Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	IBFS File No. SES-LIC-20170401-00357
ViaSat, Inc.	)	Call Sign E170088
Application for Authority to Expand an Existing Earth Station Network	)	

OPPOSITION AND RESPONSE OF VIASAT, INC.

ViaSat, Inc. ("ViaSat") opposes the petition to defer of O3b Limited ("O3b") and responds to the comments of Space Exploration Holdings, LLC ("SpaceX") regarding ViaSat's request for authority to operate two new models of earth stations in the 18.6-19.1 GHz and 28.6-29.1 GHz band segments.[1] O3b and SpaceX made their filings with respect to what should be considered to be a routine request to expand the ViaSat Ka-band earth station network that successfully has been operating in these band segments since 2012, by adding two new earth station models, and adding as a point of communication the recently-launched ViaSat-2.[2] As detailed below, nothing in ViaSat's application (the "Application") materially alters the existing operating environment or otherwise warrants any delay or new conditions with respect to the grant of the Application.

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[1] Petition to Defer of O3b Limited, File No. SES-LIC-20170401-00357 (filed June 2, 2017) ("O3b Petition"); Comments of Space Exploration Holdings, LLC, File No. SES-LIC-20170401-00357 ("SpaceX Comments").

[2] In the Application, ViaSat also requests to add WildBlue-1, Anik-F2 and Galaxy 28 as satellite points of communication in different portions of the Ka band other than 18.8-19.3 GHz and 28.6-29.1 GHz. Nothing in the SpaceX or O3b filings relates to the operation of those spacecraft.

Background

In 2009, the Commission authorized ViaSat-1 to operate in the Ka band. Operations at 28.6-29.1 GHz were authorized on a secondary basis, and operations at 18.8-19.3 GHz were authorized on a non-conforming basis, in each case conditioned on a requirement to protect current and future NGSO operations in accordance with the Commission's band plan for the Ka band.[3] The Commission subsequently granted a number of authorizations to operate earth stations of varying types in these band segments and to communicate with ViaSat-1.[4] The ViaSat-1 network was launched in 2011 and successfully has been sharing these band segments with NGSO operations.

In 2013, the Commission granted market access for ViaSat-2 in the Ka band, including in the 28.6-29.1 GHz and 18.8-19.3 GHz band segments, under similar conditions.[5] That satellite was launched on June 1, 2017 and is expected to be brought into service later this year.

Notably, the Commission approved the operation of ViaSat-1 and ViaSat-2 in the 28.6-29.1 GHz and 18.8-19.3 GHz band segments based on ViaSat's demonstration of the operational techniques it committed to employ to successfully share that spectrum with NGSO operations by avoiding transmissions in these band segments during in-line events. Specifically, the ViaSat-2 spacecraft, like ViaSat-1, is designed with the capability to cease operations in the 18.8-19.3 GHz (downlink) and 28.6-29.1 GHz (uplink) band segments in any instance where a predicted

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[3] *See* ViaSat-1 Authorization, File Nos. SAT-LOI-2008-0107-00006, SAT-AMD-20080623-00131, SAT-AMD-20090213-00023, Call Sign S2747, Attachment – Conditions for Letter of Intent ¶ 4 (granted Aug. 18, 2009).

[4] *See, e.g.*, ViaSat, Inc., Call Signs E100143, E120026, E120071, E120075, E120092.

[5] *See* ViaSat-2 Authorization, File No. SAT-LOI-20130319-00040, Call Sign S2902, Attachment at ¶ 4 (granted Dec. 12, 2013); *see also* File Nos. SAT-MOD-20141105-00121; SAT-AMD-20150105-00002 (granted Apr. 15, 2015); SAT-MOD-20160527-00053 (granted Jan. 12, 2017).

in-line event would occur between the ViaSat GSO network, and any given NGSO system. In that case, and for the duration of the in-line event, ViaSat would cease transmitting in the affected band segments, and instead would operate in other authorized parts of the Ka band.[6]

A processor at the central control site for ViaSat-2 will determine the predicted orbits of the potentially affected NGSO satellites through the use of well-understood algorithms and regularly-updated 2-line element set data obtained from reliable on-line sources, such as Space Track and/or directly from the NGSO operator itself. The processor will then identify any instances where an in-line event at the relevant "trigger angle" would occur. To the extent, and for the duration, of that in-line event, the network will cease transmissions in the 28.6-29.1 GHz and 18.8-19.3 GHz band segments.

The Commission has authorized operations over both ViaSat-1 and ViaSat-2 based on this in-line avoidance mechanism. Notably, this type of in-line avoidance mechanism is what the Commission has proposed to enable NGSO systems to share the 18.8-19.3 GHz and 28.6-29.1 GHz band segments with each other,[7] and also is the basis on which the Commission is considering authorizing OneWeb's proposed NGSO system.[8]

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[6] *See*, *e.g.*, ViaSat-1 Application, File No. SAT-AMD-200806223-00131, Call Sign S2747, Technical Annex at 15-19 (filed June 23, 2008); ViaSat-2 Application, File No. SAT-LOI-20130319-00040, Call Sign S2902, Technical Annex at 10-16 (filed Mar. 19, 2013).

[7] *The Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ka-Band*, Report and Order, 18 FCC Rcd 14708 ¶ 18 (2003); *see also* 47 C.F.R. § 25.261.

[8] *See* FCC Fact Sheet, OneWeb Market Access Grant, Order and Declaratory Ruling – IBFS File No. SAT-LOI-20160428-00041; Draft Order, FCC-CIRC1706-04, at ¶¶ 18-19 (rel. June 1, 2017).

Arguments

I. VIASAT HAS ADEQUATELY DEMONSTRATED THE COMPATIBILITY OF ITS PROPOSED OPERATIONS AT 18.8-19.3 GHZ AND 28.6-29.1 GHZ WITH NGSO SYSTEMS

In the Application, ViaSat seeks authority to deploy two new earth station terminal types to support the continued expansion of ViaSat's satellite broadband services. The proposed earth stations are simply new models that will be deployed alongside those that the Commission has already authorized to operate within ViaSat's Ka-band satellite broadband network.

O3b and SpaceX claim that ViaSat's Application does not adequately demonstrate how the proposed earth stations would successfully operate at 28.6-29.1 GHz along with NGSO systems. Specifically, both commenters claim that ViaSat's previous demonstrations do not specifically address the network architectures of the Ka-band NGSO systems proposed in the currently pending processing round.[9] What both O3b and SpaceX fail to recognize, however, is the effectiveness of in-line avoidance does not depend on such matters. If and when O3b and SpaceX ever deploy their proposed new NGSO systems, the chance of an in-line event with ViaSat-2 may increase, but the mitigation technique ViaSat will employ will be the same.[10] Moreover, nothing about the proposed new earth station models alters the effectiveness of the mechanism within ViaSat's network management technology that enables coexistence with NGSO operations at 18.8-19.3 GHz and 28.6-29.1 GHz.

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[9] *See* O3b Petition at 2-3; SpaceX Comments at 3.

[10] *See, e.g.*, ViaSat-1 Application, File No. SAT-AMD-200806223-00131, Call Sign S2747, Technical Annex at 16, 19 (filed June 23, 2008). Contrary to what O3b asserts, O3b Petition at 3-4, ViaSat has assessed its compatibility with O3b's gateway earth station in Hawaii and O3b's blanket-licensed ESV terminals. *See* ViaSat-2 Modification Application, File No. SAT-MOD-20141105-00121, Call Sign S2902, Technical Annex at 12-14 (filed Nov. 5, 2014).

As noted above, the Commission has endorsed in-line avoidance to facilitate sharing among NGSO systems, and significantly, is poised to authorize OneWeb's NGSO system. When future NGSO systems are deployed, the appropriate angles can be established within ViaSat's network in the manner described above to enable operations at 18.8-19.3 GHz and 28.6-29.1 GHz on a non-harmful interference basis, consistent with the conditions of ViaSat's authorizations in these bands.

II. THE PROPOSED EARTH STATIONS ARE COMPATIBLE WITH NGSO OPERATIONS AND ARE CONSISTENT WITH THE COMMISSION'S RULES

SpaceX's claims that the proposed operating parameters for ViaSat's new earth station models (duty cycle and power density) will somehow adversely impact NGSO operations. SpaceX also suggests that authorizing the number of earth stations requested in the Application would increase the likelihood of such a problem occurring.[11]

The issue with SpaceX's argument is that it is based on circumstances that will not occur. First and foremost, avoiding in-line events moots the question of how often, and what power density level, ViaSat's earth station transmissions would occur if in-line avoidance were not employed.[12]

Similarly, the number of earth stations deployed within ViaSat's network has no bearing on the potential for interference into NGSO systems, because the in-line avoidance mechanism will be employed for each earth station as required and appropriate. In addition, any concerns expressed by SpaceX that aggregating the operations of multiple earth stations would increase the power levels that could be directed toward NGSO satellite receivers are unfounded. Because ViaSat's Ka-band earth stations operate on TDMA network protocols, only one earth station

[11] *See* SpaceX Comments at 3.

[12] *See id.* at 2-3.

operates on a given frequency within a ViaSat satellite beam at any given time. Therefore, the maximum power levels identified in ViaSat's Application would not be exceeded as a result of a large number of authorized terminals. In other words, because only one earth station transmits co-frequency, co-polarization within a ViaSat satellite beam at any given time, no simultaneously-occurring transmissions would exist that could cause an aggregation of power from multiple earth stations located within the ViaSat satellite beam.

A technical discussion of SpaceX's argument regarding the peak power levels of ViaSat's proposed earth stations is attached as Exhibit 1.

Conclusion

ViaSat's prior demonstrations of how its Ka-band networks can protect current and future NGSO operations at 18.8-19.3 GHz and 28.6-29.1 GHz through in-line avoidance were approved long ago. ViaSat's proposed addition of new earth station models and the ViaSat-2 satellite as a point of communication does not change the effectiveness of this sharing mechanism, which the Commission intends to adopt as a means for NGSO/NGSO spectrum sharing as well. ViaSat respectfully requests that the Commission promptly grant ViaSat's Application.

Respectfully submitted,

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Exhibit 1

SpaceX is incorrect in suggesting that the proposed operations of the new 0.75 meter earth station model has a greater potential for interference into NGSO systems at 28.6-29.1 GHz than the version of the 0.75 meter earth station already authorized under call sign E100143. *See* SpaceX Comments at 2.

As an initial matter, for purposes of assessing compatibility with co-frequency NGSO operations, the relevant factor is not the peak power of the GSO earth station transmitter, but rather the power density. In this respect, SpaceX cites out of context a statement in ViaSat's Application narrative that addresses compliance with the Commission's RF exposure limits: "while the peak burst power is higher [than the version of the earth station authorized under call sign E100143], when duty cycle is taken into account, the average power is the same or lower than the previous model."

What is relevant for purposes of assessing RF compatibility is the EIRP density of the earth station. Significantly, the EIRP density for the earth stations proposed for ViaSat-2 (22.43 dBW/4 kHz) is lower than the EIRP density for the earth stations already operating with ViaSat-1 (23.9 dBW/4 kHz). This is the case because the modulated bandwidth is much wider.

Moreover, SpaceX misstates the maximum EIRP density of the 75 cm earth station in the 28.6-29.1 GHz band by referencing the levels ViaSat has proposed for a different band segment. As stated in the Form 312 to the Application, the ViaSat 75 cm earth station EIRP density of 26.59 dBW/4kHz is for the 29.5-30 GHz band.

In the 28.6-29.1 GHz band, ViaSat's highest stated EIRP density for the 75 cm antenna is 22.43 dBW/4 kHz at the 5 and 10 MBd symbol rate, used mainly in faded conditions. In clear sky conditions the higher symbol rates will be employed resulting in lower EIRP densities. For

the 1.8 meter earth station, which has a higher peak power density than the 75 cm earth station, clear sky operations will use higher symbol rates, which result in EIRP densities from the 1.8 meter earth stations that are similar to typical levels for the 75 cm earth stations operating with ViaSat-1. The 1.8 meter earth station also has a considerably reduced beam width as compared to a 75 cm earth station, and accordingly would have a lower separation angle for an NGSO system than a 75 cm earth station.

The peak EIRP and EIRP density identified in the Application is the maximum for any transmitting earth station. The fact that any individual earth station only transmits for a fraction of the time means that other stations can and will transmit in the gaps when the other stations are not transmitting. The stations in any beam transmit in accordance with a schedule controlled by the network management system, one after the other, and do not transmit co-frequency and at the same time. Thus, their EIRP densities do not aggregate in the direction of an NGSO system. In the overall RF environment, the net effect is the same, and the transmissions appear as a single continuous carrier at the specified EIRP density occupying the frequency.

As discussed in ViaSat's Opposition and Response, these maximum power levels are not an indication of the potential for harmful interference in the 28.6-29.1 GHz band, because ViaSat's system will protect NGSO operations in this band by inhibiting uplink transmissions from earth stations during in-line events.

DECLARATION

I hereby declare that I am the technically qualified person responsible for preparation of the engineering information contained in this Opposition and Response of ViaSat, Inc. ("Opposition and Response"), that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted with these Opposition and Response, and that it is complete and accurate to the best of my knowledge, information and belief.

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June 15, 2017

CERTIFICATE OF SERVICE

I, Kayla Ernst, hereby certify that on this 15th day of June, 2017, I served a true copy of the foregoing Opposition and Response of ViaSat, Inc. via first-class mail upon the following:

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