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16 February 2018

Innovation, Science and Economic Development Canada
c/o Director, Spectrum Regulatory Best Practices
235 Queen Street, 6th Floor
Ottawa, ON K1A 0H5

Dear Sirs / Mesdames :

**Re: Comments of SES S.A., Ciel Satellite Limited Partnership and O3b Limited – *Consultation on the Spectrum Outlook 2018-2022, Canada Gazette,* Part 1, October 6, 2017, Notice No. SLPB-006-17**

SES S.A. and its subsidiaries Ciel Satellite Limited Partnership and O3b Limited (collectively, "SES") hereby submit these comments in response to Innovation, Science and Economic Development Canada's ("ISED") *Consultation on the Spectrum Outlook 2018-2022 Canada Gazette*, Part 1, October 6, 2017, Notice No. SLPB-006-17 (the "Consultation").

SES, one of the world's largest commercial communications satellite operators, with both geostationary orbit ("GSO") and non-geostationary orbit ("NGSO") satellites providing telecommunications services, is uniquely positioned to address the matters raised in the Consultation. The SES fleet of more than 50 GSO satellites provides a wide range of C-, Ku-, and Ka-band services to customers in Canada and around the globe. O3b uses its constellation of Ka-band NGSO satellites to provide low-latency, high-throughput capacity to enterprise customers including mobile network operators, ISPs and governments. Many SES GSO satellites and the O3b satellite constellation have been approved by the Department to provide Fixed-Satellite Service ("FSS") in Canada and the capacity on these systems is available for use by Canadian service providers.

SES is committed to maintaining and expanding the satellite services available to Canadians in the future and has a keen interest in certain matters raised in the Consultation. Specifically, SES provides responses below to Questions 10, 11, 12, 19, 20 and 21.

**Q10 – ISED is seeking comments on the above demand assessment for FSS/BSS for the period 2018-2022. Is there additional information on demand, which is not covered above, that should be considered with regards to the below bands?**

**a) C-band**

SES participated in the deliberations undertaken by the Radio Advisory Board of Canada (the "RABC") in response to the Consultation, and generally agrees with the position which we understand will be put forth by the RABC regarding the demand outlook for satellite C-band use in Canada over the next four years. Satellites operating in the C-band will continue to provide

vital services to Canadians, and satellite access to the C-band must continue to be protected. For example, in 2016, SES began providing 12 transponders of capacity on the SES-2 satellite to the Kativik Regional Government, which delivers critical C-band communications capability to more than 14 communities in the Nunavik region. Along with providing faster internet and other services to residents in the region, SES's C-band service also enables important connectivity for schools, hospitals, and government facilities.[1]

These types of services are enabled by SES's ability to provide C-band capacity across North America. If that ability were limited in some way, the business case for building replacement or even new C-band satellites may become more difficult to make.

b) **Ku-band**

SES also agrees with the assessment made by the RABC of the Ku-band satellite market. This spectrum is already fully subscribed, and demand, particularly for aeronautical and maritime broadband service, is increasing. SES currently provides such mobile services to a number of aeronautical and maritime operators in Canada, and expects to expand this service in the future. As the RABC assessment found, new high-throughput satellites ("HTS") will partially address this demand by improving spectrum efficiency and re-use across Canada. SES recently launched the SES-15 satellite, which offers both wide-beam and HTS capability in the Ku-band over Canada and the rest of North America. SES-15 will serve the aeronautical sector and will enable other traffic-intensive data applications such as government, VSAT networks and maritime. Due to the satellite's extensive coverage, it will enable airline passengers to access full, seamless HTS coverage from Alaska to Mexico.[2]

**c) Ka-band**

SES notes that while the Department and the RABC conclude that current Ka-band satellite spectrum is unlikely to fully respond to the anticipated demand for ever-faster ubiquitous broadband service, it is also the case that ubiquitous broadband service will not be accomplished solely via terrestrial networks. Satellite services are indispensable elements for achieving ubiquitous broadband coverage. Moreover, both the Department and the RABC neglect to note that, in addition to existing and planned Ka-band GSO satellites and NGSO systems, there is already an operating NGSO satellite constellation serving Canada today. Ciel currently provides maritime broadband services within Canada using O3b's constellation of 12 satellites in Medium Earth Orbit ("MEO") in the Ka-band. Together with the SES GSO fleet of satellites, the O3b constellation supports a variety of mobile applications and provides fiber-like broadband service to customers in remote, unserved or underserved areas. Globally, O3b is already utilizing nearly all of its available capacity and is expanding its fleet, enlarging its coverage of Canada and

[1] SES Expands Government Services Portfolio in Canada, available at https://www.ses.com/press-release/ses-expands-government-services-portfolio-canada (Jan. 5, 2016).

[2] Successful Launch of SES-15, available at https://www.ses.com/newsroom/successful-launch-ses-15 (May 15, 2017).

increasing the frequencies that its future satellites will be able to use to better address growing demand for the services it offers. If Canadians are to take advantage of the services currently provided, as well as those that will be introduced in the future over both GSO and NGSO systems, the Department must ensure that satellites have protected access to Ka-band spectrum to support user terminals and gateway operations.

**Q11 – What and how will technology developments and/or usage trends aid in relieving traffic pressures and addressing spectrum demand for satellite services? When are these technologies expected to become available?**

In the C-band and other frequency bands, SES and other operators are regularly advancing compression technology to increase the capacity of any given transponder, which in turn allows for innovation in the nature of the services available. For example, in the early days of analog transmissions, one video channel occupied an entire C-band satellite transponder. The evolution of compression technology has paved the way for high definition ("HD") video formats, and SES is now offering Ultra HD. History has shown, however, that such technological developments, while they may initially relieve pressure on spectrum demand, ultimately encourage demand that must still be addressed through the allocation of additional spectrum.

SES has also been introducing HTS into its fleet to increase spectrum efficiency and to provide better broadband service through the use of spot beam technology. As noted above, SES recently launched the SES-15 satellite, which provides both wide-beam and spot beam coverage in the Ku-band. SES is also planning additional innovative HTS satellites operating in the Ka-band to respond to increased demand in the aeronautical, maritime and government services markets. For example, SES-17, which is expected to be delivered in 2020, will incorporate a powerful Digital Transparent Processor, which will allow SES to offer its mobility customers in North America extraordinary efficiency and unrivalled flexibility in bandwidth management capabilities.[3]

SES is also developing the O3b mPower NGSO system, which is scheduled to be launched in 2021 and will be capable of delivering multiple terabits of throughput globally. The constellation will have 30,000 fully-shapeable and steerable beams that can be shifted and switched in real time to align with customers' quickly changing growth opportunities, making it the most bandwidth-efficient system ever.[4]

SES and its subsidiary O3b Limited are also investing heavily in research and development focused on improving earth station antenna technology, including the use of Flat Panel Antennas

[3] SES and Thales Unveil Next-Generation Capabilities Onboard SES-17, available at https://www.ses.com/press-release/ses-and-thales-unveil-next-generation-capabilities-onboard-ses-17 (Apr. 4, 2017).

[4] SES opens new era in global connectivity with O3b mPower, available at https://www.ses.com/press-release/ses-opens-new-era-global-connectivity-o3b-mpower (Sept. 11, 2017).

and innovative earth station designs for fixed and mobile applications. Such improvements include the development of terminals that allow customers to communicate with both GSO and NGSO satellites to improve the quality of service provided to customers and to facilitate flexible and efficient spectrum use.

**Q12 – What satellite applications (e.g. broadband Internet, video broadcasting, backhaul, etc.) do you consider a priority for the period 2018-2022?**

SES expects, in addition to the satellite applications identified by the Department above, that mobility applications will be a significant priority during the 2018-2022 period. Demand for data connectivity is dramatically rising for both maritime and aeronautical applications. Similarly, offshore energy projects are seeing a notable rise in the need for connectivity and data services. Aeronautical connectivity in particular has the potential for massive growth and provides an important service to Canadian citizens.

In most instances, satellite is the only viable option for these industries to provide customers and employees with reliable, consistent data connectivity. The Department should be mindful of the growing demand for these applications when crafting spectrum policy for satellite applications.

**Q19 – Provide, with rationale, your view of the above assessments on the bands being considered internationally for commercial mobile, fixed, satellite, or licence-exempt.**

The Department is correct to note the international interest in allowing mobile access to the 3400-3800 MHz band; however, the Department's subsequent conclusion that the 3700-4200 MHz band should be considered for mobile use is unfounded. As discussed above, the C-band is used to provide critical information and connectivity across Canada. The introduction of mobile operations into this downlink spectrum could have significant negative effects on those services and ultimately harm Canadians who rely on them.

Access to the C-band is critical to these services because the propagation characteristics of C-band spectrum are ideally suited for expansive coverage and resistance to rain fade. As the International Telecommunication Union ("ITU") noted in a 2015 report, in C-band frequencies:

> The low gaseous atmospheric absorption combined with lower attenuation due to rain enables highly reliable space-to-Earth communication links. This, together with the wide coverage beams possible in this band, has led to satellites in this band being an important part of the telecommunications infrastructure in many countries.[5]

[5] Sharing studies between International Mobile Telecommunication-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands in the WRC study cycle leading to WRC-15, Report ITU-R S.2368-0 (06/2015), available at: https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-S.2368-2015-PDF-E.pdf ("Report ITU-R S.2368") at 5.

Moreover, unlike terrestrial services, the wide-band nature of C-band service make it more economical for distribution networks such as television broadcasters. Once a content provider uplinks its signal to a C-band satellite, it can be received by an unlimited number of ground stations anywhere within the footprint of the beam, and new ground stations can be added without increasing the underlying cost of the satellite capacity.

However, C-band service in the 3700-4200 MHz band is highly susceptible to terrestrial interference. Signals from geostationary satellites located more than 22,000 miles above the earth become attenuated over that long distance and are relatively weak when they reach the ground, particularly in comparison to the typical strength of a terrestrial signal. If mobile services are introduced into the band, increased interference would undermine the critical value of C-band spectrum for FSS users.

If the Department decides to proceed with considering terrestrial mobile use of the 3700-4200 MHz band, it must proceed with great caution, as any change in the spectrum sharing environment that would compromise the reliability of current services would deprive Canadian satellite customers of a key benefit of their investment in C-band satellite capacity.

**Q20 – ISED is seeking comments on the potential frequency bands for release in table 7:**
**a) the proposed services and/or applications for each frequency band**
**b) the potential timing of releasing for each frequency band**
**c) the priority of the release of the frequency bands**

**Provide supporting rationale for your responses.**

**a) 24.25-27.5 GHz**

If the Department determines to introduce additional services into the 24.75-25.05 GHz band or the 25.05-25.25 GHz band, it is critical that FSS retain access on a co-primary basis. As discussed above, the demand for Ka-band spectrum will grow substantially over the next few years, and FSS operators must have the flexibility to meet that demand. Access to the 24.75-25.05 GHz and 25.05-25.25 GHz bands is necessary to retaining such flexibility. SES believes that co-primary access to the 24.75-25.05 GHz band should be on a truly first-in-time priority basis without any preference for a particular service. FSS access to the 25.05-25.25 GHz band can continue to be subject to priority of the fixed service in accordance with Canadian footnote C44.

**b) 40-42.5 GHz, 45.5-50.2 GHz and 50.4-52.6 GHz (51 GHz)**

SES agrees with the RABC position on the above bands. The 40.0-42.5 GHz, 47.2-50.2 GHz and 50.4-52.4 GHz bands (collectively the "V-band") are a critical expansion band for next-generation satellite services. The Department should strive to make all of the V-band available for FSS use. In particular, some portion of the V-band should be allocated for dedicated use by FSS for ubiquitous user terminals. SES is already planning to use certain portions of the above bands for its O3b mPower constellation as are a number of other GSO and NGSO operators.

**Q21 – Are there any other bands that should be considered for release in the next five years for commercial mobile, fixed, satellite, or licence-exempt that are not discussed above? Provide rationale for your response.**

SES agrees with the RABC's recommendation that the Department remove the restriction on FSS in the 39.5-40.5 GHz band to government use only. Access to this additional spectrum will provide non-governmental satellite operators flexibility to provide additional services to Canadians.

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SES thanks the Department for the opportunity to participate in this proceeding.

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