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Director, Spectrum Regulatory Best Practices
Innovation, Science and Economic Development Canada
235 Queen Street
Ottawa, Ontario K1A 0H5

Re: Canada Gazette Notice No. SLPB-006-17, published October 21, 2017
Consultation on the Spectrum Outlook 2018 to 2022

Intelsat Corporation ("Intelsat") appreciates the opportunity afforded by the Department of Innovation, Science and Economic Development Canada (the "Department", or "ISED") and submits the following comments to the Consultation on the Spectrum Outlook 2018 to 2022, Canada Gazette Notice No. SLPB-006-17, published October 21, 2017 (the "Consultation").

Intelsat operates the world's first Globalized Network, delivering high-quality, cost-effective video and broadband services anywhere in the world. Intelsat's globalized network combines the world's largest satellite backbone with terrestrial infrastructure, managed services and an open, interoperable architecture to enable customers to drive revenue and reach through a new generation of network services. Thousands of organizations serving billions of people worldwide rely on Intelsat to provide ubiquitous broadband connectivity, multi-format video broadcasting, secure satellite communications and seamless mobility services. The end result is an entirely new world, one that allows us to envision the impossible, connect without boundaries and transform the ways in which we live. Several of Intelsat's fixed satellite service ("FSS") satellites have been approved for use in Canada pursuant to the procedure set out in Client Procedures Circular-2-6-01 (CPC-2-6-01).

Intelsat agrees with the Department that "rapid growth of innovative technologies and services are driving the digitization and automation of every sector of the economy,"[1] and that the effective management of the radio frequency spectrum resource is essential to ensure the development of and investment in Canada's digital economy. To that end, Intelsat notes that satellite services play a vital role in the development and delivery of media content, broadband solutions, mobility services and other essential communications.

Through the introduction of high-throughput satellite ("HTS") platforms, such as the Intelsat Epic^{NG} satellites, the satellite industry is making available a range of exciting and adventurous innovative communications services. In addition, with the introduction of non-geostationary FSS services in the near future, new HTS offerings will expand communications options for consumers. For example, Intelsat and OneWeb together will bring to market HTS services using both geostationary ("GSO") and non-geostationary ("NGSO") satellites, comprising low latency and high throughput capacity at a time which is appropriate to the introduction of future 5G/IoT applications, thus allowing a complementary and supporting satellite solution via the high capacity Epic^{NG} satellites services. This is an important development, providing diversity and flexibility for a country such as Canada, with the vast challenge of distance and coverage of a sparse population density in many places throughout the country.

Intelsat offers the following comments for consideration by ISED.

[1] Consultation, para. 1.

Principled approach to releasing spectrum

Q1 – What future changes, if any, should ISED examine with regard to the existing licensing regime to better plan for innovative new technologies and applications and allow for benefits that new technology can offer, such as improved spectrum efficiency?

Intelsat believes that ISED should streamline and simplify earth station licensing procedures in Canada for satellite terminals, in order to support new mobility and broadband applications. Intelsat urges ISED to continue their studies for earth-station-in-motion ("ESIM") systems, as there is already an increased demand for these systems, in particular in Ku-band.

Further, ISED should review the earth station license fee regime. The current regime is based on throughput, and might not be the most appropriate method taking into account the increased capacity demand for satellite services. As demands for capacity increase, earth stations will transport much larger data volumes than they do today. To keep Canada attractive for the deployment of earth stations, ISED should review and change the current earth station licensing fee structure.

Spectrum demand and technology advancement

Q2 – Do you agree with the above assessment on demand for commercial mobile services in the next few years? Is there additional information on demand, which is not covered above, that should be considered? If so, please explain in detail.

Q3 – What new technology developments and/or usage trends are expected to address traffic pressures and spectrum demand for commercial mobile services? When are these technologies expected to become available?

Q4 – Recognizing the trend of increasing commercial mobile traffic, what operational measures (e.g. densification, small cells or advanced traffic management) are being taken to respond to, and support, increasing traffic? To what extent are these measures effective?

No comments.

Q5 – Do you agree with the above assessment of demand for licence-exempt spectrum in the next few years? Is there additional information regarding demand, which is not covered above, that should be considered? If so, please explain in detail.

Q6 – What new technologies and/or sharing techniques are expected to aid in relieving traffic pressures and addressing spectrum demand for licence-exempt applications? When are these technologies expected to become available?

Q7 – What existing licence-exempt frequency bands will see the most evolution in the next five years? Are there any IoT applications that will have a large impact on the existing licence-exempt bands? If so, what bands will see the most impact from these applications?

Q8 – Will the trend for offering carrier-grade or managed Wi-Fi services continue to increase over the next five years? If so, will this impact congestion in Wi-Fi bands and which bands would be most affected?

No comments.

Q9 – ISED is seeking comments on the above demand assessment for MSS and earth observation applications for the period 2018-2022. Is there additional information on demand, which is not covered above, that should be considered?

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
b) Ku-band
c) Ka-band

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?

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

Intelsat agrees with ISED that the overall global demand for satellite spectrum is expected to grow significantly between 2018 and 2022 due to increased demand for more bandwidth and ubiquitous connectivity. Global broadband requirements are expected to continue to increase, driven by the globalization of business and the need for consumers and businesses to be connected at all times.[2] As the Department has indicated in the Consultation, satellite systems play a vital role in providing communications capabilities, not only in rural and remote areas but also in urban areas, as well as during natural disasters. Terrestrial backbones have limited availability or reliability in some of the fastest growing regions due to vast, undeveloped territories and also are unavailable on the oceans and in the air. Satellite systems, an integral part of global communications for decades, are evolving to support broadband requirements in land, in the air, and at sea.

In the last two years, Intelsat launched seven satellites, including five Epic^{NG} HTS satellites, to meet the growing demand for connectivity, many of them with coverage of Canada. The company has plans to launch several more satellites – both traditional FSS and HTS Epic^{NG}-- in the next four years. Intelsat designed its Epic^{NG} next-generation platform to meet the demands of the new global broadband infrastructure, and in particular mobility applications. Epic^{NG} satellites provide higher throughput and efficiency, and incorporate C-, Ku- and Ka-band spot beams in a high-performance platform that delivers significantly more capacity and more throughput per unit of spectrum.

Connectivity can be made available by satellites in a far shorter time span than awaiting the equivalent terrestrial roll out. New generations of HTS satellites, such as Epic^{NG}, can deliver order-of-magnitude improvement in capacity and data rates. For example, Intelsat's Epic^{NG} HTS fleet can deliver 10 times the throughput of its previous generation of satellites. With multiple spot beams and digital payloads able to be flexibly configured, these satellites are uniquely placed to support broadband applications. Intelsat Epic^{NG} satellites are designed to support, among others, fixed and wireless telecommunications operators, telecommunications service providers for the oil and gas industry, government and military communications, private data network service providers, maritime and aeronautical data service providers, global organizations, and direct-to-home ("DTH") and other television, video distribution and broadcast service providers.

In addition to the technological developments in space, it is necessary to highlight as well technological developments taking place in satellite communication user terminals. In an increased manner, terminal connected by satellites do not require traditional dishes to receive the signal from the satellite. Intelsat, for example, is working with antenna manufacturers to develop flat-panel antennas that can fit discreetly into a vehicle, a train, or an airplane. These antennas are currently working in the Caribbean to restore lost connectivity after recent hurricanes, and are available for commercial Internet access as of the end of 2017. New flat panel

[2] See Consultation, para. 65 ("Consumers and businesses expect to be connected anywhere, anytime, including in areas that are beyond the reach of terrestrial networks.").

antennas -- the first to be designed for mass production -- are able to steer without mechanical components or intervention, and consume little power.

As the Department recognizes throughout the Consultation, spectrum is a valuable resource. Regardless of the frequency band (C-, Ku-, or Ka-band) being used, there is a limited amount of spectrum available for satellite services. Therefore, there is a need for spectrum to be utilized efficiently. One approach is to employ frequency reuse, which refers to a satellite using the same frequency multiple times simultaneously. The more frequency reuse supported, the greater the total bandwidth that spectrum can deliver. Frequency reuse is a concept that is used both by terrestrial (e.g. cellular) as well as by satellite networks. Intelsat has implemented frequency reuse in its satellites for several decades, and incorporates this spectrum efficiency approach in its Epic^{NG} platform. These satellites allow connectivity among multiple spot beams, including star and mesh network configurations, as well as loopback within the same user beam. This HTS solution guarantees backward compatibility with existing networks, and forward compatibility with full flexibility to evolve the network design and technology as and when customers want.

Intelsat wishes to note that C-band spectrum remains an important workhorse of the satellite industry. Intelsat's recent satellite launches and future contracts for new satellites that include communications payloads in C-band show that the demand for such satellite services is still robust. As ISED correctly acknowledges in the Consultation, the popularity of C-band for satellite communications is mainly due to its superior propagation conditions as compared to other higher frequency bands , as C-band frequencies are less susceptible to rain attenuation.[3] Intelsat sees continued strong demand for C-band satellite services in Canada and also other parts of North America, in particular to serve unconnected areas .

In addition, the demand for increased connectivity has placed tremendous strain on Ku- band spectrum, particularly for ubiquitously deployed earth stations, aeronautical satellite services and other in-motion platforms which now have increased the market demand for the use of this frequency band. Furthermore, NGSO satellite systems will provide additional connectivity options across the entire Ku-band frequency range. These various satellite systems will contribute to provide broadband solutions which will help bridge the digital divide, and support the economy in all parts of Canada. Ku-band is one of the most important and heavily used frequency bands by the satellite industry, for very small aperture terminal ("VSAT") applications, satellite news gathering ("SNG"), and video distribution services. In addition, this frequency band is used for uncoordinated and ubiquitous earth stations, for a variety of fixed and in-motion applications. Therefore, Intelsat believes that it is important for ISED to consider the type of growth expected for services and applications supplied by the satellite industry, as this will directly influence the demand on spectrum resources.

The use case for communications on the move is about high-bit rate backhaul connectivity to planes, trains, vehicles, and vessels (including cruise ships and other passenger vessels), with the ability to multicast the same content (e.g., video as well as other non-video data) across a large coverage (e.g., for local storage and consumption), or unicast to individual users or devices. The same capability also allows for the efficient connection of aggregated IoT traffic to and from moving platforms. It assumes that Ku-band satellite connectivity will connect directly with the end user or device, or complement existing terrestrial connectivity, where available (such as, airports, harbors, train stations, connected cars, etc.). Taking into account the technological developments in the satellite arena, Intelsat urges ISED to continue their studies on ESIM systems, as there is already an increased demand for these systems and mobility applications, in particular in Ku-band.

Q13 – Do you agree with the above assessment on demand for backhaul in the next five years? Is there additional information on demand, which is not covered above, that should be considered? If so, please explain in detail.

Q14 – Backhaul service in Canada is delivered using a variety of solutions, including fibre optics, microwave radio and satellites. What changes, if any, are anticipated to the mix of backhaul solutions employed?

[3] See Consultation, para. 73.

Q15 – What and how will technology developments and/or usage trends aid in relieving traffic pressures and addressing spectrum demand for backhaul services? When are these technologies expected to become available?

Q16 – Will the demand for commercial mobile, licence-exempt, satellite, or fixed wireless services/applications impact the demand for backhaul spectrum? If so, how and which of these services/applications will create the most impact?

Q17 – Is there a range or ranges of frequencies that will be in higher demand over the next five years? Why is higher demand anticipated for these frequency ranges?

Q18 –Will allowing flexible fixed and mobile services within the same frequency band change how backhaul is planned and used?

No comments.

Potential frequency bands for future release

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

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.

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.

Q22 – Are there specific frequency ranges/spectrum bands that should be made available for specific applications?

Q23 – Are there any factors that would impact the potential release of these frequency bands between 2018 and 2022?

There are currently important developments under way within the International Telecommunications Union ("ITU") prior to the World Radio Conference in 2019 ("WRC-19"), including Agenda items 1.5, 1.6, 1.13, 1.14 and 9.1.9. Intelsat believes that it would be in Canada's best interest for ISED wait for the outcome of these Agenda items and avoid any decisions that may turn out to be internationally incompatible with the WRC-19 outcomes. This is particularly important given the breadth and number of frequency bands being evaluated under these Agenda Items.

It is also important to note that the frequency bands 40-42.5 GHz, 45.5-50.2 GHz and 50.4-52.6 GHz listed in Table 7 of the Consultation have a Satellite allocation, beside a Commercial mobile and Fixed allocation. Those frequency bands will be very important spectrum for FSS systems in the future, for gateways as well as for user fixed and in-motion terminals. With the increased capacity demand for satellite broadband, these frequency bands will be an important component of the FSS and 5G ecosystem. Therefore, Intelsat is of the opinion that ISED should guarantee access to this spectrum by satellite operators, not only for gateways but also for satellite user terminals. In particular, ISED should also lift the current restriction in the 39.5-40.5 GHz band (Footnote C49 to the Canadian Table of Frequency Allocation), which limits the use of this band to the Government of Canada. Removal of this restriction would harmonize this important future spectrum band for increased economy of scales as well as efficient spectrum utilization.

A number of millimeter wave bands in higher parts of the spectrum will be considered for 5G/IMT-2020 terrestrial mobile services under WRC-19 Agenda Item 1.13, including the 66-76 GHz and the 81-86 GHz frequency bands.

Intelsat believes that it should be possible at WRC-19 to identify adequate spectrum in these frequency bands to meet terrestrial 5G requirements, without contending with existing and planned uses of spectrum in these bands by satellite services and applications.

The 66 GHz band, in particular, is considered very good prospects for international harmonization for 5G terrestrial mobile services, given the limited existing and planned use of this band by other radio services. The 66 GHz and 81 GHz bands in the “high” end of the millimeter wave bands should yield about 15 GHz of spectrum - which is relatively lightly used by other systems - in contiguous blocks of at least 5 GHz, which could support very wide-band 5G/IMT-2020 carriers as have synergies with WiGig devices.

Intelsat appreciates the opportunity afforded by the Department to submit comments in response to the Consultation, and looks forward to participating further in this proceeding.

Sincerely yours,

/s/ Hazem Moakkit

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Intelsat Corporation