

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

In the Matter of	)	
	)	
WorldVu Satellites Limited	)	File No. SAT-LOI-20160428-00041
	)	Call Sign S2963
Petition for a Declaratory Ruling	)	
Granting Access to the U.S. Market for the	)	
OneWeb System	)	

COMMENTS OF SES S.A. AND O3B LIMITED

SES S.A. (“SES”) and its subsidiary O3b Limited (“O3b”), pursuant to Section 25.154 of the Commission’s Rules, 47 C.F.R. § 25.154, hereby submit their comments concerning the above-captioned request of WorldVu Satellites Limited, doing business as OneWeb (“OneWeb”), for authority to serve the U.S. using a non-geostationary orbit (“NGSO”) satellite system.¹ SES requests that prior to acting on the OneWeb Petition the Commission seek additional details regarding how the OneWeb system would protect geostationary orbit (“GSO”) satellites from interference. In addition, any grant of the OneWeb Petition should include conditions consistent with those imposed in the U.S. market access grant for O3b, which operates the only NGSO satellite system currently authorized in Ka-band spectrum requested for use by OneWeb.

¹ *WorldVu Satellites Limited*, Call Sign S2963, File No. SAT-LOI-20160428-00041 (the “OneWeb Petition”). *See also* Attachment to Letter of Kalpak S. Gude, Vice President of Legal-Regulatory, WorldVu Satellites Limited, to Marlene H. Dortch, Secretary, Federal Communications Commission, File No. SAT-LOI-20160428-00041, dated June 24, 2016, “OneWeb Response to the Commission’s Letter dated June 10, 2016” (the “OneWeb Supplement”).

BACKGROUND

SES is one of the world's largest commercial communications satellite operators, with both GSO and NGSO satellite fleets.

SES subsidiaries operate more than 50 GSO satellites able to reach 99% of the world's population. Three of these entities – SES Americom, Inc., SES Satellites (Gibraltar) Ltd., and New Skies Satellites B.V. – hold Commission authorizations for GSO space stations, earth stations and U.S. market access. SES's GSO facilities provide satellite-based communications solutions to broadcasters, direct-to-home ("DTH") service providers, and corporate and government customers worldwide. SES GSO satellite capacity is used for such services as video and audio content distribution, DTH services, private networks, broadband services, satellite news gathering, broadcasting, aeronautical and maritime services, and mobile backhaul.

SES has also recently acquired full ownership of O3b, which provides high-throughput, low-latency connectivity for enterprise, government, and mobility clients via a constellation of NGSO satellites. The Commission has granted O3b authority to provide services in the U.S., finding that O3b met Commission requirements for market access based on O3b's legal and technical qualifications.² Because the O3b system combines the reach of satellite with the speed of a fiber-optic network, it offers the performance of terrestrial networks in places those networks do not reach, and makes access to affordable broadband connectivity possible for billions of consumers and businesses in nearly 180 countries. The O3b constellation currently consists of twelve satellites in a Medium Earth Orbit ("MEO") configuration, with a vast

² *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").

coverage area that includes emerging and underserved markets in Latin America, Africa, the Middle East, Asia Pacific, and Australia, with a collective population of over three billion people. O3b is already in the process of expanding the total number of satellites in its constellation from twelve to twenty, a much needed increase to accommodate the growing demand for high-throughput, high-performance connectivity.³

The OneWeb Petition seeks U.S. market access for a new NGSO system that would operate in Ku- and Ka-band spectrum currently in use by SES's GSO networks and the O3b NGSO system. OneWeb recognizes that in order to obtain a market access grant, it must demonstrate its ability to comply with U.S. and international rules designed to prevent interference to other authorized spectrum users.⁴ For protection of GSO networks, that requires a showing that OneWeb will comply with applicable equivalent power flux density ("EPFD") limits.⁵ OneWeb states that it will also be able to share spectrum with currently operational NGSO constellations, indicating that it intends to rely in the first instance on negotiating coordination agreements with other operators to permit maximum flexibility in the use of all authorized spectrum.⁶

Based on its review of the OneWeb Petition, SES is concerned that the information provided regarding OneWeb's ability to protect GSO satellites from interference is insufficient. Accordingly, before acting on the OneWeb Petition, the Commission should require One Web to submit additional information necessary for SES and other operators of Ku-band

³ *O3b Limited*, Call Sign S2935, File No. SAT-MOD-20160624-00060.

⁴ OneWeb Petition at 10-12.

⁵ *Id.* at 11.

⁶ *Id.* at 12.

and Ka-band GSO spacecraft to fully evaluate OneWeb’s compliance with applicable EPFD limits.

In addition, under Commission precedent, any grant of the OneWeb Petition must include conditions similar to those applied to O3b, including international coordination obligations and compliance with Commission regulatory requirements.

I. ADDITIONAL INFORMATION IS NEEDED TO ASSESS ONEWEB’S SHOWING REGARDING ITS ABILITY TO SHARE GSO SPECTRUM

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 OneWeb to access GSO-primary spectrum used by these spacecraft unless it has adequate assurances that OneWeb’s operations will reliably ensure that current and future GSO satellite networks are protected from interference. The record to date is insufficient in this regard. Accordingly, SES requests that the Commission require OneWeb to supply additional analysis and explanation of the methods it will use to avoid causing interference to GSO systems and the effectiveness of those methods, as discussed below.

Progressive Pitch Technology: OneWeb states that its “patent pending ‘progressive pitch’ technology is the key to the interference protection of Ku-band GSO satellite networks by the OneWeb system.”⁷ However, further clarification is needed regarding the specifics of this approach.

First, there are inconsistencies in the description of what happens as a OneWeb satellite approaches the equator. The OneWeb Petition states that “[a]s the OneWeb satellites

⁷ OneWeb Petition, Attachment A at 32.

pass over the equator they are temporarily turned off while they adjust their pitch.”⁸ However, at other places in the application, OneWeb says that only “certain Ku-band beams are turned off” as the satellites approach the equator.⁹ OneWeb must be required to reconcile these conflicting statements.

OneWeb also does not explain whether its system has failsafe mechanisms in place to ensure protection of GSO networks. For example, is there a back-up that makes it possible for OneWeb to maintain compliance with applicable EPFD limits if a satellite beam that is supposed to be turned off as a OneWeb satellite approaches the equator does not in fact turn off?

More broadly, while the OneWeb Petition describes conceptually how pitching the satellites and turning off beams is intended to decrease the risk of interference to the GSO arc, OneWeb does not quantify the effect on EPFD levels. In response to Commission questions, OneWeb stated that “[d]ue to the effect of the antenna gain roll off, it can be generalized that increasing [the] GSO exclusion angle will decrease EPFD levels.”¹⁰ Rather than relying on generalizations, OneWeb should be required to demonstrate the specifics of how EPFD limits change in response to latitude, satellite pitch, and turning off satellite beams.

Gateway Siting and Operations: OneWeb states that “[b]y careful choice of OneWeb gateway sites, and by placing modest constraints on the possible positions of the OneWeb satellites with which each gateway site can communicate, the GSO arc avoidance

⁸ *Id.*

⁹ *Id.* at 16-17. *See also id.* at A1-3 (“At latitudes close to the equator, the downlink EPFD is progressively reduced in certain beams in order to ensure compliance with the EPFD limits at these latitudes. In addition, certain beams are eventually turned off to achieve the EPFD objective.”).

¹⁰ OneWeb Supplement at 3.

scheme can be implemented.”¹¹ However, OneWeb does not describe how the gateway locations will be selected or what limitations will be imposed on gateway communications with OneWeb satellites in order to protect GSO network operations.

User Operations: The OneWeb Petition provides little information regarding the interactions between user terminals in the Ku-band and the OneWeb constellation with respect to protection of the GSO arc. For example, there is no mention of whether when a beam is turned off, the user terminals associated with that beam have to search for another, active beam. In addition, OneWeb does not indicate how its system will monitor user terminal operations to ensure compliance with Commission rules.

To clarify these matters that are essential to ensuring protection of the GSO arc, the Commission should direct OneWeb to respond to the following questions:

1. When a OneWeb satellite approaches the equator, is the satellite as a whole turned off, or are only certain beams turned off?
2. If only certain beams are turned off, how does the system determine which beams to turn off and which beams can remain active?
3. At what latitude do OneWeb satellites begin turning off beams, and how was that latitude determined?
4. Are there any redundancy mechanisms in place to prevent EPFD limits from being exceeded if a system error prevents a beam from turning off when the satellite approaches the equator?
5. What would be the effect on protection of GSO networks if one or more beams do not turn off as planned?
6. How do the OneWeb system’s EPFD values vary based on:
 - satellite latitude,
 - satellite pitch value,

¹¹ *Id.* at 34.

- powering off beams, and
- GSO exclusion angles?

Can OneWeb supply plots demonstrating these relationships?

7. What criteria will OneWeb use in selecting gateway earth station locations in order to effectuate its GSO arc avoidance approach?
8. What factors will be used to determine whether to permit a gateway to communicate with a OneWeb satellite at a given location in order to ensure protection of GSO networks?
9. Will a user terminal need to search for a new beam if the beam it has been communicating with is turned off?
10. What monitoring mechanisms will OneWeb employ to ensure that user terminal operations do not result in interference to GSO networks?

The Commission should require OneWeb to provide supplemental information addressing these points before any further consideration of the OneWeb Petition.

II. ANY GRANT OF THE ONEWEB PETITION SHOULD INCLUDE CONDITIONS SIMILAR TO THOSE IMPOSED ON O3B

If the Commission determines that grant of the OneWeb Petition is in the public interest, it should adopt conditions designed to ensure that OneWeb's operations will be consistent with Commission policies and rules as well as international coordination obligations. The O3b Market Access Grant can be used as a template with respect to OneWeb's planned NGSO operations in Ka-band spectrum. In particular, the following condition paragraphs from the O3b Market Access Grant appear to be appropriate for application to OneWeb:

Condition 1: Limitation of services that can be provided to include only those covered by the WTO agreement, consistent with OneWeb's statement that it does not seek authority for non-covered services.¹²

¹² OneWeb Petition at 10 n.26.

Condition 2: Standard requirement that 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: Specification that 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 power flux density (“pfd”) and EPFD limits.

Condition 5: Requirement to comply with pfd limits in the 18.8-19.3 GHz frequency bands.

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 28 GHz frequency band with respect to terrestrial Local Multipoint Distribution Service operations. If the OneWeb Petition is granted following effectiveness of the Commission’s Spectrum Frontiers decision,¹³ O3b assumes that this condition language would be updated to reflect that order’s designations regarding the status of 28 GHz band satellite operations.

Condition 9: Specification that operations in the 28.35-28.6 GHz frequency band are secondary and on an unprotected, non-harmful interference basis.

Condition 10: Specification that operations in the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands are subject to the sharing method specified by the Commission for Ka-band NGSO operations.¹⁴

¹³ See *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).

¹⁴ See *Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ka-band*, Report and Order, IB Docket No. 02-19, 18 FCC Rcd 14708 (2003) and 47 C.F.R. § 25.261.

Condition 11: Restrictions on the ability to reposition non-active satellites in the NGSO constellation without Commission approval.

Condition 12: Designation of the means by which the system will share spectrum with other current and future NGSO constellations.

Condition 15: Finding that the system is subject to regulation by the United Kingdom with respect to mitigation of orbital debris.¹⁵

Although some of the conditions discussed above refer to specific Ka-band segments used by the O3b network, a number of the conditions also would apply equally to other spectrum proposed for use by OneWeb. For example, Condition 5 of the O3b Market Access Grant references the pfd limits in the 18.8-19.3 GHz band, but Section 25.208 of the Commission's rules imposes other pfd limits, including those applicable to NGSO operations in Ku-band spectrum at 10.7-11.7 GHz.¹⁶ Similarly, the EPFD limits described in Condition 6 of the O3b Market Access Grant apply to the Ka-band spectrum used by O3b, but those limits apply in the 29.5-30 GHz band as well, and Section 25.146 of the Commission's rules specifies EPFD limits applicable to the Ku-band.¹⁷ Condition 9, which describes the limitations on operations resulting from the secondary status of NGSO operations in the 28.35-28.6 GHz spectrum, is equally applicable to the 29.5-30.0 GHz band proposed for use by OneWeb. Thus, the condition language the Commission used in the O3b Market Access Grant should be broadened and supplemented as necessary to reflect the additional frequency bands covered by the OneWeb Petition.

¹⁵ See OneWeb Petition at 16.

¹⁶ 47 C.F.R. § 25.208(b).

¹⁷ 47 C.F.R. § 25.146.

Incorporation of these provisions is consistent with Commission rules and precedent and is necessary to ensure that the OneWeb operations will conform to applicable regulatory requirements.

For the foregoing reasons, the Commission should require supplemental information regarding the specifics of how the OneWeb system will protect GSO networks before further considering the OneWeb Petition and should condition any grant of the petition in a manner consistent with Commission requirements and with the O3b Market Access Grant.

Respectfully submitted,

SES S.A. AND O3B LIMITED

Of Counsel

Karis A. Hastings
SatCom Law LLC
1317 F Street, N.W., Suite 400
Washington, D.C. 20004

By: /s/ Gerald E. Oberst

Gerald E. Oberst
Senior Vice President, Global Regulatory and
Governmental Strategy, SES S.A.

Petra A. Vorwig
Regulatory Counsel, SES Americom, Inc.
1129 20th Street N.W., Suite 1000
Washington, D.C. 20036

Suzanne H. Malloy
Vice President, Regulatory Affairs, O3b Limited
900 17th Street, N.W.
Washington, D.C. 20006

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CERTIFICATE OF SERVICE

I hereby certify that on this 15th day of August, 2016, I caused to be served a true copy of the foregoing “Comments of SES S.A. and O3b Limited” by first class mail, postage prepaid, upon the following:

Mr. Kalpak S. Gude
Vice President of Legal-Regulatory
WorldVu Satellites Limited
1400 Key Boulevard, Suite A1
Arlington, VA 22209

Dara A. Panahy
Phillip L. Spector
Milbank, Tweed, Hadley & McCloy LLP
1850 K Street, N.W., Suite 1100
Washington, D.C. 20036

Jennifer D. Hindin
Colleen King
Wiley Rein LLP
1776 K Street, N.W.
Washington, D.C. 20006

/s/ _____
Norma Herrera