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Radio Advisory Board of Canada Conseil consultatif canadien de la radio

February 28, 2011

Manager, Mobile Technology and Services
Industry Canada,
300 Slater Street,
Ottawa, Ontario, K1A 0C8.

By email at: Spectrum.Engineering@ic.gc.ca

Subject: **Canada Gazette, Part I, December 4, 2010, Notice SMSE-018-10 Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum**

The Radio Advisory Board of Canada is pleased to respond Canada Gazette, Part I, December 4, Notice SMSE-018-10 Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum

The Board's response, prepared by RABC's Mobile and Personal Communications Committee, is attached.

This response was balloted to Board members. Seventeen of the RABC's 20 members responded as follows: 13 approved, 2 approved with comments, 1 abstention and 1 disapproved with comments.

The Sponsor Members' comments (which form an integral part of the RABC's response) are as follows:

Comments from the Broadcasters Technical Coordinating Committee:

"The Broadcasters Technical Coordinating Committee (TCC) considers it premature for the RABC to take the position that 500 MHz of additional spectrum will be required for commercial mobile services over the next 10 years. We believe that, in the absence of any relevant Canadian service demand and technical studies, the Board is not in a position to make fully-informed recommendations on this matter at this time."

Comments from the Broadcasters UTC Canada:

"UTC Canada supports a 10+10 MHz allocation for public safety"

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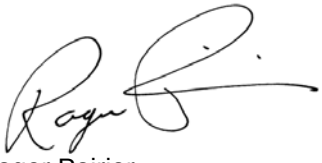
Comments from APCO Canada:

APCO Canada believes that this consultation is integral to the future development of communications technologies for Public Safety in Canada. As such APCO Canada cannot support anything less than the full 10+10 MHz of broadband spectrum be allocated to Public Safety. This consultation does attempt to create a compromise with the allocation of 5+5 MHz and the recommendation to wait until the United States makes a firm decision on the D Block.

It is our belief that any compromise in this area will also compromise Public Safety. For this reason we disapprove of this response.

Yours truly,



Roger Poirier
General Manager

Canada Gazette Notice SMSE-018-10
Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum

Response of the Radio Advisory Board of Canada

Executive Summary

1.1 The RABC has reviewed SMSE-018-10 and offers responses to the specific questions raised by the Department in the Consultation Paper. The RABC has also commented on other areas of the Consultation Paper where input was deemed appropriate. The paragraphs are numbered for ease of reference.

Our specific recommendations are summarized as follows and developed in more detail in the specific sections:

1.2 The RABC supports harmonization of the band with the USA and recommends that the Department adopt Option 1 which is to dynamically harmonize with the U.S. band plan.

1.3 The RABC further recommends that Industry Canada should keep step with the U.S. band plan, should the U.S. choose to make modifications before the Canadian auction begins.

1.4 The RABC suggests that mobile broadband will be a key platform for innovation over the next decade, thus the Department would be wise to view spectrum policy

as a key element of Canadian economic policy going forward.

1.5 The RABC would be pleased to assist the Department in drafting the detailed RSS and SRSP standards and suggests that for commercial bands within 698-806 MHz, base transmit powers be limited to 1 kW/MHz ERP (2kW/MHz ERP rural) and mobile stations be limited to 3W ERP. The RABC recommends that 698-716 MHz and 776-798 MHz be designated for mobile transmit only and paired with 728-746 MHz and 746-768 MHz respectively for base transmit.

1.6 Some of the RABC members believe that if the public safety broadband allocation in the current USA band plan is not modified to include a total of 10 +10 MHz of broadband spectrum, Industry Canada must consider a variance to the USA plan to accommodate such an allocation for Canada. The RABC recommends that the Department harmonize the public safety allocations in Canada with the current 5+5 MHz broadband allocation in the U.S. bandplan. The RABC further recommends that the Department defer its consideration, decision and licensing of D block spectrum until the situation in the U.S. has been resolved. Once the U.S. has decided on the services for which D block spectrum will be licensed, the Department should hold a separate consultation to consider the licensing of D block spectrum in Canada.

1.7 The RABC highly recommends that the Department work closely with the public safety agencies and their associations in order to include spectrum management and harmonization measures that will facilitate cross-border radio interoperability in the future bands from the outset.

1.8 The RABC supports the Department's proposals for the termination of LPTV stations operating above 698 MHz.

1.9 The RABC agrees with the Department's proposed March 31, 2012 date for the termination of wireless microphones and other devices licensed in spectrum above 698 MHz; however, the Board considers that additional regulatory action will be required in order to deal with the unlicensed devices believed to be operating in these bands.

1.10 The RABC agrees with the proposed changes to the Canadian Table of Frequency Allocations.

4. Commercial Mobile Services

4-1 What is the general need for additional commercial mobile spectrum at this time and what do you anticipate the future needs to be?

4.1 On April 21st, 2010 at the Spectrum 20/20 conference under the topic "Spectrum Demand – is there a looming crisis?" Mr. Peter Rysavy (President, Rysavy Research) clearly made the case that demand for mobile broadband spectrum will exceed the supply.

4.2 Indeed Rysavy Research has published several papers on this topic[1]. In particular, the RABC would like to highlight two such "white papers":

4.3 (1) An analysis written for the (US) CTIA and filed with the FCC on the consequences of not obtaining sufficient spectrum for the wireless industry, considering both technical and marketing aspects, April 21, 2010[2].

4.4 (2) A detailed report on the capacity constraints of today's mobile-broadband networks and the need for optimization, February 2010[3].

4.5 The RABC believes that a review of these analytical reports clearly supports the need for additional mobile broadband spectrum, and justifies Industry Canada's allocation of 700 MHz and 2.5 GHz bands for mobile services.

4.6 In addition, in March 2010 the Federal Communications Commission (FCC) released its *National Broadband Plan*[4] which included a comprehensive assessment of the United States' need for additional commercial mobile spectrum now and into the future. Noting the significant positive contribution of wireless services to gross domestic product, a situation mirrored in Canada according to a 2010 Ovum study[5],

[1] http://www.rysavy.com/papers.html.

[2] http://www.rysavy.com/Articles/2010_04_Rysavy_Spectrum_Shortfall_Filing.pdf.

[3] http://www.rysavy.com/Articles/2010_02_Rysavy_Mobile_Broadband_Capacity_Constraints.pdf.

[4] http://www.broadband.gov/download-plan/.

[5] http://cwta.ca/CWTASite/english/pdf/OVUM_Study.pdf

the FCC concluded that "Spectrum policy must be a key pillar of U.S. economic policy." The RABC suggests that if, as the U.S. believes, mobile broadband will be a key platform for innovation over the next decade, then the Department would be wise to adopt a similar policy premise for Canada going forward.

4.7 Regarding the need for additional commercial mobile spectrum, the FCC, for its part, concluded that an additional 500 MHz of new spectrum would be required for wireless broadband use within the next 10 years, further recommending that 300 MHz of that amount be made available for mobile broadband use within 5 years. The RABC notes that Canadian carriers are now beginning to see the types of exponential mobile data growth previously experienced in the U.S. Relating this to Canada, it is noted that the FCC has licensed more commercial mobile spectrum to date than has Canada and that, as in the U.S., the lead times required to allocate and licence spectrum can take years. In light of all this, the RABC believes that to meet the needs of Canadians for mobile broadband connectivity, in both urban and rural areas: (1) additional Canadian commercial mobile spectrum is urgently required; and (2) the requirements identified by the FCC, i.e., 500 MHz of additional wireless spectrum over the next 10 years, is a reasonable planning proxy of the requirement to meet trending demand, at least in larger urban Canadian markets. The RABC notes that the record of this consultation will likely provide further analysis and granularity regarding the need for additional commercial mobile spectrum in Canada.

5. 700 MHz Band Plan Issues and Considerations

General Comment

5.0.1 The use of broadband and multicarrier radio interface technologies is a general trend in high-speed mobile telecommunications systems[6] [7]. In particular, Orthogonal Frequency Division Multiplexing (OFDM) has been the primary technology selected by the industry in general, and is the basis for advanced new mobile technologies[8]. OFDM is a multiple-carrier technology in the sense that the entire signal bandwidth contains many sub-carriers, e.g., a 20 MHz LTE signal comprises 1200 sub-carriers.

5.0.2 The treatment of each OFDM sub-carrier individually requires much simpler mathematical methods than other air interface techniques that require the receiving station to handle an entire broadband signal all at once. Simpler receiving algorithms require fewer baseband processor operations. From a practical mobile device design and manufacturing perspective, this means devices require less current drain and longer battery life with smaller and less expensive baseband processing. The benefits of lower complexity, cost, power consumption and smaller size exist across the value chain for network operators and equipment manufacturers as well.

[6] "Transitioning to 4G, 3GPP Broadband Evolution to IMT-Advanced", (Peter Rysavy, Rysavy Research), September 2010
[7] Fourth-Generation (4G) Wireless Networks: Applications and Innovations, (edited by Sasan Adibi, Amin Mobasher, and Mostafa Tofighbakhsh, IGI publication), Jan. 2010
[8] Examples include 3GPP LTE definition at http://www.3gpp.org/LTE, and IEEE WiMAX definition at http://standards.ieee.org/about/get/802/802.16.html.

5.0.3 Because OFDM has the ability to carry data at very high speeds over wireless channels, and because speed is directly related to capacity, OFDM is economically attractive as well. For example, the higher the bandwidth, the greater the number of wireless users can be served at a given data rate, which provides the network operator with the ability to generate greater revenue than was possible with older, narrow-band technologies.

5.0.4 With increased demand for more capacity and data rates, global industry participants and government regulators carefully consider the impact of any wireless technology on spectral efficiency, as spectrum is of short supply and is a finite resource. One reason that OFDM was selected by the industry for future wireless broadband systems is its ability to substantially increase spectral efficiency when the signal comprises a relatively large number of sub-carriers, which requires a relatively large amount of contiguous spectrum[9]. This is a statistical trunking efficiency increase in spectral efficiency. Trunking efficiency increases as data for various users are scheduled for transmission over a large number of sub-carriers. Trunking efficiency is therefore dependent on two things: a) the network scheduling algorithms and b) the amount of spectrum the RF signal occupies. These gains may be dramatic at times, e.g. 100% – 300% under certain conditions.

[9] "Carrier Load Balancing Methods with Bursty Traffic for LTE-Advanced Systems", (Yuanye Wang*, Klaus I. Pedersen†, Preben E. Mogensen*†, and Troels B. Sørensen*; *Aalborg University, †Nokia Siemens Networks – Denmark), 2010

Depending on the scheduling technique, gain in statistical system capacity may be exponentially related to RF spectral occupation[10] [11] [12].

5.0.5 In a practical sense, OFDM can exhibit a significant increase in spectral efficiency if the occupied spectrum is 10 MHz or more[13] [14] [15]. For this reason, it is important for Industry Canada to focus on ways to enable band plans and licensing policies that provide for the possibility of licensees holding significant amounts of contiguous spectrum, rather than limiting licensees to relatively small amounts of contiguous spectrum.

5.0.6 As researchers push the limits of wireless communication and system capacity, there are now experiments and proposals for wireless air interface techniques, including extensions to OFDM, that would occupy 40 to 100 MHz or even more contiguous spectrum, with substantial improvements in spectral efficiency[16] . This trend would suggest the government take a flexible approach to spectrum management that may incorporate the notion of contiguous spectrum for future use, e.g. spectrum adjacent to an allocation for an LTE network operator that is currently in use, but may be re-farmed as technology advances to the point that

[10] "Spectrum Sharing for Future Mobile Cellular Systems", (Mehdi Bennis, University of Oulu, Finland), November 20, 2009
[11] "Business models and business role interaction for wireless broadband access services provided by non-telecom actors and mobile network operators", (Jan Markendahl, Royal Institute of Technology, Kista, Sweden), June 20, 2008
[12] "Comments on the 1800 MHz Question", (Hi3G Access AB, Stockholm, Sweden), January 19, 2010
[13] "HSPA+ is Here! What's Next?", (Qualcomm Incorporated), May 2010
[14] LTE and the Evolution to 4G Wireless: Design and Measurement Challenges, (Moray Rumney, Agilent Technolgies), July 2009
[15] LTE, the UMTS long term evolution: from theory to practice, (Stefania Sesia, Matthew P. J. Baker, Issam Toufik; Wiley Publishing), 2009
[16] LTE and the Evolution to 4G Wireless: Design and Measurement Challenges, (Moray Rumney, Agilent Technolgies), July 2009

systems possibly occupy 100 MHz or more. Currently, the 3GPP standard for LTE supports a flexible spectrum option whereby the operator is able to occupy channels between 1.4 MHz and 20 MHz of RF spectrum. Given this trend, it is conceivable that as LTE-Advanced/IMT-Advanced evolve further, that this flexible spectrum option may be extended to support spectral occupation of 100 MHz or more in various increments. An additional benefit of allocating large blocks of contiguous spectrum is to reduce the number of guardbands required.

5.0.7 Industry Canada needs to develop a path for systematically releasing larger contiguous spectrum blocks or much of the expected capacity gains from new technologies such as OFDM will be given up. Serious consideration should be given on how to extend above and below the currently proposed frequency allocations, if refarmed, in a contiguous manner.

5-1 Based on the criteria listed above, which of the four band plan options should be adopted in Canada? Why is this option preferred over the other options? If Option 3 (APT band plan) is selected, what should the block sizes be? In providing your responses, include supporting arguments, including potential benefits to wireless subscribers.

5.1.1 The RABC agrees with the Department view that, it is important to have a band plan enabling “harmonization of equipment specifications to the extent possible, enabling economies of scale and greater equipment availability for consumer and infrastructure equipment”, and “cross-border frequency coordination”.

5.1.2 This also means a band plan unique to Canada is absolutely undesirable for the Canadian implementation.

The Consultation Paper presented 4 options for the band plan.

5.1.3 The RABC recommends that the Department adopt Option 1 which is to harmonize with the U.S. band plan. While Option 1 is not "perfect" it is the only option that will work due in part to the ready availability of standards and equipment. The RABC further recommends that IC should keep step with the U.S. band plan, including guardbands, should the U.S. choose to make modifications before the Canadian auction begins.

The following is the rationale for this recommendation.

5.1.4 The RABC concurs with the Department that Option 3 "maximizes the available contiguous spectrum in the 700 MHz band given that there is a total of 90 MHz of paired spectrum available to be licensed". However, if this band plan is adopted, Canadian industry would face an uncertain timeframe for available equipment designed for this band plan. More importantly, adopting this band plan would introduce significant dislocation to existing public safety users, cross-border interference issues and U.S. roaming issues. Therefore, the RABC recommends that the Department not adopt Option 3.

5.1.5 While Options 2a and 2b are initially appealing as a means to maximize the "usable" amount of spectrum, in practice they would introduce several problems due to:

- Potential interference from adjacent TV stations (below 698 MHz) requiring at least 1 MHz guardband.
- Potential interference from blocks D and E (716 MHz – 728 MHz) both within Canada (depending on Canadian use of D and E) and from cross-border interference necessitating at least 1 MHz guardband.

Rationale for Adoption of Option 1

(1) Spectral Efficiency:

5.1.6 In the lower 700 MHz portion, because of interference from TV channel 51 and potential interference from the lower D block, 1 MHz guardbands are required at 698 MHz and 716 MHz rendering the actual available spectrum from 699 MHz – 715 MHz. Thus only 16 MHz of the allocated 18 MHz is available for operation.

5.1.7 Taking into consideration the need for the guardbands, with Option 1 (three 6 MHz blocks), any combination of 5 MHz and 10 MHz channels can be fitted into the 3 blocks of 6 MHz resulting in 15 MHz of spectrum used over the allocated total of 18 MHz.

5.1.8 Again taking into consideration the need for guardbands, with option 2a (one 8 MHz and one 10 MHz), only a 1.4 MHz and 5 MHz channels can fit into the

8 MHz block; a 3 MHz plus a 5 MHz channels can be fit into the 10 MHz block. This would result in 14.4 MHz of spectrum used over the allocated total of 18 MHz.

5.1.9 Similarly including consideration for guardbands, with option 2b (one 3 MHz and three 5 MHz blocks), only a 1.4 MHz channel can be fit into the 3 MHz block. Either two 5 MHz channels or a 10 MHz channel can be fit into the next two 5 MHz block. A 3MHz channel can be fit into the last 5 MHz block. This would result in 14.4 MHz of spectrum used over the allocated total of 18 MHz.

5.1.10 In a commercial implementation for the US market, it is likely that equipment is designed to support only 5 MHz and 10 MHz channelization. In this situation, Option 1 would still be able to support three 5 MHz channels, or a 5 MHz and 10 MHz channels, i.e., 15 of 18 MHz is used.

5.1.11 Option 2a and Option 2b would only be able to support two 5 MHz channel fitting into each of the 8MHz and 10MHz block. Similarly, Option 2b would only be able to support two 5 MHz channels fitting into the middle 5 MHz blocks. Therefore both options 2a and 2b would provide 10MHz of spectrum usage over the total of 18 MHz. Thus Option 1 will be significantly more spectrally efficient than either Options 2a or 2b.

(2) Developments in the US:

5.1.12 While the U.S. band plan does not specify the duplex directions and the necessary guardbands at 698 MHz and 716 MHz the, standardization bodies and commercial implementations have taken into consideration the detailed technical constraints and have made adjustments. For example:

- The duplex direction was decided based on compatibility between commercial services and incumbent public safety services,
- the guardband at 698 MHz was included to address interference from broadcasting services in channel 51, and
- The lower C block's upper edge is adjusted to 715 MHz to accommodate potential mobile broadcast services in the adjacent D block.

5.1.13 Therefore, to maintain compatibility with operations in lower D and E blocks, the upper paired D block and TV channel 51, it is prudent for the Canadian band plan to maintain alignment with the standards and harmonization with the US band plan. Without harmonization in the band plan, unique Canadian equipment may be necessary.

5.1.14 Note that interference from TV channel 51 and lower D and E blocks will occur not only because of Canadian users in those blocks but also because of U.S. users at the Canada-U.S. border areas.

(3) Equipment ecosystem:

5.1.15 Even though technical standards support various bandwidths from 1.4 MHz to 20 MHz, it is likely that equipment manufacturers will first develop products consistent with the larger U.S. market with 5 MHz and 10 MHz bandwidths. There is some uncertainty on whether manufacturers would develop specific equipment solely for the Canadian market using 1.4 MHz and 3 MHz bandwidth unless it represented sufficient scale. Therefore, even if it is technically possible, Canadian specific bandwidths needing the 1.4 MHz and 3 MHz variants would cause a delay in equipment availability and likely increase cost.

(4) Handover (during calls) at the border:

5.1.16 Canadian specific channel bandwidths may impact handover operations at the border. For example, it may be more challenging to maintain the calls and perform a handover across the border between a carrier with a 5 MHz or 10 MHz channel and a cross border carrier using a 3 MHz or 1.4 MHz channel.

5.1.17 The RABC has identified a minor deviation from the U.S. band plan that should be considered by the Department since it would allow more operators to acquire scarce 700 MHz spectrum in the upcoming auction. Specifically, the paired block 746-757 MHz / 776-787 MHz (known as the “Upper C block”) could be split into two paired blocks of 5+5 MHz (e.g., 746-751 MHz / 777-782 MHz and 751-756 MHz / 782-787 MHz).

5.1.18 Although this would represent a deviation from the size of the block that was licensed in the U.S., it would not violate the fundamental structure of the U.S. band plan and would maintain the upper and lower limits of the Upper C block. This means that consumer devices designed for operation in the Upper C block in the U.S. could be used by Canadian licensees of either of the sub-blocks proposed above. The RABC would note that Canada has already similarly deviated from the U.S. PCS band plan with respect to the licensing of PCS B1, B2, and B3 blocks as three separate paired blocks in Canada, whereas this spectrum has been licensed as a single paired block in the U.S.

5.1.19 At the same time, the licensing of two smaller paired blocks rather than a single larger paired block would provide more flexibility for operators and would not preclude the possibility of any party from successfully bidding for the two paired sub-blocks and assembling them into a single paired block, in the event that they wish to acquire a larger paired block of contiguous spectrum in order to support their business plans.

Additional Comments

5.1.20 In the consultation paper, the Department points out that "U.S. operators in the band have announced and/or have started deploying systems based on 3rd Generation Partnership Project (3GPP) and proprietary standards as depicted in 5.2.", and as part of this statement the Department references 3GPP TS36.104.

5.1.21 While the regulations should maintain technology neutrality, it would be unwise to ignore the frequency band definitions and the duplex directions contained in TS36.104. The frequency plan defined in this standard includes the placement of certain guardbands that are designed to be practical within the U.S. band plan. The duplex direction should be considered in the development of the Canadian band plan.

5.1.22 It should be further noted that since the publication of this consultation paper, TS36.104 has been updated (new version V9.6.0) to adjust the lower edges of Band 12 as starting at 699 and 729 MHz, respectively. Further revisions are quite possible as the device manufacturers resolve technical issues within the band. While the Notice discusses potential interference from DTV transmitters, the Board notes that both digital and analog TV operations will exist for some time in the spectrum below 698 MHz.

5.1.23 It should also be noted that, while the 3GPP standards contain provisions for many features and configurations, many possibilities will not become part of the product ecosystem. TS36.104 is a clear example of compromise for products to be practical in the complex U.S. band plan. Other variations will not be entertained as there is an associated cost or performance penalty. Bands different from those defined within TS36.104 are not practical.

5.1.24 The RABC would be pleased to assist the Department in drafting the detailed RSS and SRSP standards and suggests that for commercial bands within 698-806 MHz, base transmit powers be limited to 1 kW/MHz ERP (2kW/MHz ERP rural) and mobile stations be limited to 3W ERP. The RABC recommends that 698-716 MHz and 776-798 MHz be designated for mobile transmit only and paired with 728-746 MHz and 746-768 MHz respectively for base transmit.

5.1.25 The lower power limits than what FCC defined for the D and E blocks are based on the fact that AT&T, a major US licensee who has substantial holdings within the lower D and E blocks, has publicly announced their intention to use this spectrum to augment the capacity of their commercial mobile network. This effort by AT&T will most likely lead to a de-facto low power limit for these blocks in the US irrespective of FCC's rules.

5-2 The band plans presented in the options above include guardbands. Should the Department auction the guardbands, or should these frequencies be held in reserve for future use such that they are technically compatible with services in the adjacent bands?

5.2.1 As noted previously, the RABC recommends that IC should keep step with the U.S. band plan, should the U.S. choose to make modifications to any guardband definitions before the Canadian auction begins. Speaking only with respect to the need for guardbands adjacent to and separating public safety band spectrum, the Board recommends that Industry Canada continue to support the four 1MHz partitions defined in the April 2010 release of the narrowband related SRSP 511 Issue 2. Two of these blocks (768 – 769 MHz paired with 798 – 799 MHz)

provide isolation to the proposed public safety broadband allocation immediately below the narrowband channels, and a third block (775 – 776 MHz) provides isolation to potential commercial broadband allocations immediately above the lower narrowband channels. The SRSP did not specifically label these as guardband blocks, but instead channelized these blocks into 6.25 kHz aggregable channels with the intent of utilizing these blocks, in a limited way, pending the outcome of future consultations. The fourth block (805-806 MHz) is also defined in the SRSP as a simplex block for public safety with the intent of providing some isolation with the existing land mobile spectrum immediately above the upper narrow band 700 MHz channels. These blocks also align with the guardband allocations defined by the FCC in the U.S.

5.2.2 It should be noted that in the U.S. band plan, the existing guardbands between the D and C blocks were intended to provide interference isolation between the original 10+10 MHz public/private shared public safety/commercial broadband network and the commercial C block. Specifically, if Industry Canada allocates 10+10 MHz to public safety, the 1 MHz guard band (757-758 MHz and 787-788 MHz) shown in SMSE-018-10 (Figures 5.3, 5.4 and 5.5) will continue to be required. However, if Industry Canada allocates only 5+5 MHz to public safety (763-768 MHz and 793-798 MHz), a 1 MHz guard band should be placed immediately below the public safety broadband block (at 762-763 MHz and 792-793 MHz). The impact of interference from adjacent channel systems is especially of concern to public safety as incidents cannot be planned around areas of poor or

non-existent coverage. These guardbands must be held in reserve rather than auctioned.

5-3 Do public safety agencies need spectrum for broadband applications? If so: (a) How much and for which type of applications? (b) What are the anticipated deployment plans and the possible constraints, if any, in implementing these plans? (c) Is there suitable alternate spectrum to the 700 MHz to meet these broadband requirements?

5.3.1 (a) Spectrum is the primary building block for any wireless communications. With the advances in commercial broadband technology available today, including the newest generation of broadband known as 4G, public safety has identified an urgent need to have access to 21st century data and video communications during all emergency incidents. Aside from the obvious answer that more spectrum is always the best choice for public safety, or any licensee of wireless communications, public safety in Canada must be assured of sufficient contiguous and dedicated broadband capacity to serve public safety's mission critical broadband communication requirements.

5.3.2 Some members of the RABC request that Industry Canada allocate 20 MHz (contiguous 10+10) of 700 MHz spectrum to support first responder's broadband applications, not only for those envisioned today, but for future applications that will evolve. In the event that the FCC does not allocate the D Block to public safety**,** some members of the RABC are convinced that such an allocation remains a necessity in Canada. 20 MHz of spectrum for public safety will allow the best use of broadband technologies such as LTE, to provide the necessary capacity for future data-intensive applications. The deployment of LTE would bring compatibility and enable interoperability amongst first responders in both Canada and United States where the public safety community has already sanctioned the LTE standard. Deployment of LTE by commercial operators in the adjacent 700 MHz bands may provide further roaming opportunities for public safety onto commercial networks for their non-mission critical communications.

5.3.3 It should be noted that the Federal Communications Commission (FCC) in the U.S. initially allocated 5+5 MHz of broadband spectrum to public safety and, with the failure to create a public/private broadband network, public safety has been strongly urging both Congress and the FCC to reallocate an additional adjacent 5+5 MHz (known as the D Block). The U.S. Obama administration has recently announced its support for this reallocation and if approved, will provide a 10+10MHz broadband block available for public safety use

5.3.4 Any single public safety agency using public safety broadband network must have sufficient capacity to handle day to day operations as well as managing major incidents. In capacity models built to analyze projected broadband needs, three levels of incidents were considered including day to day, major incident, and catastrophic; and projections were made for the number of public safety personnel, front-line vehicles, and command vehicles that would normally respond. In addition, the broadband demand at an incident scene can be divided into three general classes of usage:

5.3.5 Individual Computer Aided Dispatch (CAD) functions: Overhead functions associated with a person or vehicle, including incident data, GPS information, medical telemetry and other status messaging and queries. While each individually consumes relatively low down/uplink bandwidth, it can be significant when considered in aggregate across many personnel and vehicles.

5.3.6 Incident scene database lookups, downloads and information searches: In general, all expected initial data, including downloads of manuals, incident scene images, maps, topography information and building plans, must be downloaded and available in the first 10 minutes of an incident so commanders can quickly assess the scene and develop a response strategy. Demand is scaled with size and complexity of the incident.

5.3.7 Video: Personal video cameras for responders in the hot zone, incident car videos positioned around the perimeter, and situational awareness cameras deployed around the scene. Video is uplinked via the network and a subset of streams is down-linked and switchable on command to the on-scene commander.

5.3.8 Calculating the above broadband uplink and downlink demands and comparing them to the expected average capacity of a single LTE serving sector (cell edge performance, especially in the uplink, would be considerably less, while optimistic peak rates can be much higher), and adding a minimum background load of 20% for non-incident related (day-to-day) activities across the sector coverage area, show that 5+5 MHz of spectrum capacity is insufficient to service the uplink demands for even a Level 1 incident. 10+10 MHz services the demands of a Level 1 and Level 2 incident, but potentially falls short for the Level 3 incident workload demands.[17]

5.3.9 (b) The RABC has no comment.

5.3.10 (c) The RABC believes that no other suitable spectrum exists currently that could be licensed to public safety to meet the wide-area mobile broadband requirements of public safety.

5.3.11 The 700 MHz band possesses several advantageous characteristics that make it very desirable to implement public safety broadband applications over other frequency bands including a good balance between in-building and longer distance coverage, and having sufficient channel bandwidth required to provide the necessary capacity for broadband. Additionally, the 700 MHz band will be

[17] Based on Motorola analysis results presented to the FCC Office of Engineering and Technology, the Public Safety and Homeland Security Bureau and the Wireless Telecommunications Bureau on April 9, 2010. Presentation filed as public record in Ex Parte by Motorola on April 12, 2010 on WT Docket 06-150 and PS Docket 06-229.

available nation-wide and will be ideally harmonized with the U.S., fulfilling public safety requirements for national and international interoperability.

5.3.12 By definition, broadband communications require a broad channel. There is very little "green" spectrum that is open in the 1 kHz to 1 GHz range, resulting in no contiguous spectrum availability that has the operational capacity required for broadband communications. While there may be some opportunity for on-scene hot spot broadband implementation in the higher GHz bands including the 4.9 GHz band, the reduced coverage footprint and the related increase in infrastructure costs make this spectrum much less favourable for any wide-area public safety use.

5-4	Comments are sought on the need for public safety broadband radio systems to be interoperable: (a) between various Canadian public safety agencies; (b) between Canadian and U.S. public safety agencies.

5.4.1 (a) The need for interoperability with respect to public safety radio communications has been well documented and noted over the past several years. Thousands of incidents that require mutual aid and coordinated responses occur every day. The RABC believes that Industry Canada should allocate a contiguous nationwide block of spectrum for broadband applications to ensure that broadband user devices will function on any public safety network in Canada.

5.4.2 (b) It is imperative that the Canadian 700 MHz public safety broadband spectrum allocation align with the U.S. band plan identified in Figure 5.7 - Canadian and U.S. Band Plan for Public Safety, which includes the potential allocation of the D Block to public safety. This will ensure that broadband user devices will function on any public safety network and in either country. This not only provides the required cross border interoperability functionality, but creates a much larger market for specialized public safety devices creating scale and lower costs. The FCC in the U.S. has recently mandated the use of LTE technology for 700 MHz public safety broadband systems setting the precedent for public safety agencies.

The RABC recommends that Canada align with this standard for Public Safety agencies.

5-5 What are the challenges faced today by public safety agencies to have cross-border radio interoperability in other frequency bands?

5.5.1 Many obstacles exist today between public safety agencies when attempting to achieve communications interoperability with their partners across the Canada-U.S. border. This includes the limited availability of common spectrum, and some restrictions that impede the free movement of user equipment for mutual aid responses.

5.5.2 Agencies, for the most part, operate in different frequency bands from their counterparts on the opposite side of the border including the VHF, UHF 400 MHz, and 800 MHz bands. These allocation plans for public safety are not aligned and have evolved differently in both countries with dissimilar services being authorized across the border. These bands also lack established common channels for the purpose of first responder interoperability. As these bands are very congested along the border, the identification and coordination of channels to be shared and to fill coverage gaps become a very difficult and very lengthy process. This is considered by first responders as a significant barrier in providing timely and effective emergency responses.

5.5.3 These challenges have been mitigated somewhat with the advent of network connectivity, IP gateways, Inter RF Subsystem Interface (ISSI) and soon with

multi-band radios when widely available. These methods, however, add levels of complexity and great costs/redundancy with each agency having often to deploy an additional overlay to their own infrastructure to provide interoperability communications distinct from the daily operations. Other solutions also involve carrying multiple user radios to be compatible with the other agencies; this has an operational and economic impact on the agencies.

5.5.4 The future holds promises for the 700 MHz public safety narrowband plan with channels reserved for the purpose of interoperability and associated with a common technical standard and a clear set of rules, all harmonized between Canada and United States.

5.5.5 The RABC highly recommends that the Department work closely with the public safety agencies and their associations in order to include spectrum management and harmonization measures that will facilitate cross-border radio interoperability in the future bands from the outset .

5-9 If band plan Option 1, 2a, or 2b in Section 5.1 is chosen, which one of the three options described above should be adopted and why is this option preferred over the other options? Provide supporting rationale.

5.9.1 Some members of the RABC believe that synergy with the U.S. is important. The RABC recommends that the Department defer its consideration, decision and licensing of D block spectrum until the situation in the U.S. has been resolved. Once the U.S. has decided on the services for which D block spectrum will be

licensed, the Department should hold a separate consultation to consider the licensing of D block spectrum in Canada. However, some of the members believe that to meet the public safety broadband spectrum capacity requirements, Canadian public safety agencies require Option 3: 10+10 MHz designated for public safety immediately. These members do not believe that a broadband system based on a 5+5 MHz block defined in Option 1 will provide the capacity necessary as discussed in our response to 5.3. As an absolute minimum, the RABC believes that a 5+5 MHz block for public safety broadband should be allocated providing harmonization with current U.S. public safety bandplan.

5-11 If the APT band plan (See Option 3 in Section 5.1) is adopted: (a) Given that the APT band plan requires a 55 MHz duplexing separation, can Canadian public safety services operate their current narrowband systems in this band plan configuration? If not, what are the possible alternatives to address public safety needs? (b) Should spectrum be designated for dedicated public safety broadband systems, and how much?

5.11.1 (a) The existing narrowband channelling established in SRSP-511 was designed to align with the U.S. band plan incorporating a 30 MHz duplex separation assigning the uplink mobile transmitters to the upper frequencies (798 to 806 MHz), and downlink base transmitters to the lower frequencies (768 to 776 MHz). Current narrowband systems being manufactured for the North American market based on this band plan would not be able to accommodate a shift in channelling to align with the APT plan. This is not only due to the differing duplex separation (55 MHz), but also due to the reverse configuration of the uplink and down link partitions incorporating mobile transmitters on the lower frequencies and base transmitters on the upper frequencies.

5.11.2 The adoption of the APT band plan in Canada would therefore necessitate the production of unique product for the Canadian Public Safety marketplace which is

highly unlikely. This concern is in addition to the fact that many Canadian Public Safety agencies are now well into the purchasing process for 700 MHz narrow band systems based on product designed to the established band plan. Even if manufacturers could modify existing products, or could be convinced to produce unique products for Canada, the costs of delaying implementation and the likely increase in the cost of this hardware because of smaller production volumes would be significant, and therefore not acceptable.

5.11.3 Another major consideration if the band plan does not align with the American plan is cross-border interoperability. The existing SRSP 511 band plan sets out interoperability channels that are common on both sides of the border so that Public Safety responders can easily interoperate when responding to incidents at or near the Canada U.S. border. These efforts to harmonize interoperability channels have been sponsored by Public Safety Canada, and the Department of Homeland Security in the U.S.

5.11.4 The Board is not aware of any available alternative spectrum allocation for Public Safety radio systems if the APT plan is adopted and narrowband is therefore excluded due to the lack of equipment availability. The demand for additional narrowband spectrum is immediate, and incurring an additional lengthily delay to identify and transition an alternate spectrum allocation is simply not acceptable.

5.11.5 (b) If the APT plan was actually adopted, Public Safety would request a 10+10 MHz broadband allocation as addressed in the response to question 5-9. The narrowband allocation of 6+6 MHz (not including guardbands) would also have to be accommodated.

5-14	The Department seeks comments on the transition policy proposed above.

5.14.1 The RABC supports the Department's proposals for LPTV stations. The RABC notes that SRSP-511 contains the provision for national low power, national high power, and national interoperability channels that could be used at anytime and at any location. For public safety radio systems, rural areas are as important as urban areas and differing transition notification periods, depending on the LPTV station location, could cause implementation delays. The provision of one- or two-year notification periods for LPTV to transition to alternate channels does not align well operationally for 700 MHz radio users who could be called to respond to any location in the country at a moment's notice. Industry Canada's broadcasting database shows that there are only three LPTV transmitters remaining in the bands 764-776 MHz and 794-806 MHz, and that these are located in two relatively remote areas of British Columbia. The Board recommends that Industry Canada initiate and mediate discussions between the Public Safety and TV licensees, with a view to negotiating specific dates, after 31 August 2011, on which these TV operations would terminate.

5-15 The Department seeks comments regarding its proposal to permit low-power licensed devices, including wireless microphones, to operate in the band 698-764 MHz and 776-794 MHz only until March 31, 2012.

5.15.1 The RABC agrees with the Department's proposed March 31, 2012 date; however, the Board has concerns about the number of unlicensed devices that are believed to be operating in the band. To address this problem, Industry Canada should implement a public information campaign as soon as possible to notify all users, licensed and unlicensed, about the termination date. To discourage further unauthorized uses, the Department should also issue an order prohibiting the

manufacture, importation, distribution, leasing and sale of any such equipment capable of operating in the band 698-806 MHz.

6. Changes to Canadian Table of Frequency Allocations

6-1	The Department seeks comments on its proposed changes to the *Canadian Table of Frequency Allocations* for the band 698-806 MHz.

6.1.1 The RABC agrees with the proposed changes.

6-2	The Department seeks comments on the spectrum utilization policy proposed above.

6.2.1 The RABC agrees with the MBS designation and notes that SP-768 has already designated 768-776MHz and 798-806MHz for public safety use.