ViaSat, and Theia have requested waivers of Section 2.106 of the Commission's rules so that they would be able to operate their respective systems using V-band spectrum that is not currently available for FSS use.<sup>27</sup> These operators argue that their proposed operations will not interfere with the limited existing uses of these bands, and will serve the public interest by increasing system capacity.

The situation with respect to the 50.4-51.4 GHz band is a bit unusual. The Commission's domestic table of allocations identifies this band as available for FSS (Earth-to-space) use on a co-

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<sup>26</sup> The Commission has deferred consideration of requests to operate in the 42.0-42.5 GHz band. SpaceX supports these requests as well and will address them at the appropriate time.

<sup>27</sup> OneWeb Application at 16-17, 19-20; ViaSat Application at 24-25; Theia Application at 13-16.

primary basis, but the Commission has not made a corresponding entry in Section 25.202(a)(1). A waiver may not be required under these circumstances, but it clearly should be granted to the extent deemed necessary.<sup>28</sup>

Neither the Commission's rules nor the ITU Radio Regulations currently allocate the 51.4-52.4 GHz band for FSS uplink operations. However, at least two factors make this band ideal for FSS uplink use. First, this band is almost entirely free of non-federal incumbents in the United States, and those few existing federal users appear to use this band in only a limited way, easing potential coordination concerns between commercial FSS and these federal users.<sup>29</sup> Second, this band is directly adjacent to the other spectrum allocated for commercial FSS uplink use. Thus, a waiver here would create 5 GHz of nearly contiguous FSS spectrum from 47.2 to 52.4 GHz. It is worth noting the Commission is currently considering a petition for rulemaking filed by Boeing that requests addition of a co-primary allocation for FSS in the 51.4-52.4 GHz band,<sup>30</sup> and that the ITU has initiated international study of the need for allocating this band for FSS use as well.<sup>31</sup>

Accordingly, SpaceX supports other applicants' requests for waivers to operate NGSO FSS systems in these bands.

## VII. CONCLUSION

For the reasons set forth above, the Commission should seek certain additional information from OneWeb, ViaSat, Theia, and Audacy and, in certain cases, impose license conditions to

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<sup>28</sup> The Commission recently proposed to eliminate the list of FSS frequencies in Section 25.202(a)(1) and rely solely on the spectrum identified in the allocation tables in order to avoid just this sort of confusion. *See NGSO NPRM* ¶ 14.

<sup>29</sup> *See* NTIA Office of Spectrum Management, *Federal Spectrum Use Summary, 30 MHz – 3000 GHz* at 78 (2010), available at [https://www.ntia.doc.gov/files/ntia/Spectrum\\_Use\\_Summary\\_Master-06212010.pdf](https://www.ntia.doc.gov/files/ntia/Spectrum_Use_Summary_Master-06212010.pdf).

<sup>30</sup> *See* Public Notice, Rep. No. 3051 (Sep. 16, 2016) (opening RM-11773).

<sup>31</sup> *See* ITU-R Res. 162 (WRC-15), "Studies relating to spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space)."

ensure that their proposed V-band systems will make efficient use of spectrum. Independent of any single operator, however, these and other proposed V-band systems highlight the need for the Commission to make available additional V-band spectrum, and develop technical standards to ensure that all operators are able to adequately prevent in-line interference and split spectrum efficiently when necessary.

Respectfully submitted,

SPACE EXPLORATION HOLDINGS, LLC

William M. Wiltshire  
Paul Caritj  
HARRIS, WILTSHIRE & GRANNIS LLP  
1919 M Street, N.W.  
Suite 800  
Washington, DC 20036  
202-730-1301 tel  
202-730-1301 fax

*Counsel to SpaceX*

By: /s/ Tim Hughes  
Tim Hughes  
Senior Vice President, Global Business  
and Government Affairs

Patricia Cooper  
Vice President, Satellite Government  
Affairs

SPACE EXPLORATION TECHNOLOGIES CORP.  
1030 15<sup>th</sup> Street, N.W.  
Suite 220E  
Washington, DC 20005  
202-649-2700 tel  
202-649-2701 fax

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## CERTIFICATE OF SERVICE

I hereby certify that, on this 17<sup>th</sup> day of July, 2017, a copy of the foregoing pleading was served via U.S. mail upon:

Brian D. Weimer  
Douglas A. Svor  
Ashley Yeager  
SHEPPARD MULLIN RICHTER & HAMPTON LLP  
2099 Pennsylvania Ave., N.W., Suite 100  
Washington, D.C. 20006  
*Counsel to WorldVu Satellites Limited (“OneWeb”)*

Jennifer L. Richter  
AKIN GUMP STRAUSS HAUER & FELD LLP  
1333 New Hampshire Ave N.W.  
Washington, DC 20036 USA  
*Counsel to Theia Holdings A, Inc.*

John P. Janka  
Elizabeth R. Park  
Jarrett S. Taubman  
LATHAM & WATKINS LLP  
555 Eleventh Street, N.W., Suite 1000  
Washington, DC 20004  
*Counsel to ViaSat, Inc.*

Timothy Bransford  
Denise Wood  
MORGAN, LEWIS & BOCKIUS LLP  
2020 K Street, N.W.  
Washington, DC 20006  
*Counsel to Audacy Corporation*

/s/ Sarah Atkinson

Sarah Atkinson