



Industry
Canada

Industrie
Canada

SMSE-010-11
July 2011

Spectrum Management and Telecommunications

Consultation on Spectrum Utilization of Frequency Bands 71-76 GHz, 81-86 GHz and 92-95 GHz by the Fixed Service

Aussi disponible en français

Canada

Contents

1.	Intent.....	1
2.	Background.....	1
3.	Canadian Allocations.....	2
4.	Use of the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands in the United States.....	4
5.	Applications in Canada.....	4
6.	Frequency Band Structure and Technical Considerations.....	5
	6.1 International Band Plans.....	5
	6.2 Canadian Band Plan Options.....	5
	6.3 Interference Analysis.....	6
	6.4 Technical Specifications.....	6
7.	Licensing.....	7
	7.1 Licensing in Other Jurisdictions.....	7
	7.2 Authorizations.....	8
	7.3 Licensing Mechanisms.....	10
	7.4 Band Managers.....	10
	7.5 Future Licensing Considerations.....	11
8.	International Coordination.....	11

1. Intent

As announced in *Canada Gazette* notice SMSE-010-11, this consultation paper seeks comments on a proposed policy for the use of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz by the fixed service. Respondents may put forward, with supporting rationale, alternative proposals to those presented in this paper.

2. Background

Through *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation* (DGTP-008-04),¹ published in October 2004, Industry Canada initiated consideration of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz for fixed service operation. The Department sought comments on a policy framework, including technical and operational rules, which would be required to open these bands.

As a result, the Department received comments² from Bell Mobility, the Radio Advisory Board of Canada (RABC) and Telesat Canada. Telesat Canada indicated that it did not oppose the authorization of fixed service applications in the three bands, with the exception of the band 74-76 GHz due to concerns with respect to the future protection requirement identified in footnote 5.561³ of the *Canadian Table of Frequency Allocations*. The RABC supported harmonization with the United States in general, but shared the concerns expressed by Bell Mobility regarding the complexity of the issues in these bands and urged Industry Canada to conduct a separate consultation when equipment is more widely available.

The Department has recently been approached by several wireless companies that are interested in using these bands for the deployment of high-capacity links in the fixed service, under conditions similar to those adopted in the United States.

This consultation paper puts forward proposals and seeks comments on the use of these bands by the fixed service.

¹ *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation*: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08217.html>

² Comments received on *Canada Gazette* notice DGTP-008-04 – *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation*: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08518.html>

³ In the band 74-76 GHz, stations in the fixed, mobile and broadcasting services shall not cause harmful interference to stations of the fixed-satellite service or stations of the broadcasting-satellite service operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service (WRC-2000).

3. Canadian Allocations

This section describes the Canadian frequency allocations in the bands 71-76 GHz, 81-86 GHz and 92-95 GHz as per the *Canadian Table of Frequency Allocations*:⁴

GHz	
71-74	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)
74-76	BROADCASTING BROADCASTING-SATELLITE FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Space Research (space-to-Earth) 5.561
...	
81-84	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space Research (space-to-Earth) 5.149 5.561A
84-86	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY 5.149
...	

⁴ *Canadian Table of Frequency Allocations 9 kHz to 275 GHz (2009 Edition)*: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09686.html>

92-94	<p>FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION</p> <p>5.149</p>
94-94.1	<p>EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio Astronomy</p> <p>5.562 5.562A</p>
94.1-95	<p>FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION</p> <p>5.149</p>

- 5.149** In making assignments to stations of other services to which the bands: ...76-86 GHz, 92-94 GHz, 94.1-100 GHz... are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 4.5 and 4.6 and Article 29). **(WRC-07)**
- 5.561** In the band 74-76 GHz, stations in the fixed, mobile and broadcasting services shall not cause harmful interference to stations of the fixed-satellite service or stations of the broadcasting-satellite service operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service. **(WRC-2000)**
- 5.561A** The 81-81.5 GHz band is also allocated to the amateur and amateur-satellite services on a secondary basis. **(WRC-2000)**
- 5.562** The use of the band 94-94.1 GHz by the Earth exploration-satellite (active) and space research (active) services is limited to spaceborne cloud radars. **(WRC-97)**
- 5.562A** In the bands 94-94.1 GHz and 130-134 GHz, transmissions from space stations of the Earth exploration-satellite service (active) that are directed into the main beam of a radio astronomy antenna have the potential to damage some radio astronomy receivers. Space agencies operating the transmitters and the radio astronomy stations concerned should mutually plan their operations so as to avoid such occurrences to the maximum extent possible. **(WRC-2000)**

From the *Canadian Table of Frequency Allocations*, it is clear that the fixed service has a primary allocation in all bands under consideration except the band 94-94.1 GHz.

4. Use of the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands in the United States

In the United States, use of the frequency bands 71-76 GHz, 81-86 GHz, 92-94 GHz and 94.1-95 GHz for fixed service broadband applications is permitted on a licensed basis. Indoor licence-exempt use in the bands 92-94 and 94.1-95 GHz is also permitted.

5. Applications in Canada

Respondents to *Canada Gazette* notice DGTP-008-04 indicated a desire to deploy high-capacity fixed links in the 70 to 90 GHz frequency range.

In addition to the frequency allocations outlined in section 4, Industry Canada also notes that *Canada Gazette* notice DGTP-008-04 made provisions for the use of indoor licence-exempt low-power devices in the bands 92-94 GHz and 94.1-95 GHz, such that these devices cannot claim protection from other radio systems or cause interference to licensed radio services.

It is noted that there are debris detection radars operating at 94.5 GHz in Vancouver, British Columbia (at the Vancouver International Airport), and radio astronomy operation at 81 GHz and 90 GHz in Penticton, British Columbia.

As per the *Canadian Table of Frequency Allocations*, satellite services are allocated on a primary basis in the 71-76 GHz and 81-86 GHz bands, and footnote 5.561 stipulates that fixed stations operating the 74-76 GHz band shall not cause harmful interference to stations of the fixed-satellite service or stations of the broadcasting-satellite service. As such, potential fixed service operators in the 71-76 GHz and 81-86 GHz bands should be aware that coordination would be required with future satellite systems in these bands. All licensees will be subject to any future technical requirements that are developed to facilitate the sharing of this spectrum by both fixed and satellite operators.

The Department seeks comments on making the bands 71-76 GHz, 81-86 GHz, 92-94 GHz and 94.1-95 GHz available for point-to-point fixed links.

Comments are also sought on the technical parameters for satellite systems in the 71-76 GHz and 81-86 GHz bands that should be used in the development of measures to coordinate the use of the fixed and satellite services in these bands.

6. Frequency Band Structure and Technical Considerations

6.1 International Band Plans

In the United States, the 71-76 GHz and 81-86 GHz bands were each originally divided into four unpaired 1.25 GHz segments for a total of eight segments, with the segments aggregated without limit. However, the United States later eliminated the segmentation scheme in order to provide greater flexibility. The co-primary portion of the 92-95 GHz band is divided into two segments: 92-94 GHz and 94.1-95 GHz, which may also be aggregated by licensees. The U.S. band plan is shown in Figure 1.

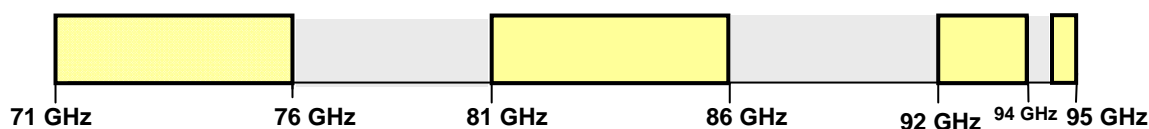


Figure 1 - U.S. Band Plan

In Europe, a CEPT Recommendation has the 71-76 GHz frequency band segmented into 19 x 250 MHz channels, with the same segmentation in the 81-86 GHz band. Channels are deployed in a frequency division duplex (FDD) arrangement, with a duplex separation of 10 GHz. Included in the CEPT Recommendation are two 125 MHz guardbands⁵ on either side of the 71-76 GHz and 81-86 GHz bands, as shown in Figure 2. This scenario has the benefit of clearly identified guardbands. In addition, with segmentation, channels can be assigned using a common structure, allowing for channel aggregation and simplified interference coordination.

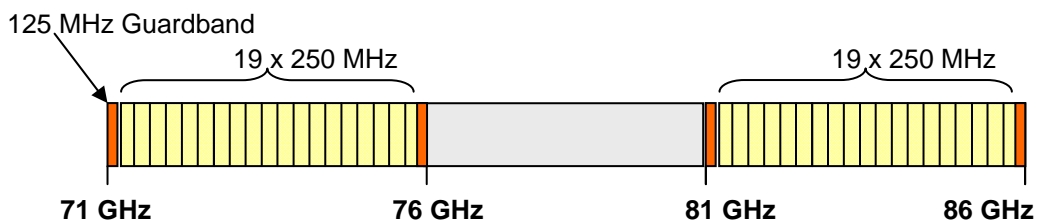


Figure 2 - CEPT Recommended Band Plan

Regarding the 92-95 MHz range in Europe, different channel arrangements appear to segment the bands into various 50 MHz and 100 MHz channel plans.

6.2 Canadian Band Plan Options

Industry Canada is seeking comments on the relative merits of the above band plans. In addition, any suggestions on alternate band plans are welcome.

The Department seeks comments on the band plan structure.

⁵ In the United Kingdom, the 125 MHz guardbands are maintained; however, the remaining spectrum is not segmented further, leaving two 4.75 GHz blocks.

6.3 Interference Analysis

The short-range, narrow-beam nature of fixed links using the 71-76 GHz, 81-86 GHz and 92-95 GHz bands enables such radio systems to coexist in close proximity to each other without the need for comprehensive technical coordination measures. Nevertheless, comments are sought on the likelihood of interference and possible mitigation measures, should they be deemed necessary.

An excerpt from section 4 of the *Canadian Table of Frequency Allocations* provides information on the other radio services with allocations in the 70-90 GHz range, including associated footnotes that specify requirements to ensure protection from interference.

Interference to and from these other services is unlikely due to the short-range, narrow-beam nature of the proposed fixed service operations. Given the nature of these operations, such systems could be deployed with little or no coordination.

The Department seeks comments, with technical justification and interference analyses, on the likelihood of interference to/from other radio services and on the appropriate mitigation measures that should apply in the bands 71-76 GHz, 81-86 GHz and 92-95 GHz.

Comments are also sought on what requirements would be necessary to facilitate sharing between the various services, such as coordination requirements, operational constraints and/or power flux density (PFD) limits.

Comments are additionally sought on the feasibility of uncoordinated deployment of fixed systems. If coordination is needed, input is sought on appropriate technical and/or operational mechanisms for coordination.

6.4 Technical Specifications

Respondents to *Canada Gazette* notice DGTP-008-04 indicated a desire to harmonize with the United States in terms of technical characteristics. Having the same or similar technical specifications as those adopted by the United States would have the potential to reduce the cost of Canadian equipment. The following table summarizes these technical limits:

Table 1: FCC Technical Rules

Band	71-76 GHz	81-86 GHz	92-94 GHz	94.1-95 GHz
Maximum power	5 dBW		5 dBW	
Maximum e.i.r.p.	55 dBW		55 dBW	
Automatic Transmitter Power Control (ATPC)	Optional		Optional	
Maximum power spectral density (PSD)	150 mW / 100 MHz		None	
Minimum antenna gain	50 dBi		50 dBi	
Provision for reduced gain with reduced power	Yes, to a minimum of 43 dBi		No	
Minimum spectral efficiency	0.125 bits/s/Hz		1.0 bits/s/Hz	

It is noted that the FCC technical limits for the 92-94 GHz and 94.1-95 GHz bands differ somewhat from their rules for the 71-76 GHz and 81-86 GHz bands. In considering the adoption of these limits, it is evident that the limits in the 71-76 GHz and 81-86 GHz bands could apply equally in the 92-94 GHz and 94.1-95 GHz bands, given that the bands have similar properties and that equipment used in the four bands would also be similar. Although this would create slight differences with respect to the FCC limits, it should not prevent the use of the same equipment in both the United States and Canada.

Consequently, the following rules could be applied to Canadian use of the 71-76 GHz, 81-86 GHz, 92-94 GHz and 94.1-95 GHz bands:

- a maximum power limit of 5 dBW
- a maximum e.i.r.p. of 55 dBW
- a minimum spectral efficiency of 0.125 bits/s/Hz
- automatic transmit power control (ATPC) not mandatory
- a maximum power spectral density (PSD) of 150 mW/100 MHz
- a minimum antenna gain of 50 dBi, and
- a provision to allow the antenna gain to be further reduced to a minimum of 43 dBi, provided that the e.i.r.p. is reduced by 2 dB for every 1 dB reduction in gain below 50 dBi.

In terms of unwanted emissions, it is noted that the limits adopted in the U.S. differ from those in Europe. These limits will be considered in the development of the relevant Standard Radio System Plan (SRSP).

Comments are sought on the technical rules for the 71-76 GHz, 81-86 GHz, 92-94 GHz and 94.1-95 GHz bands, as listed above.

Interested parties are invited to comment on the technical specifications such as minimum and maximum antenna gain, power spectral density limit, etc. Parties who advocate different service rules for these bands should include a technical analysis and justification.

7. Licensing

7.1 Licensing in Other Jurisdictions

United States

In the United States, the FCC is licensing the entire 12.9 GHz of spectrum in the 71-76 GHz, 81-86 GHz and 92-95 GHz bands on a non-exclusive, nationwide basis.

As well, a “light licensing” approach is being employed to authorize the use of the 70-80-90 GHz spectrum by non-federal government users for shared use with federal government users.⁶ This involves the issuance of a licence and advance registration of links. Prior to operating a link, users must first

⁶ For more information, please visit the FCC website: <http://wireless.fcc.gov/>.

obtain a licence to use the band. Advance registration of each proposed link is then entered into a common database. Note that this database is to be collectively administered by several third party managers in the United States.

Licences are issued for a period of 10 years, with rights to non-exclusive access to the entire 12.9 GHz of spectrum on a first-come, first-served (FCFS) basis, with site-by-site registration and coordination by database managers. Interference protection is based on the date and time that a licensee registers a link in the database.

Although there is no limit to the number of non-exclusive nationwide licences that may be granted for these bands, there is a 12-month build out requirement that, if not met, voids the database registration for the particular links involved. Unconstructed link information is removed from the collective database either upon notification by the licensee, or upon discovery by database managers or other spectrum users.

United Kingdom

Ofcom, the U.K.'s radio spectrum regulator, has also adopted a "light licensing" approach to the 71-76 GHz and 81-86 GHz bands for broadband fixed wireless systems, similar to that in the United States.⁷ Licences are available on an unlimited, non-exclusive, national basis, with an indefinite licence term and a 5-year notice period of revocation. Prior to operating in the band, an operator must apply for a licence. Once this prerequisite is met, the licensee is required to register the links with the Ofcom link registration database, as the licence itself does not authorize the use of the spectrum until a link is registered. For the purpose of interference protection, links registered will have first-in-time priority, and will be based upon the date and time entered. At this time, there appear to be no specific system deployment requirements.

Australia

In Australia, the 71-76 GHz and 81-86 GHz bands are authorized as fixed point-to-point apparatus licences. However, in 2006, the Australian Communications and Media Authority (ACMA) issued a consultation paper recommending that a link registration framework similar to those of the United States and the U.K. be adopted, using a fixed-fee approach to encourage commercial deployment, and that roll-out requirements be established to mitigate against hoarding, which has been made possible due to the low fee.⁸ To date, no specific policy decisions resulting from this consultation have been made.

7.2 Authorizations

There are three authorization options available for use of the 71-76 GHz, 81-86 GHz and 92-95 GHz frequency bands:

- radio licences, which are site-specific authorizations for the installation and operation of radio apparatus;

⁷ For more information, visit the Ofcom website: <http://stakeholders.ofcom.org.uk/>.

⁸ SSP 2006-10, *Planning of the 71-76GHz and 81-86GHz Bands for Millimetre Wave High Capacity Fixed Link Technology*

- spectrum licences, which are authorizations to operate in specific geographic areas using a specific frequency or frequency block; and
- licence exemption.

Radio Licences

Radio licensing is still used for the majority of radio authorizations issued by Industry Canada.

With this approach, a licence is issued for each radio apparatus used. A fee is charged for each transmit and receive channel being used, as prescribed under the *Radiocommunication Regulations*. The licence term is for one year; rights and privileges are limited.

While this approach continues to work well, the fee schedules currently prescribed by the *Radiocommunication Regulations* do not yet recognize the advent of new, more spectrally efficient radio technologies, which could lead to inappropriately high licence fees.⁹ In addition, given that radio licences must be issued for each radio apparatus, each additional radio apparatus also requires the prior submission of radio station licence applications to the Department in order to receive an authorization, which adds administrative burden.

Spectrum Licences

Spectrum licences authorize the operation of a device(s) within a defined spectrum space (geographic area and frequency band); site-specific radio authorizations are not required.

In general, spectrum licences provide users with privileges such as divisibility and transferability, as well as greater autonomy to deploy and configure radio systems as desired within a defined service area. The fee charged is generally described in terms of the amount of radio spectrum used and population served.

Accordingly, the spectrum licensing regime permits more flexibility to licensees and reduces administrative burden.

Licence Exemption

As discussed earlier, fixed services operating in the 71-76 GHz, 81-86 GHz and 92-95 GHz frequency bands would have limited propagation characteristics associated with relatively low-power, highly directional pencil-sized beams.

The licence exemption approach is a possibility when the risk of radiocommunication interference is relatively low.

Generally, users of radio devices that require a licence must first provide Industry Canada with detailed technical information, undergo a thorough interference and operational assessment, and pay an annual licence fee.

⁹ Industry Canada is currently undertaking an internal review of the current radio licence fee structure as set out in the *Radiocommunication Regulations*, but it may take several years to implement any changes.

Conversely, licence-exempt radio equipment users are not required to pay annual licence fees; do not have to provide any technical information; and can operate anywhere in Canada provided that only specially designated frequency bands are used and that other applicable regulatory and technical standards are met.

Although it may seem advantageous to not require a radio licence, users of licence-exempt radio devices can face other difficulties. The most common problem encountered is radio interference, often resulting from other licensed or licence-exempt radio users operating within the same general area. Consequences can range from reduced radio equipment performance to complete system failure.

It should be understood that, unlike licensed radio systems that are provided some assurance of interference-free operation by Industry Canada, licence-exempt radio devices operate on a strict “no-interference, no-protection” basis in relation to all other radio systems. This means that licence-exempt radio devices are not permitted to either cause interference, or claim protection from any interference that they may receive.

7.3 Licensing Mechanisms

For a band that is subject to licensing, the two mechanisms available for the Minister’s consideration when assigning licences are:

- FCFS process; or
- competitive process (e.g. spectrum auction).

First-Come, First-Served (FCFS) Process

The FCFS approach involves the evaluation and issuance of licences to eligible operators in the order that requests for authorizations arrive. In general, this approach is used in instances where there is sufficient spectrum to meet anticipated demand in a given frequency band. The majority of radio licences are issued using an FCFS process for radio apparatus, which may include shared spectrum use.

Competitive Process - Spectrum Auctions

Auctions are a market-oriented, competitive process that is used to assign spectrum licences in situations where the demand for spectrum in a given band is, or is likely to be, greater than what is available, or is unknown. Auctions are an efficient way to allocate spectrum by placing such spectrum in the hands of licensees that value it most highly.

7.4 Band Managers

Normally, users of spectrum submit a licence application or participate in an auction to gain access to spectrum and are then issued licences. However, given the characteristics of this band, independent band managers could be assigned responsibility to facilitate and manage third party access for use of the 71-76 GHz, 81-86 GHz and 92-95 GHz bands.

The Department notes that other countries use a “light licensing” approach for these bands. While such an approach may be viewed as desirable for Canada, respondents should note that this may not be feasible given legislative and database limitations. A band manager approach could, however, bring about the same advantages for the actual spectrum users.

Other advantages of the band manager concept may include more expedient user access to desired spectrum, and streamlined management of many spectrum-related functions currently undertaken by Industry Canada. It is anticipated that a band manager would be licensed via an auction and, in turn, would authorize users on a cost-recovery or market-based regime.

The Department requests comments on the authorization approach to be undertaken for use of the 71-76 GHz, 81-86 GHz and 92-95 GHz frequency bands. Should licensing be recommended, comments are requested on the manner in which such authorizations are to be issued (i.e. non-exclusive spectrum licences, FCFS, spectrum auction, etc.).

Comments are also sought on the option to allow independent band managers to oversee user access and coordination within these bands.

7.5 Future Licensing Considerations

Depending upon comments received with respect to issues noted earlier in this section, other considerations such as licensee eligibility, service areas, licence terms and conditions, service standards and licence fees may be the subject of a future consultation.

8. International Coordination

Canada does not currently have an agreement with the U.S. government for the sharing of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz along the border regions. However, licensees will be subject to any future agreements between Canada and the United States regarding use of these systems in the border regions.

July 8, 2011

MARC DUPUIS
Director General
Engineering, Planning and Standards Branch

FIONA GILFILLAN
Director General
Spectrum Management Operations Branch