Abridged

Comments of Shaw Communications Inc.

Consultation on the Technical and Policy Framework for Radio Local Area Network Devices Operating in the Band 5150-5250 MHz

Canada Gazette, **Part I, January 28, 2017, Notice No. SMSE-002-17**

March 29, 2017

I. Introduction

1. The following constitutes the initial comments of Shaw Communications Inc. ("Shaw") to Innovation, Science and Economic Development Canada (the "Department") in response to its call for comments in *Consultation on the Technical and Policy Framework for Radio Local Area Network Devices Operating in the Band 5150-5250 MHz,* Notice No. SMSE-002-17 (the "Consultation Document").[1] In accordance with section 20(1) of the *Access to Information Act* and sections 38 and 39 of the *Telecommunications Act*, Shaw has filed certain of the information contained in these comments in confidence with the Department. This information falls within the exemptions set out in section 20(1) of the *Access to Information Act* relating to third party information. In particular, this information includes details regarding Shaw's strategic business plans and network operations and is of an extremely commercially sensitive nature. Release of this information on the public record would enable existing and potential competitors to use the information against Shaw, and would interfere with commercial and contractual negotiations. This type of information is never disclosed by Shaw on the public record, and any public interest in disclosure of the information would be greatly outweighed by the specific direct harm that would flow to Shaw. Accordingly, Shaw respectfully requests that this information be accorded confidential treatment by the Department and that the Department refuse all requests for public disclosure of such information. An abridged version of the filing is being provided for inclusion in the public record.

2. Shaw participated in a working group of the Radio Advisory Board of Canada ("RABC"), which included broad representation from the communications services and equipment vendor sectors, and contributed to the development of RABC's submission to this proceeding.

3. Shaw is pleased to provide its own initial comments below.

II. Executive Summary

4. Shaw submits that our Government's innovation and economic growth agenda depends on the availability of competitive, dynamic connectivity services that are responsive to the needs of Canadian consumers and businesses.

[1] Shaw's understanding is that the Consultation Document (e.g. paragraph 21) contemplates both indoor and outdoor use of RLANs in the 5150-5250 MHz band at increased power levels.

5. These objectives are reflected in the Minister of Innovation Science and Economic Development's mandate[2] to help Canadian businesses grow, innovate and export, while keeping Canada at the leading edge of the digital economy through support for competition, choice and availability of services, and fostering a strong investment environment for telecommunications. At the same time, one of the core mandates of the Department is to manage scarce spectrum resources in the public interest in order to maximize the economic and social benefits flowing from this resource to Canadians.[3] Shaw submits that reforming the rules for the 5150-5250 MHz band, along the lines and for the reasons described below, is essential to achieving the government's innovation agenda and to maximize the public interest in realizing the full economic and social benefits of scarce spectral resources.

6. Unlicensed spectrum is increasingly important for the development of Canada's digital network infrastructure to meet the burgeoning data demands on both wireline and wireless facilities. It is also critical that Canadian consumers and businesses be able to access the most innovative equipment possible if Canada is to compete effectively in a global, digital economy. Unlicensed spectrum enables a wide variety of network, consumer and commercial equipment and devices, including Wi-Fi hotspots, a broad range of connectivity devices, such as smartphones, tablets, televisions, laptops, headsets, cameras, security alarms, baby monitors, vehicles, appliances, and many other innovative uses. Given the endless possibilities associated with unlicensed spectrum in today's dynamic environment, it is a safe bet that some uses and innovations that arise in the future will defy our current expectations today.

7. With the emerging Internet of Things, billions of objects will be connecting over the coming years. This will create enormous potential for economic and social development, but it depends upon the connectivity provided by multiple platforms, including Wi-Fi and other license-exempt use.

8. Shaw therefore supports the expeditious harmonization of Canada's technical rules in the 5150-5250 MHz frequency range with those that have been established by the Federal Communications Commission ("FCC") in the United States – that is, increasing the acceptable power limits of Radio Local Area Network Devices ("RLANs") for indoor and outdoor use and removing the ban on their outdoor use in the 5150-5250 MHz band.

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[2] http://pm.gc.ca/eng/minister-innovation-science-and-economic-development-mandate-letter

[3] Specifically, it is noted that the overall objective of ISED's spectrum management program is to "maximize the economic and social benefits that Canadians derive from the use of the radio frequency spectrum resource" (http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09444.html#a2.1)

Harmonization is of critical importance for Canadian consumers and to Canada's digital future, and is crucial to meeting the substantial, growing demand for this spectrum in Canada, ensuring that Canadians have access to the same connectivity experiences as are available in the U.S., and conforming Canadian and American equipment ecosystems.

9. Reforming the 5150-5250 band is Canada's single best current opportunity to rapidly bring additional unlicensed spectrum channels into use and to thereby address consumer demand and empower next generation gigabit Wi-Fi (the 802.11ac standard). Reforming this portion of the band would enable the only contiguous block of 5 GHz spectrum that is sufficient for gigabit Wi-Fi. This means that the Department must act now. Delay will lead to a real and substantial negative impact to the connectivity potential of Canadian consumers and businesses, relative to their counterparts in the U.S.

10. Shaw is committed to creating a seamless, always-on, ultra-broadband experience for Canadians through an innovative, customer-centric network of wireline, Wi-Fi and wireless networks. Shaw is passionate about Wi-Fi and the tremendously important role that it plays in the daily lives of Canadians. As Canada's leader in service provider Wi-Fi, Shaw built the Shaw Go WiFi network, with approximately 85,000 access points spanning from Victoria to Sault Ste. Marie. We have also brought SmartWiFi and other important innovations that allow Canadian businesses to grow and compete in today's global marketplace.

11. Moreover, it is critically important to acknowledge that Wi-Fi is not uniquely important to Shaw nor uniquely important to the communications industry. Wi-Fi has emerged as an essential communications tool for Canadians and Canadian businesses to participate in the digital economy. There is clear and convincing evidence which shows that Wi-Fi is the most common method for consumers and businesses to access the Internet, representing 55.2% of total global Internet traffic in 2015, a figure that is expected to climb to almost 60% of total Internet traffic by 2020.[4]

12. Wi-Fi represented 57.6% of total Canadian Internet traffic in 2015, which will increase to 64.9% of total internet traffic by 2020.[5] There is also considerable data demonstrating that Canadians are more intensive users of Wi-Fi than their counterparts in other

[4] http://www.cisco.com/c/m/en_us/solutions/service-provider/vni-forecast-highlights.html
[5] http://www.cisco.com/c/m/en_us/solutions/service-provider/vni-forecast-highlights.html#

countries.[6] Wi-Fi is clearly of critical importance to the way Canadians connect with each other and the world.

13. Wi-Fi is also an enabling technology that is critical to the future development of mobile wireless and terrestrial broadband networks and for facilitating next-generation connectivity technologies. For example, Wi-Fi already carries the vast majority of wireless data traffic, and that volume will continue to grow.[7] In 2016, 60% of total global mobile data traffic was offloaded to Wi-Fi or femtocell, a figure that is only expected to continue to grow, heightening Wi-Fi's importance as global mobile data traffic increases seven-fold in the next five years.[8]

14. The potential benefits to reforming the rules governing the 5150-5250 MHz band are not limited to Wi-Fi. Liberalizing the technical requirements governing the 5150-5250 MHz band will be technologically agnostic, thereby enhancing the availability of spectrum for unlicensed use and RLANs generally. This creates the potential for further innovation in connectivity technologies and platforms, driving consumer benefit and maximizing the value of the spectrum.

15. In order to facilitate these potential innovations and enable Wi-Fi to meet the growing connectivity needs of Canadians, the Department needs to act now. It has been three years since the FCC liberalized its rules in the 5150-5250 MHz band, and a robust equipment ecosystem that can take advantage of these reforms has already emerged. At the same time, there is a growing body of evidence that shows an increasing risk of insufficient spectral capacity given the rate of growth of demand. In the 2.4 GHz band, the most popular Wi-Fi band, congestion has become critical in Canada, rendering this spectrum virtually unusable for popular applications such as video streaming and conferencing. As a result, usage is now growing rapidly in the 5 GHz band. #

– a trend that is likely to accelerate due to limited capacity and congestion on 2.4 GHz networks.

16. On top of these concerns, the 2.4 GHz band cannot deliver the ultra-high speed Internet products and services that ISPs are now offering throughout the country because they do not have sufficiently wide channels in the 2.4 and 5 GHz bands that are required for

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[6] Canada is the fourth most intensive user of Wi-Fi in the world as measured by percentage of time that users in the country were connected to Wi-Fi rather than cellular network (https://opensignal.com/reports/2017/02/global-state-of-the-mobile-network/)

[7] http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html

[8] https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1819296

these speeds. Wireline providers are now investing heavily in infrastructure that will deliver gigabit Internet speeds in order to address the ongoing demands of their customers for more bandwidth and higher speeds. However, Wi-Fi does not – and will not – have sufficient spectrum to match the increasing capabilities of these networks, resulting in network bottlenecks, delays and dropped connections. Clearly, this would compromise the connectivity experiences of Canadians and undermine the Government's innovation agenda, which is premised on the requirement that we have a world class connectivity infrastructure to promote productivity, the competitiveness of our businesses, and economic growth.

17. Increasing the acceptable power limits of RLANs for indoor and outdoor use and removing the ban on their outdoor use in the 5150-5250 MHz band will significantly enhance the utilization of this spectrum and will create wider usable channels within the 5 GHz band by harmonizing the rules with other portions of the band that are available for RLAN use. This will enable providers to leverage the band to offer faster speeds and provide a better user experience overall by reducing congestion. As illustrated in the attached Appendix 1 table, which compares the availability of spectrum in the 5 GHz band for RLANs under Canada's current rules with the availability of 5 GHz spectrum under the FCC's rules, liberalizing the rules in this band is an obvious, pragmatic opportunity to prudently increase the spectral resources available for RLAN use in Canada while at the same time fully protecting incumbent users in the band.

18. The technical benefits described above will have profound implications for the indoor connectivity experiences of Canadians, whether in homes or offices, by increasing the throughput and range of their Wi-Fi access, ensuring that they are actually able to experience the speeds and quality of Canada's increasingly powerful wireline networks.

19. The impact from these technical benefits will be no less significant for outdoor deployments. Whether in a municipal park, a small town's main street or on the country's transit and ferry systems, a Canadian's connectivity experience will be substantially enhanced through this reform. It goes without saying that consumers and businesses increasingly use, and need, connectivity outdoors, whether for work, communicating or using popular interactive outdoor applications, a compelling recent example of which is Pokemon Go. Outdoor connectivity is also crucial during times of emergency or crisis, as illustrated by Shaw's past and current efforts to ensure the connectivity of Canadians when they need it most (e.g. throughout the Fort McMurray wild fires and current rebuilding efforts, flooding in July 2014 along the Assiniboine River, and the major floods in June, 2013 in Southern Alberta).

20. It is widely acknowledged that Canada's market is too small for manufacturers to design unique consumer and network equipment for our country alone. As a result, Canada generally tries to coordinate its spectrum policies with those of the U.S.[9] Shaw recognizes the importance of exceptions to harmonizing our spectrum policies with the U.S. – from time to time there are important or unique Canadian needs that demand such exceptions. However, the factual circumstances relating to the reform of the 5150-5250 MHz band offer a compelling case to align with the U.S. This reform will make more spectrum immediately available to enhance connectivity, with significant benefits for Canadian consumers and businesses while facilitating further innovation. At the same time, interference mitigation strategies similar to those adopted by the FCC will prevent harmful interference to the incumbent service providers in the band.

21. Given these considerations as well as those discussed below, we believe that it is of critical importance to Canada's digital future that the Department proceed expeditiously to harmonize the technical rules in Canada for RLANs in the 5150-5250 MHz frequency range with those that have been established by the FCC in the U.S. so that RLANs can be more fully utilized indoors and outdoors. The FCC's rules have proven to be effective in protecting satellite uplink operations in the 5150-5250 MHz band in the United States and there is no evidence to suggest that these operations would be adversely affected by RLANs that operate in Canada in compliance with similar technical rules.

III. Background

(i) The 802.11ac Standard

22. The new Wi-Fi standard – IEEE 802.11ac – allows for wider bandwidth transmissions by devices that operate across more than one band, thus increasing use of the band for broadband services, permitting faster speeds, and easing Wi-Fi congestion.[10] Among other things, this standard uses wideband channels, higher-order modulation and coding schemes and the use of enhanced channel-bonding techniques that allow flexible and efficient use of spectrum. This results in a wider pipe that can transmit data more efficiently to achieve higher speeds. This Wi-Fi standard has enabled "gigabit" or "next-generation" Wi-Fi.

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[9] ISED Commercial Mobile Spectrum Outlook (http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09444.html)

[10] FCC's First Report and Order at paragraph 9 (https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-30A1.pdf

23. This translates into substantial benefits to consumers and businesses, and allows for wireless broadband speeds in excess of 1 gigabit per second and better overall customer experiences.[11] In addition, gigabit Wi-Fi:

- Increases wireless network capacity and improves spectral efficiency;[12]
- Allows consumers to experience improved energy efficiency, as their devices will consume less battery power due to faster and more efficient data transfers;[13]
- Delivers enhanced performance where user density is high because of its superior ability to handle data traffic over multiple spatial streams;[14] and,
- Delivers relatively high data rates over a larger area than current Wi-Fi standards, which improves in-home and in-office Wi-Fi networks as well as significantly bolstering the coverage and usability of shared, public Wi-Fi access points.[15]

24. In order to realize its potential and deliver these benefits, the 802.11ac standard requires 160 MHz contiguous channels. Such channels are not available in existing spectrum bands commercially usable for RLANs in Canada. The standard cannot be deployed in the 2.4 GHz band. Through the proposed reforms in this consultation, Canada has the rare opportunity to prudently provide this amount of usable, contiguous 5 GHz spectrum to support this standard.

25. By 2020, a majority of global Wi-Fi access points will support 802.11ac.[16] However, Canadians and Canadian businesses will not be able to reap the benefits of next generation Wi-Fi if reform to the 5150-5250 MHz rules does not go ahead.

(ii) The FCC's Liberalization of the U-NII-1 Band Rules

26. The FCC issued its First Report and Order on March 31st, 2014. The FCC noted that it was in the public interest to increase the permissible power limits in the 5150-5250 MHz band (referred to as the "U-NII-1 band" in the U.S.) and permit outdoor operation of devices in the band and that it could do so while appropriately protecting the mobile

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[11] http://www.cisco.com/c/en/us/products/collateral/wireless/aironet-3600-series/white_paper_c11-713103.html
[12] http://www.networkworld.com/article/2162970/wireless/q-a--what-the-fcc-s-wi-fi-expansion-means-for-you.html
[13] https://www.cnet.com/news/5g-wi-fi-802-11ac-explained-its-cool/
[14] http://www.nicpartnersinc.com/wp-content/uploads/2014/04/80211ac_White_Paper_0712-web.pdf
[15] *Ibid.*
[16] https://www.abiresearch.com/press/80211ac-cpe-shipments-rise-represent-nearly-65-all/

satellite service (or "MSS") from harmful interference. The FCC also noted that the liberalized rules would, among other things, make 100 MHz of spectrum more accessible for use in homes and congested spaces, increase the potential for more unlicensed spectrum innovation, enable gigabit Wi-Fi, and allow U-NII (or RLAN) devices to better integrate with other unlicensed portions of the 5 GHz band to offer faster speeds and reduce congestion at crowded Wi-Fi hot spots.[17]

27. Throughout the proceeding, the FCC cited data predicting that Wi-Fi devices would power a majority of all internet traffic by 2017, which, as discussed below, came to fruition two years ago in 2015.[18]

28. Only one company opposed the FCC's U-NII-1 proposal – the MSS provider, Globalstar. Even Globalstar stated that an increase in power limits in the U-NII-1 band up to the limits permitted in the U-NII02A band would be manageable in terms of interference to its feeder link operations.[19]

29. With respect to concerns expressed by Globalstar about outdoor use, the FCC noted that studies filed by NCTA (conducted by CableLabs) and Globalstar (conducted by Roberson & Associates) regarding possible interference involved analyses based on fundamentally different assumptions. However, the FCC concluded that it could minimize their significance with a technical resolution which restricts a device's emissions when operating above a certain elevation angle, coupled with a reporting requirement directed at large-scale outdoor deployments, which would facilitate corrective measures should they become necessary.[20] To date, there have been no interference complaints to the FCC regarding the outdoor operation of RLANs in the U-NII-1 band.

30. Throughout the proceeding, the FCC acknowledged the shortage of unlicensed spectrum in the U.S.[21] As discussed in greater detail below, there is even less spectrum available for unlicensed use in Canada even though Canada's use of Wi-Fi is increasing at a more-rapid rate than that of the U.S. The FCC also acknowledged that the 802.11ac

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[17] http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0331/DOC-326341A1.pdf

[18] https://apps.fcc.gov/edocs_public/attachmatch/DOC-326341A2.pdf

[19] FCC's First Report and Order at paragraph 28 (https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-30A1.pdf

[20] FCC's First Report and Order at paragraphs 34 and 35 (https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-30A1.pdf. The FCC went on to note that allowing fixed access point outdoor operations at a conducted power level of up to 1 W, and a PSD of 14 dBm/MHz with an allowance for a 6 dBi antenna gain, and limiting the maximum EIRP above 30 degrees elevation to 125 mW EIRP, provides reasonable protection from harmful interference. FCC's First Report and Order at paragraph 37 (https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-30A1.pdf

[21] https://apps.fcc.gov/edocs_public/attachmatch/FCC-13-22A1.pdf

standard allows for a significant increase in bandwidth and data rates in the 5 GHz band.[22]

IV. Responses to Questions set out in SMSE-002-17

a) The demand for and benefit, if any, of allowing HPODs in the 5150-5250 MHz frequency band before WRC-19.

Meeting the Demands for Unlicensed Use

28. Increasing the acceptable power limit for both indoor and outdoor use of RLAN devices in the 5150-5250 MHz frequency band before WRC-19 is critical to meeting the substantial, growing demand for Wi-Fi in Canada, ensuring that Canadians have access to the same connectivity experiences as are available in the U.S., and that Canada does not create an insular and outdated equipment ecosystem for RLAN devices. This reform also creates potential for further innovation from unlicensed uses beyond Wi-Fi.

29. As noted above, technologies that use unlicensed spectrum, including Wi-Fi, are essential to the future of wireless and broadband and for enabling next-generation connectivity platforms. According to ABI Research, more than 20 billion Wi-Fi chipsets are expected to ship between 2016 and 2021, and Wi-Fi will continue to be one of the fastest growing elements of the wireless market.[23]

30. As alluded to previously, Wi-Fi carries the vast majority of wireless data traffic at the present time, and that volume is projected to grow exponentially in the coming years. As demand for wireless and wireless traffic continues to increase, so too does the demand for Wi-Fi. There is an abundance of evidence of this substantial and relentless demand:

- According to Cisco, from 2016 to 2021, global mobile data traffic will increase seven-fold.
- In 2016, 60% of total global mobile data traffic was offloaded to Wi-Fi or femtocell, and will climb to 63% by 2021.
- Global Wi-Fi traffic was 55.2% of total Internet traffic in 2015, and will be 59.1% of total Internet traffic by 2020.[24]

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[22] *Ibid.*

[23] https://www.abiresearch.com/press/abi-research-anticipates-more-20-billion-cumulativ/

[24] As stated previously, in the FCC proceeding, the FCC cited data predicting that Wi-Fi devices would power a majority of all internet traffic by 2017, which came to fruition 2 years before predicted.

- Global Wi-Fi Internet Protocol traffic grew 30% in 2015 alone.
- The total number of public Wi-Fi hotspots (including homespots) will grow six-fold from 2016 to 2021, from 94.0 million in 2016 to 541.6 million by 2021.[25]

31. As the Department itself has observed in its Consultation Document, public and home Wi-Fi hotspots in Canada alone will grow from 0.8 million to 10.2 million between 2015 and 2020, representing a 13-fold increase.[26] In addition, the growth rates in Wi-Fi usage by Canadians exceed global averages in many instances. For example, according to Cisco: [27]

- WiFi use in Canada will reach 2.1 Exabytes[28] per month in 2020, up from 698 Petabytes[29] per month in 2015 and will grow at a compound annual growth rate of 24% during this period;
- WiFi represented 57.6% of total Internet traffic in 2015, which is higher than the global percentage referenced above, and will rise to 64.9% of total Internet traffic in 2020. This will be 2.6X the amount of fixed/wireline Internet; and,
- Mobile data traffic in Canada is expected to grow 6-fold from 2015 to 2020.

32. Although this dramatic growth in Wi-Fi traffic is partly a function of Wi-Fi on smartphones, it also comes from an entire new range of devices that have been equipped with Wi-Fi capabilities, including laptops, tablets, televisions, gaming consoles and cameras. Gartner Research forecasts that by 2018, more than 50% of users will use a tablet or smartphone first for all online activities and 40% of enterprises will specify Wi-Fi as the default connection for non-mobile devices, such as desktops and desk phones.[30]

33. Wi-Fi is one of the most important platforms for the Internet of Things. Gartner Research estimates that 6.4 billion “connected things” were used in 2016, up 30% from 2015, and will reach 20.8 billion by 2020.[31] Wi-Fi that uses 5 GHz spectrum will be a critical

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[25] https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1819296

[26] SMSE-022-17.

[27] http://www.cisco.com/c/m/en_us/solutions/service-provider/vni-forecast-highlights.html#

[28] One Exabyte is equal to one billion gigabytes.

[29] One Petabyte is equal to one million gigabytes.

[30] http://www.gartner.com/newsroom/id/2939217

[31] http://www.gartner.com/newsroom/id/3165317

source of connectivity for all of these things,[32] putting very significant demand on our already constrained unlicensed spectrum resources.

34. Wi-Fi and unlicensed technologies also deliver massive economic and social benefits. For example, the value of Wi-Fi access in Europe in 2013 was estimated to be approximately €15 billion and is projected to grow to €23 billion by 2023. The corresponding value for the avoided cost of carrying Wi-Fi traffic over mobile networks was estimated to be €5 billion in 2013, rising to €13 billion in 2023.[33] Additionally, in 2013, the economic value of unlicensed spectrum was predicted to be $222 billion per annum in the U.S. alone, contributing $6.7 billion to U.S. GDP.[34] Moreover, in 2011, McKinsey estimated that the internet was contributing over $1.5 trillion to global GDP and that the true economic value provided to the end user would reach $1.4 to $2.2 trillion per year by 2020 (up from $240 to $370 billion in 2011).[35] It is clear that both consumers and businesses alike depend heavily on Wi-Fi as a means of managing their wireless data costs.

Shaw's Wi-Fi Experience

35. Shaw has been a leader in providing Wi-Fi innovations in Canada. Our Shaw Go WiFi network has transformed the way consumers in our footprint connect both in cities and outside of metropolitan areas. With approximately 85,000 access points deployed from Sault Ste. Marie to Vancouver Island, Shaw customers can seamlessly connect to the Shaw network, whether in or outside the home. #

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[32] The following link highlights the notion that Wi-Fi is crucial for connecting such Internet of Things technologies: http://www.wi-fi.org/discover-wi-fi/connect-your-life. Moreover, the "Wi-Fi Spectrum Needs Study" by Quotient Associates (Feb 2017) notes at page 23 that the current generation of Wi-Fi targets 5 GHz exclusively (https://www.wi-fi.org/download.php?file=/sites/default/files/private/Wi-Fi%20Spectrum%20Needs%20Study_0.pdf)
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[33] "Future Use of Licence Exempt Radio Spectrum", John Burns, Selcuk Kirtay, Philipa Marks, July 2015

[34] http://www.wififorward.org/wp-content/uploads/2013/01/Value-of-Unlicensed-Spectrum-to-the-US-Economy-Full-Report.pdf

[35] The Economic Significance of Licence Exempt Spectrum in the Future of the Internet", Richard Thanki, June 2012

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37. As a core component of community connectivity, Shaw Go WiFi has also been leveraged during times of crisis, as well as during important community events. This has been important for larger and smaller communities alike, as illustrated by the following examples:

- During the Fort McMurray Wild Fires in May, 2016, Shaw provided all residents and visitors in Northern Alberta, including Fort McMurray and Edmonton, with open access to Shaw Go WiFi. This allowed residents to receive timely news and information, and to stay in touch with friends and loved ones, regardless of whether they were Shaw customers. The Shaw Go WiFi network is still open to the public in Fort McMurray as recovery and rebuilding efforts continue.

- In July, 2014, we opened Shaw Go WiFi to all of the communities it serves along the Assiniboine River, to assist with the flood relief effort. All residents and visitors of Portage la Prairie, Southport, St. Eustache, Elie and Headingley were given full, open access to Shaw Go WiFi, allowing them to connect with friends and loved ones, and receive timely and critical updates from local authorities and emergency response teams.

- Similarly, during the June, 2013, flooding in Southern Alberta, Shaw opened Shaw Go WiFi across the region, including the affected communities of Calgary, Lethbridge, High River, Canmore, and Okotoks.

- In happier circumstances, we also opened the Shaw Go WiFi network to the public during the Canada Winter Games in Prince George in Winter, 2015, as well as in downtown Edmonton in 2015, during the Federation of Canadian Municipalities conference.

38. One of the fastest growing users of Wi-Fi is the small and medium-sized business segment. At the end of 2015, Shaw launched its SmartWiFi solution, which enables this customer segment to leverage enterprise grade Wi-Fi technology and security.

39. As already described, Shaw and Shaw Go WiFi are by no means the only examples of Wi-Fi's incredible impact on Canadians and their connectivity experiences. Wi-Fi has emerged as the most important connectivity platform for Canadians. However, given Shaw's leadership in Wi-Fi in Canada, we have gained unique and highly informative insights into the existing constraints on the spectral resources for Wi-Fi. We respectfully ask the Department to give these insights, as described below, due regard as it weighs the various issues under consideration in this proceeding.

The Scarcity of Unlicensed Spectrum

40. It is clear that Wi-Fi's success in connecting Canadians and the world is dependent on a scarce resource – namely radio spectrum – and there is a growing body of evidence showing that Wi-Fi spectrum resources will not be able to keep pace with this demand.[36] As mentioned, in the U.S. proceeding the FCC acknowledged this spectrum shortage, and Canada has even less spectrum available for unlicensed use. This shortage will directly impact and diminish the experience of users that rely on Wi-Fi for connectivity. For example, in the 2.4 GHz band, congestion has become critical, rendering this spectrum virtually unusable for popular applications such as video streaming and conferencing. As a result, usage is now growing rapidly in the 5 GHz band.

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[36] See for example the "Wi-Fi Spectrum Needs Study" conducted by Quotient Associates (Feb 2017). The report finds that at least 500 MHz of spectrum will be needed by 2025 to satisfy the explosion in Wi-Fi capable devices and the continued surge in traffic. It also notes that as much as 1.3-1.6 GHz of spectrum may be needed if growth rates exceed current expectations.

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42. Amplifying the demand for more usable spectrum in the 5 GHz band is the fact that the 2.4 GHz band is not capable of delivering the ultra-high speed Internet services that ISPs are now offering to their customers because this band does not have the wide channels required for these speeds. As detailed previously, the latest Wi-Fi technology, known as 802.11ac, is designed for gigabit speeds and is already beginning to dominate the wireless connectivity market. For example, according to ABI Research:

- Wi-Fi access points based on 802.11ac represented 39% of total Wi-Fi access points shipped in 2015, and adoption is projected to accelerate going forward; and

- Wi-Fi access point shipments are projected to surpass 204 million units in consumer applications and 19.3 million units in enterprise in 2020, with a majority of those shipments supporting 802.11ac.[37]

43. However, 802.11ac is not capable of operating in the 2.4 GHz band. In order to maximize the potential of 802.11ac, there must be sufficiently wide, contiguous channels of 5 GHz spectrum to use. As the Department, itself, has acknowledged:

[37] https://www.abiresearch.com/press/80211ac-cpe-shipments-rise-represent-nearly-65-all/

> While RLANs in the 2.4 GHz and 5 GHz band can now operate on channels that are 20 MHz- and 40 MHz-wide, RLANs in the 5 GHz range will be able to operate on channels that are 80 MHz- and 160 MHz-wide once the IEEE 802.11ac standard is ratified. Contiguous channels across the 5 GHz range would allow RLANs to operate at these larger bandwidths, thereby supporting high-throughput applications. RLANs are also becoming key components of mobile operators' network deployment strategies as operators look to offload more traffic from their cellular networks. As a result, the 5 GHz band will likely play an increasingly important role in network deployment.[38]

44. Usage is also growing in those portions of the 5 GHz band that do not require DFS. Modem manufacturers are responding by applying for DFS certification so that modems can also leverage the 5470-5600 MHz and 5650-5725 MHz portions of the 5 GHz band, although service provider Wi-Fi networks and other devices have been using these bands for some time.

45. All of these developments point to the fact that there is a tremendous amount of pressure on the currently available 5 GHz spectrum, which will only intensify as carriers offer faster speeds and consumers shift to more bandwidth intensive applications as reflected in the increasingly common offering of gigabit speeds in the Internet services market. As Canadians move to these speeds, the few sufficiently wide channels will congest, deteriorating the quality of the user's Internet experience, whether at home, at the office or on-the-go. In order to deliver these speeds over Wi-Fi, user modems need to leverage wider channels in the 5 GHz band, such as the 100 MHz that would become available if Canada harmonized its technical rules for RLANs in the 5150-5250 MHz frequency range with those in the United States. This issue is all the more critical in Canada because another portion of the 5 GHz band, namely the 5600-5650 MHz, is unavailable for RLAN use in Canada owing to an allocation for weather radars.[39] This allocation significantly reduces the utility of this portion of the 5 GHz band (which is the widest channel, non-DFS band in the 5 GHz range) and places even more pressure on the 5150-5250 MHz portion of the band.

46. The 5150-5250 band is Canada's best opportunity to alleviate the pressure on the currently available 5 GHz spectrum, address rapidly growing consumer demand and empower next-generation gigabit Wi-Fi.

47. Modifying the technical rules in the 5150-5250 MHz portion of the band would address many of the above-mentioned issues. It would make available another 100 MHz of

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[38] ISED Commercial Mobile Spectrum Outlook (http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09444.html)

[39] See attached Appendix 1 which compares the 5 GHz band in Canada and the U.S.

contiguous spectrum, enabling Canada's first 160 MHz-wide (indoor and outdoor) channel in the lower part of the band. This would increase the amount of usable spectrum in the band by almost 20%, alleviating the looming performance and congestion challenges, and helping carriers to reliably deliver gigabit speeds. It would also improve the transmit reach of this channel (and all 20, 40 and 80 MHz channels in the band) by up to 4.5x, which would translate into a material improvement in coverage in the home and other indoor locations. #

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48. In addition, it would greatly enhance the use of Wi-Fi for current and evolving applications, such as 4K video, that require wider channels (e.g., 80 MHz and 160 MHz) to enhance the customer experience. Moreover, it will provide the capacity necessary to achieve the full potential of 802.11ac Wi-Fi and overcome some of the fundamental challenges associated with outdoor Wi-Fi deployments. For example, outdoor transit deployments, such as trains and stations, ferries, and buses, have a higher density of mobile devices and require ground-to-train backhaul coverage. If these reforms proceed, carriers would be able to provide customers with higher downlink data rates, which would significantly enhance the connectivity experience of these deployments by Canadians.

We Cannot Allow Canada to Fall Behind

49. The evidence is clear that Canada needs to move quickly to address the escalating demands for more useable unlicensed spectrum in the 5 GHz band. However, quite apart from this demand, there are other, equally important factors to take into account. For example, because the technical rules for RLANs in the 5150-5250 MHz frequency range are different in Canada than the U.S., there is an increasing need to correct this 'disconnect' in order to ensure that we do not fragment the North American ecosystem for these devices by creating an insular and, ultimately, unattractive market here in Canada for device manufacturers and users.

50. In the U.S., the technical rules for indoor and outdoor operations of RLANs were liberalized in 2014, and American consumers have been reaping the benefits of this decision. As of March 2017 there have been over 1,000 devices certified in the U.S. to take advantage of the new rules.[40] Additionally, in the United States, as of December

[40] See the FCC's Office of Engineering and Technology datasite (https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm).

2016, 72% of the 17.3 million total cable public access points would be able to leverage the FCC's reforms to the 5150-5250 MHz rules.[41] Given that this data relates only to cable deployments, we would expect the actual number of access points that could leverage the new rules in the U.S. to be substantially higher. By harmonizing our technical standards with those adopted in the U.S., Canadian consumers would have access to the same technologies and devices as their counterparts south of the border.

51. On the other hand, delaying or neglecting to take action will deprive Canadian consumers and businesses of the many benefits associated with the FCC's reform, not to mention an entire new range of RLAN devices that operate in conformity with those rules. Limiting Canada's network potential through unnecessary delays in these reforms will hinder Canadian participation in the global, digital economy, hurting the competitiveness of our businesses and the growth potential of our economy.

52. It is also worth noting that, by the time that WRC-19 is over and new rules are adopted in Canada, more than five years will have passed from the time that the FCC updated its own rules – a period of time during which the number of higher power indoor and outdoor devices in the United States will continue to increase exponentially with users reaping the benefits of gigabit speeds, reduced congestion in Wi-Fi bands and a superior user experience both indoors and outdoors.

53. #

[41] Obtained from NCTA via CableLabs.

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The International Landscape

54. Although the International Telecommunications Union ("ITU") itself has not yet adopted technical rules for higher power RLANs operating in the 5150-5250 MHz band,[42] it is unrealistic and indeed, unfair to make Canadians wait until after WRC-19 is over before developing a domestic solution to this issue when it is both feasible and necessary to discharge the Department's mandate of maximizing the potential benefits of Canada's spectral resources. Given the strong growth and intensive usage that already exists in the 5 GHz band in Canada, not to mention the fact that higher power equipment has already entered the ecosystem in the U.S. and will inevitably find its way across the border, a practical, balanced solution is needed in the intervening period.

55. In Shaw's view, the growing importance of Wi-Fi and similar technologies globally make it unlikely that the ITU will reduce or restrict the spectral resources that are needed for RLANs, particularly in the 5 GHz band, for which the rules are 14 years old and in critical need of updating to reflect the current technological landscape. Furthermore, other members of the international community have started to recognize the need to reform these rules. For example, in December, 2016, Panama modified its national frequency allocation place (Plan Nacional Atribucion de Frecuencias) to reflect the same reforms undertaken by the U.S.[43] Similarly, in May 2016, Ofcom launched a consultation in the United Kingdom to consider a number of proposals for increasing the amount of radio spectrum available for Wi-Fi in the 5 GHz band to deliver high speed wireless broadband for consumers. Included in these proposed reforms were the removal of the indoor-only restriction and increase of power limits for RLANs operating in the 5150-5250 MHz band,[44] for which there was broad support among commenting parties.[45]

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[42] Shaw notes that the ITU allows for divergence from its parameters provided that they develop regulations to meet their obligations. Specifically, ITU Res 229 notes that "administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS and the SRS based on their system characteristics and interference criteria as stated in Recommendation ITU0R RS, 1632".

[43] Resolucion AN No. 10789-Telco, Panama, 21 de diciembra de 2016.

[44] https://mentor.ieee.org/802.18/dcn/16/18-16-0032-00-0000-ofcom-5-ghz-consultation.pdf

[45] See for example: CISCO (https://www.ofcom.org.uk/__data/assets/pdf_file/0030/89328/Cisco-Systems.pdf);
Sky (https://www.ofcom.org.uk/__data/assets/pdf_file/0026/89405/Sky.pdf);
Wi-Fi Alliance (https://www.ofcom.org.uk/__data/assets/pdf_file/0025/89413/Wi-Fi-Alliance.pdf)

56. Moreover, given its recent contributions to the ITU,[46] we anticipate that the U.S. will be an active participant in WRC-19 proceedings, strongly advocating for reform to the international rules.

57. For its part, Canada can play an important role at WRC-19. By establishing an interim approach to the authorization of higher power and outdoor RLANs here at home, Canada can share its experiences at WRC-19 and serve in a leadership role at the conference.

58. It is also important to emphasize that, during this interim period, all RLANs that are authorized for use in Canada – whether at higher power levels or those currently specified in RSS-247 – would continue to be subject to the requirement that their operation is on a "no interference no protection" basis.

59. This point needs to be underscored because there is no suggestion in this submission or otherwise that Canada should adopt a domestic approach to the authorization of higher power RLANs that is inconsistent with its international obligations. And, in the event that further changes to our domestic rules are required as a result of WRC-19, this is unlikely to pose a material operational risk because it is feasible, from a technical perspective, to modify equipment configurations via firmware upgrades.

60. Taking all of the foregoing into account, we urge the Department to move forward expeditiously to remove the restrictions on the outdoor use of RLANs in the 5150-5250 MHz portion of the band and increase the permissible power level of these devices to the levels adopted by the FCC in both the indoor and outdoor settings.

b) The potential impacts on domestic and foreign satellite systems in the 5150-5250 MHz frequency band of authorizing HPODs use prior to WRC-19 on the basis of a maximum e.i.r.p. of 4 W. Requirements for an elevation mask towards satellites and an exclusion zone of 25 km around receiving earth stations to protect all satellite systems would likely also apply.

61. Shaw is not aware of any interference-related complaints to the FCC regarding the operation of higher power indoor and outdoor devices in the 5150-5250 MHz frequency range, notwithstanding the fact that, as described in detail at paragraph 50, devices certified for operation in this portion of the 5 GHz band have been widely available in the U.S. market since the FCC liberalized its rules.

62. The FCC's rules and other interference mitigation measures have proven to be effective in protecting satellite uplink operations in the 5150-5250 MHz frequency band and there

[46] Document 210 submitted to WP5A, November 2016 (https://www.itu.int/md/R15-WP5A-C-0210/en)

is little reason to believe that these operations would be adversely affected by RLANs that operate in Canada in compliance with similar technical rules. Globalstar, the only existing MSS user in this band, is a U.S. system and the U.S. regulator has established unique protection measures that it deems sufficient to ensure Globalstar's ongoing operation without any interference from unlicensed uses of the band. Absent any evidence of interference to Globalstar's operations from the United States, which has a much denser population than Canada, there is no reason to suggest that additional protective measures, beyond those instituted by the FCC, are required here in Canada.

63. With respect to receiving earth stations in the 5150-5250 MHz band, Shaw notes that there appears to be only one such earth station operating in Canada at the present time in the National Capital Region. While Shaw does not rule out the possibility that other receiving earth stations may be established in Canada in the future, it seems unlikely that there will be a proliferation of these stations in Canada, especially when there are many other countries that could and, indeed, would likely be chosen for the siting of these facilities.

64. With respect to the Department's proposal for a 25 km exclusion zone, this proposal appears to be based on a study which is not publicly available. Accordingly, it is not possible to comment on the size or reasonableness of this exclusion zone. Having said that, we note that if a 25 km exclusion zone is applied to the current location of the only receiving earth station that is operating in the 5150-5150 MHz band in Canada at the present time, this will effectively prohibit higher power operations of RLANs in one of the most populated regions of the country, namely the National Capital Region. Hundreds of thousands of users in this region would thus be deprived of the benefits of liberalized rules in the 5150-5250 MHz band.

65. In light of this impact, and given that there is only one such earth station facility in Canada at the present time, consideration should be given as to whether other interference mitigation techniques, including possible coordination approaches, can be employed. Another alternative would be to designate the area as a "special registration zone" involving an additional information reporting requirement for those parties that have the "light licences" referred to below and operate in that zone. Compared to the substantial negative impact of an exclusion zone, this solution efficiently balances protection of the earth station while ensuring that users in the region are not deprived of the benefits of liberalized rules.

c) Should the Department proceed to authorize HPODs use prior to WRC-19, what regulatory approach would best ensure a balance of timely deployment and the

protection of other existing and future services in the 5150-5250 MHz frequency band? Also, indicate any and all considerations that should be given to equipment standards, technical requirements, eligibility criteria and/or conditions of licence depending on the relevant approach.

66. Although the ITU has not yet adopted technical rules for the operation of HPODs in the 5150-5250 MHz frequency band, it would not be appropriate to wait until after WRC-19 is over before harmonizing Canada's rules with those of the U.S. The 5 GHz demand data and evidence provided in our responses to (a) and (b) above demonstrate the need to create a practical, immediate solution.

67. The Department's Consultation Document states that there are two possible approaches to authorizing higher power operations of RLANs in the 5150-5250 MHz frequency range prior to WRC-19. The first of these approaches is a licence exempt ("LE") approach which, according to the Department, would involve the "*development of specific equipment standards and technical requirements that would apply only to HPODs in this band*," but would also, apparently, require amendments to the *Radiocommunication Regulations*.

68. The Department does not explain in its Consultation Document why amendments would need to be made to the *Radiocommunication Regulations* in order to apply an LE approach to HPODs. It is difficult, therefore, to comment on this statement. We note, however, that all LE devices that are certified for use in Canada must be manufactured and operated in accordance with technical rules established by the Department (set out in relevant radio standards specifications documents) for the operation of those devices on a licence exempt basis. This includes RLANs that currently operate in conformity with RSS-247. Therefore, if a party operates an LE device in contravention of those rules (e.g., in contravention of specific instructions in user manuals for outdoor installations) or a Ministerial order, such that the party is causing harmful interference, then recourse under the 'offences' provisions of the *Radiocommunication Act* may be made (see, for example, subsections 9(1)(b) and 10(1)(a)-(c) of the Act). It seems therefore that there is a mechanism by which the Department can (a) establish technical standards for the operation of higher power RLANs on a licence exempt basis and (b) prosecute parties who cause harmful interference by operating their devices in contravention of the technical rules for licence exempt operations.

69. The second approach that is described in the Consultation Document to the authorization of higher power devices involves the licensing of users of these devices. Under this approach, rules would be established for user licensing as well as the placement and installation of the devices. In addition, obligations to reduce power or take other actions

in the case of interference issues would be enforced under the relevant provisions of the Radiocommunication Act. According to the Department:

> This option entails a higher administrative burden for users; however, the process of developing a licensing policy and conditions of licence is often more expeditious than one involving regulatory changes and may allow for more timely deployments of HPODs. The Department could also consider eligibility criteria, such as making licences only available to radiocommunication service providers, in order to minimize both the complexity of licensing and the potential for harmful interference.

70. For both of these approaches, it is important to note that, like the FCC's rules for higher power RLANs, there would be no change to the requirement that these devices be operated on "no interference no protection basis". Additionally, under both approaches, the Department could establish technical and administrative safeguards to shield existing and future users from harmful interference. This would allow the spectrum to be used efficiently and effectively, while respecting other users in the band.

71. In Shaw's view, the FCC's approach appropriately balanced the timely deployment of RLANs that can take advantage of its reforms, with the protection of other services in the band by imposing elevation mask and registration requirements that allow the tracking of major deployments of HPODs in the event that corrective action is required.

72. Shaw would prefer a regulatory model in Canada that aligns as closely as possible with the FCC's approach. This will ensure that Canada and the U.S. have the same paths forward for the development of our equipment ecosystems and similar opportunities for Canadians to enjoy the best possible connectivity experiences as their counterparts in the U.S.

73. However, in the interest of moving forward expeditiously, Shaw would not oppose a light licensed approach, as long as it is efficiently designed, does not compromise the experience of users and applies on a per-operator basis rather than a per-device basis. In Shaw's view, an administratively efficient light-licensed approach along these lines would provide an effective additional enforcement tool to the Department to alleviate any future potential interference concerns. In terms of the specific elements of this licensing framework, the following measures could be adopted:

a. A "blanket" or "light" licensing approach which requires parties who wish to operate multiple higher power devices that have similar or identical technical characteristics to register with and obtain a licence from the Department. The Department has implemented

a similar licensing approach for parties that wish to operate VSAT terminals in the Ka and Ku frequency bands;

b. The requirement to adhere to a standard set of technical rules that align with the rules established by the FCC in the United States, including a limit on outdoor emissions to 125 mW above a 30° elevation angle[47]; and

c. The requirement to operate higher power devices on a "no interference no protection" basis.

74. This framework could be administered by the Department until such time as the ITU has completed its study and analysis of higher power RLAN operations in the 5150-5250 MHz frequency band. In addition, and as noted above, if further changes to our domestic rules are required as a result of WRC-19, this is unlikely to pose a material operational risk because equipment configurations could be modified via firmware upgrades. #

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V. Conclusion

75. The evidence is clear that it would be both impractical and unrealistic to wait until the outcome of WRC-19 before establishing technical rules for the operation of RLANs in Canada that align with the reforms that the FCC undertook to the rules governing the 5150-5250 MHz band in 2014.

76. There is indisputable evidence that Wi-Fi and other unlicensed technologies are critical for Canadians' connectivity, the future of Canada's digital infrastructure, the Government's innovation agenda, and, ultimately, Canada's economic and social development. Wi-Fi and other unlicensed connectivity innovations also clearly promote the Government's policy objectives for Canada's communications industry, namely to increase customer choice and to promote competition, innovation and network deployment.

77. Expeditiously increasing the acceptable power limits of RLANs for indoor and outdoor use and removing the ban on their outdoor use in the 5150-5250 MHz band is necessary to

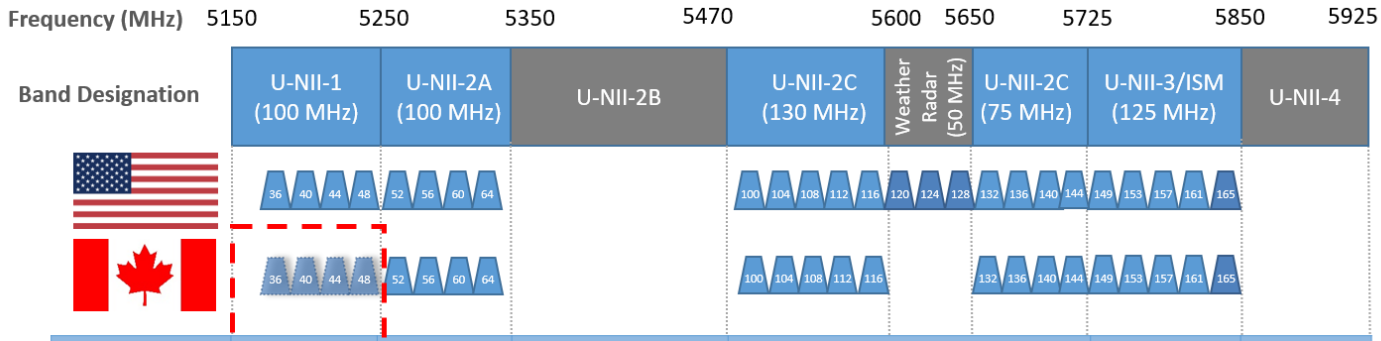
[47] Elevation mask provided in FCC's First Report and Order at paragraph 37 (https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-30A1.pdf)

alleviate concerns of insufficient spectrum in license-exempt bands due to the rapidly increasing demand for Wi-Fi and other RLAN use in Canada. It would also have profound implications on Canadians' connectivity experiences. In their homes, work places, and outdoors, Canadians and Canadian businesses deserve to have a comparable user experience to our American neighbours. Delaying or neglecting to take action will deprive Canadian consumers and businesses of the many benefits associated with liberalized rules in the 5150-5250 MHz band as well as an entire new range of Wi-Fi and other RLAN devices that operate in conformity with devices south of the border.

78. The FCC's rules and protective measures have proven to be effective in protecting incumbents using the band. Shaw understands the importance of minimizing the potential for harmful interference and submits that this can be achieved by adopting adequate, reasonable protective measures, as was the case in the U.S.

79. Accordingly, even though Shaw favours a license exempt approach that aligns as closely as possible with the FCC's approach, if this approach is too time consuming or complex to implement, we recommend that the Department move as expeditiously as possible to establish a light licensing framework for these devices in Canada along the guidelines summarized above.

Appendix 1: Comparison of Canadian and U.S. 5 GHz Band



25 Indoor/Outdoor 1W+ Channels

18 Indoor/Outdoor 1W+ Channels
4 Indoor 200mw Channels

	U-NII-1 (100 MHz)	U-NII-2A (100 MHz)	U-NII-2B	U-NII-2C (130 MHz)	Weather Radar (50 MHz)	U-NII-2C (75 MHz)	U-NII-3/ISM (125 MHz)	U-NII-4
Max. EIRP	4W/1W* US **200 mW CA**	1 W		1 W			4W	
Subject to elevation mask for outdoor use?	US: Yes (FCC) CA: not yet available	Yes (Res 229 and RSS 247)	No	No			No	No
Uses	In/OutDoor US **Indoor only CA**	Indoor-Outdoor	*[EESS/Radarsat, SRS, Radilocation]*	Indoor-Outdoor			Indoor-Outdoor	*[FS, MS, FSS & ISM]*
DFS	No	Yes		Yes			No	
TPC	No	Yes		Yes			No	

*	4W for fixed AP's; 1W for client devices
DFS	Dynamic Frequency Selection
EESS	Earth Exploration SatelliteServices (e.g., Radarsat)
EIRP	Effective Isotropic Radiated Power
FS	Fixed Services
FSS	Fixed Satellite Services
ISM	Industrial, Science & Medicine
MS	Mobile Services
TPC	Transmit Power Control
U-NII	Unlicensed National Information Infrastructure

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