# CanWISP Response: SLPB-006-17—Consultation on the Spectrum Outlook 2018 to 2022

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Please find attached comments from CanWISP (Canadian Association of Wireless ISPs) regarding Notice No. SLPB-006-17—Consultation on the Spectrum Outlook 2018 to 2022, published October 6, 2017 in Canada Gazette, Part I.

For any questions or inquiries, please contact me.

Truly yours,

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# ISED Spectrum 2018-22 Consultation

## CanWISP Response to Consultation Questions

## Introduction

CanWISP is an organization representing Canadian Wireless Internet Service Providers. Our members operate networks providing Internet access to households in rural and remote areas throughout Canada – areas where large telecom operators are either not servicing or have not upgraded their old copper network and thus provide only basic services.

Our members' business model allows them to serve areas of low density profitably and at low cost, unlike the large telecom service providers, whose business model is usually designed to optimize return to shareholders and is not suited to provide service in these areas, even if they are close to large population centers.

Our members' networks range in size from several hundred to some 25,000 subscribers and supply high speed internet service as well as VoIP-based voice services, and video services. Some even provide mobile roaming services over LTE. Overall, our 53 members provide service to around 160,000 subscribers in hard to reach rural areas. We estimate that the total number of subscribers serviced by similar wireless operators (more than 100 others) that are not members, to be around 150,000 for a total WISP subscribership of some 310,000 and revenues of over $100M a year. More than 98% of the connections are wireless.

While the total subscribership of WISPs is a relatively small portion of total Canadian subscribers, WISPs service a significant portion of subscribers in regional and remote areas and are thus essential to meeting the national broadband goals of 50 Mbps / 10 Mbps.

This Response paper has been developed based on discussions within the CanWISP Board and membership and Nordicity's research paper: *White Paper of CanWISP's Position on the Spectrum Outlook 2018 to* 2022. This research includes a CanWISP survey of WISPs, analysis of technology and the Canadian wireless industry and benchmarking of regulatory best practices. This White Paper is presented as Appendix 1 to this Response paper.

## Changes to licensing regime

*Q1 – What future changes, if any, should ISED examine with regards 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?*

ISED has been successful in its 'lightly-licensed' approach with the 3.65 GHz band whereby simplified licensing obligations allowed fixed wireless internet access (FWA) service providers in the congested 900 MHz and 2.4 GHz bands to accommodate increased bandwidth demands of existing users as well as the addition of new subscribers on the 3.65GHz band.

The expansion of FWA service in the 3.65 GHz band was facilitated by the availability of a robust ecosystem of LTE TDD products for licensed FWA (Fixed Wireless Access) services in the 3GPP LTE band 43 which overlaps with the 3.65 GHz band and by the development of equipment capable of operating in the band by manufacturer of proprietary FWA equipment.

Access by WISPs to this standards-based and proprietary wireless ecosystem - traditionally reserved for larger service providers in the case of LTE - has enabled WISPs to benefit from continuous technological improvement by suppliers and develop more robust and efficient networks. Access to the 3.65 GHz band has played a significant role in allowing WISPs to expand their service portfolio, including VOIP, and provide better quality to their subscribers while establishing a measure of financial security. CanWISP undertook an Online Survey for members and non-members WISPs in December 2017. 52 % of the respondents who shared their technology mix have adopted LTE and 45% of respondents already provide VOIP services.

It is this winning combination of easily accessible spectrum and widely available standards-based and proprietary wireless ecosystem that ISED should consider as the model to enable access to innovative services for citizens in rural and remote areas and protect the viability of their service providers.

Changes to the Conditions of Licence and to Auction procedures and eligibility rules would greatly contribute to the repetition of the 3.65GHz WISP success story and ensure rural spectrum is put to use and provides benefits to citizens in rural and remote communities.

1. **Conditions of Licence**
    a. Definition and reporting of spectrum in 'use':

Currently, operators are credited for using spectrum by simply transmitting signals rather than actually providing services to citizens in their geographic coverage areas.

ISED should consider changing the definition of spectrum 'in use' to ensure services are actually available to subscribers. Licence holders should be required to report on the availability of broadband services in their coverage areas and correspondingly, the number of subscribers to broadband services.

b. Designation of Lightly-licensed Spectrum

ISED's designation of the 3.65GHz band as 'lightly licensed' spectrum enabled WISPs to roll out new services and increase subscribership in rural and remote service areas. ISED should consider applying the lightly licensed spectrum approach that was successful in the 3.65GHz band to other bands where LTE or proprietary based ecosystem exist in order to promote easy access to service for rural Canadians.

c. Arbitration Process for Subordinate Licensing

WISPs requesting subordinate licenses from primary licensees – typically incumbent operators frequently encounter significant delays or outright refusals.

ISED should provide an arbitration process for subordination spectrum requests or get involved in the management of subordination requests by the smaller service providers in order to ensure requests are not arbitrarily rejected to keep potential competitors out of the market.

## 2. Auction procedures and eligibility rules

a. Use of Tier 5 Licence Area

Currently, WISPs in rural and remote areas are unable to effectively participate in auctions because bid prices for the Tier 3 and Tier 4 lots significantly exceed their financial means. The Tier 3 and Tier 4 lot size significantly exceed WISP service areas and typically include urban centres which are of interest to incumbent operators.

ISED should consider delimiting licence areas by applying Tier 5 lot structures or perhaps even grid licensing hexagon by hexagon.

b. Priority licensing of spectrum to service providers in regional and remote areas

WISPs are spectrum poor and need access to lightly-licensed or primary licenses at affordable prices in order to ensure financial viability.

ISED should enable licensing spectrum to smaller service providers in rural and remote communities on a priority basis allowing for example,

- Equipment featuring the LBT (Listen Before Talk) functionality borrowed from LTE to make use of the 5GHz licence-exempt spectrum[1],
- Formally promote programs such as TVWS (TV White space) in remote areas where the spectrum is likely unused
- etc.

This would also mean offering new spectrum as it becomes available to service providers in rural and remote communities in a competitive licensing process with spectrum caps, set asides or other measures that would enable the spectrum poor smaller service providers to acquire spectrum at a reasonable price.

## Spectrum Demand and technology advancements

*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.*

CanWISP agrees with the general assessment of demand for commercial mobile services portrayed by ISED in section 5.2 of the Consultation paper. However, it should be noted that overall demand for commercial mobile services currently is, and will remain much higher in

[1] This functionality is used today to allow licensed operators to use the 5GHz licence-exempt band through the use of LAA (Licenced Assisted Access or LTE-U (LTE Unlicenced) technology without penalty to Wi-Fi users.

urban than in rural and remote areas and consequently, ISED should take this into account when setting out the geographic dimensions of lots so as not to unduly penalize rural and

remote areas. Also, given the inherent uncertainties with regards to the difficulties in predicting the amount of traffic consumed by mobile services including the impacts of new disruptive services ISED needs to provide updates on a regular basis for review and analysis in order to foster collaboration by stakeholders.

Data consumption in general, (re. depicted briefly in section 5.1 of the Consultation document) will also face similar growth. WISPs will need more spectrum to face that increased demand in the areas that they serve today. According to the Communication Monitoring report[2] published by CRTC in 2016, the annual growth rate of download usage varied between 39.9 and 57.7% between 2011 and 2015. The 2017 edition of the report[3] states an increase of 25.6% in 2016 over the previous year. Wireline internet providers (Cable and Telco operators) have reported similar growth figures for well over 10 years. Increases in usage of this magnitude means the volume of data consumed at least doubles every second year. Based on this, it is not hard to believe that by 2022, the volumes would be 4 or 5 times those of 2018.

In light of the exponential increase in broadband services and correspondingly, spectrum, ISED needs to take proactive measures to remain at the forefront of the industry and to ensure that state-of-the-art services are delivered with the latest available technologies across Canada – including rural and remote areas.

The licensing measures proposed in answer to Q. 1 above would go a long way to ensure that WISPs are able to access spectrum at a reasonable price and in turn, the technology and investment capital required to upgrade their networks and enhance their broadband service offerings to residential and business subscribers in rural and remote areas.

*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?*

[2] https://www.crtc.gc.ca/eng/publications/reports/policymonitoring/2016/cmr5.htm
[3] Communications Monitoring report 2017 p. 260

4G LTE and LTE-Advanced are continuing to be deployed by WISPs and other facility-based service providers to address the ever-increasing traffic demand and have not yet reached the limit of their useful life. The technology cycles that led to 4G LTE becoming the global standard

for mobile connectivity will, in the near future, evolve based on preparatory work being done by the 3GPP working groups on the 5G standard. On December 21st, 2017, the 3GPP TSG RAN Plenary Meeting in Lisbon successfully completed the first implementable 5G NR (New Radio)

specification. This first set of specifications was completed as part of 3GPP Release 15 which is to be the first 3GPP 5G release, planned for September 2018 according to 3GPP.

Equipment manufacturers claim that the first deployable equipment to fully meet the 5G specifications will be available in 2019[4].

To provide some perspective, 3GPP release 8, which was the first to cover LTE specifications, was finalized in December 2008. The first commercial LTE deployments in Canada were launched by Rogers and Bell in September 2011, Telus followed in February 2012. This means Canada saw deployment of LTE technology within 3 years of the release of the standard: considering that manufacturers must develop, manufacture, test and proceed with certification of the equipment, that operators have to deploy the equipment in the field working through real estate and municipal approvals and integrate it in a functional network before commercial release, three years is not that long.

Some things could be done in parallel if the Canadian industry wanted to introduce 5G sooner (after release of the standard) than was the case with LTE; however, speeding things up comes with a risk as accelerated deployment schedules have a tendency of being more expensive and increasing the risk of technical problems.

The traditional lag between availability of network gear and mass market devices - or customer premises equipment (CPE) - operating in a specific frequency band also adds to the difficulty of accelerating the schedule. For 3G and 4G, this time delay has often been in the order of 12 and even up to 24 months. For example, the iPhone 5, which was the first Apple phone to support LTE, was released in September 2012, a full year after LTE was available in Canada and almost 4 years after the first 3GPP LTE standard was frozen. In short, there is a significant commercial

[4] https://www.rcrwireless.com/20180202/business/sprint-ceo-mobile-5g-network-tag17

risk in accelerating deployment of a new technology only to realize there are no devices to sell once the network is ready.

Nevertheless, the traffic pressures described by ISED is are increasing and it is realistic to assume 5G will be available in Canada in 2020 or 2021.

Manufacturers of proprietary technologies that are often deployed by CanWISP members and other WISPs (such as Cambium Networks and Ubiquiti) are continuing to improve the efficiency of their technologies and its robustness to interference. In light of the fact that these technologies use mainly license-exempt spectrum and the ever-increasing demand for bandwidth that WISPs are facing, manufacturers have introduced features to promote spectral efficiency such as dynamic channel allocation where the equipment constantly monitors the spectrum in search of the cleanest possible channels.

WISPs are ready to meet the ever-increasing demand for higher bandwidth on the part of subscribers – subject to being able to access affordable spectrum and technologies as they emerge between 2018 and 2022.

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

No comment (*Note: this is largely a problem in dense urban areas – suggest not responding)*

## License-exempt Spectrum

*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.*

CanWISP agrees with ISED's assessment of demand for licence-exempt spectrum and notes that it is through licence-exempt spectrum that WISPs originally started and continue to provide connectivity in rural and remote communities.

The coordination between various international agencies to foster a certain level of alignment on the allocation of licence-exempt bands has greatly contributed to the development of an ecosystem of affordable solutions that WISPs, and consumers have been able to use for almost 2 decades. CanWISP suggests that ISED continues to follow international trends in spectrum management by making more spectrum available on a licence-exempt basis in alignment with other regulatory agencies.

*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?*

The 802.11ax standard - to be released in 2019[5], plans to integrate technologies such as MU-MIMO (Multi-user, Multiple-input, Multiple-output), OFDMA (Orthogonal Frequency Division Multiple Access) and resource scheduling versus contention to enable serving multiple devices per access point simultaneously.

Technologies such as the LBT ('listen before talk') functionality, developed for LTE to make use of licence-exempt spectrum while mitigating negative impact on Wi-Fi users, show a great potential to increase spectral efficiency and ensure the resource is used optimally to benefit Canadians.

However, to be effective, new technologies need to be accompanied by the appropriate regulatory framework. Technologies such as LBT will require priority licencing (or multiple layer

[5] https://en.wikipedia.org/wiki/IEEE_802.11ax

of licencing for the same spectrum) so they can develop. There are precedents established by best practice regulators as illustrated in the following examples:

- Assignment of spectrum bands to licence-exempt use has fostered the deployment of the Wi-Fi ecosystem,
- Assignment of the 3.65 GHz band, (a subset of LTE band 43), as a lightly-licenced band (affordable, no exclusivity or protection) has enabled WISPs to start making use of carrier grade LTE technology to complement the use proprietary FWA technologies in serving their subscribers. This latter example was pioneered by ISED.

Technology advances could enable WISPs and other service providers to be able to dynamically use any spectrum that is not in use at any point in time thus ensuring maximum spectral efficiency in a near future, as long as ISED adopts the necessary policy framework. CanWISP argues that there is a strong case for ISED to adopt priority licencing in rural and remote areas, so manufacturers are encouraged to apply functionalities such as LBT to other bands and WISPs can gain access to affordable spectrum in sufficient amounts to serve the increasing needs to their customers in rural and remote areas.

*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?*

The roll out of 5G networks and IoT applications will occur first urban areas where conditions of spectrum scarcity are more likely, and this will indubitably have major impacts on the type and intensity of use of unlicensed spectrum. In rural areas, the demand for spectrum for IoT applications by resource-based commercial activities or residential subscribers will not place as much demand on networks.

In evaluating these impacts and setting the licensing and conditions of use frameworks, ISED should be careful in distinguishing between the needs of service providers and their subscribers in rural versus urban areas.

*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?*

CanWISP agrees that the trend towards offering carrier-grade or managed Wi-Fi services will intensify over the next five years due to a number of factors.

Deployment of 802.11ax technologies in businesses and public spaces will certainly impact the Wi-Fi bands.

Additionally, with the erosion of LTE prices and development of new capabilities, a new generation of technologies (other than Wi-Fi and existing proprietary FWA technologies) will be deployed using licence-exempt spectrum over the next 5 years. For instance, technologies such as MuLTEfire[6] will be deployed in enterprises to achieve carrier grade services and seamless transition with other LTE networks thus addressing limitation currently experienced with Carrier grade Wi-Fi[7]. The band most likely to be affected by this trend is the 5GHz licence-exempt band.

## 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?*

N/C.

*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?*

1. C-band

CanWISP agrees with ISED and NSR assessment for the demand for satellite capacity (i.e. negative compounded annual growth rate) for traditional systems in the C-band in the 2016-25 period with the key reason being increasing competition from fiber and terrestrial services.

CanWISP also agrees with the 2014 CRTC *Satellite Inquiry Report*, which states that a significant portion of C-band capacity in Canada remains available.

[6] use of LTE over the 5GHz licence-exempt band, without the recourse of a control channel on licensed spectrum
[7] MuLTEfire allows tighter security and a more control over the transition to a Macro-LTE network than Carrier grade Wi-Fi

Similarly, in the US, the FCC in its Notice of Enquiry, sought input on potential opportunities for additional flexible access — particularly for wireless broadband services — in spectrum bands between 3.7 and 24 GHz. The FWCC (Fixed Wireless Communications Commission) proposed changes to the FCC in 2016, with regards to the coordination procedures that govern FSS and FS co-existence in the 3.7-4.2 GHz band. The FWCC based their arguments on the spectrally inefficiencies of current procedures.[8]

In its response to the Notice of Inquiry, the Dynamic Spectrum Alliance submitted that the 3.7–4.2 GHz Band was extremely underutilized in the US and urged the FCC to leverage dynamic spectrum sharing techniques to enable more Intensive use of the band.[9] Given the similarities between Canada and US geography and spectrum management policies and the evidence presented by the CRTC, it is easy to conclude that similar action is likely required by ISED.

Closer to home, in a paper filed by Telesat on October 8th, 2014 in response to Industry Canada's consultation on Policy Changes in the 3500 MHz Band (3475-3650 MHz) and a New Licensing Process in Rural Areas, the satellite operator submitted, referring to the deployment of FWA services in the WBS band, that FWA transmitters and C-band earth station receivers in Canada tend to be geographically separated and interference has not become a serious issue.

As stated by ISED in its consultation paper, these trends of decreasing demand paired with the expectation of a surplus of C-band capacity in Canada create an opportunity to consider how C-band will be used in the future. CanWISP argues that it would be relatively simple and straightforward for ISED to immediately expand the portion of the C-band adjacent to the 3.65 GHz band (the block between 3700 and 3800 MHz) for FWA deployment in a manner similar to what has been done with the 3.65 GHZ band (lightly licenced, no priority, no protection and 1 year terms) with the caveat that existing FSS stations operating in the C-Band must not be disturbed by FWA operations.

The existing FWA ecosystems (both standard-based and proprietary) would allow WISPs to take advantage of this much-needed additional spectrum immediately to increase serve levels in rural and remote areas without having to wait for ISED's review of the 3400MHz to 4200MHz band promised at paragraph 142 of the consultation paper.

[8] Federal Communications Commission FCC-CIRC1708-04 Notice of Inquiry the FCC made public on July 13th, 2017.
[9] Comments of Dynamic Spectrum Alliance GN Docket No. 17-183, October 2, 2017

2. Ku-band

No Comment

3. Ka-band

No Comment

*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?*

No Comment.

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

No Comment.

## *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.*

CanWISP agrees with ISED's assessment that backhaul demand will continue to increase over the next 5 years, especially with the emergence of 5G. In the case of rural and remote areas, wireless backhaul will continue to be a solution of choice given the high cost of deploying fibre assets in scarcely populated areas.

This highlights the importance for ISED to quickly proceed with the completion of the review of its backhaul licencing regime. As mentioned in the CanWISP Whitepaper filed along this submission, the current licensing regime, where backhaul is priced per multiple of DS0 rather than per bandwidth used, has perverse result of discouraging the use of spectrally efficient technology. This is detrimental to WISPs and impairs their ability to make used of licensed backhaul technology in their facility-based networks. CanWISP urges ISED to complete its review of the backhaul licensing regime, adopt pricing that takes into account the propagation characteristics of the various bands, encourage the use of spectrally efficient technology and take into account the economic reality of service providers in rural and remote areas.

*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?*

The rapid expansion of fibre networks will in some circumstances, enable a better technology for WISPs than their current microwave and satellite backhaul solutions. However, fibre will not be a viable solution in most WISPs' territories and microwave backhaul links will continue to be the workhorse solution.

*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?*

Backhaul will be enhanced by the same technology evolution that affects access networks such as LTE and Wi-Fi: LBT, dynamic channel allocation, carrier aggregation, better spectrum efficiency, more resilient to interference, etc.

*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?*

FWA service providers are faced with significant year over year increases in bandwidth demand and will need increased access to spectrum for both access and backhaul purposes in order to balance their network loads. The demand for backhaul spectrum in the 5GHz, 12GHz and micro bands to mention just those bands, will largely be determined by the equipment ecosystems including the availability and cost of equipment, technology pathways for upgrades, etc.

*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?*

In the larger metropolitan markets, congestion in the lower bands will oblige service providers to seek spectrum in the higher frequencies. However, in rural and remote areas, congestion is not an issue and service providers require access spectrum that has a longer reach. The regulatory framework should recognize these differences and be adapted to the circumstance. Thus, as described in our answer to Q. 1 under the title: Auction procedures and eligibility rules,

ISED should adopt favourable access policies for service providers in rural and remote regions (Tier 5 licensing areas, priority access). In that case, WISPs should be able to utilize bandwidth in lower frequencies.

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

Yes, backhaul spectrum will be impacted. With technology change, equipment is becoming more resilient to interference and this might allow the re-use of the same spectrum, especially in rural and remote areas.

Based on the CanWISP survey of WISPs (January 2018, CanWISP filing to ISED) some WISPs are doing it today out of necessity although they suffer from increased levels of interference.

## 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.*

CanWISP view is that access to global technology ecosystems and equitable spectrum licensing regimes are just as important as the designation of new bands. Release of new bands in the absence of commercial ecosystems is not a viable solution for service providers. Harmonization of Canada's spectrum planning with international best practices by ISED will ensure access to global equipment ecosystems. Adapting to the realities of the Canadian market and more specifically to its rural and remote environment requires changes to the licencing regime:

- lightly-licenced spectrum,
- priority licensing, and,
- recognition of the differences between urban and rural realities.

*Q20 – ISED is seeking comments on the potential frequency bands for release in table 7:*

1. *the proposed services and/or applications for each frequency band*

2. *the potential timing of releasing for each frequency band*
3. *the priority of the release of the frequency bands*

*Provide supporting rationale for your responses.*

As indicated in response to Q17, with appropriate changes to ISED's spectrum licensing regime, WISPs as service providers in rural and remote areas would be able to access spectrum in the lower bands where there are well-established equipment ecosystems.

Sub-1GHz bands are particularly well-suited to FWA applications in extremely rural areas; that is, these bands can be used to connect households that would otherwise remain un-connected in the foreseeable future. These bands can bring connectivity to households that are very far from infrastructure, or in regions characterized by dense tree cover and rolling terrain. As ISED releases additional spectrum under 1 GHz in the future, it should keep in mind the connectivity needs of rural Canadians.

More specifically, in the 600MHz band, ISED should enable progress on the development of new dynamic sharing technology for the TV white space bandwidth in order to replace RRBS. For example, ISED could enable the market to experiment with technology relying on functionalities such as LBT ('listen before talk') in addition to the central database contemplated under the TV white space framework. This could potentially speed up the progress on TVWS, lead to more efficient use of the spectrum resource and open opportunities to develop broadband services in rural and remote areas.

Viability of upper frequency bands for WISPs will depend on the development of their equipment ecosystems.

*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.*

No Comment.

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

No Comment.

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

No Comment.