

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

In the Matter of	)	
	)	
Telesat Canada	)	SAT-PDR-20161115-00108; Call Sign S2976
	)	
The Boeing Company	)	SAT-LOA-20161115-00109; Call Sign S2977
	)	
Space Norway AS	)	SAT-PDR-20161115-00111; Call Sign S2978
	)	
LeoSat MA, Inc.	)	SAT-PDR-20161115-00112; Call Sign S2979
	)	
Karousel LLC	)	SAT-LOA-20161115-00113; Call Sign S2980
	)	
Audacy Corporation	)	SAT-LOA-20161115-00117; Call Sign S2982
	)	
Space Exploration Holdings, LLC	)	SAT-LOA-20161115-00118; Call Sign S2983
	)	
ViaSat, Inc.	)	SAT-PDR-20161115-00120; Call Sign S2985
	)	
Theia Holdings A, Inc.	)	SAT-LOA-20161115-00121; Call Sign S2986
	)	
NGSO-Like Satellite Applications and Petitions for U.S. Market Access in the 12.75-13.25 GHz, 13.85-14.0 GHz, 18.6-18.8 GHz, 19.3-20.2 GHz, and 29.1-29.5 GHz Bands	)	

**COMMENTS OF SES S.A. AND O3B LIMITED**

SES S.A. (“SES”) and its subsidiary O3b Limited (“O3b”), hereby comment on the above-captioned non-geostationary orbit (“NGSO”) satellite license applications and requests for authority to serve the U.S. market (collectively, the “Ku/Ka NGSO Filings”).<sup>1</sup> Prior to acting

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<sup>1</sup> *Telesat Canada*, File No. SAT-PDR-20161115-00108 (the “Telesat Petition”); *The Boeing Company*, File No. SAT-LOA-20161115-00109 (the “Boeing Application”); *Space Norway AS*, File No. SAT-PDR-20161115-00111; *LeoSat MA, Inc.*, SAT-PDR-20161115-00112 (the “LeoSat Petition”); *Karousel LLC*, File No. SAT-LOA-20161115-00113; *Audacy Corporation*, File No. SAT-LOA-20161115-00117 (the “Audacy Application”); *Space Exploration Holdings, LLC*, File No. SAT-LOA-20161115-00118 (the “SpaceX Application”); *ViaSat, Inc.*, File No. SAT-PDR-20161115-00120 (the “ViaSat Petition”); *Theia Holdings A, Inc.*, File No. SAT-LOA-20161115-00121.

on the Ku/Ka NGSO Filings, the Commission must ensure that each applicant has demonstrated how it will protect geostationary orbit (“GSO”) networks from interference. In addition, the Commission must impose clear requirements regarding any future NGSO system’s obligation to share spectrum with other co-frequency NGSO operations. The Commission should defer consideration of requests for relief from system construction and operation milestones. Finally, any authorizations issued must include terms and conditions consistent with those imposed on other operators, including O3b.

## **BACKGROUND**

SES, one of the world’s largest commercial communications satellite operators, is uniquely positioned to address issues raised by the Ku/Ka NGSO Filings because its facilities include both GSO and NGSO satellite fleets. SES entities operate more than 50 GSO satellites able to reach 99% of the world’s population, many of them pursuant to Commission authority. These spacecraft serve broadcasters, direct-to-home (“DTH”) service providers, and corporate and government customers worldwide with offerings that include video and audio content distribution, DTH, private networks, broadband, satellite news gathering, aeronautical and maritime services, and mobile backhaul.

SES subsidiary O3b provides high-throughput, low-latency connectivity for enterprise, government, and mobility clients via an NGSO satellite network authorized to serve the U.S.<sup>2</sup> The O3b system combines satellite reach with fiber optic speed, delivering the performance of terrestrial networks in places those networks do not reach, and making affordable broadband connectivity possible for billions of consumers and businesses in nearly 180

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<sup>2</sup> *O3b Limited*, Call Sign S2935, File Nos. SAT-LOI-20141029-00118 & SAT-AMD-20150115-00004, grant-stamped Jan. 22, 2015, corrected and re-issued June 2, 2015 (the “O3b Market Access Grant”).

countries. O3b currently operates twelve satellites in a Medium Earth Orbit (“MEO”) configuration, and has requested authority for additional spacecraft and spectrum in order to accommodate growing demand for O3b’s high-performance connectivity.<sup>3</sup>

The Ku/Ka NGSO Filings seek Commission authority for new NGSO fixed-satellite service (“FSS”) systems that would operate in Ku- and Ka-band spectrum used by SES’s GSO networks and the O3b NGSO system. Before acting on the filings, the Commission must ensure it has sufficient evidence that the proposed NGSO operations will not interfere with GSO satellites and will be able to successfully co-exist with other NGSO systems. The Commission is considering milestone issues as part of a pending rulemaking,<sup>4</sup> and should decline to address individual milestone relief requests until the policy has been decided. Any grants issued must also include terms and conditions similar to those applied to O3b and other FSS systems.

**I. ADDITIONAL INFORMATION AND APPROPRIATE CONDITIONS ARE NEEDED TO ENSURE GSO OPERATIONS ARE PROTECTED**

As discussed above, SES operates GSO satellites in the Ku-band and Ka-band that provide critical services to a range of government and commercial customers across the globe. The Commission cannot permit new NGSO systems to access GSO-primary spectrum used by these spacecraft unless it has adequate assurances that the NGSO systems will comply with applicable equivalent power flux density (“EPFD”) limits designed to protect current and future GSO satellite networks from interference.

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<sup>3</sup> *O3b Limited*, Call Sign S2935, File Nos. SAT-MOD-20160624-00060; SAT-AMD-20161115-00116; & SAT-AMD-20170301-00026.

<sup>4</sup> Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters, Notice of Proposed Rulemaking, IB Docket No. 16-408, FCC 16-170 (rel. Dec. 15, 2016) (“NGSO NPRM”).

The showings made by several of the filers are deficient in this regard because they lack the data necessary to permit verification of their EPFD compliance claims. For example, Telesat states that its proposed constellation will meet the worst-case EPFD limit 100 percent of the time,<sup>5</sup> but Telesat does not supply the Equivalent Isotropically Radiated Power (“EIRP”) and power flux density (“PFD”) masks that would allow others to independently confirm this claim. Section 1.1 of International Telecommunication Union (“ITU”) Recommendation ITU-R S.1503 specifies that both PFD masks and EIRP masks are necessary input parameters for assessing EPFD compliance, including determining the EPFD cumulative distribution function, which allows an assessment of how frequently a given PFD level would be exceeded.<sup>6</sup> Because Telesat has not supplied these masks, the EPFD analysis presented in the Telesat Petition does not conform to the Recommendation S.1503 output agreed by the ITU Radiocommunication Sector to analyze and illustrate conformance with EPFD limits. Similarly, while the EPFD validation output is shown in their applications, Audacy, Boeing, and SpaceX have not included files with EIRP and PFD masks necessary to independently assess the proposed systems’ compliance with applicable EPFD limits.

The Commission should defer action on these proposals pending submission of the relevant PFD and EIRP mask data.<sup>7</sup> These masks must be provided to the ITU in support of

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<sup>5</sup> Telesat Petition, Technical Exhibit at 13.

<sup>6</sup> Recommendation ITU-R S.1503-2 (December 2013), Section 1.1.

<sup>7</sup> The Commission should also ask Audacy to confirm its proposed Ka-band uplink frequencies, which are identified in the text materials filed with the Audacy Application as 29.5-30 GHz (*see, e.g.,* Audacy Application, Narrative at 2), but in the Schedule S Operating Frequency Band section as 27.5-30 GHz. The Schedule S entry appears to be erroneous, but Audacy should clarify what band segment it is seeking.

the underlying satellite network filings on which applicants are relying, so requiring the filers to submit the information to the Commission will not impose an extra burden.

The ViaSat Application presents another potential threat to GSO operations that is not adequately addressed in the materials before the Commission. ViaSat proposes to use Ka-band FSS spectrum for links between its planned fleet of MEO satellites, at an altitude of 8200 km, and its GSO spacecraft.<sup>8</sup> ViaSat, however, does not provide sufficient evidence to show that GSO satellites would be protected from interference resulting from the MEO transmissions. ViaSat claims that its MEO transmissions will comply with the Commission's two-degree spacing framework, which establishes default operating levels for FSS operations.<sup>9</sup> But ViaSat ignores the simple fact that those limits were intended to address transmissions from earth stations – not from satellites 8200 km closer to the geostationary arc. ViaSat also argues that MEO-to-GSO transmissions should not be subject to EPFD ↑ limits,<sup>10</sup> but does not explain how, absent application of the EPFD ↑ limits, the Commission could ensure that the MEO transmissions will not interfere with GSO satellites adjacent to the target spacecraft. Before the Commission can consider authorizing ViaSat's planned MEO-to-GSO operations, it must require ViaSat to provide a more robust showing regarding how GSO networks will be protected.

The Commission must also take steps to ensure that applicable aggregate EPFD limits are met in order to prevent interference to GSO networks. NGSO systems using the same spectrum will need to work together to determine how they can manage their operations to avoid exceeding the applicable limits. Because it may be difficult for NGSO operators to reach

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<sup>8</sup> ViaSat Petition, Narrative at 5.

<sup>9</sup> *Id.*, Technical Annex at 33.

<sup>10</sup> *Id.*, Technical Annex at 23.

agreement on these issues, however, the Commission must be prepared to step in as necessary to implement a solution that will constrain aggregate EPFD levels. Accordingly, any grants of the Ku/Ka NGSO Filings must incorporate aggregate EPFD compliance requirements and be subject to modification as necessary to keep aggregate interference levels within the specified limits.

**II. SHARING AMONG NGSO SYSTEMS CAN PRIMARILY BE ACHIEVED THROUGH COORDINATION, BUT BAND SEGMENTATION DURING IN-LINE EVENTS MAY BE NEEDED AS A LAST RESORT**

In response to the NGSO NPRM, SES and O3b joined other commenters in supporting Commission proposals to facilitate sharing among NGSO systems by encouraging coordination agreements focused on avoiding in-line events, as described in Section 25.261 of the Commission's rules.<sup>11</sup> We agreed that band segmentation should not be the first recourse in accommodating multiple NGSO systems but noted that dividing up the spectrum for the duration of an in-line event would be necessary in certain instances.<sup>12</sup> Moreover, SES and O3b urged the Commission to reject arguments that ITU priority should determine sharing status among NGSO systems authorized to serve the U.S. market.<sup>13</sup> The Commission should apply these policies for NGSO-to-NGSO sharing to the Ku/Ka NGSO Filings.

For example, the Audacy Application illustrates the type of situation in which band segmentation may be necessary to make sharing with other NGSO systems possible.

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<sup>11</sup> Comments of SES S.A. and O3b Limited in IB Docket No. 16-408, filed Feb. 27, 2017 (“SES/O3b NGSO NPRM Comments”) at 23-27; Reply Comments of SES S.A. and O3b Limited in IB Docket No. 16-408, filed Apr. 10, 2017 (“SES/O3b NGSO NPRM Reply Comments”) at 19-27 & n.85 (citing other comments).

<sup>12</sup> SES/O3b NGSO NPRM Comments at 24-25.

<sup>13</sup> SES/O3b NGSO NPRM Reply Comments at 26-27 & nn.118 & 120.

Because Audacy is proposing to operate only three satellites and three gateways,<sup>14</sup> it will not be able to use space or earth station diversity as a sharing mechanism. As a result, during an in-line event with another NGSO system with which Audacy has not reached a coordination agreement, band segmentation will be the only feasible option to enable sharing.

In addition, the Commission should make clear in any action on the Telesat and LeoSat Petitions that the ITU priority of the filings on which they rely<sup>15</sup> is not relevant to the Commission's expectations regarding sharing with other NGSO networks. Instead, any authority to serve the U.S. market must be conditioned on Petitioners' ability to share with other NGSO networks authorized prior to or as part of this processing round, without regard to ITU priority.

Finally, the ViaSat proposal for MEO-to-GSO links discussed above could have implications for the ViaSat system's ability to share with other NGSO operations and requires careful study. ViaSat does not adequately explain how it would protect NGSO constellations operating in a higher orbit than its planned MEO satellites, or NGSO satellites operating between the ViaSat MEO satellite and the limb of the Earth, from interference caused when its MEO spacecraft transmit toward the geostationary arc. The Commission should require ViaSat to submit additional information on this issue before acting on the ViaSat Petition.

### **III. THE COMMISSION SHOULD DEFER ACTION ON MILESTONE ISSUES**

The Commission should not act at this time on requests for relief from NGSO system implementation milestones. Such action would be premature at this stage of the application proceedings, and could be viewed as prejudging the milestone policy issues being

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<sup>14</sup> Audacy Application, Narrative at 2-3.

<sup>15</sup> See Telesat Petition, Technical Exhibit at 29; LeoSat Petition, Narrative at 2-3 & 12-13.

considered pursuant to the NGSO NPRM.<sup>16</sup> Instead, the Commission should defer action on the requests of Boeing and SpaceX for extended system implementation schedules.<sup>17</sup>

Deferral will permit the Commission to consider all relevant factors in making milestone decisions. It will allow the Commission to first settle the underlying milestone framework in the rulemaking proceeding. Moreover, deferral will enable the Commission to appropriately take into account actual implementation efforts, and not to prejudge those efforts, in determining whether additional time is warranted in particular cases.

#### **IV. ANY GRANTS OF Ku/Ka NGSO FILINGS SHOULD INCLUDE STANDARD OPERATING CONDITIONS**

If the Commission determines that grant of a Ku/Ka NGSO Filing is in the public interest, it should include in the authorization conditions designed to ensure that the planned operations will be consistent with Commission policies and rules as well as with international coordination obligations. The Commission can look to the O3b Market Access Grant and the authorization recently issued for the OneWeb system<sup>18</sup> for appropriate language on these matters. In particular, the following condition paragraphs from the O3b Market Access Grant should be applied to any grants of the Ku/Ka NGSO Filings:

*Preamble:* Operations pursuant to the grant must comport with the legal and technical specifications set forth by the applicant or petitioner and with Federal Communications Commission rules not waived herein.<sup>19</sup>

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<sup>16</sup> NGSO NPRM at ¶¶ 32-33.

<sup>17</sup> See Boeing Application, Narrative at 23-25; SpaceX Application, Waiver Requests at 8-10.

<sup>18</sup> WorldVu Satellites Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System, File No. SAT-LOI-20160428-00041, Order and Declaratory Ruling, FCC 17-77 (rel. June 23, 2017) (the “OneWeb Market Access Grant”).

<sup>19</sup> Under the specific circumstances presented, the Commission determined that including this language in the OneWeb Market Access Grant was unnecessary (*see id.* at 11 n.71), but SES and O3b note that this provision is standard in International Bureau space station license grants and



Condition 2: Operations must comply with all coordination agreements.

Condition 3: Requirement to maintain and make available to the North American Defense Command ephemeris data for each satellite.

Condition 4: Operation in the 17.8-18.6 GHz frequency bands is on a non-conforming, unprotected basis and subject to immediate termination if harmful interference occurs. Requirements to comply with applicable PFD and EPFD limits.

Condition 5: Requirement to comply with applicable PFD limits.

Condition 6: Requirement to comply with applicable EPFD limits.

Condition 7: Requirement to coordinate operations in the 17.8-19.3 GHz frequency band with U.S. Federal Systems. Specification that non-conforming operations in this band are on an unprotected, non-harmful interference basis with respect to present and future Federal and non-Federal GSO and NGSO systems or any non-conforming services previously authorized on a non-harmful interference basis and must terminate immediately if harmful interference occurs.

Condition 8: Statement regarding status of operations in the 27.5-28.35 GHz frequency band with respect to terrestrial operations, updated to reflect the rule changes adopted in the Commission's Spectrum Frontiers decision.<sup>20</sup>

Condition 9: Specification that operations in certain frequency bands are secondary to GSO FSS.

Condition 10: Specification that operations must comply with the sharing method specified in Section 25.261.

Condition 12: Designation of the means by which the system will share spectrum with other NGSO constellations issued prior to or as part of this processing round.

Grants should also include a provision similar to paragraph 26 of the OneWeb Market Access Grant specifying that authorizations granted are subject to modification in order to conform to future rules or policies adopted by the Commission.

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market access authorizations. *See, e.g.,* SES Americom, Inc., File No. SAT-MOD-20170316-00051, granted June 14, 2017, Attachment to Grant at 1; SES Satellites (Gibraltar) Ltd., File No. SAT-PPL-20160512-0048, granted Dec. 7, 2016, Attachment to Grant at 2. Consistent with this precedent, the language should be included in any grants of the Ku/Ka NGSO Filings.

<sup>20</sup> *In the Matter of Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89 (rel. July 14, 2016).

The following conditions imposed on O3b should also be incorporated in grants of petitions seeking U.S. market access for foreign-licensed NGSO networks:

Condition 1: Limitation of services that can be provided to include only those covered by the WTO agreement.

Condition 11: Restrictions on the ability to reposition or activate satellites in the NGSO constellation without Commission approval.

Condition 15: Specification regarding the orbital debris regulatory framework for applicants relying on the orbital debris mitigation rules of other jurisdictions.

Incorporation of the above provisions is consistent with Commission rules and precedent and is necessary to ensure that operations pursuant to the Ku/Ka NGSO Filings will conform to applicable regulatory requirements.

## V. CONCLUSION

For the foregoing reasons, the Commission should require supplemental information and impose appropriate conditions to ensure that operations pursuant to the Ku/Ka NGSO Filings meet requirements for sharing with both GSO satellites and other NGSO systems. The Commission should hold off acting on milestone extension requests and should employ its standard condition language in any grants issued in response to the filings.

Respectfully submitted,

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## CERTIFICATE OF SERVICE

I hereby certify that on this 26th day of June, 2017, I caused to be served a true copy of the foregoing “Comments of SES S.A. and O3b Limited” by electronic mail upon the following:

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