Spectrum Outlook 2018 to 2022

Nordicity White Paper in Support of CanWISP's Submission

Key Findings & The Case for Additional Spectrum for WISPs

March 28th 2018

Delivered to

CanWISP Conference

Prepared by

Nordicity

Table of Contents

Nordicity

Technology & Market Issues and Trends

‘Broadband deficit’ in rural Canada

- 95% of all CDN households but only 76% in rural CDN households have access to 5Mbps/1Mbps (old CRTC broadband target). That is 24% of rural do not have access to minimum broadband - except via satellite
- Only 39% have access to the new target of 50Mbps/10Mbps

The broadband deficit is likely to increase

- Overall, 30%-40% increase in bandwidth usage per annum forecasted over the next 5 years
- 5G networks are likely to rollout in Canada-starting in 2020 in metro areas
- The broadband deficit risks CDN national goals of *broadband internet access as a basic service:* access to ehealth, e-learn & other public services and as well as economic opportunities & growth in rural areas

Nordicity

WISPs role in the CDN communications industry & Ability to meet user needs

WISPs role in the CDN communications industry

WISPs Play a crucial role in overcoming the rural broadband deficit

- 150+ WISPs (of which 53 are CanWISP members) have presence across Canada
- 31% of rural households have broadband access via FWA service providers (2017 CMR report)
- WISPs played an essential role in meeting the previous national broadband goals & are essential in meeting the new goals 50 Mbps / 10 Mbps.

Nordicity

WISP Bandwidth Usage Trends & Services

- WISPs subscribers' usage driven by Netflix & other wide bandwidth video services
  - WISPs have differentiated service levels (speed, data) to accommodate needs of residential & business clients
  - Several WISPs have launched VOIP and some are considering licence-exempt BDUs – hence a 'triple play' service offerings: data, voice, and video

Nordicity

Profile of WISP technologies, networks & spectrum bands utilized

Nordicity

WISP technologies & networks

- FWA technologies currently deployed by Canadian WISPs *(based our analysis from the subscriber breakdown)*

Technology	No. Subscribers	WISPs
LTE (Telrad, Huawei, ZTE, etc.)	14611	14
WiMAX	4150	4
Wi-Fi (including Cambium Ubiquiti and Cisco Wi-Fi)	2104	4
Cambium (including Motorola)	62837	18
Ubiquiti	7824	8
Alvarion	300	2
Mikrotik	1945	3
Mimosa	25	1
TV White Space	50	1
RRBS	85	1
Other Proprietary	508	2
TOTAL	94439	

Nordicity

WISP technologies & networks

WISPs networks still a mixture of 3 and 4G technologies

- WISPs need additional licensed spectrum to satisfy subscribers' demand for bandwidth; and
- Remain competitive with the large ISPs which are owned by 'spectrum-rich', vertically-integrated operators

Nordicity

Benchmarking of technologies in use by WISPs in Benchmark Countries

In Australia:

- WISPs are currently using long range fixed point to multi-point wireless, the very same 4G – LTE used for mobility.
- Ubiquiti, Mikrotik, Wi-Fi and WiMax are also being used by Australian WISPs

In the United States:

- Vendors have taken advantage of the semiconductors mass-produced for Wi-Fi and use adapted hardware and high-gain antennas along with software optimized for outdoor use.
- They created outdoor radio systems, which combine the low cost of Wi-Fi with the high performance specialized microwave radio systems, costing thousands of dollars per unit.
- Likewise, WISPs are using WiMAX , Cambium, Ubiquiti and Mikrotik.

Nordicity

Current usage of spectrum by the CanWISPs

Access Bands Used by WISPs

Bands currently in use by WISPs	Number of Respondents using each band & Status	Percentage of Total Responding WISPs using a particular band out of total (N= 42) Respondents*
2.3 GHz	2 respondents (1 though spectrum subordination)	5%
3.5 GHz –	3 respondents (2 through spectrum subordination)	7%
3.65 GHz –	40 respondents	95%
900 MHz	35 respondents	83%
2.4 GHz	33 respondents	79%
5 GHz	34 respondents	81%

Note: the number exceeds 100% given multiple bands in use by WISPs

Nordicity

Backhaul Bands Used by WISPs

Bands used by WISPs	Number of Respondents & Status	% of Total WISPs using a particular band out of total 42 respondents
900 MHz (unlicensed)	1 respondent	2%
2.4 GHz (unlicensed)	1 respondent	2%
3.5 GHz (licensed)	2 respondents*	5%
3.65 GHz (lightly licensed)	4 respondents	9%
5 GHz (unlicensed or lightly-licensed for U-NII-1)	37 respondents	88%
6 GHz (licensed)	2 respondents	5%
11 GHz (licensed)	10 respondents	24%
15 GHz (licensed)	4 respondents	9%
18 GHz (licensed)	11 respondents	26%
23 GHz (licensed)	3 respondents	7%
24 GHz (unlicensed)	28 respondents	67%
60 GHz (unlicensed)	9 respondents	21%

Notes: the number exceeds 100% given multiple bands in use by WISPs

Nordicity

Assessment of current spectrum framework

Nordicity

Backhaul Licensing Regime for Canada & 3 benchmark countries.

Frequency bands used		Canada	UK	US	Australia
900MHz	902MHz-928MHz	License exempt	Mobile designation	Unlicensed, but share with licensed LMS operator	Digital Cellular Mobile Telephone Service & Radiolocation Class licensing arrangement
1.5GHz		Mobile designation	Radiocommunication license	N/A	License exempt
2.4 GHz		License exempt	License exempt	License exempt	Licensed
3.65 GHz		Lightly licensed	Licensed	Licensed	Licensed
5GHz	5150-5250MHz	Lightly license	Light licensing	License exempt	License exempt
5GHz	5250-5350MHz	License exempt	License exempt	License exempt	Licensed
5GHz	5470-5600MHz and 5650-5725MHz	License exempt	License exempt	License exempt	License exempt
5GHz	5725-5850MHz	License exempt	License exempt	License exempt	License exempt

Backhaul Licensing Regime for Canada & 3 benchmark countries *(Cont'd)*

Frequency bands used		Canada	UK	US	Australia
5.8GHz		License exempt	Lightly licensed	License-exempt	Licensed
Lower 6 GHz		Licensed	Radio local area network (RLAN)	Licensed	Licensed
11 GHz	10.7-11.7 GHz	Licensed	N/A	Licensed	Licensed
15 GHz	14.50-15.35 GHz	Licensed	Defense Spectrum	N/A	Licensed
18 GHz	17.8-18.3 and 19.3-19.7 GHz	Licensed	Amateur full license	Licensed	Licensed
23 GHz	21.8-22.4 and 23.0-23.6 GHz	Licensed	Mobile backhaul	Licensed	Licensed (fixed point-to-point links and Television Outside Broadcast (TOB) services)
24GHz		License exempt	Mobile backhaul	Unlicensed	Unlicensed
60GHz		License exempt	License exempt	Unlicensed	Licensed for distance/speed measurement

WISPs' Backhaul Spectrum - Synopsis

- *5GHz, is the most frequently used spectrum*
  - *Similarly in benchmarked countries, most spectrum in 5GHz is license-exempt, with light-license spectrum in the band 5150-5250MHz.*
  - *5.8 GHz in UK and Australia are allocated as a licensed*
  - *Other popular spectrum used in Canada, like 11GHz and 18GHz is licensed*

- *Current ISED fee structure for licensed backhaul spectrum is based on throughput (multiple of DS0s) instead of bandwidth used, results in fees that are cost prohibitive to most WISPs - even if the spectrum was made available.*

Nordicity

Recommendations for spectrum planning

WISPs are essential for ISED & CRTC to reach national 50/10Mbps goals.ISED should recognize the WISPs' current status as 'spectrum poor' and actively promote WISPs' access to affordable, secure spectrum in their service areas.

Specific measures that ISED could undertake:

- Promote access for WISPs to the 3.5MHz and 3.65MHz bands – the 'workhorse bands' for WISPs.
- Priority licensing for WISPs in rural and remote areas.
- Expand the 3.65GHz band to include a portion of the C band (3.7GHz to 3.8GHz) with similar licensing conditions and ensure fixed satellite (FSS) stations that are using the spectrum, have protection from FWA operations.
- Promote access for WISPs in both lower (e.g. 600MHz) and higher bands (mm Wave bands) as they become available for spectrum auctions.

Nordicity

Spectrum licensing: auctions & other

Nordicity

Spectrum license conditions

Issues:

- WISP service areas have high Capex & Opex requirements:
  - Typically much lower household density, lower disposable income and lower (ARPU) than urban & suburban service areas.
  - Require higher investment in backhaul infrastructure to connect to the Internet
- Little incentive for 'spectrum rich' incumbent operators to share unutilized or underutilized spectrum with spectrum needy service providers such as WISPs.

Recommendations

- Lighter licence conditions for service providers in rural areas
- Require spectrum rich operators to expedite subordination process & report on spectrum utilization, status of requests for subordination

Nordicity

Auction frameworks

- ISED's use of large, highly aggregated license areas by ISED in auction processes favors large, well-financed operators over smaller players such as ISPs and WISPs.
  - ISED has used Tier 3 and 4 mapping to delimit lot sizes for its auction events. These larger lots are simply too expensive for WISPs.
- Auction formats used by ISED, such as the combinatorial clock auctions (CCA), have been complex and require significant financial and professional resources which are out of reach for many smaller firms.

Nordicity

Recommendation for auction processes

- In order to be effectively promote participation in auction processes for WISPs and other smaller, 'spectrum-poor' service providers, ISED should consider the following:
  - Simple auction formats: SMRA & single-envelop auctions & simple, straight-forward rules.
  - Impose spectrum set asides &/or spectrum caps
  - Delimit smaller license areas for auctions e.g. Tier 5 to encourage access for WISPs at an affordable price & promote services to rural customers.
  - Setting reserve prices lower for lots in rural areas

Nordicity

Spectrum licence Fees

Nordicity

Spectrum license fee calculation

- Currently ISED's spectrum fee policy for backhaul is based on equivalent DS0 or 64 kbps channels
- 90% (38/42) of respondents indicated that current backhaul licence fee calculations prevent effective use of spectrum
- 21% (9/42) indicated problems with both access and backhaul spectrum fees
- In benchmarked countries , fees are based on market value – typically auction events and are quoted in $/MHz, not as $/Mbps. In the US, the FCC approach results in much lower fees than In Canada.

Nordicity

Recommendations for license fees

- The calculation of spectrum fees should be based on market valuation and quoted in $/MHz
- Fees should be higher for lower spectrum bands;
- ISED should consider a congestion-based fee structure that would result in a fee reduction in less congested rural and remote areas;
- ISED should consider a reduction in current fees associated with high capacity links used by WISPs in rural and remote areas based on the economic value to the service providers; and,
- ISED should charge spectrum licensees higher spectrum fees in the case that the spectrum is underutilized or simply not utilized at all.

Nordicity

Broadband funding

Nordicity

ISED Broadband Access Funding Programs

- ISED has funded two ‘windows’ of funding to service providers for enhanced broadband access in rural areas: Broadband Canada grant program of 2011-2012, Connecting Canadians (2014-15) and Connect to Innovate (2016-17).
- A significant number of WISPs applied under both funding windows. However, delays in announcements from ISED’s original and the lack of an easily accessible, centralized data base of funded projects has resulted in considerable uncertainty and delays in plans and service deployments - especially to smaller players in rural markets.
- Service providers, whether applicants or non-applicants have had to delay or cancel deployments, for fear that winning applicants will be build overtop of their networks.

Nordicity

CRTC Funding of Broadband Access

- In the decision rendered on December 21, 2016 - Telecom Regulatory Policy CRTC 2016-496 - the CRTC declared broadband internet access services ‘’basic telecommunication services’’. The decision also included the creation of a new fund of $750 million in the first 5 years, over and above existing government programs, to support projects in areas that do not met these targets
- To replace the existing funding of voice-based essential services, this amount is very modest in comparison with the capital requirements for rolling out broadband in rural areas.
- In the absence of permanent funding, it is difficult for service providers in rural areas to attract investment capital or otherwise secure funding for long term investments

Nordicity

Recommendations for funding of broadband access

It is incumbent for ISED - as the policy ministry, to provide permanent funding programs that are commensurate with the funding needs of its own broadband policy.

- ISED should ensure that the funding rules enable smaller service providers opportunities for funding equal to those of the national operators.
- ISED should consider funding cost efficient last mile solutions as well as the fiber – based backbone projects which tend to favor projects by the national operators.
- ISED should work closely with CRTC's funding in order to maximize the impacts in rural areas.
- ISED should use the mapping database to determine eligibility of areas and eliminate case of overbuild and where existing service providers contest the eligibility of service areas, there should be a dispute process.

Nordicity

Conclusions

Conclusion

- WISPs have demonstrated their ability to provide broadband service to subscribers with innovative and cost-efficient service offerings. However, WISPs current lack access to adequate, dedicated spectrum will compromise their ability to deliver the next generation of broadband services to their subscribers.
- In absence of dynamic, competitive WISP sector in provision of telecommunications services in rural and remote communities, the introduction of new and innovative services will be delayed, the price of broadband services will be significantly higher, and overall access to broadband services lower.
- WISPs require enhanced access to additional secure, licensed spectrum in a number of bands.

Nordicity

Contact: Nordicity Team **(Ottawa office)**

Stuart Jack, *Partner & Telecoms Lead Tel. (613) 234-0120*
Email: sjack@nordicity.com

Tanveer Ahmed, *Partner & Financial Lead Tel. (613) 234-5852*
Email: tahmed@nordicity.com

François Picard, *Senior Associate*
Email: fpicard@nordicity.com

124 O'Connor Street, Suite 605
Ottawa, ON K1P 5M9
www.nordicity.com

Nordicity

Thank you

Nordicity.com
@NordicityGlobal