COMMENTS OF TELESAT CANADA

In response to:
Canada Gazette, Part I, October 21, 2017, *Consultation on the Spectrum Outlook 2018 to 2022*, SLPB-006-17 and *Canada Gazette*, Part I, December 30, 2017, *Extension to the Comment Period: Consultation on the Spectrum Outlook 2018 to 2022*, SLPB-010-17

TELESAT CANADA

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COMMENTS OF TELESAT CANADA

1 Telesat Canada (Telesat) welcomes the opportunity to provide these Comments in response to the *Consultation on the Spectrum Outlook 2018 to 2022*, SPLB-006-17 (the Consultation Document)[1] issued by Innovation, Science and Economic Development Canada (ISED or the Department).

I. INTRODUCTION

2 Telesat applauds the Department for taking a holistic view of spectrum requirements over the next five years and considering satellite requirements, along with commercial mobile, fixed and licence-exempt requirements, for spectrum over the period. As recognized in the Consultation Document, satellite systems play a vital role in the provision of essential communications services to locations that are not served by terrestrial infrastructure, including rural, remote and northern parts of Canada, in the delivery of broadcasting signals to cable head-ends and directly to consumers throughout the country, in the provision of communications services when terrestrial infrastructure has been disabled due to emergencies such as natural disasters, and in supporting national security and environmental monitoring requirements.

3 Satellite services will also play an increasing role in addressing rapidly growing demand for ubiquitous high-speed broadband data services and addressing the digital divide over the next five years. New satellite technologies, such as high throughput satellite (HTS) technology, low earth orbit (LEO) satellite constellations, earth-station-in-motion (ESIM) systems, and developments in antenna technology are reducing the costs of satellite infrastructure and increasing satellite capacity available to deliver high-speed data services in response to this

[1] Published in the *Canada Gazette*, Part I, December 30, 2017 [*Consultation Document*].

demand. LEO constellations will also support low latency applications, including 4G and 5G backhaul and IoT applications, such as connected cars. These new satellite technologies will enable satellite operators to meet the growing demand for high speed broadband data satellite services to and from all locations, including areas that are not served by terrestrial networks, provided that sufficient spectrum is available for satellite user terminals and gateway earth stations.

4 As recognized in the Consultation Document, C-band fixed satellite-service ("FSS") is used extensively for the delivery of broadcasting services throughout Canada, as well as to support vital communications services to locations that are not served by terrestrial networks, including telephone and Internet connectivity to rural and remote communities. There is a large installed base of C-band satellite infrastructure that supports these critical services. No significant change in broadcasting demand for C-band FSS is forecast within the next five years. In addition, the use of C-band has increased significantly over the past several years, supporting delivery of greater Internet connectivity to rural and remote communities. The majority of Telesat's C-band data services customers are also indicating that Ka- and Ku-band broadband satellite services will supplement (and not replace) existing C-band services. C-band satellite services will be retained for redundancy and diversity, and because they are less prone to rain fade. As a result, C-band use is expected to continue to grow over the period covered by the Consultation Document.

5 Existing C-band licensees and their customers must therefore be protected from any potential re-allocation of C-band frequencies that interferes with or diminishes FSS use of the band.

6 Telesat also agrees with the Department that Ku-band satellite spectrum is heavily used for the delivery of broadcasting and broadband data services and demand for this spectrum is expected to remain strong. Demand for Ka-band satellite spectrum is growing rapidly, also in response to the growing demand for broadband data services in all market segments – consumer, business and government. Telesat and other operators have already deployed a number of high throughput geo-stationary Ka-band satellites and additional satellites are planned. The new LEO constellations that will initially be deployed use Ka-band satellite frequencies. Existing Ku and Ka-band satellite spectrum is therefore expected to be fully utilized and, as a result, satellite operators are already planning new satellite systems in the V-band.

7 Therefore and as proposed by the Department, V-band spectrum allocations to satellite services are required. Clarity on the V-band spectrum available for satellite user terminals and gateway earth stations will assist satellite operators in planning V-band satellite systems to meet growing demand. The current Ka-band allocation to FSS at 24.75-25.25 should also be retained, in the event that the Department decides to release spectrum in the 24.25-27.5 GHz band for terrestrial use.

8 Satellite operators are also beginning to look at E-band and higher spectrum for satellite services. Accordingly, should the Department proceed to release portions of these frequencies, it should ensure that satellite services will be able to access dedicated and shared E-band spectrum.

II. DETAILED COMMENTS

9 This section responds to a number of specific issues raised in the Consultation Document. For convenience, the questions and issues set out in the Consultation Document are set out below, highlighted in grey, with Telesat's comments on each issue following.

B. SPECTRUM DEMAND AND TECHNOLOGY ASSESSMENT

SATELLITE

Question 10: 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 bands below?

a) C-band

b) Ku-band

c) Ka-band

10 Surging demand for ubiquitous data services is expected to significantly increase demand for FSS over the next five years. Satellites are ideally suited to address this demand, given their broad coverage areas and ability to support anywhere, anytime connectivity. Due to the security and resiliency of satellite networks, they also address demand for highly secure, mission critical services and provide critical back-up to terrestrial services that are disabled by natural disasters or other emergencies.

11 Demand for satellite services from all customer segments – consumer, business and government – is expected to grow substantially. Key areas of strong and growing demand for satellite services include demand for data services to areas that are beyond the reach of terrestrial networks (e.g., demand for connectivity in unserved and underserved areas and on ships and planes), and demand generated by IoT, connected cars, and other applications that require global

connectivity. Demand for satellite backhaul services, supporting 5G extension, IoT and other services, is also expected to increase.

12 As explained in the response to Q.11, new satellite technologies will enable satellite networks to meet the increased demand for satellite services, provided that sufficient spectrum is available. HTS satellites support higher speed broadband service at lower cost. High capacity, low latency LEO constellations will support fibre-like broadband communications, to meet demand for rural and remote connectivity, satellite backhaul, aviation connectivity and maritime connectivity.

13 Meanwhile, longstanding broadcasting use of C-band and Ku-band satellite spectrum should remain relatively constant over the next five years, with some increasing demand pressure from 4K TV.

14 Demand for FSS satellite spectrum is therefore expected to exceed existing satellite spectrum allocations and, as a result, satellite operators are already looking to FSS spectrum in the V-band for future satellite deployments.

C-band

15 As stated in the Consultation Document, C-band is used extensively in Canada for the delivery of satellite services. C-band's favourable propagation characteristics support delivery of a more robust signal than other bands. This quality, along with the ability of C-band to support wide-beam coverage and mesh connectivity, are critical to existing users of C-band satellite services.

16 C-band satellite services are used to deliver Canadian and US broadcasting signals to cable head-ends and to deliver vital telephone and broadband communications to rural and remote communities. C-band satellite services are also used to support critical communications systems, including NAVCAN aircraft communications, the North Warning System and the High Arctic Data Communication System.

17 Telesat expects demand for C-band satellite applications to continue to grow over the next five years as customer demand for higher speeds and greater Internet connectivity increases. Telesat's customers are indicating that they do not intend to release existing C-band capacity when they acquire new Ku and Ka-band broadband satellite services. Rather, they intend to retain these C-band satellite services to provide diversity and redundancy. If any C-band capacity is freed up, it can be used to provide higher capacity/speed broadband service in other communities, using a community aggregator model. In addition, broadcasting demand for C-band satellite services may increase slightly as 4K TV is rolled out.

18 Therefore, Telesat expects demand for C-band satellite services to remain strong over the next five years.

Ku-band

19 Ku-band satellites services are used to deliver Direct-to-Home (DTH) broadcasting services, as well as for consumer, enterprise and government data services.

20 Telesat agrees with the Department that Ku-band satellite spectrum is highly congested today and will remain so over the foreseeable future. As noted in the Consultation Document,

although the number of DTH subscribers may decline slightly, this will not materially affect the demand for Ku-band satellite services. 4K TV, once launched, will also increase broadcasting demand, as advanced compression technologies will not fully offset the additional bandwidth required.

21 In addition, demand for Ku-band satellite broadband services is forecast to remain strong over the next five years. While demand for Ku-band satellite services is growing across all market segments, growth has been, and is expected to continue to be, particularly significant in the aeronautical and maritime markets, supported by advancements in ESIMs and antenna technology. Although HTS technology permits more efficient use of available Ku-band spectrum for broadband use, increased traffic will more than offset these efficiencies.

22 Accordingly, Ku-band satellite spectrum is expected to remain highly congested.

Ka-band

23 Satellite operators are increasingly turning to Ka-band spectrum for new GSO and NGSO satellites, due to congestion in the Ku-band. Telesat agrees with the Department that demand for Ka-band satellite services is growing and will continue to grow significantly over the next five years, fueled by growth in demand for broadband Internet and data intensive applications. As an example of demand for Ka-band broadband capacity, Telesat has signed long term contracts for all of the Ka-band HTS capacity over the eastern part of Northern Canada on its Telstar 19 VANTAGE satellite that is scheduled to be launched later this year.

24 Demand for Ka-band satellite services is therefore expected to exceed the capacity of Ka-band spectrum that has been allocated to satellite services over the next five years.

Question 11: 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?

25 The Consultation Document identifies a number of important developments in satellite technology, such as HTS technology, ESIM systems and LEO satellites. While a technology such as HTS significantly increases spectral efficiency, HTS satellites, ESIM systems and LEO satellites along with other technological developments such as advances in Close-Circuit Television (CCTV) and 4K TV are all expected to drive increased satellite traffic and demand for satellite spectrum over the next five years.

HTS Technology

26 As stated by the Department in the Consultation Document, HTS technology uses multiple spot beams, a high level of frequency re-use and advanced coding techniques to increase spectral efficiency, significantly enhancing satellite broadband capability. Telesat's existing Telstar 12 Vantage satellite uses HST technology, and its Telstar 18 Vantage and 19 Vantage HTS satellites which are expected to be launched later this year include HTS Ku-band and/or Ka-band spot beams. Other satellite operators have also launched and/or are planning to launch HTS satellites. The next generation of BSS satellites will also incorporate HTS technology to support on-demand video capability, with individual streams dedicated to single users.

27 HTS technology cannot effectively address spectrum requirements for the delivery of DTH or broadcasting services to cable head-ends, as these services require the delivery of the same content unicast to each subscriber or head-end across wide geographic areas. Therefore, a combination of HTS and broad beam BSS offers the most efficient and effective approach to delivering linear and on-demand content to a large number of users. In addition, while HTS technology represents a significant improvement in spectral efficiency and satellite broadband capacity, it is expected that growth in demand will more than offset these efficiency gains.

28 Additional spectrum will therefore be required to support satellite user terminals and gateways for HTS services. User terminals are ubiquitous and require exclusive spectrum. Gateways may be able to share spectrum with other services, provided there is a reasonable and well-defined regulatory framework.

ESIMs

29 Telesat agrees with the Department that demand for ESIMs is expected to increase over the next five years, in response to growing demand for mobile connectivity. This demand is also being supported by technological developments, such as phased array antennas and advanced digital processing. Current ESIM traffic to maritime and aeronautical customers has already put significant pressure on Ku-band, and increasing demand will need to be supported at Ka-band.

Low Earth Orbit NGSO satellites

30 LEO systems are also being deployed to meet demand for ubiquitous high-speed satellite data services. As stated in the Consultation Document, the deployment of these constellations is

supported by advances in satellite technology, including the availability of lower cost satellites and satellite launches, and developments in antenna technology.

31 High capacity, low latency LEO systems will support fibre-like connectivity anywhere, including high-speed broadband and the extension of 5G services to rural and remote communities and other locations that are not served by terrestrial networks, 5G backhaul, and IoT/M2M applications such as connected cars. Telesat's Ka-band and V-band LEO constellations have been licensed by ISED and Telesat launched a Phase 1 Ka-band LEO satellite in January of this year. A number of other operators have proposed LEO constellations that would cover all or portions of Canada.

32 LEO constellations will significantly increase satellite requirements for both user terminal and gateway spectrum.

4K TV

33 Telesat agrees with the Department that 4K TV requires more bandwidth and, as a result, advances in compression technologies will be important to the roll-out of 4K TV. However, even with advanced compression technologies, 4K TV is expected to require additional BSS and FSS spectrum.

Other

34 Other technology developments, such as advances in in flat panel antennas (FPAs) and in CCTV, are driving increased demand for satellite services and spectrum. Advances in FPAs, for

example, have improved user terminal performance and cost-effectiveness, increasing the attractiveness and capability of satellite services. Advances in CCTV support new real-time monitoring and data intensive applications in areas that are only or best-served by satellites.

Question 12: What satellite applications (e.g. broadband Internet, video broadcasting, backhaul, etc.) do you consider a priority for the period 2018-2022?

35 Addressing demand for all satellite applications is a priority. However, Telesat does expect that broadband data services, including broadband Internet will be a primary driver of increased demand for satellite services over the 2018 to 2022 period. These data services will in turn support new and existing applications, including OTT video. As discussed below, LEO constellations will address growing demand for backhaul solutions. Video broadcasting will remain a critical application.

BACKHAUL

Question 14: 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?

36 New LEO constellations will support high speed, low latency, resilient and secure backhaul services. Key demand segments are the mobile community (both for extension of service to remote communities and to meet urban traffic requirements), IoT and connected cars, as well government/military and other enterprise applications requiring ubiquitous, high speed backhaul services. Accordingly, Telesat expects that satellite will play an increasing role in the provision of backhaul services.

C. POTENTIAL FREQUENCY BANDS FOR FUTURE RELEASE

Question 19: Provide, with rationale, your view of the above assessments on the bands being considered internationally for commercial mobile, fixed, satellite, or licence-exempt.

3500 MHz

37 As discussed above, Telesat expects the demand for C-band satellite services to continue to grow over the next five years and C-band FSS will remain critical to the delivery of vital communications services, including both broadcasting services and broadband services, throughout Canada. Existing C-band licensees and their customers must be protected from any interference resulting from re-allocation of C-band frequencies.

28 GHz, 37 GHz, 38 GHz and 64-71 GHz

38 Telesat's position on release of the above-referenced bands is set out in its submissions in the *Consultation on Releasing Millimetre Wave Spectrum to Support 5G*.

Question 20: 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.

24.25-27.5 GHz

39 The 24.25-27.5 GHz band is included in Table 7 of the Consultation Document as a potential band for release in the near term to commercial mobile, fixed and licence-exempt use. A portion of this band, namely, 24.75-25.05 GHz, is allocated to FSS on a primary basis, and

25.05-25.25 GHZ is allocated to FSS on a co-primary basis with fixed service, subject to Canadian footnote C44, which grants fixed service priority over FSS in 25.05-25.25 GHz.

40 In its recent *Spectrum Frontiers Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum of Opinion and Order*,[2] the FCC has proposed to facilitate shared use of the 24.75-25.25 GHz band by FSS for individually-licensed earth stations that satisfy siting requirements. Access to this spectrum provides satellite operators with important flexibility in designing their systems to meet the growing demand for Ka-band satellite services, particularly if access to other shared Ka-band spectrum is subject to siting restrictions. Telesat therefore proposes that any release of the 24.25-27.5 GHz band to commercial mobile, fixed or licence-exempt use provide for continued use of 24.75-25.25 GHz band by FSS.

<u>40-42.5 GHz, 45.5-50.2 GHz and 50.4-52.6 GHz</u>

41 Table 7 identifies the V-band frequencies 40-42.5 GHz, 45.5-50.2 GHz and 50.4-52.6 GHz as potential bands for release to commercial mobile, fixed and satellite services or applications over the next five years.

42 As discussed above (in response to Q10), demand for FSS is forecast to grow significantly and to outstrip available satellite spectrum in the C, Ku and Ka-bands over the period. Indeed, satellite operators are currently planning satellite systems using additional

[2] *Spectrum Frontiers Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum of Opinion and Order*, FCC 17-152 (November 16, 2017) (the "*Spectrum Frontiers Second Report and Order*"), paragraphs 90-97.

spectrum bands, such as the V-band, for the dedicated spectrum that they require for user terminals and the spectrum that is necessary for satellite gateways. Telesat, for example, has been licensed to use V-band spectrum, including spectrum in the identified ranges, for its V-band LEO constellation. The FCC has also recently affirmed that in the U.S., the 40-42 GHz and 48.2-50.2 GHz bands are allocated exclusively to satellite use, while the 37.5-40 GHz and 47.2-48.2 GHz bands are available for FSS on a shared basis. (*Spectrum Frontiers Second Report and Order*, paragraphs 185-192) Canada should similarly take steps in the near term to identify dedicated satellite spectrum in the V-band, as well as V-band spectrum for use by satellite gateways that may be shared with other services.

71-76 GHz and 81-86 GHz

43 Table 7 identifies the E-band frequencies 71-76 GHz and 81-86 GHz as potential bands for release to fixed, commercial mobile and licence-exempt services or applications in the 2018-2022 period.

44 The 71-76 GHz and 81-86 GHz bands are currently allocated on a co-primary basis to FSS and satellite operators are considering these bands for future satellite systems. Therefore, any allocation of this spectrum should ensure that E-band frequencies will be available for satellite user terminals and gateways.

Question 21: Are there any other bands that should be considered for release in the next five years for commercial mobile, fixed, satellite or licence-exempt use that are not discussed above? Provide rationale for your response.

45 In Canada, FSS use of the 39.5-40.5 GHz band is reserved for the Government of Canada. A similar restriction does not exist in the U.S. The FCC has also recently confirmed

that some of this spectrum (40-40.5 GHz) is dedicated to FSS, while the remainder of the band is available to FSS on a shared basis. (*Spectrum Frontiers Second Report and Order*, paragraphs 190-192) Allowing non-government use of this spectrum for FSS will support the deployment of advanced satellite systems in V-band to address the growing demand for satellite data services in Canada.

III. CONCLUSION

46 In conclusion, Telesat commends the Department for its comprehensive assessment of the demand for satellite services and spectrum in 2018 to 2022. Telesat concurs with ISED's conclusion that satellite services will require V-band spectrum to meet growing demand. Existing Ka-band spectrum allocations to satellite services should also be retained, including the allocation at 24.75-25.25 GHz. At some point, satellite services will also require E-band spectrum allocations. Finally, demand for C-band FSS, which supports critical communications services, is expected to remain strong and any potential reallocation of C-band frequencies must ensure that existing FSS licensees and their customers are protected from interference from new services.

All of which is respectfully submitted on behalf of TELESAT CANADA

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