

**Before
INNOVATION, SCIENCE AND ECONOMIC DEVELOPMENT CANADA
Ottawa, ON K1A 0H5**

In the Matter of)	
)	
Consultation on the Spectrum Outlook 2018 to 2022)	Canada Gazette, Part I
)	October 21, 2017
)	Notice No. SLPB-006-17

COMMENTS OF NOKIA

Nokia respectfully submits Comments in response to the above-captioned Consultation from Innovation, Science and Economic Development Canada (“ISED”) on the Spectrum Outlook 2018 to 2022.

Nokia offers unparalleled leadership in the technologies that connect people and things. Nokia is leveraging its strengths to create a new type of network that is intelligent, efficient, and secure, and which will serve as a critical enabler of many capabilities and use cases associated with the Internet of Things (IoT). We are weaving together the networks, data, and device technologies to create the universal fabric of our connected lives. In this new paradigm, new applications and data will flow without constraint, services and industry will automate and run seamlessly, and communities and businesses can rely on privacy, security, and near instant response times by connecting through the cloud. The role of analytics and data science in this world will be a significant contributor to the design of new infrastructure and services supporting the network and creating value to fuel investment and innovation.

Nokia brings together, in one company, mobile broadband with fixed line access, and the underlying IP routing and optical technology that connects them. Nokia has made pioneering

advancements in reducing the footprint of mobile base station infrastructure, from compact yet full power macro sites down to the full range of small cell solutions, which are expected to be critical to enabling 5G deployment and the IoT. Nokia also offers the industry's most comprehensive portfolio of services for integrating heterogeneous networks ("HetNets"), encompassing analysis, optimization, deployment, and management. With approximately 40,000 employees focused exclusively on research and development ("R&D"), including a major R&D center in Ottawa, Nokia is well placed to play a leading role in shaping the new revolution in connectivity.

In these Comments, Nokia addresses the spectrum bands that it believes should be the focus for ISED over the next 5 years for the purpose of unlocking the promise of terrestrial broadband, both fixed and mobile. We discuss priority bands, some of which were identified in previous consultations and some of which are newly added to the proposed spectrum pipeline, divided into three categories: (1) low-band spectrum, (2) mid-band spectrum, and (3) high-band spectrum.

I. LOW-BAND SPECTRUM IS KEY TO WIRELESS COVERAGE THROUGHOUT CANADA: 600 MHZ, 800 MHZ, L-BAND, AWS-2 AND AWS-3

Spectrum bands below 3 GHz, and especially below 1 GHz, remain the gold-standard for coverage in mobile networks, and it also is rare to have opportunities to unlock new spectrum in that range.

600 MHz Band. The Consultation recognizes the 600 MHz band as a band that Canada is repurposing for mobile broadband in collaboration with the U.S.¹ Nokia agrees with this approach, and with Canada adopting the U.S. band plan to free up 70 MHz of spectrum for

¹ *Consultation on the Spectrum Outlook 2018 to 2022*, Innovation, Science and Economic Development Canada, SLPB-006-17 (Oct. 21, 2017) at ¶ 108 ("*Spectrum Outlook Consultation*").

commercial mobile services. Based on our work with service providers in the U.S., Nokia expects this band to be used for 4G LTE as well as for 5G wireless networks. Nokia urges ISED to complete its consultation on this band and move toward issuing licenses to facilitate deployment without delay.

800 MHz Band. Nokia agrees with ISED’s assessment that “The 800 MHz spectrum is attractive as service provisioned over lower frequencies can reach subscribers at a greater distance.”² Indeed, the appeal of this band is similar to 600 MHz, including the fact that the band is allocated to mobile broadband in the U.S. There are already mobile devices as well as network equipment available in this band. The Consultation recognizes that “harmonizing this band would ease cross-border coordination, interoperability, economies of scale and roaming between countries.”³ This is a clear near-term choice for the ISED spectrum pipeline and should be part of Canada’s 5-year plan for spectrum.

L Band. In the Consultation, ISED concludes that, because the majority of the L-band (1427-1518 MHz) is expected to be globally harmonized, that there is little current use of this band in Canada and that there is expected to be a global equipment ecosystem, the L-band or portions thereof could be released for fixed and mobile use.⁴ Nokia agrees.

AWS-2 and Unpaired AWS-3 Bands. The AWS-2 band covers the frequency range 1915-1920 MHz /1995-2000 MHz (also referred to as PCS H Block in the U.S.). The downlink part of the spectrum (1995-2000 MHz) is now part of 3GPP Band 70. The AWS-3 unpaired band (1695-1710 MHz) is also part of Band 70.

Dish Network has announced plans to construct a low power narrow-band IoT (NB-IoT)

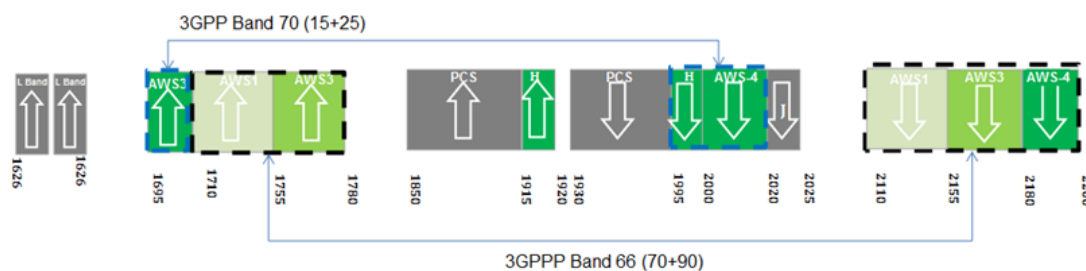
² *Id.* ¶ 121.

³ *Id.*

⁴ *Id.* ¶ 132.

network in the U.S., which will be deployed on AWS-4 spectrum (2000-2020 MHz/2180-2200 MHz).

Nokia agrees with ISED that equipment covering the unpaired AWS-3 spectrum will become available within the next five years and as a result, the AWS-3 unpaired spectrum could be made available for commercial mobile.⁵ Since AWS-2 and the unpaired AWS-3 will likely be covered by the same equipment ecosystem (band 70), we recommend that ISED also make available the AWS-2 spectrum at the same time as the unpaired AWS-3 block.



II. MOVING EXPEDITIOUSLY ON MID-BAND SPECTRUM FOR TERRESTRIAL MOBILE – INCLUDING AT 3.475-3.7 GHz AND 3.7-4.2 GHz – IS CRITICAL TO CANADA’S NEAR-TERM SPECTRUM STRATEGY

Nokia urges ISED to issue service rules and auction mid-band spectrum as part of its 5-year outlook, in particular in the 3.5 GHz (3.475-3.7 GHz) and 3.7-4.2 GHz band. While Nokia is pleased that the Consultation seeks to expand beyond the 3.5 GHz band to cover the entire range 3475-4200 MHz,⁶ we ask that ISED not allow this to slow deployment in Canada of the 3.5 GHz range, for which U.S. deployments are expected to commence starting as soon as late 2018. Therefore, we advocate that ISED move quickly to facilitate deployment at 3.5 GHz in the next 8 to 12 months, and that deployment in the 3.7-4.2 GHz range would come next in the pipeline.

⁵ *Id.* ¶ 134.

⁶ *Id.* ¶ 142.

A. The 3.5 GHz Band (3.475-3.7 GHz)

Spectrum in the 3 GHz range has favorable propagation characteristics compared to high-band spectrum, but provides larger bandwidth than is available today in low-band spectrum. Notably, the propagation characteristics in the 3 GHz range supports the existing grid of wireless sites, and thus is perfectly suited to overlay (macro sites) as well as underlay (micro of outdoor small cell) deployment. These deployments would accelerate the mass rollout and adoption of the 5G ecosystem in Canada supporting the promise of new services and business opportunities for Canadians. The contiguous bandwidth in the 3.5 GHz band allows service providers to achieve peak throughput performance and capacity that lives up to the expectations of 5G.

The 3.5 GHz range is also being considered in other regions and countries for 5G and has the potential to become a globally harmonized range. Canada would be well-served to stay on the leading edge with other innovative countries to unlock the promise of mid-band spectrum for 5G.

B. The 3.7-4.2 GHz Band

Nokia also urges that ISED explore additional mid-band spectrum, such as the 3.7-4.2 GHz band shortly after that. For years, Nokia has actively advocated for opening the 3.7-4.2 GHz and the 3.1-3.55 GHz portions of the 3 GHz band for licensed terrestrial mobile broadband services in the U.S. When combined with the U.S. 3.5-3.7 GHz band, those bands would provide more than 1 GHz of contiguous spectrum for mobility.

While we see substantial benefits to unlocking the full 3 GHz band, Nokia supports ISED including the upper portion of the band (3.7-4.2 GHz) in its 5-year outlook, consistent with the spectrum pipeline being driven in the United States. The 3.7-4.2 GHz range has strong potential for innovative wireless applications for several reasons:

Favorable propagation characteristics: The 3.7-4.2 GHz range has similar propagation characteristics to the 3.5 GHz band but even more promise for 5G services, based on greater bandwidth. We anticipate greater opportunity in the 3.7-4.2 GHz band to minimize encumbrances, thus creating a “cleaner” interference environment for 5G terrestrial deployments.

Adjacent to terrestrial use at 3.475-3.7 GHz range. As noted above, the 3.7-4.2 GHz range is just above the 3.475-3.7 GHz range and, when combined, can provide 725 MHz of contiguous spectrum that could enable extreme broadband delivery.

Global harmonization. The 3.475-4.2 GHz range is also being considered in other regions and countries for 5G and has a potential to become a globally harmonized range. As discussed above, these bands are a key priority for the United States. Other regions of the world, however, are moving even faster on these bands. For instance, on September 14, 2016, the European Commission published its 5G action plan which mentions that the “3.5 GHz band seems to offer high potential to become a strategic band for 5G launch in Europe.”⁷ The 3.5 GHz and 4 GHz ranges are also being considered in Japan and China.⁸ 3GPP is specifying a 5G New Radio (NR) band that covers 3.3-4.2GHz range. Spectrum harmonization helps to achieve economies of scale, enables global roaming, reduces equipment design complexity and improves spectrum efficiency.⁹ All of this ultimately reduces costs for consumers. In particular, device costs are a significant issue as widely supported spectrum bands and channels can lower the

⁷ See 5g for Europe, Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, *5G for Europe: An Action Plan*, Sept. 16, 2016, available at <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-588-EN-F1-1.PDF>.

⁸ See *Asia gets busy with latest 5G projects in Japan and China*, Mobile Europe, Nov. 9, 2016, available at <http://www.mobileeurope.co.uk/press-wire/asia-gets-busy-with-latest-5g-projects-in-japan-and-china>.

⁹ See Document 5D/246-E, Canada’s input to ITU-R WP 5D, “Technical perspective on benefits of spectrum harmonization for mobile services and IMT,” 23 January 2013.

crucial radio frequency (RF) component costs. Harmonization also aids in addressing cross border coordination.

III. HIGH-BAND SPECTRUM

A. Highest Priority Spectrum Bands in Tables 6 and 7: 24.25-27.5 GHz, 28 GHz, 37-40 GHz, 47 GHz, and 64-71 GHz

Nokia agrees that the high-band spectrum identified by ISED shows great promise for the next generation of wireless and should be priority mmWave bands for the near term. Nokia suggests that Canada focus on the following bands as its priority high-band spectrum ranges, as they are already on the cusp of deployment in the United States: (1) 24 GHz; (2) 28 GHz; (3) 37-40 GHz; (4) 47 GHz, and (5) 64-71 GHz. In 2016 and 2017, the U.S. Federal Communications Commission (“U.S. FCC”) issued service rules for each of these spectrum ranges. Further, three of these spectrum ranges (28 GHz, 37-40 GHz and 64-71 GHz) are also under consideration in a 2017 Consultation, SLPB-001-17 (*“Millimetre Wave Consultation”*), on which Nokia submitted comments.

24.25-27.5 GHz Band. Nokia supports the ISED’s review of the 24.25-27.5 GHz range, which is being studied in International Telecommunication Union (ITU) leading up to the World Radiocommunication Conference of 2019 (WRC-19). That spectrum range presents an excellent opportunity for global harmonization and implementation. Nokia has recommended that the U.S. open the whole 24.25 to 27.5 GHz range for 5G, not just the 24.25-24.45 GHz and 24.75-25.25 GHz portions of the range considered by the U.S. FCC. Similarly, we favor Canada’s consideration of that entire range. Indeed, given the interest in 26.5-29.5 GHz in Korea, 24.25-27.5 GHz in Europe, 24.75-27.5 GHz in China and 27.5-29.5 GHz in Japan, this would allow the U.S. to leverage the ecosystem being developed globally and create around 4 GHz of contiguous spectrum for 5G that includes the 24 GHz, 26 GHz and 28 GHz bands.

28 GHz (27.5-28.35 GHz). Nokia agrees with ISED's proposed changes to its frequency allocations and policies to introduce flexible use licensing in the 28 GHz band, set out in the *Millimetre Wave Consultation*. Nokia recommends that ISED adopt a band plan and rules aligned with the United States, with two blocks of 425 MHz each. Such alignment will facilitate equipment harmonization and simplify coordination along the border. One key factor in moving quickly on 28 GHz is that, in the United States, an auction is not required for large portions of the band already held and licensed. As such, an equipment ecosystem for terrestrial mobile services in that band could launch more quickly compared to certain other bands awaiting an auction as a necessary step toward any similar deployments.

37-40 GHz. Nokia supports the ISED's proposal in the *Millimetre Wave Consultation* to implement flexible fixed and mobile use licensing in the 37-40 GHz frequency band. Nokia fully supports ISED's proposal to align with the new band plan adopted in the United States for the 37.6-40 GHz band plan comprised of 200 MHz blocks. Nokia also agrees that it is prudent for ISED to allow the U.S. band plan to further develop for the range 37-37.6 before adopting a Canadian band plan. However, it is important to note that the U.S. treatment of that lower 600 MHz portion of the band involves sharing with U.S. Federal Government uses not present in the proposed Canadian structure. If the U.S. adopts aspects of its rules that limit commercial operations to accommodate potential U.S. Federal uses, such limitations may not make sense in Canada.

47 GHz (47.2-48.2 GHz). The Consultation references 45.5-50.2 GHz as a potential band for release between 2018-2022.¹⁰ Nokia supports this goal, but suggests that ISED prioritize 47.2-48.2 GHz within that range. The 47 GHz band was among the bands for which the U.S.

¹⁰ *Spectrum Outlook Consultation* at Table 7.

FCC recently issued service rules and will likely be deployed in the U.S. in the near term. As such, an equipment ecosystem likely will evolve more quickly for 5G in that portion of the larger spectrum range.

64-71 GHz Band. In its *Millimetre Wave Consultation*, ISED proposes to authorize unlicensed operations in the 64-71 GHz band, creating a 14 GHz block of unlicensed spectrum when combined with the adjacent 57-64 GHz band. While Nokia supports the allocation of additional spectrum for unlicensed services, we note that the ISED's proposal would result in a vast imbalance in the amount of unlicensed and licensed spectrum considered for near-term release by Canada in high-band spectrum ranges: 7 GHz of allocated for unlicensed operations (from 64-71 GHz) versus only 3.85 GHz allocated for licensed operations in 28 GHz, 37 GHz and 39 GHz. Moving forward, the amounts of licensed spectrum and unlicensed spectrum should be more balanced. Some candidate bands for licensed spectrum include the 24 GHz and 47 GHz, as discussed above, as well as the bands discussed in the following section.

B. Additional High-Band Ranges to Prioritize between 2018 and 2020

There are a number of additional bands that Nokia believes will be key 5G bands, but that may be released after the bands discussed above. Nokia believes it is imperative, however, to continue to study bands that are part of the spectrum pipeline, and has put substantial engineering resources into innovative uses for the following bands.

32 GHz, 42 GHz and 51 GHz bands. Nokia recommends that ISED consider allocating and developing service rules for 31.8-33.4 GHz (32 GHz), 42-42.5 GHz (42 GHz), and 50.4-52.6 GHz (51 GHz) for flexible licensed terrestrial use, taking into account the study that T-Mobile submitted to the U.S. FCC showing that 5G can readily coexist with Radio Astronomy Services ("RAS") and the Earth Exploration Satellite Service ("EESS") that are in the adjacent bands to

these bands.¹¹ Nokia is pleased that each of these ranges are encompassed in Table 7 of the Consultation.

70/80GHz. The 71-76 GHz and 81-86 GHz band offer great opportunity for introduction of mobile services, with the large amounts of spectrum available, with the understanding that fixed microwave usage that already exists needs to be protected. Nokia has conducted analysis that demonstrates that terrestrial mobile and fixed sharing is feasible. Further, massive MIMO technologies make possible propagation characteristics, and similar base station form-factors, similar to lower mmWave bands, such as the 37 GHz band. Nokia therefore agrees with the Consultation's inclusion of these bands in the 5-year outlook for both Fixed and Commercial Mobile services.

95 GHz and Above: Nokia also supports ISED's inclusion in its 5-year outlook of spectrum above 95 GHz. However, Nokia urges that ISED should consider these bands for both terrestrial fixed and mobile communications uses, not just fixed. Furthermore, ISED should consider this spectrum for licensed services as well as license-exempt. To help lead the way for the next leap forward in wireless technologies and further push the spectrum frontiers, Nokia is joining with other technology leaders in founding the mmWave Coalition,¹² which supports the establishment of a regulatory framework to permit the use of radio frequencies above 95 GHz that will assist in bringing new applications to the market for these bands.

¹¹ See Letter from Steve B. Sharkey, Vice President, Government Affairs, Technology and Engineering Policy, T-Mobile USA, Inc., to Marlene Dortch, Secretary, Federal Communications Commission, IB Docket Nos. 15-256 and 97-95, WT Docket No. 10-112, filed Oct. 2, 2017.

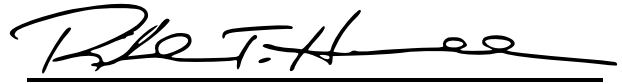
¹² See, Monica Allevan, *Nokia Leading Effort to Push for Spectrum Above 95 GHz*, FIERCE WIRELESS, Dec. 1, 2017, available at <https://www.fiercewireless.com/wireless/nokia-leading-effort-to-push-for-spectrum-above-95-ghz>; Home Page, mmWave Coalition, available at <http://mmwavecoalition.org/> (visited Jan. 22, 2018).

IV. CONCLUSION

Nokia appreciates ISED's efforts to ensure that Canadian consumers, businesses and public institutions continue to benefit from the latest wireless telecommunications services across the country. Nokia stands ready to work with ISED to meet this goal and urges ISED to unlock the promise of spectrum for 5G as discussed in these Comments.

Respectfully submitted,

Nokia

A handwritten signature in black ink, appearing to read 'R. T. Herald', written over a horizontal line.

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