

Radio Advisory Board of Canada

Conseil consultatif canadien de la radio

October 27, 2006

Leonard St-Aubin
Director General
Telecommunications Policy Branch
Industry Canada
300 Slater Street
Ottawa, Ontario
K1A 0C8

Subject: **Canada Gazette, Part I, August 2006, DGTP-006-06 - Proposed Spectrum Utilization Policy, Technical and Licensing Requirements for Wireless Broadband Services (WBS) in the Band 3650-3700 MHz,**

Dear Mr. St-Aubin

The Radio Advisory Board of Canada is pleased to respond to Canada Gazette Notice DGTP-006-06.

The Board's response, prepared by Fixed Wireless Committee, is attached.

This response was balloted to Board members. Seventeen of the RABC's 21 members responded as follows: 11 Approved, 3 Approved with comment, 3 Abstained. There were no Disapprove ballots. The Sponsor Members' comments (which form in integral part of the RABC's response) are:

From Rogers Communications

Rogers strongly supports the licensing of this band as two 25 MHz blocks, with one block licensed on an exclusive basis and one block licensed on a non-exclusive basis, in each geographic area. Rogers does not support the licensing of this band as a single 50 MHz block

From the RCMP

The RCMP supports the RABC comments with some reservation on the licencing fees proposed for the non-exclusive block of spectrum as a similar scheme is under review in the 4.9 GHz DGRB-002-06 consultation currently underway.

From the CSSIF

The Canadian Satellite and Space Industry Forum (CSSIF) approves of the RABC submission in response to DGTP-006-06 subject to the following comments. For ease of reference the section references are the same as in the Department's Consultation and the RABC comments:

1. **5.2 Fixed Satellite Service**

The CSSIF does not agree with the proposed secondary allocation to FSS in the 3650 – 3700 MHz band. While “sharing between FSS stations deployed on a limited basis and ubiquitous WBS” might indeed be impractical, the fact is that there are vast tracts of Canadian territory where WBS will never be economically feasible. That is WBS will not be “ubiquitous”. In such circumstances, the appropriate sharing mechanism for efficient spectrum use is a “soft segmentation” approach, which is already precedented in the adjacent 3500-3650 MHz band by virtue of footnote C20.

2. **B1) Impact of the proposed WBS transmitters power level (operating below 3700 MHz) into FSS receivers LNB (operating above 3700 MHz)**

The CSSIF does not agree that frequency coordination is a possible technique to mitigate the serious problem of earth station LNB overload. The LNB passband covers the entire proposed WBS band of 3650 – 3700 MHz. There is therefore no possible frequency coordination that would mitigate the problem.

3. **B2) Impact of the proposed WBS transmitters OOB emissions above 3700 MHz into FSS receivers**

The CSSIF believes that frequency coordination is not a suitable technique to address the OOB interference, especially given the large installed base of unlicensed receive-only stations that have been operational for many years in the adjacent 3700 – 4200 MHz band. The onus should be on the emitter of OOB interference to reduce OOB levels to tolerable levels.

Additional RF filtering is also an inappropriate technique. OOB emissions fall within the passband of the desired signals between 3700 – 4200 MHz. Additional filtering at the earth station could only reduce OOB emissions to the extent that desired signals are also attenuated.

Yours truly,

President

Introduction

The Radio Advisory Board of Canada is pleased to respond to Gazette Notice DGTP-006-06, Proposed Spectrum Utilization Policy, Technical and Licensing Requirements for Wireless Broadband Services (WBS) in the Band 3650-3700 MHz.

We are aware that the FCC in the U.S. may revise its current licensing approach for this band. As such Industry Canada should take into consideration the final FCC decision in this regard.

For ease of reference this response uses the section numbering system contained in the Consultation paper.

5.1 Point-to-point systems

The Department proposes to either grandfather or displace existing point-to-point systems in the band 3650-3700 MHz. Further, extensions and/or expansions of grandfathered systems on a case-by-case basis, outside of urban areas, may be permitted.

Comments are invited on whether point-to-point systems in the band 3650-3700 MHz should be grandfathered or displaced and what conditions should apply in either case.

The Board recommends that the Department displace point-to-point systems in the band 3650-3700 MHz. The Board also agrees with the Department's intention to implement transition policy principles similar to those outlined in Appendix 3 of the *Policy and Licensing Procedures for the Auction of Spectrum Licences in the 2300 MHz and 3500 MHz bands* (DGRB-003-03).

5.2 Fixed Satellite Service

The Department proposes that FSS receive earth stations located at Weir, Quebec be grandfathered. Operators wishing to establish wireless access systems within a 150 km radius of these earth stations would be required to coordinate with the earth station operators.

The Department further proposes that any future FSS receive earth stations in the band 3650-3700 MHz operate on a secondary basis.

Comments are invited on this proposal.

The Board agrees with the grandfathering of the FSS receive earth station located at Weir, Quebec and the proposed coordination requirements. The majority of members of the Board agree with the Department's proposal that any future FSS receive earth stations in the band 3650-3700 MHz operate on a secondary basis. It is their understanding that sharing between FSS stations deployed on a limited basis and ubiquitous WBS would be impractical.

One member of the Board proposes that new FSS receive earth stations in this band be operated on a co-primary basis with WBS systems with similar provisions as applicable to the FSS in the band 3500-3650 MHz under footnote C20.

6. Applications in Canada

The Department seeks comments on types of wireless broadband applications which may be deployed in Canada in the near future.

There is a significant growth of fixed services occurring today therefore the mix of wireless broadband applications and services that can be expected is greater than ever.

WBS will be an important resource supporting internet connectivity for data, voice, video and other value-added services. The band will be able to directly support consumers, schools and businesses in urban, suburban and rural applications. The band is capable of being used by wireless mesh networks for high-density consumer applications in small cells, as well as being used for lower-density applications in larger cells, and also offering point-point and point-multipoint backhaul capability for operators.

7. Licensing Approach

The Department is of the view that the issuance of spectrum licences, as described above, would be the appropriate licensing mechanism for this service. Comments are invited on this proposal.

The Board strongly supports the Department's intention to use spectrum licences as the appropriate licensing mechanism for this band.

7.1 Service Areas

Comments are sought on the proposal to use Tier 4 service areas for the licensing of the bands 3650-3700 MHz.

The Department invites alternative proposals on service areas, including rationale, where a Tier 4 service area is not suitable.

The Board support the use of Tier 4 service areas for the licensing of the band 3650-3700 MHz and notes that this was the licensing tier adopted for the licensing of the 3475-3650 MHz band.

7.2 Spectrum Structure and Licensing Options

Comments are invited on the proposed options for exclusive and/or non-exclusive licensing and any other options not outlined in the table, with supporting rationale. Any option could be applied to all or part of the spectrum. In the case of urban/rural service areas, the Department seeks the rationale and criteria for defining urban and rural.

It should be noted that the licensing process and requirement for contention-based protocols will be determined based on the option selected.

The Board notes that there is considerable discussion in the U.S. regarding the final spectrum structure and licensing options. As a general principal we support alignment with the U.S. to the greatest extent possible.

At this time the Board proposes splitting the band into 2 blocks along a 30/20 MHz split. Some of the members prefer the entire band to be licensed on an exclusive basis for both urban and rural Tier 4 service areas. An exception could perhaps be made for the rural areas where the 20 MHz

block could be made available on a FCFS basis for point-to-point systems in those tier 4 areas having a population of less than 30,000. The use of this criteria for defining the FCFS areas ensures that while the urban/rural definition debate continues those areas having the least dense population will be assured service while still maintaining the integrity of the exclusive licensing process. On the other hand, some members would prefer the 20 MHz block be reserved for non-exclusive use.

Given our current understanding of standards developments, the 30/20 MHz split would seem to offer the greatest accommodation of channel widths. For example, the 25/25 MHz split would eliminate the N= 3/10 MHz case and the 10+20 MHz case or the 10+10+10 MHz case or require multiple technologies. Nevertheless, we also believe the 25/25 MHz structure could be acceptable.

7.3 Contention-based Protocols

Comments are invited on the proposed definition as well as the Department's proposal to require the use of contention-based protocols for non-exclusively licensed spectrum in the band 3650-3700 MHz. Alternative proposals are welcome and should include details as to how these proposals address the potential for interference between non-exclusive licensees.

The Department invites comments on the requirement to enter station and contact information into a publicly accessible database.

Should a non-exclusive block of frequencies be made available, the use of contention-based protocols or other coordination procedures will be required. Final decisions in the U.S. in regard to non-exclusive use and contention-based protocols would significantly impact whatever decisions are made in Canada.

8.0 Licence Term

Comments are sought on the proposed licence term.

The Board agrees that licences assigned through a competitive process have most often been issued for ten-year terms and can support that proposal in this band. The Board also notes however that the FCC has used a fifteen year licence term in the recent AWS spectrum auction.

8.1 Licence Fees

The Department requests comments on the proposed licence fee of \$0.0042 per 50 MHz per population.

If the Department adopts the Board's recommended licensing regime for the 3650-3700 MHz band then the only areas subject to the proposed licence fees would be those tier 4 licence areas with a population of 30,000 or less as the vast majority of the licence fees would be determined through a competitive process. The Board further notes that the Department's proposed fee for these areas is based on a 50 MHz block.

8.2 Eligibility

The Department requests comments on the proposal for open eligibility.

The Department is suggesting that those intending to operate as radiocommunication carriers must be able to demonstrate that they meet the eligibility criteria for radiocommunication carriers as set out in subsections 9 and 10 of the *Radiocommunication Regulations*. Given the recommended licensing approach for the majority of this band the Board further recommends that the Department either implement such a determination phase prior to the competitive licensing process or vastly streamline the present procedure to make this determination.

8.3 Spectrum Aggregation Limit

The Department invites comments on whether it should impose in-band or out-of-band spectrum aggregation limits on licensees in the event a competitive process is adopted, and the rationale for such limits.

The Board does not believe that in-band or out-of-band spectrum aggregation limits are warranted for the band 3650-3700 MHz at this time, irrespective of whether this spectrum is licensed as a single block of 50 MHz or in the form of two blocks.

8.4 Departmental Service Standards

Please provide comments on whether this service standard is appropriate.

This service standard seems appropriate for those Tier 4 areas with a population of fewer than 30,000 that would have access to the FCFS licensing process for the 20 MHz block.

9.0 Technical Considerations

The Department invites comments on the proposed technical rules. In particular, will the proposed out-of-band emission limits provide sufficient protection to services operating in adjacent spectrum, including FSS earth stations operating in the conventional C-band (3700-4200 MHz)? How would this compare to the potential impact of in-band WBS emissions below 3700 MHz on FSS receivers?

In the Board's opinion there are three main technical considerations that need to be addressed. These are the in-band WBS-WBS technical considerations, the issue of FSS (operating above 3700MHz) being sensitive to WBS emissions below 3700 MHz and the issue of out-of-band intersystem interference from WBS into FSS services above 3700 MHz. The Board considers it important that Canada harmonizes to the greatest extent feasible with the final FCC determinations.

It should be noted, however that the FCC has received a number of Petitions for Reconsideration in relation to the intersystem and adjacent band interference issues and this matter is not yet concluded at the FCC.

a) WBS to WBS considerations

The Board supports the proposed emission limits

The board agrees with the proposed technical rules as presented in DGTP-006-06 (Proposed Spectrum Utilization Policy, Technical and Licensing Requirements for Wireless Broadband Services (WBS) in the Band 3650-3700 MHz), Paragraph 9-Technical Considerations. This

approach will simplify equipment certification and licensing of services in the 3650-3700 MHz in both US and Canadian markets. A common set of technical rules means less work by equipment vendor in developing, testing and certifying new products.

b) FSS Interference Considerations

FSS is an incumbent service above 3700 MHz.

As noted in Section 3.0 of the Gazette Notice, the FCC has received a Petition for Reconsideration in relation to “the Out-of-Band emission limits for WBS transmitters” to avoid the possibility of unacceptable levels of interference into FSS earth station receivers in the bands above 3700 MHz.

The potential impact of both of these elements (i.e. WBS transmission below 3700 MHz and OOB above 3700 MHz) will cause intersystem interference from WBS to FSS services and is analyzed and presented below:

B1) Impact of the proposed WBS transmitters power level (operating below 3700 MHz) into FSS receivers LNB (operating above 3700 MHz)

The majority of C-band earth stations operating in Canada utilize LNBs, which amplify and downconvert the 3.7-4.2 GHz signals to an IF frequency of 950-1450 MHz, for transport via coaxial cable. The majority of the deployed LNBs act as band pass filters and are designed to cover the entire 3.7-4.2 GHz band. Their filter response characteristics do not exhibit any significant signal rejection towards the 3650-3700 MHz band. Thus, these C-band earth stations are as susceptible to overloading and saturation from transmitters in the adjacent Extended C-band as they are to in-band transmitters in the Conventional C-band. Annex 1 provides additional detail on the impact of potential interference from WBS into FSS earth stations LNBs.

A typical LNB exposed to Single-Entry interference from a WBS base station located at a separation distance of 800 meters or less would experience saturation and distortion of the received satellite signal. The same would be applicable in the case of a WBS Mobile transmitter 160 meters or less away from a typical LNB.

Consideration should be given to the following techniques; Frequency coordination, additional filtering below 3700 MHz at FSS receivers, reduction of WBS power levels or a flexible spectrum block approach may be needed to mitigate interference into FSS earth station receivers.

B2) Impact of the proposed WBS transmitters OOB emissions above 3700 MHz into FSS receivers

Furthermore, the Board would like to highlight that it is necessary to protect the operation of FSS C-band earth stations receivers in the adjacent band 3700-4200 MHz against potential interference as a result of operating WBS transmitters in the 3650 – 3700 MHz band. This protection may require that the higher power WBS transmitters be confined to operating only in a lower band segment of the 3650-3700 MHz band or additional WBS OOB filtering be applied above 3700 MHz. Alternatively, frequency coordination or a flexible spectrum block approach may prove to be more accommodating to mitigate interference into FSS earth station receivers.

The Gazette Notice proposes that any emissions outside of the authorized band of 3650-3700 MHz, in a measured bandwidth of 1 MHz, must be attenuated by at least $43 + 10 \log(P)$ dB below the transmitter power level P, where P is measured in watts. Annex 2 provides additional detail on the impact of potential interference from the OOB emissions of WBS transmitters into the FSS earth station receivers in the band 3700-4200 MHz.

Given the results of the above analyses and considering the Petitions for Reconsideration submitted to the FCC, it is very important that the Department consider the need for mitigating of interference to FSS. Various techniques are available depending on circumstance, including:

- Frequency coordination
- Additional WBS OOB filtering above 3700 MHz
- Additional FSS filtering below 3700 MHz
- The use of guardbands
- Adjustments to WBS transmitter power levels

Appendix A

The Board notes that the proposed licence conditions outlined in Appendix A do not include two conditions that the Department has imposed for other similar and recently licensed bands that have been allocated for Fixed and/or Mobile services. Specifically, the Board notes that the licence conditions that the Department has proposed in Appendix A do not include conditions regarding research and development and implementation of spectrum usage. The Board recommends that the Department add these conditions to the list of licence conditions that will apply to the 3650-3700 MHz band if licensed on an exclusive basis. In the alternative, if the Department elects to not proceed on this basis, then the Board recommends that the Department conduct a consultation to consider whether such licence conditions should continue to apply to the Fixed Wireless Access (FWA) and Wireless Communication Services (WCS) bands.

Conclusion

It is important to mention that the Canadian environment for the 3650-3700 MHz band is quite different from the US environment. Specifically, any proposed 3650-3700 MHz band modifications must take into account existing Canadian licensed users both within the band and in the adjacent bands.

Annex 1
Example of Impact of the proposed WBS transmitters power level into FSS receivers LNB

This example considers the case of a 4.5 m C-band earth station receiving a 36 MHz fully saturated downlink satellite signal with an EIRP of 41 dBW. Assuming free space loss of 196 dB and an antenna gain of 43.5 dBi, the desired signal at the input to the LNB would be -111.5 dBW. If all 12 transponders of the satellite (in the same polarization) are active, then the total received satellite power at the LNB input will be -100.7 dBW or -70.7 dBm.

Because of the large transmission distances and free space losses between the satellite and the earth, received satellite signals at the surface of the earth have very low power densities. Typical FSS LNBs reach saturation with an input signal of about -55 dBm. At about this level, the LNB would start exhibiting a non-linear behaviour distorting the satellite signal. The proposed Peak EIRP limits for the WBS devices are given as:

- Fixed and base station = 25 watts/25 MHz
- Mobile station = 1 watt/25 MHz

Assuming the WBS signal is received directly by the earth station LNB, without any amplification by the earth station reflector or obstruction loss, the following table depicts the level of interference into the LNB as a result of Single-Entry interference from one WBS base station or one Mobile station operating over 50 MHz of bandwidth:

WBS Device EIRP (watts)	Distance (m)	WBS signal level at input to LNB (dBm)
2	100	-51
	160	-55
	200	-71
	500	-65
	1000	-71
50	100	-37
	500	-51
	800	-55
	1000	-57
	2000	-63
	3000	-67
	4000	-69.5
	5000	-71.5

Thus, a typical LNB exposed to Single-Entry interference from a WBS base station located at a separation distance of 800 meters would experience saturation and distortion

of its received signals. The same would be applicable in the case of a WBS Mobile transmitter 160 meters away from a typical LNB. Note that depending on the angle of arrival of the interfering signal, the impact could be greater due to the gain of the earth station reflector.

Annex 2
Example of Impact of the proposed WBS transmitters OOB emissions into FSS receivers

This example considers the case of OOB emissions of WBS transmitters into a 4.5 m C-band earth station receiving a 36 MHz fully saturated downlink satellite signal with an EIRP of 41 dBW. Assuming free space loss of 196 dB and antenna gain of 43.5 dBi, the desired signal at the input to the LNB would be -111.5 dBW or -81.5 dBm. Assuming a required C/I of 22.0 dB due to interference from OOB emissions of an adjacent band is a reasonable representation of the noise apportionment in a satellite link. In accordance with ITU-R Recommendation S.1432-1, the allotted noise for all non-primary services and other sources of interference is 1% of the total satellite link system noise.

The table below depicts the impact of the proposed WBS OOB emission level of -43 dBW/MHz into the band 3700-4200 MHz, arriving at the FSS earth station at various off-axis angles and from various distances. These computations depict the case of Single-Entry interference from one WBS transmitter:

Separation Distance (m)	Angle of Arrival at FSS antenna (°)	Interfere level at FSS antenna LNB (dBm/36 MHz)	FSS signal level at antenna LNB (dBm/36 MHz)	C/I (dB)	Required C/I (dB)	C/I Margin (dB)
50	5	-63.6	-81.5	-17.9	22.0	-39.9
100	5	-69.6	-81.5	-11.9	22.0	-33.9
200	5	-75.6	-81.5	-5.9	22.0	-27.9
500	5	-83.6	-81.5	2.1	22.0	-19.9
1000	5	-89.6	-81.5	8.1	22.0	-13.9
50	15	-72.5	-81.5	-9.0	22.0	-31.0
100	15	-78.5	-81.5	-3.0	22.0	-25.0
200	15	-84.5	-81.5	3.0	22.0	-19.0
500	15	-92.5	-81.5	11.0	22.0	-11.0
1000	15	-98.5	-81.5	17.0	22.0	-5.0
50	30	-80.0	-81.5	-1.5	22.0	-23.5
100	30	-86.0	-81.5	4.5	22.0	-17.5
200	30	-92.0	-81.5	10.5	22.0	-11.5
500	30	-100.0	-81.5	18.5	22.0	-3.5
1000	30	-106.0	-81.5	24.5	22.0	2.5
50	45	-84.4	-81.5	2.9	22.0	-19.1
100	45	-90.4	-81.5	8.9	22.0	-13.1

200	45	-96.5	-81.5	15.0	22.0	-7.0
500	45	-104.5	-81.5	23.0	22.0	1.0
1000	45	-110.4	-81.5	28.9	22.0	6.9

The above table demonstrates that the proposed OOB emission limits for the WBS service would result in harmful level of interference into FSS earth station receivers under realistic conditions, even for single entry interference. The situation would be even worse in the case of aggregate interference from multiple transmitters.