

Senior Director
Spectrum Licensing and Auction Operations
Industry Canada
235 Queen Street
Ottawa, Ontario K1A 0H5

26 February 2015

RE: *Consultation on Repurposing the 600 MHz Band*, Reference SLPB-005-14, published on January 3, 2015 in *Canada Gazette*, Part 1.

Dear Ms Hall:

Please find attached the submission of the Canadian Association of Wireless Internet Service Providers (CanWISP) to Industry Canada on the *Consultation on Repurposing the 600 MHz Band*.

While CanWISP prefers the remaining OTA spectrum be held for current and future users under DTV, LPTV, RRBS, and TV White Space operations, we have taken the opportunity to advance the best long term solution under any planned repack of the OTA band to enable you to deliver 160 MHz of technology-agnostic spectrum.

We are pleased to have the opportunity to submit this proposal to you and look forward to the next steps.

Best regards,

/s

Daniel Mullen, MBA

Director, CanWISP

The Canadian Association of Wireless Internet Service Providers - *Association des fournisseurs de service internet sans fil* - is pleased to have the opportunity to comment on the *Consultation on Repurposing the 600 MHz Band* for Industry Canada. CanWISP is a Canada-wide Industry Association with individual operator members as small as 500 users and as large as 50,000 users. We are the voice of the enabling infrastructure in rural and remote regions of Canada.

CanWISP summarizes its position on the 600 MHz Band, and by extension, the entire OTA Spectrum, as follows.

It is our preference that the spectrum plan be left as it is, to ensure a robust public commons of spectrum shall be able to exist for the benefit of remote and rural Canadians. This approach provides a basis for continued development of systems based on traditional TV channel sizes in a digital context and ensures all of Canada will have access to spectrum in the band, and not just in remote and rural areas.

Industry Canada should make policy decisions in a Canadian context to the benefit of all Canadians, which can mean a Canada-centric approach rather than abiding by often arbitrary and politically-driven decisions made by the FCC in the United States of America. Where such decisions offer clear and overwhelming benefits to Canada it would be appropriate to work within such a framework, but within the context of the proposed Incentive Auctions in the United States, it would not.

Canadians seek to ensure an optimal use of their spectrum resources and to ensure improved access to our connected world outside of the major population centres.

Therefore we are also proposing two important approaches to consider, should Industry Canada determine that spectrum in the 600 MHz Band should be recast in some form.

Should Industry Canada seek to give guidance to the FCC as it plans its Incentive Auctions after deciding to make changes in the OTA spectrum in Canada, CanWISP recommends re-farming of all spectrum above the VHF TV channel 22 with the 524 MHz to 608 MHz and 614 MHz to 698 MHz range. While this could be available for a *potential* coordination with those users near the Canada-U.S. border, it would in itself not be an optimal solution as it would imply that Industry Canada would also support paired channel FDD operation, a declining approach, rather than unpaired channels for TDD operation.

With years of real-world data along with third-party measurements, we see that traffic is increasingly becoming asymmetric, and so TDD will ensure maximum spectral efficiency overall and deliver lower-cost access to Canadians.

Therefore, if Industry Canada does not allow the OTA spectrum to remain as it is currently, we advocate that spectrum from 524 MHz to 608 MHz and from 614 MHz to 698 MHz be placed in technology-agnostic 5 MHz blocks which can be assembled in the sizes required for delivery of services which meet the needs of Canadians.

Our position is laid out through answering the Industry Canada questions which follow.

Question 1:

Industry Canada is seeking comments on the overall proposal of re-purposing the band to include commercial mobile broadband and the initial step of participating in a joint repacking process with the United States.

CanWISP Response 1:

While it remains early in its development, the 700 MHz auction has failed to result in lower costs to Canadians and has not appeared to increase competition in rural and remote service. Further to this, Canadians are less and less likely to find meaningful differences in the designations 'mobile' or 'fixed' in terms of broadband usage.

Consumers expect broadband where they are, at home, at work, and at play.

Usage is adaptive, with map updates while on the road, and high definition movies while at home in front of the big screen. Thin connections outside of the home, in part driven by service plans that charge on a per-bit basis, are matched with thick connections in the home, typically on flat-rate pricing. It is the personal environment that determines the usage, and its cost determines its intensity.

Deploying nation-wide networks is more expensive than ever, and the Big Three mobile providers in Canada – Rogers, Bell, and Telus - have almost insurmountable financial and operational advantages over any other regional or intra-regional provider, including leading cable system operators with large available free cash flows.

It is our belief that local providers, operating beyond the reach of the financial models required by traditional carriers, are best able to offer local services which meet the needs of rural Canadians, and to provide the value proposition that Canadians are seeking.

TV White Space and RRBS can be valuable tools in delivering these advanced services, but uncertainty following the effective band reduction through the 700 MHz auction, and now a potential 600 MHz auction, has chilled investment plans.

We note this Consultation on re-purposing the 600 MHz band comes as Gazette Notice SMSE-007-15 announces availability of spectrum in 470-608 MHz and 614-698 MHz, which therefore challenges the scope of the allocation and increases concerns in the sector that additional initiatives, such as the potential for re-purposing the 500 MHz band may eventually come about. Uncertainty can deter investment, block innovation, and increase costs for existing operators who are forced to make significant engineering changes.

For these reasons, CanWISP proposes that the spectrum plan be left as it is, to ensure a robust public commons of spectrum shall be able to exist for the benefit of remote and rural Canadians. This approach provides a basis for continued development of systems based on traditional TV channel sizes in a digital context and ensures all of Canada will have access to spectrum in the band, and not just in remote and rural areas.

While our formal position is that Industry Canada should make policy decisions in a Canadian context to the benefit of all Canadians, the consultation itself implies there is an expectation that Canada should coordinate with the FCC Incentive Auction with the intent to thereby ensure an optimal use of spectrum resources.

Along with calling for Industry Canada to leave the 600 MHz band alone in favour of a Canada-centric alternative, we are proposing two important approaches that evolve from the concept of making changes, and ensuring that such changes will be innovative and future-friendly.

The first is to re-farm that spectrum above VHF TV channel 22 with the 524 MHz to 608 MHz and 614 MHz to 698 MHz range being marked as available for a *potential* coordination near the Canada-U.S. border.

Such a 'Big Bang' approach to the entire band posited for the 600 MHz auction would see the spectrum set aside immediately so as to permit the maximum availability for coordination under the FCC-led Incentive Auction and following the results in the U.S. be blocked identically. The resulting relocation of LPTV and RRBS systems would be as envisioned in the Consultation and provide certainty to those user groups.

Industry Canada could then auction the very same number of licenses in the very same channels within the coordination area as are auctioned under the FCC Incentive Auction plan, with the rest placed into the RRBS and TVWS inventory under the 600 MHz band plan using ITU standard channel sizes based on 5 MHz multiples, such as 5 + 5 Mhz channels in addition to potentially making use of 10 + 10 MHz channels.

These TV White Space and RRBS variants using 5 and 10 MHz channel sizes would permit more efficient use of the valuable spectrum resource while allowing investments in existing TV White Space and RRBS equipment to continue, with the remainder of the lower 500 MHz TV White Space and RRBS be permitted to operate under the current TVWS and RRBS rules using legacy 6 MHz channel sizes.

The second and most logical evolution is to propose use of larger unpaired TDD channels instead of smaller paired FDD channels in the re-purposed spectrum, consistent with real-world data demand and user behaviour.

This recognizes the fact that while FDD-based systems *may* have somewhat longer range they are not well-suited to asymmetric traffic loads, and that TDD will ensure **maximum spectral efficiency** for typical broadband usage.

FDD was based in traditional voice networks where Rx/Tx traffic tended to be balanced, versus general end-user IP-based traffic which tends to have a 4:1 ratio in terms of traffic to and from remote users.

The most recent Ookla study of broadband traffic in Canada shows an average download rate of 25.5 Mbps with and upload rate of 6.6 Mbps, which is reflective of the user experience and confirmed by the findings of other countries throughout the world.

It should be noted that the major mobile carriers in Canada all also operate major fibre optic networks, which at least in principle are able to operate at identical data transfer rates in each direction, but which are offered to the end-users in service packages where speeds to the remote user are multiples of the speeds from the remote user to the Internet. This indicates a pervasive and very well accepted ratio between Rx/Tx that is best suited to TDD technology.

Not only are RRBS and TV White Space systems able to use unpaired channels, new LTE Advanced systems using TDD are rapidly gaining momentum and point the way to new 5G networks also being based on unpaired channels. The FCC approach of offering paired channels for FDD use therefore seems ill-considered and not at all in keeping with good spectrum resource management into the future.

Question 2:

Industry Canada is seeking comments on the future spectrum requirements for OTA TV broadcasting, taking into consideration the overall changes to the broadcasting industry, and noting that the CRTC Let's Talk TV hearing recently closed.

CanWISP Response 2:

While there will always be a need for maintaining a robust and high-availability OTA TV broadcast capability, especially in times of dramatic weather events or civil disruptions, users are increasingly consuming both linear and non-linear TV programming through IP-based broadband networks, principally in high data rate networks that can support the transfer rates required for high definition images.

For rural and remote communities, where OTA TV variety is already highly constrained, the demand for – and requirement for bandwidth which enables – a wider variety of programming automatically means a need for more efficiency in the spectrum and more absolute spectrum to deliver on these demands. The lack of large numbers of OTA TV broadcasters in such areas permits more spectrum to be available to RRBS, TV White Space, and other technologies, and thus the approaches are complementary.

Further evidence of the future of Internet Protocol delivery, the dominant Canadian supplier of satellite-fed delivery of television programming to distribution undertakings is now piloting a fibre delivery model rather than satellite. Even when the 'last mile' is over the air, the delivery and connection may be enabled by broadband.

Question 3:

Industry Canada is seeking comments on the Department's proposal to:

- adopt the U.S. 600 MHz band plan framework; and
- commit to re-purpose the same amount of spectrum as the United States, as determined in the FCC's incentive auction.

CanWISP Response 3:

The Fixed Wireless Access sector has concerns that former TV Band spectrum has already been recovered for licensed use, such as AMPS and the 700 MHz Auction, with the proposal to potentially re-farm the entire 600 MHz band, and perhaps some portion or all of the 500 MHz band at some point in time, so it will be best for all stakeholders to now agree a long-term plan for all remaining current and former TV Band spectrum.

We do not believe it is in the best interests of Canada to adopt the U.S. 600 MHz band plan framework as it fails to accommodate the real and growing need to enable delivery of broadband into rural and remote communities. Additionally, the **fatal flaw** of the U.S. approach is to implement FDD at a time when the market has clearly begun to shift to advanced TDD strategies to match the bandwidth consumption patterns of users.

Major LTE TDD-based networks are being rapidly deployed and chip vendors, including Qualcomm, were already supporting this as early as Releases 8 and 9 of 3GPP, which translates into hundreds of available models of terminal devices. Adaptive techniques such as MIMO and beam-forming are also well-suited to TDD.

While FDD offers a theoretical advantage in spectral efficiency, FDD LTE and TDD LTE offer similar performance in this regard, with the advantage that TDD LTE is less expensive, which translates into lower end user costs and greater scope for infrastructure investment, and more closely matches the true demand curve for bandwidth capacity.

In the LTE ecosystem, there is a 90% commonality of FD-LTE and TD-LTE with a measurable cost advantage for TD-LTE, which can translate into less expensive and thereby faster network deployments with lower prices for Canadian consumers.

The most efficient approach would be to set aside the maximum amount of spectrum which minimizes spectrum loss due to guard bands or other technical considerations. The optimal solution is to re-purpose all of the TV Band spectrum above VHF TV channel 22 with the 524 MHz to 608 MHz and 614 to 698 MHz range being marked as available for a *potential* coordination with those users near the Canada-U.S. border, while encouraging use of larger TDD channels instead of smaller FDD channels in that spectrum.

Even if FDD operation is required, 16 paired channels of 5 MHz each would be available, as shown here.

506	512	518	524	529	534	539	544	549	554	559	564	569	574	579	584	589	594	599	604	608	614	618	623	628	633	638	643	648	653	658	663	668	673	678	683	688	693	698
20	21	6	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	4	37	4	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	700 MHz UL

This proposal provides up to 16 FDD 5 Mhz + 5 MHz channels between 524 MHz to 604 MHz and 618 MHz to 698 MHz so that no spectrum should be given up for non-productive use. It makes use of ITU standard 5 MHz sized block multiples and starts and ends within the legacy band plans, with the traditional Channel 22 on the lower side and the 698 Mhz edge of the 700 MHz licensed spectrum on the upper side.

Software defined radio and superior filtering enables FDD and TDD operation side-by side, so this approach would deliver 160 MHz of spectrum for any operator using any technology, including LTE Advanced variants.

Most notable is the very efficient use of spectrum in the 500 and 600 MHz bands with only 14 MHz, and possibly as little as 12 MHz, being unavailable, instead of up to 28 MHz required for guard bands as potentially foreseen in the Consultation itself. It can be noted that Channel 22 itself could in some circumstances remain in use, meaning just six to eight MHz are set aside this way.

Potential FDD Channel Pairs would be as seen here.

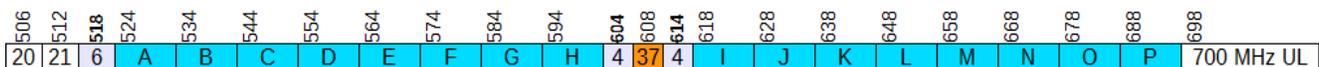
Proposed FDD Frequency Pairs

A	A'	524-529 MHz	618-623 MHz
B	B'	529-534 MHz	623-628 MHz
C	C'	534-539 MHz	628-633 MHz
D	D'	539-544 MHz	633-638 MHz
E	E'	544-549 MHz	638-643 MHz
F	F'	549-554 MHz	643-648 MHz
G	G'	554-559 MHz	648-653 MHz
H	H'	559-564 MHz	653-658 MHz
I	I'	564-569 MHz	658-663 MHz
J	J'	569-574 MHz	663-668 MHz
K	K'	574-579 MHz	668-673 MHz
L	L'	579-584 MHz	673-678 MHz
M	M'	584-589 MHz	678-683 MHz
N	N'	589-594 MHz	683-688 MHz
O	O'	594-599 MHz	688-693 MHz
P	P'	599-604 MHz	693-698 MHz

In an FDD configuration there would be no net loss as the Duplex Gap would be placed around Channel 37, with the ability to increase the allocation available for RAS and WMTS from the current standard width of 6 MHz for the legacy Channel 37 to a wider 8 MHz channel with two 3 MHz guards instead of 6 MHz with two 4 MHz guards. Even the guard bands may have potential for utilization in specific use cases.

The optimal solution would be to support up to 16 TDD channels of 10 MHz or more each. This approach would deliver more data in terms of bits per Hertz to users and ensure the long-term flexibility of the band to meet the evolving demands of the marketplace. Consumers could expect up to 60% more bandwidth or data transfer capacity under TDD-driven links in place of FDD links, with negligible effects on range especially given that the 600 MHz band will already provide excellent propagation characteristics.

With 10 MHz unpaired channels, the 600 MHz Band Plan would be as shown here.

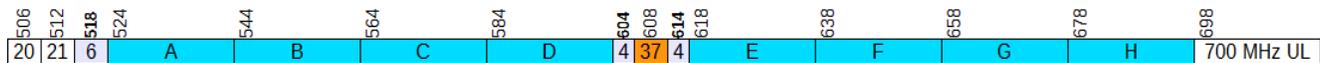


In taking a TDD-centric approach the band would be able to support both LTE Advanced and TV White Space equipment which is already available to carriers. CanWISP has surveyed manufacturers of TV White Space and RRBS compliant equipment and determined that a majority can immediately support ITU channel size multiples of 5 MHz, with sizes of 5 MHz, 10 MHz or larger, and are able to co-exist with 3G LTE equipment at neighbouring channels.

Using unpaired 10 MHz channels, or any combination of unpaired 5, 10, 15, 20, or 25 MHz channels, both LTE Advanced TDD and RRBS or TV White Space compliant equipment could be deployed to provide the long-reach links to sparsely populated areas throughout rural and remote regions of Canada.

In sparsely populated areas, including the Near and Far North, capacity becomes a crucial and determining factor in the suitability of a proposed delivery solution. Channel aggregation, not suited to TV White Space as currently envisioned, allows for the 'fat pipes' that are necessary in these regions and makes good on the premise that clear and tangible benefits from our spectrum resource should be seen and appreciated by Canadians.

A 20 MHz channel size band plan would be as seen below.



It should be noted that from the manufacturers surveyed, all expressed the ability to co-exist with LTE TDD and FDD systems due to use of Software Defined Radios and tight filter design. This should enable a technology-agnostic approach to the spectrum whereby broadcast sites could be licensed in 5 MHz block multiples, with FDD users seeking two 5 MHz blocks and TDD users requesting one, two, or more contiguous 5 MHz blocks so as to create the required channel size for the anticipated bandwidth requirement.

The block-based model means that truly rural areas can build large pipes if required and that market requirements driven by consumers determines usage rather than inflexible, and potentially dated, licensing models that struggle to decide between urban and rural, densely populated versus sparsely, shorter range versus longer range, and one access type versus another.

This technology-agnostic approach enabled by block-based rights, rather than defined channels, would ensure the ability to implement the most appropriate technology for the need and the location, and future-proof the band from being restricted to a specific technology platform or protocol requirement, which in the past has hampered development of equipment ecosystems in the bands above 2 GHz.

As an example, a user requiring extremely low latency and willing to forgo the power and throughput advantages of TDD could implement narrow-channel FDD for a given site, and once other technologies are available, could migrate the spectrum to a more efficiency-driven platform.

Under the CanWISP proposal, the least amount of spectrum is lost to guard bands and the entire industry benefits, first from high availability going into the FCC Incentive Auction, the maximum spectrum available to Canadian bidders to ensure channel coordination, and the potential for long-term planning security for rural and remote operators using unallocated 600 MHz spectrum using ITU standard channel size under RRBS and TVWS platforms.

Manufacturers such as 6 Harmonics, Runcom, and Carlson are able to support these new channel sizes immediately which ensures investment security for operators and improves service for remote and rural communities.

Question 4:

Industry Canada is seeking comments on the size of the proposed guard band between the TV broadcasting and mobile services.

- Is the mobile service appropriately protected by the proposed guard band?
- Is the TV broadcasting service appropriately protected by the proposed guard band?

- If additional protection measures are needed, what alternatives (such as increasing the size of the guard band, adding a pass band/notch filter at the TV receiver port, etc.) could be used and what alternatives would be practical to deploy?

CanWISP Response 4:

Any condition of use should require sufficient filtering in the 600 MHz Band equipment itself to ensure protection of legacy TV broadcasting services. Our proposal of using TV Channel 22 as the guard or buffer between the traditional 6 MHz channels and proposed 5 MHz channels is sufficient given that co-channel interference can be largely mitigated in good system design. In some areas it would be recommended that OTA receive antennas outfitted with filters be supplied or subsidized by the 600 MHz user ecosystem. We note that markets such as Germany offer such antennas with filters following introduction of new bands in the former OTA spectrum and that such antennas are not subsidized.

Question 5:

Industry Canada is seeking comments on the proposed transition policy for the regular power TV stations, including but not limited to

- the design objectives for the development of the new DTV allotment plan;
- the methodology and parameters to ensure minimal impact to TV reception;
- the minimum notification period for the relocation to the new DTV assignments; and
- the overall timing for the transition to the new DTV allotment plan.

CanWISP Response 5:

Our proposal relieves pressure on the DTV, RRBS, and TV White Space community by requiring highly efficient use of the 160 MHz of spectrum above TV Channel 22 and thus providing alternative spectrum for potentially competing users of the remaining OTA spectrum. We recommend that the Radio Advisory Board of Canada develop a plan in concert with the DTV, RRBS, and TV White Space community so that a rapid but minimally disruptive transition can be realized.

While we defer to the insights of the DTV community, it is our belief that such a transition is possible by **July 1, 2016** and that if licensing fees result from the 600 MHz Band or some portion of it, that a transition fund for the DTV, RRBS, and TV White Space community may be created to ensure a timely and orderly transition.

Question 6:

Industry Canada is seeking comments on the proposed transition policy for LPTV undertakings in the spectrum to be repurposed to mobile use.

CanWISP Response 6:

While noting that we believe the designation *mobile use* is contrary to optimal use of the proposed 600 MHz Band, LPTV, like full power DTV users, can be accommodated through the remaining and wider – as proposed by Industry Canada – spectrum under TV Channel 22 in areas where fewer channels are in use, these being rural and remote communities. However, in those areas where sufficient channels are not available, CanWISP observes that these very areas tend to have very high broadband penetration rates, and that these broadband connections tend to have high capacities. It would be appropriate then to require any operator in the 600 MHz Band in areas where LPTV operators will not be able to be relocated to carry the LPTV channel in question as part of any OTT or IPTV undertaking it provides, and that this carriage requirement can be met with wireline, fibre, cable, or wireless delivery methods.

Question 7:

Industry Canada is seeking comments on the proposed transition policy for LPTV undertakings below the 600 MHz band.

CanWISP Response 7:

Due to the status of LPTV versus regular full-power DTV operators the priority for access should be as it now stands, and as noted in Response 6, LPTV operators be permitted to remain provided there are channels available after priority users are relocated below TV Channel 22 in our proposal. Displaced users should be accommodated in the same manner as we propose, so that in densely populated areas there will be digital carriage provided by operators in the 600 MHz Band and their affiliates. Our expectation that this approach, along with reducing costs of operation for LPTV broadcasters, is 'self-leveling' in that remote and rural areas will generally have available OTA channels while in urban areas the digital carriage option ensures continued audience access.

Question 8:

Industry Canada is seeking comments on the proposed transition policy for RRBS.

CanWISP Response 7:

RRBS systems play an important role in delivery of Internet connectivity in remote and rural areas, especially in consideration of the ability to use higher emission levels at the point of presence. The withdrawal of RRBS would have an impact on users which would be mitigated by two avenues. One being the ability of operators in sparsely populated areas to continue to operate in a new channel in the OTA spectrum below TV Channel 22 as we propose, and the other being the ability to transition to the spectrum available under our proposal for the 600 MHz Band using currently available TV White Space and RRBS systems which can be adapted in the field to operate using 5 MHz, 10 MHz, or larger channels. The manufacturers we surveyed are able to provide FDD and TDD operation with 5 and 10 MHz channel sizes and to coexist with future systems such as LTE Advanced and 5G technologies.

Given there would be 160 MHz assigned for the proposed 600 MHz Band, RRBS operators using currently offered equipment would be able to quickly transition into the band with a simple firmware update in some cases while RRBS operators with older equipment would be able to choose between operating in OTA below TV Channel 22, if channels are available, at relatively low cost, or making the transition to ITU standard size channels in the 600 MHz Band with new equipment, which could be based on LTE, *RRBS or TV White Space type equipment updated for the band*, or new technology provided it complies with out of band emission limits and does not cause interference with operators in other blocks.

Competition fosters innovation.

It is for this reason that we propose the future 600 MHz Band, which we have termed Digital Services Band, be technology-agnostic and based upon ITU-standard size 5 MHz blocks. It would be up to operators in the DSB to assemble blocks or sets of blocks in those service areas as required to deliver the type and quality of service the market requires. One cannot know if the prevailing technology of the day will be the prevailing technology of tomorrow, but we do know that major technological advances have delivered appreciable benefits for Canadians, and it would stifle innovation if we decided to limit this spectrum to any one technology or band plan concept due to a lack of foresight at regulatory entities outside of Canada.

We therefore submit our proposal for your consideration and look forward to the greater discussion with other interested parties on the future of our shared resource.