

SaskTel Comments:

Gazette Notice SLPB-006-17

Consultation on the Spectrum Outlook
2018 to 2022

February 16, 2018

EXECUTIVE SUMMARY

1. The following represents a summary of SaskTel's Comments in response to SLPB-006-17, *Consultation on the Spectrum Outlook 2018 to 2022* ("the Consultation").
2. SaskTel has reviewed the Department's Spectrum Outlook in the Consultation, including assessments of spectrum bands and candidate spectrum bands for future release. The consultation on the Spectrum Outlook is timely considering the rapid evolution of the wireless industry expected in the next few years. New 5G technologies are being tested and are close to being ready for commercial deployment. These new networks will feature vastly increased capacity and efficiency, allowing for the delivery of new enhanced services. Anticipated use cases include ultra-fast mobile broadband, massive machine type communications, ultra-reliable and very low latency communications.
3. Satellite systems are also evolving and growing, with new technology advances allowing for more satellites to be launched, and new and enhanced services to be offered, including advanced mobile satellite systems. The use of licence-exempt spectrum is also growing at a fast pace, with new services being offered with advancing technologies. The rapid growth of all wireless networks and the resulting increased consumer demand for bandwidth has also created a rapidly growing demand for additional backhaul facilities.

4. A principled approach to releasing spectrum

4. SaskTel has found that the Department's policy objectives of maximizing economic and social benefits for Canadians are appropriate. Market forces should be relied upon to the maximum extent possible, although consideration of the public interest of all Canadians, rural and urban, must take precedence. It is crucial that flexible and innovative licensing regimes be considered to adapt to the rapidly evolving wireless industry.
5. One example of such a licensing regime is the flexible use licensing model proposed in the 5G mmWave spectrum consultation. SaskTel agrees with the proposed flexible use licensing model, and suggests similar innovative licensing

models will need to be considered by the Department as new spectrum and wireless technologies are introduced.

6. Any licensing model must take into consideration the requirements of not only densely populated urban areas, but also rural areas. Consideration must be given to the unique requirements of rural Canadians, and to ensure that any licensing model utilized does not unintentionally hinder or impede new rural wireless deployments such as 5G services in rural areas. This may require unique models for rural areas.
7. In particular, the Department is strongly urged to develop policies and licensing models that ensure that rural wireless networks can be deployed cost effectively using this new spectrum. A cost-effective model is an essential pre-requisite to any rural wireless deployment.
8. Research into spectrum sharing methods and protocols is under way, and some of the spectrum sharing technologies are being tested. For example, SaskTel notes research being done on spectrum sharing models at the Communications Research Centre (CRC) and the US Defense Advanced Research Projects Agency (DARPA).
9. Although all of this work is promising, the spectrum sharing techniques and algorithms are still in early phases of development and testing. These new methods and algorithms are not ready for introduction into the mobile wireless environment. It would be very premature to consider implementation of any of these sharing protocols into mobile spectrum. SaskTel would recommend that the Department continue to monitor the progress of research and development work on future spectrum sharing techniques, including collaborative sharing.
10. Any new spectrum sharing protocols or algorithms must not be introduced into any existing mobile spectrum band without an extensive investigation and a thorough public consultation process that considers impacts to existing networks.

5.2 Commercial mobile services

11. SaskTel agrees with the Department's assessment that demand for broadband data will continue to grow. Subscriber growth and new applications and services

will also drive an increase in data demand. This will in-turn drive increased demand for commercial mobile spectrum.

12. SaskTel agrees with the assessment by the Department that the existing mobile spectrum will not be sufficient to sustain future networks¹. Deployment of new 5G network technologies with higher spectral efficiencies and the use of additional commercial mobile will both be required to meet demands for increased broadband data. The increased network performance and efficiencies will also allow for the delivery of new services and applications.
13. Some examples of new wireless technologies include:
 - 5G New Radio (NR) Interface for reduced latency
 - Small Cell architecture
 - Carrier Aggregation for increased throughput
 - Multiple Input Multiple Output (MIMO) antennas for increased throughput
 - Smart antennas and beamforming
 - Cloud RAN or Centralized RAN architecture to reduce latency
 - New 5G Core Network
 - License Assisted Access (LAA) to incorporate unlicensed spectrum
14. All operators will be upgrading their networks and evolving to new 5G technologies and architectures because it will be essential to deliver future services. However, the timing and pace of network migration to 5G will be determined by each operator and the drivers and business case to do so. Many of the new architectures and technologies to improve network performance can be deployed on existing LTE networks prior to launching a full 5G network. For example, many operators are choosing to upgrade their existing LTE networks to offer Gigabit LTE² speeds as a first step to 5G, and some operators may also choose to implement a Non-Stand-

¹ The Consultation, para 42

² Gigabit LTE generally refers to LTE networks that are capable of using carrier aggregation, 256 QAM, 4x4 MIMO, and License Assisted Access (LAA) together to potentially deliver download speeds up to 1 Gbps.

Alone³ version of 5G using an existing LTE core network for their initial 5G service launch.

15. It must be noted that appropriate spectrum for 5G needs to be made available well prior to service launch. SaskTel agrees with the Department that multiple spectrum bands will be required for effective launch and delivery of 5G services, including low-range, mid-range, and mmWave spectrum.
16. SaskTel recommends that the Department give consideration for licensing of 5G rural deployments in all 5G bands, including mmWave spectrum. SaskTel anticipates that there will be substantial rural 5G deployments, certainly over the long term. This applies to mmWave spectrum as well, where 5G systems could potentially serve small population clusters in rural areas using mmWave spectrum. SaskTel urges the Department to ensure that the licensing policies for any and all 5G spectrum bands do not restrict or preclude rural 5G deployment of the spectrum. Furthermore, SaskTel recommends that a cost-effective licensing model be utilized for rural areas that will allow and encourage rural deployments of 5G networks, in all 5G spectrum bands including mmWave.

5.3 Licence-exempt

17. SaskTel agrees that the demand for licence-exempt spectrum will increase in the next few years, as described in the Department's assessment provided in the Consultation.
18. SaskTel has deployed over 4200 Wi-Fi Select access points in over 2000 locations spread across 23 communities in Saskatchewan. Overall, SaskTel sees the trend of wireless service providers such as SaskTel offering carrier-grade or managed Wi-Fi services continuing to increase over the next five years.

5.4 Satellite

19. SaskTel agrees with the demand assessments for FSS/BSS for the 2018-2022 period as described in the Consultation. SaskTel utilizes C and Ku band FSS

³ Non-Stand Alone (NSA) 5G refers to some 5G network architecture options where 5G radio access (RAN) equipment interfaces with an existing LTE core network.

satellite links to provide telephony services to two remote communities, and provides IP-based WAN data services to 19 remote communities. SaskTel also provides C band broadcast video distribution to over 260 communities. SaskTel sees the demand for C band and Ku band FSS services remaining stable or slightly increasing over the next 3 to 8 years.

5.5 Backhaul

20. SaskTel uses fibre backhaul almost exclusively, except for areas of remote northern Saskatchewan where fibre deployment is not practical and microwave backhaul is used. Because of the long distances between the towers, SaskTel is using the 6 and 8 GHz bands for these backhaul links.
21. SaskTel anticipates some growth in our microwave backhaul network in northern Saskatchewan in response to growth in broadband data demands of the residents.

6. Potential frequency bands for future release

22. SaskTel has reviewed the Department's assessments for the potential frequency bands identified in the Consultation for future release. Some key findings from our review are given below.
23. The 800 MHz band has the potential to be a very important band for new commercial mobile services because the spectrum is adjacent to existing 3GPP band 5 LTE spectrum, and the existing 800 MHz RAN infrastructure can be re-used, reducing the costs of 800 MHz band deployments. This allows cost-effective deployments of commercial mobile services, and low deployment costs will encourage further expansion of mobile services such as LTE and 5G, particularly in rural areas
24. However, prior to releasing this spectrum for commercial mobile services, extensive studies and consultation will be required to ensure that a proper transition plan is established for the large number of incumbent narrowband users in this band. SaskTel recommends that the Department initiate studies on the 800 MHz band as soon as possible.

25. The L-band (1427-1518 MHz) offers potential for commercial mobile services. There is global activity in this band to develop it for mobile services. SaskTel suggests the Department continue to monitor developments in this spectrum, and initiate a public consultation some time within the next few years.
26. There is great interest internationally in the 3500 MHz band for 5G mobile services, and SaskTel sees the 3500 MHz band as a high priority for commercial mobile services. We therefore urge the Department to complete the 3400-4200 MHz review and initiate the public consultation process as soon as possible.
27. For the spectrum bands above 24 GHz as listed in Table 7 of the Consultation, SaskTel recommends that the Department wait for decisions from WRC-19 before making any decisions to release the mmWave spectrum bands listed in Table 7. Consideration also needs to be given to future FCC decisions on these spectrum bands.

INTRODUCTION

28. The following represent Saskatchewan Telecommunications' (SaskTel's, or "the Company's") Comments in response to SLPB-006-17, *Consultation on the Spectrum Outlook 2018 to 2022* ("the Consultation").
29. SaskTel has participated in the creation of the Radio Advisory Board of Canada (RABC) response to the Consultation, and supports the RABC submission. SaskTel's comments on this Consultation are meant to clarify our position on certain questions and issues raised by the Department.
30. The section numbering of the remainder of this document corresponds to the numbering of the consultation paper released by the Department. Failure to address any particular issue or item, or the Comments made by any other party, should not be construed as agreement with those Comments where such agreement is not in the interests of SaskTel.

SASKTEL RESPONSE TO THE CONSULTATION

4. A 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?

31. As described by the Department in paragraph 25 of the Consultation, the evolution of the wireless industry has had a significant impact on all sectors of the economy. This evolution is of course continuing, with new technologies such as 5G, leading to networks that are both more efficient and more capable, offering vastly increased network capacity and allowing delivery of enhanced services. Anticipated use cases include ultra-fast mobile broadband, massive machine type communications, ultra-reliable and very low latency communications. The future networks will need to be highly efficient to meet future demands for new and enhanced services, and the networks will also need to be ultra-reliable to meet growing needs for "mission-critical" communications.

32. Satellite systems are also evolving and growing, with new technology advances allowing for more satellites to be launched, and new and enhanced services to be offered, including advanced mobile satellite systems. The use of licence-exempt spectrum is also growing at a fast pace, with new services being offered with advancing technologies. The rapid growth of all wireless networks and the resulting increased consumer demand for bandwidth has also created a rapidly growing demand for additional backhaul facilities.
33. In view of all of the ongoing and anticipated changes in the wireless industry, SaskTel has reviewed the Department's policies and objectives for spectrum management, with consideration of all of the anticipated and ongoing changes in the wireless industry and we have found that the Department's policy objectives are appropriate. We believe the policy objective of maximizing the economic and social benefits that Canadians derive from the use of radio spectrum resources is still appropriate. Market forces should be relied upon to the maximum extent possible, although consideration of the public interest of all Canadians, rural and urban, must take precedence.
34. Any licensing regime, either existing or proposed, must take into consideration the requirements of not only densely populated urban areas, but also rural areas. SaskTel is focused on serving both urban and rural residents. It is important that the Department continue to consider the unique needs of rural Canadians in any licensing process to ensure that all Canadians, both urban and rural, will benefit from the utilization of spectrum resources.
35. In particular, the Department is strongly urged to develop policies and licensing models that ensure that rural wireless networks can be deployed cost effectively using this new spectrum. A cost-effective model is an essential pre-requisite to any rural wireless deployment. This may require unique policies and models for rural areas.
36. For example, it is envisioned that new 5G networks will be deployed in urban areas using mmWave spectrum for high data throughput, and low or mid band spectrum will be used as an urban coverage layer. It is important however that efforts are made to ensure that 5G spectrum is made available in a cost-effective manner for 5G network deployments in rural areas, in order to allow rural residents to also

benefit from new 5G mobile services. This objective should be applied to all 5G spectrum in rural areas, including low band, mid band, and mmWave spectrum.

37. The turbulence in the wireless industry, and the rapid amount of change that is anticipated in both the near-term and long-term future will require some flexibility with the licensing regime currently in place at the Department. For example, as noted in the Consultation⁴ the Department has already proposed an innovative flexible use licensing model for proposed spectrum for 5G in the mmWave consultation. SaskTel believes that the flexible use licensing model is appropriate for the highly complex 5G networks now being tested and developed.
38. Other flexible and innovative licensing models will likely be required to properly regulate future spectrum utilization, and SaskTel urges the Department to consider innovative approaches for licensing processes as wireless networks evolve.
39. With finite spectrum resources and the demand for spectrum for future networks expected to grow, it is clear that spectrum sharing models will play a dominant role in future spectrum management. Some new techniques and technologies mentioned in the Consultation include cognitive radio, dynamic spectrum access, smart antennas, and radio resource management.
40. SaskTel is aware of the research and development work being done at the Communications Research Centre (CRC) Canada investigating and developing future models for spectrum sharing.
41. SaskTel also notes the work being done in the US Defense Advanced Research Projects Agency (DARPA) Spectrum Collaboration Challenge⁵, which includes research and development work done by academia and industry vendors, to develop optimum solutions for dynamic and efficient collaborative spectrum sharing algorithms.
42. Although all of this work is promising, the spectrum sharing techniques and algorithms are still in early phases of development and testing. These new methods and algorithms are not ready for introduction into the mobile wireless

⁴ The Consultation, para 21

⁵ <https://spectrumcollaborationchallenge.com>

environment. It would be very premature to consider implementation of any of these sharing protocols into commercial mobile spectrum.

43. SaskTel would recommend that the Department continue to monitor the progress of research and development work on future spectrum sharing techniques, including collaborative sharing.
44. SaskTel recommends that new innovative sharing techniques not be implemented into existing commercial mobile spectrum bands without first completing extensive studies and full public consultations. The existing mobile networks are designed to operate with pre-determined noise and interference limits. Improper introduction of shared users in the mobile bands, without proper measures to protect the existing mobile networks will likely result in interference and service disruptions.
45. SaskTel would also caution the Department in introducing any new spectrum sharing protocol or algorithm, in any spectrum, that has not been fully tested and previously implemented. Being the first to implement an innovative sharing technique brings a high risk of unintended consequences. This high risk and high uncertainty could place a damper on network investments.
46. Any new spectrum sharing protocols or algorithms must not be introduced into any existing mobile spectrum band without an extensive investigation and a thorough public consultation process that considers impacts to existing networks.

5. Spectrum demand and technology advancement

5.1 Overall demand for data

5.2 Commercial mobile services

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.

47. SaskTel agrees with the assessment presented by the Department in the Consultation on the estimated demand for commercial mobile services in the next few years. We agree with the data growth forecasts from various sources as cited in the Consultation. Strong growth in data demand has been seen over the past

number of years, and there is no evidence that this growth will be slowing down in the future.

48. Demand for broadband data, particularly mobile broadband data, will continue to grow, based on both increasing consumer demand generated by more bandwidth-intensive applications, as well as growth in subscribers. The expected growth in machine-to-machine (M2M) devices and applications will drive both network growth and data demands. Both network expansion (e.g. additional cell sites including more small cell deployments) and new technologies such as 5G will be required to meet future consumer demands, which will in-turn drive the demand for additional mobile spectrum for wireless service providers.

49. SaskTel agrees with the Department's assessment as stated in the Consultation:

... ISED recognizes that the continued growth in data traffic generated by an increasing number of users in various sectors and the data-intensive applications running on mobile networks may not be sustainable with the use of existing mobile spectrum only.⁶

50. As noted in our responses to questions 3 and 4, SaskTel recognizes that while additional mobile spectrum will be essential to support new 5G networks and to meet future demands for data and enhanced services, the additional spectrum alone will still not be sufficient to allow for future enhanced services. Both additional commercial mobile spectrum and deployment of new network technologies and architectures, including 5G, will be required to meet forecasted increases in data demand.

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?

51. It is a given in the wireless industry that new technologies such as 5G will be essential to meet the demands for ever increasing growth in data traffic, as well as to allow the delivery of future enhanced services to meet consumer demands and in-turn allow for the development of new data-intensive and real-time applications. The new 5G network architectures and technologies are primarily aimed at making

⁶ The Consultation, para 42.

the wireless networks more efficient to reduce delays, improve throughput, and at making the networks more spectrally efficient. With more efficient networks, costs for the service provider to deliver high bandwidth services with low latency will be reduced. The improved spectral efficiency in 5G networks will also reduce costs to deliver high bandwidth data services.

52. The new technologies and architectures being developed and tested include numerous features to improve network performance and efficiency. Some examples include:

- 5G New Radio (NR) Interface for reduced latency
- Small Cell architecture
- Carrier Aggregation for increased throughput
- Multiple Input Multiple Output (MIMO) antennas for increased throughput
- Smart antennas and beamforming
- Cloud RAN or Centralized RAN architecture to reduce latency
- New 5G Core Network
- License Assisted Access (LAA) to incorporate unlicensed spectrum

53. All operators will be upgrading their networks and evolving to new 5G technologies and architectures because it will be essential to deliver future services. However, the timing and pace of network migration to 5G will be determined by each operator and the drivers and business case to do so. Many of the new architectures and technologies to improve network performance can be deployed on existing LTE networks prior to launching a full 5G network. For example, many operators are choosing to upgrade their existing LTE networks to offer Gigabit LTE⁷ speeds as a first step to 5G, and some operators may also choose to implement a Non-Stand-Alone⁸ version of 5G using an existing LTE core network for their initial 5G service launch.

⁷ Gigabit LTE generally refers to LTE networks that are capable of using carrier aggregation, 256 QAM, 4x4 MIMO, and License Assisted Access (LAA) together to potentially deliver download speeds up to 1 Gbps.

⁸ Non-Stand Alone (NSA) 5G refers to some 5G network architecture options where 5G radio access (RAN) equipment interfaces with an existing LTE core network.

54. The new performance enhancing technologies listed above are either being developed, tested or deployed today. SaskTel anticipates a number of operators launching Gigabit LTE in 2018. For example, Bell has recently announced their launch of Gigabit LTE.⁹
55. All the major US carriers and most of the carriers in Canada are actively testing 5G network equipment now. Although timelines can change, currently Verizon is stating that they intend to launch a fixed 5G service late in 2018, while AT&T and Sprint are planning launches of mobile 5G services in 2019. In Canada, 5G service launches are not anticipated until 2020 or 2021.
56. It must be noted that appropriate spectrum for 5G needs to be made available well prior to service launch. SaskTel agrees with the Department that multiple spectrum bands will be required for effective launch and delivery of 5G services:

The new applications and services that are expected to be made available through 5G technologies will likely need bands in different frequency ranges in order to be realized. 5G networks will require low frequency bands for coverage, mid-range frequency bands to provide both coverage and capacity, and high frequency bands to provide large bandwidths to meet high broadband speeds. When considering spectrum releases for commercial mobile services ISSED will also take into account the different frequency ranges needed for the deployment of 5G networks.¹⁰

57. With regards to licensing of future 5G spectrum, in low-range, mid-range, and even in 5G mmWave bands, SaskTel recommends that the Department give consideration for licensing of 5G rural deployments in all 5G bands. SaskTel anticipates that there will be substantial rural 5G deployments, certainly over the long term. This applies to mmWave spectrum as well, where 5G systems could potentially serve small population clusters in rural areas using mmWave spectrum. SaskTel urges the Department to ensure that the licensing policies for any and all 5G spectrum bands do not restrict or preclude rural 5G deployments in the spectrum.

⁹ BCE Press Release dated Feb 2, 2018 located at: <http://www.bce.ca/news-and-media/releases/show/Bell-the-first-wireless-provider-in-Canada-to-achieve-Gigabit-LTE-speeds-1>

¹⁰ The Consultation, para 43.

58. In particular, the Department is strongly urged to develop policies and licensing models that ensure that rural wireless networks can be deployed cost effectively using this new spectrum. A cost-effective model is an essential pre-requisite to any rural wireless deployment.
59. SaskTel recommends that the 5G mmWave consultation¹¹ decisions and auction of 5G mmWave spectrum be completed as soon as possible. Therefore, SaskTel urges the Department to complete the 5G mmWave consultation decision process as soon as possible.

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?

60. In addition to the technology improvements discussed in our response to question 3 above, SaskTel is implementing a small cell architecture in high traffic regions of our network. On a wide area basis, the use of small cells increases spectral efficiency, and allows a more effective response to meeting network capacity demands when compared to traditional macro cell type architectures. For this reason, small cell type deployments are a cornerstone of 5G network architectures.
61. SaskTel continues to deploy our Wi-Fi Select service mostly in urban areas across the province, allowing subscriber data to be off-loaded from the LTE network.
62. We are also investigating the deployment of C-RAN (Cloud RAN or Centralized RAN) for our LTE and future 5G networks. By keeping as much of the data and network intelligence as possible in the RAN “edge” of the network, efficiencies can be increased and network latency delays can be reduced.

¹¹ Gazette Notice SLPB-001-17, “Consultation on Releasing Millimetre Wave Spectrum to Support 5G”, released June 2017

5.3 Licence-exempt

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.

63. SaskTel agrees with the assessment of demand for licence-exempt spectrum in the next few years as described in the Consultation. The demand for licence-exempt spectrum will increase in the next few years.
64. SaskTel has deployed over 4200 Wi-Fi Select access points in over 2000 locations spread across 23 communities in Saskatchewan. These Wi-Fi access points are used by SaskTel not only to enhance service in and near these locations, but also to off-load subscriber data from the SaskTel macro network. SaskTel continues to grow and expand the number of access points and locations for SaskTel Select Wi-Fi.

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?

65. SaskTel has no specific comment on this question.

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?

66. SaskTel has no specific comment on this question.

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?

67. SaskTel has deployed over 4200 Wi-Fi Select access points in over 2000 locations spread across 23 communities in Saskatchewan. These Wi-Fi access points are used by SaskTel not only to enhance service in and near these locations, but also to off-load subscriber data from the SaskTel macro network. SaskTel continues to

grow and expand the number of access points and locations for SaskTel Select Wi-Fi, and this is expected to continue over the next five years.

68. SaskTel also anticipates the deployment of Licensed Assisted Access (LAA) in unlicensed spectrum, both as part of SaskTel's evolution to 5G, and as a method to continue the off-load of network capacity from our LTE and future 5G networks. SaskTel's plans for LAA deployments are still quite tentative, but it is anticipated that LAA could be deployed by SaskTel at our LTE/5G small cell locations and/or at our macro cell sites, possibly as early as late 2018 or 2019.
69. Overall, SaskTel sees the trend of wireless service providers such as SaskTel offering carrier-grade or managed Wi-Fi services continuing to increase over the next five years.

5.4 Satellite

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?

70. SaskTel has no comment on this question.

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

71. SaskTel agrees with the demand assessments for FSS/BSS for the 2018-2022 period as described in the Consultation.
72. Currently SaskTel utilizes FSS satellite services to provide the following services:
 - C band FSS to provide voice telephony services to two very isolated communities in northern Saskatchewan
 - Both C band and Ku band FSS to provide IP-based WAN data services to 19 remote communities, where fibre or other terrestrial facilities are either too costly or simply impractical.

- C band FSS to provide broadcast video distribution to approximately 260 communities

73. SaskTel requires continued access to both C band and Ku band FSS spectrum for delivery of telecommunications trunking and IP services and broadcast video for remote and northern locations. Demand for these services is expected to remain flat or slightly increasing for the next 3 to 8 years. This depends on network and technology evolutions both at SaskTel and in the satellite industry.

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?

74. SaskTel expects LEO service offerings may supplant FSS C Band requirements for trunking and IP services. We expect those changes may take place in the 2021 to 2025-time frame.

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

75. Both satellite telecommunications trunking for telephony and IP services for government/enterprise broadband network access (WAN) are priorities for SaskTel. Another priority for SaskTel is the use of C band FSS to distribute broadcast video signals.

5.5 Backhaul

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.

76. SaskTel agrees with the assessment on demand for backhaul in the next five years, as described in the Consultation.
77. SaskTel uses fibre backhaul exclusively in urban areas, and only uses microwave backhaul in remote rural parts of northern Saskatchewan where fibre is simply not practical.

78. Despite their isolation and the small populations of these northern communities, SaskTel is finding that there is a very high demand for broadband data from the residents. SaskTel is building microwave systems in far northern Saskatchewan using multiple RF channels providing backhaul capacities of approximately 1 Gbps in order to meet the broadband data demands of these communities.
79. Because of the long distances between the towers, SaskTel is using the 6 and 8 GHz bands for these backhaul links.
80. SaskTel anticipates some growth in our microwave backhaul network in northern Saskatchewan in response to growth in broadband data demands of the residents. Because of the long distances between towers in this sparsely populated area, SaskTel would prefer to use microwave spectrum below 10 GHz to achieve the link distances required.

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?

81. SaskTel is not anticipating any change to the mix of backhaul solutions we are employing. SaskTel will continue to focus on fibre deployments to provide backhaul links to our sites and facilities. With some minor exceptions, microwave backhaul will continue to be used by SaskTel only in northern Saskatchewan.
82. SaskTel anticipates some new microwave backhaul to be deployed in northern Saskatchewan, primarily though to replace or upgrade existing microwave link equipment. Therefore, SaskTel is anticipating only a small growth in our microwave deployments in northern Saskatchewan.

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?

83. New microwave systems being deployed by SaskTel utilize a number of techniques to increase throughput and improve performance. This includes adaptive modulation, high orders of Quadrature Amplitude Modulation (QAM), and co-channel dual polarized operation. As SaskTel replaces our older microwave

equipment, the benefits of the new technologies will allow for increasing backhaul capacities to the communities.

84. SaskTel notes the discussion in the Consultation of mmWave spectrum for backhaul, and the potential for mmWave to be utilized for very high capacity backhaul links. Because of our extensive fibre network, and our strong preference to deploy fibre over other solutions, it is not likely that SaskTel can or would utilize mmWave spectrum for microwave backhaul applications.
85. SaskTel however notes with interest, as mentioned in the Consultation, of the decision by the European Union to allow flexible fixed and mobile use in the 3500 MHz band.¹²
86. SaskTel would have interest in microwave backhaul spectrum below approximately 10 GHz that could provide for longer link lengths, such as those seen in remote parts of northern Saskatchewan.

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?

87. As noted previously, SaskTel uses fibre almost exclusively to connect our cell sites and facilities. Considering that SaskTel uses microwave backhaul to only provide connectivity to communities in northern Saskatchewan, with a few minor exceptions, SaskTel does not anticipate that demands for licence-exempt, satellite, or fixed wireless services/applications will impact our demand for backhaul spectrum.
88. There may be some limited impact on our demand for microwave spectrum based on demand for backhaul for commercial mobile services provided in northern Saskatchewan. There are a few cell sites serving remote parts of northern Saskatchewan, and these cell sites would use the microwave backhaul network. When these cell sites are upgraded to either provide more capacity or a technology upgrade, then the required microwave backhaul capacity would increase.

¹² The Consultation, para 103

89. However, having said this, SaskTel does not believe that the impact on our demand for backhaul microwave spectrum will be significant in northern Saskatchewan from having to upgrade the handful of cell sites serving the area.

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?

90. For SaskTel we anticipate some demand for microwave spectrum below 10 GHz in northern Saskatchewan, primarily 6 and 8 GHz which we are currently using, to meet some growth in data demands from communities in the far north. This is because of the long distances between microwave towers in the very sparsely populated areas of northern Saskatchewan.

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

91. SaskTel agrees that flexible fixed and mobile services should be allowed within the same frequency band. This allows the licence holder the flexibility to utilize self-backhaul in their network. It is not clear at this time precisely how self-backhaul would be utilized, but the use of self-backhaul would be based on the business case for the network deployment, which also is not clear at this time.
92. However, allowing flexible fixed and mobile services within the same band will change how backhaul is planned in that it provides more options for the network planner, and therefore will result in lower backhaul costs for the wireless service provider by allowing the lowest cost option for backhaul to be chosen.

6. 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.

800 MHz

93. SaskTel agrees with the Department's assessment of the 800 MHz band. We note the following statements in the Consultation:

Given that there is an available commercial mobile ecosystem and a reduced demand for commercial narrowband wireless systems, ISED believes that it would be beneficial to review this band for potential commercial mobile services in the next five years. Additionally, harmonizing this band would ease cross-border coordination, interoperability, economies of scale and roaming between countries.¹³

94. SaskTel agrees that the available mobile device ecosystem for 3GPP band 26, as well as the fact that this band is being used in the United States, makes this band very attractive for mobile services. The 800 MHz band will be particularly useful for providing mobile services in rural areas, both because of its propagation characteristics but also because band 26 includes 3GPP band 5 which is currently heavily used for LTE services by SaskTel and other wireless service providers. Band 26 deployments can easily re-use RAN and antenna equipment currently in place for band 5.
95. We note that, although declining, there are still a large number of narrowband mobile users in this band, including a large number of public safety users. A thorough study and a transition plan would need to be completed to ensure a smooth transition process for such a large number of users.
96. In agreement with the Department's proposal, SaskTel recommends that the Department initiate a review of the 800 MHz band for potential commercial mobile services in the next five years.
97. SaskTel sees the potential use of the 800 MHz band as a high priority for commercial mobile services because the adjacent commercial mobile bands are heavily used for 3GPP band 5 LTE deployments, and the existing 800 MHz RAN and antenna infrastructure can be re-used. This allows cost-effective deployments of commercial mobile services, and low deployment costs will encourage further expansion of mobile services such as LTE and 5G, particularly in rural areas.
98. Because of the time it will take to complete studies of this band including reviewing options for the transition of existing users with a minimum of disruption, SaskTel

¹³ The Consultation, para 121

urges the Department to begin their studies and reviews of this band as soon as possible.

900 MHz

99. SaskTel agrees with the Department's assessment of the 900 MHz band, and that a review of the spectrum would be worthwhile. If commercial mobile services are considered for this band, then it is important that the spectrum be harmonized with the US. Therefore, any review of this spectrum by the Department must consider FCC decisions regarding this band.

L-band

100. SaskTel agrees with the Department's assessment of the L-band, and that the L-band or portions thereof could be released for fixed and mobile use.

AWS-3 unpaired

101. SaskTel agrees with the Department's assessment of the AWS-3 unpaired spectrum, and that these spectrum blocks could be made available for commercial mobile use.

3500 MHz

102. SaskTel agrees with the Department's assessment of the 3500 MHz band. Given the international interest in this band for 5G mobile services, and the potential for a global ecosystem, SaskTel agrees that a public consultation for mobile services in this band is required, and that the Department's review of the band should be expanded to include the entire 3400-4200 MHz band. Due consideration needs to be given to existing FSS band users and other incumbents in the spectrum.
103. SaskTel sees the 3500 MHz band as a high priority for commercial mobile services because of the global efforts to use this band for 5G services. We therefore urge the Department to complete the 3400-4200 MHz review and initiate the public consultation process as soon as possible.

5 GHz

104. SaskTel agrees with the Department's assessment of the 5 GHz-band.

Earth exploration satellite service bands (7 and 9 GHz)

105. SaskTel agrees with the Department's assessment of the 7 and 9 GHz Earth exploration satellite service bands.

Bands above 24 GHz

106. SaskTel agrees with the Department's assessment of the bands above 24 GHz.

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.

800 MHz (814-824 MHz paired with 859-869 MHz)

107. This band will be well suited for commercial mobile services because it is currently in use in the US and standardized by 3GPP as band 26. There is a device ecosystem available for this band, and for wireless service providers deployment will be economical as it is adjacent to 3GPP band 5 currently being used by many operators for LTE services. The existing RAN equipment and antennas can very likely be re-used, reducing deployment costs.
108. The timing for release of this frequency band will depend on the amount of time required for the transition of the large number of existing narrowband users in this spectrum, including public safety users. SaskTel recommends that the Department initiate studies of this band and formulate options and plans for transition as soon as possible, in order to allow a public consultation to be issued in a timely manner.
109. SaskTel sees this band as a high priority band for release for commercial mobile services.

900 MHz (896-960 MHz)

- 110. As noted in the Consultation, there is some activity by the FCC to allow commercial mobile services in this spectrum.
- 111. SaskTel sees this band as a medium priority for release for commercial mobile services.

L-Band (1427-1518 MHz)

- 112. As noted in the Consultation, there is activity globally to allow commercial mobile services in this spectrum.
- 113. SaskTel sees this band as a medium to high priority for release for commercial mobile services.
- 114. SaskTel suggests that the Department continue to monitor developments in this spectrum, and recommends that a public consultation on this band be issued in the next few years.

AWS-3 unpaired (1695-1710 MHz)

- 115. Due to this spectrum being immediately adjacent to existing AWS spectrum, and the fact that this band has been standardized by 3GPP, SaskTel sees a potential for deployment of commercial mobile services in this spectrum.
- 116. However, the lack of a current device ecosystem, and the fact that there is only one licensee for this spectrum for the entire US market, makes it very uncertain that this band will be suitable for commercial mobile services any time soon.
- 117. SaskTel recommends that the Department continue to monitor developments in this spectrum. We would suggest the high uncertainty makes it unlikely that the spectrum will become usable in the near future, and sees this band as a low priority for the Department at this time.

Spectrum Bands Above 24 GHz in Table 7

118. SaskTel notes that these bands are all being considered for IMT at WRC-19, as per the Consultation.¹⁴ SaskTel agrees that these bands are candidates for future release for use by commercial mobile services; however, SaskTel recommends that the Department wait for decisions from WRC-19 before making any decisions to release the mmWave spectrum bands listed in Table 7. Consideration also needs to be given to future FCC decisions on these spectrum bands.
119. At this time SaskTel does not see any preferences for any of the mmWave bands in Table 7. SaskTel would assign an equal priority to each of the mmWave bands in Table 7. SaskTel would recommend that a higher priority be placed on the mmWave spectrum bands where final decisions have been released by the FCC, as it is likely that 5G equipment will become available first for the bands already approved and released by the FCC for commercial mobile services.

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.

120. At this time SaskTel does not have any suggestions or recommendations for other frequency bands that should be considered for release in the next five years that are not discussed in the Consultation. The Consultation appears to have covered the frequency bands that are being discussed and studied by the FCC and the ITU.
121. Going forward ISED should consider any spectrum bands that come under future study by either the FCC or the ITU as potential candidate spectrum bands for future release by the Department.

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

122. At this time, SaskTel does not have any suggestions or recommendations for other frequency bands that should be made available for specific applications that are not

¹⁴ The Consultation, para 154-155 and Table 5

discussed in the Consultation. The Consultation appears to have covered the frequency bands that are being discussed and studied by the FCC and the ITU.

123. Going forward ISED should consider any spectrum bands that come under future study by either the FCC or the ITU as potential candidate spectrum bands for future release by the Department.

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

124. SaskTel has no specific comment on this question.

CONCLUSION

125. SaskTel has reviewed the Department's Spectrum Outlook in the Consultation, including assessments of spectrum bands and candidate spectrum bands for future release.
126. SaskTel has found that the Department's policy objectives of maximizing economic and social benefits for Canadians are appropriate. Market forces should be relied upon to the maximum extent possible, although consideration of the public interest of all Canadians, rural and urban, must take precedence.
127. Flexible and innovative licensing regimes must be considered to adapt to the rapidly evolving wireless industry. One example of such a licensing regime is the flexible use licensing model proposed in the 5G mmWave spectrum consultation. SaskTel agrees with the proposed flexible use licensing model, and suggests similar innovative licensing models will need to be considered by the Department.
128. Any licensing model must take into consideration the requirements of not only densely populated urban areas, but also rural areas. Consideration must be given to the unique requirements of rural Canadians, and to ensure that any licensing model utilized does not unintentionally hinder or impede new rural wireless deployments such as 5G services in rural areas. This may require unique models for rural areas.
129. In particular, the Department is strongly urged to develop policies and licensing models that ensure that rural wireless networks can be deployed cost effectively

using this new spectrum. A cost-effective model is an essential pre-requisite to any rural wireless deployment.

130. Research into spectrum sharing methods and protocols is under way, and some of the spectrum sharing technologies are being tested. Although all of this work is promising, the spectrum sharing techniques and algorithms are still in early phases of development and testing. These new methods and algorithms are not ready for introduction into the mobile wireless environment. It would be very premature to consider implementation of any of these sharing protocols into commercial mobile spectrum. SaskTel would recommend that the Department continue to monitor the progress of research and development work on future spectrum sharing techniques, including collaborative sharing.
131. Any new spectrum sharing protocols or algorithms must not be introduced into any existing mobile spectrum band without an extensive investigation and a thorough public consultation process that considers impacts to existing networks.
132. SaskTel agrees with the Department's assessment that demand for broadband data will continue to grow. Subscriber growth and new applications and services will also drive an increase in data demand. This will in-turn drive increased demand for commercial mobile spectrum.
133. SaskTel agrees with the assessment by the Department that the existing mobile spectrum will not be sufficient to sustain future networks. Deployment of new 5G network technologies with higher spectral efficiencies and the use of additional commercial mobile will both be required to meet demands for increased broadband data. The increased network performance and efficiencies will also allow for the delivery of new services and applications.
134. SaskTel agrees that the demand for licence-exempt spectrum will increase in the next few years, as described in the Department's assessment provided in the Consultation.
135. SaskTel will continue to deploy additional Wi-Fi Select access points in more locations and communities across Saskatchewan. Overall, SaskTel sees the trend

of wireless service providers such as SaskTel offering carrier-grade or managed Wi-Fi services continuing to increase over the next five years.

136. SaskTel agrees with the demand assessments for FSS/BSS for the 2018-2022 period as described in the Consultation. SaskTel heavily utilizes both C and Ku band FSS satellite links to provide telephony, IP-based WAN data services, and video distribution to remote communities in Saskatchewan. SaskTel sees the demand for C band and Ku band FSS services remaining stable or slightly increasing over the next 3 to 8 years.
137. SaskTel will continue to use fibre backhaul almost exclusively, except for areas of remote northern Saskatchewan where fibre deployment is not practical and microwave backhaul is more suitable.
138. SaskTel anticipates some growth in our microwave backhaul network in northern Saskatchewan in response to growth in broadband data demands of the residents.
139. SaskTel has reviewed the Department's assessments for the potential frequency bands identified in the Consultation for future release. Some key findings from our review are given below.
140. The 800 MHz band has the potential to be a very important band for new commercial mobile services because the spectrum is adjacent to existing 3GPP band 5 LTE spectrum, reducing the costs of 800 MHz band deployments. This allows cost-effective deployments of commercial mobile services, and low deployment costs will encourage further expansion of mobile services such as LTE and 5G, particularly in rural areas. However, prior to releasing this spectrum for commercial mobile services, extensive studies and consultation will be required to ensure that a proper transition plan is established for the large number of incumbent narrowband users in this band. SaskTel recommends that the Department initiate studies on the 800 MHz band as soon as possible.
141. The L-band (1427-1518 MHz) offers potential for commercial mobile services. There is global activity in this band to develop it for mobile services. SaskTel suggests the Department continue to monitor developments in this spectrum, and initiate a public consultation some time within the next few years.

142. There is great interest internationally in the 3500 MHz band for 5G mobile services, and SaskTel sees the 3500 MHz band as a high priority for commercial mobile services. We therefore urge the Department to complete the 3400-4200 MHz review and initiate the public consultation process as soon as possible.
143. For the spectrum bands above 24 GHz as listed in Table 7 of the Consultation, SaskTel recommends that the Department wait for decisions from WRC-19 before making any decisions to release the mmWave spectrum bands listed in Table 7. Consideration also needs to be given to future FCC decisions on these spectrum bands.
144. SaskTel thanks the Department for the opportunity to provide input into these crucial matters. It is our hope that our comments will provide the Department with a fuller view of the issues identified in the Consultation, and provide input and guidance for the Department's decisions and plans regarding future spectrum bands for release.