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Spectrum Management and Telecommunications

Spectrum Utilization Policy

# **Decisions on the Frequency Bands 71-76 GHz, 81-86 GHz and 92-95 GHz**

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## 1. Intent

This spectrum utilization policy, announced in *Canada Gazette* notice SMSE-008-12, addresses the introduction of fixed radio systems into the frequency bands 71-76 GHz, 81-86 GHz and 92-95 GHz, including the band plan, technical specifications and licensing framework.

## 2. Background

In October 2004, Industry Canada released SP 3-30 GHz, *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation*, which announced various revisions to spectrum utilization policies for services in the frequency range 3-30 GHz, as well as further consultations, including opening the bands 71-76 GHz, 81-86 GHz and 92-95 GHz for fixed services on a licensed, non-exclusive basis. Based on the comments received, the Department decided to wait until equipment was more readily available before developing a policy.

With mobile traffic expected to increase significantly over the next few years, the advent of higher capacity applications and augmented subscriber requirements, wireless operators are upgrading and expanding their networks. In addition, Internet service providers (ISP) are employing more backhaul spectrum to meet their subscribers' traffic needs. This has resulted in a growing demand for short-range backhaul facilities. Consequently, the Department released SMSE-010-11, *Consultation on Spectrum Utilization of Frequency Bands 71-76 GHz, 81-86 GHz and 92-95 GHz by the Fixed Service*, in July 2011. The 2011 consultation sought comments on the introduction of fixed point-to-point links, as well as on various aspects, such as frequency band structure, technical considerations and the licensing mechanisms for these bands.

In response to the consultation, the Department received comments from:

- Alliance Corporation;
- Environment Canada (Meteorological Service of Canada);
- Radio Advisory Board of Canada (RABC);
- Rogers Communications Partnership;
- Siklu Communication;
- TeraGo Networks Inc.; and the
- World Meteorological Organization (WMO) and EUMETNET.

Respondents indicated their strong support for making the bands available for the licensed use of the point-to-point fixed service (FS). The use of this spectrum is ideal for many applications, including the connection of base stations and cell sites to points of presence, the interconnection of university campuses and hospitals, as well as fibre backup.

As this spectrum is shared and adjacent to other services, some respondents stressed that sharing criteria should be developed to accommodate the future fixed-satellite service (FSS), and that adequate criteria should be established for the protection of in-band and existing adjacent-band users, notably in the Earth exploration-satellite service (EESS) passive, from harmful interference.

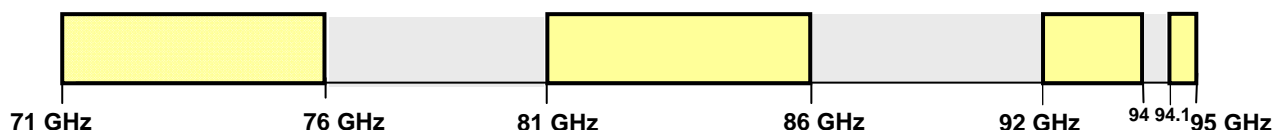
### 3. Spectrum Policy

#### 3.1 Decisions on the Frequency Band Structure

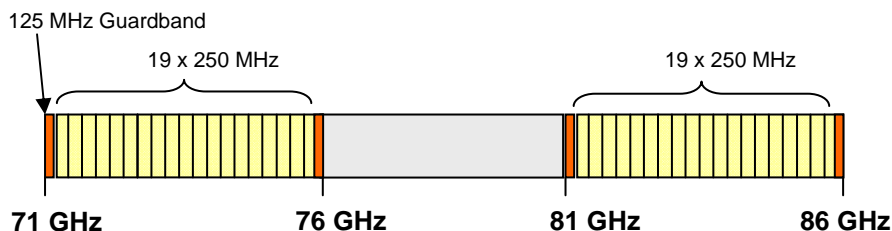
Given the maturity of the fixed service used in the bands 71-76 GHz and 81-86 GHz in the United States and Europe, the Department identified the U.S. and European Conference of Postal and Telecommunications Administrations (CEPT) band plans as possible options, as shown in Figure 1 below, in the SMSE-010-11 consultation. Comments were sought on their relative merits, as well as alternate band plans.

The 71-76 GHz and 81-86 GHz portions of the U.S. band plan are unsegmented to provide greater flexibility, whereas the CEPT-recommended band plan is segmented into 19 × 250 MHz channels with two 125 MHz guardbands on each end of the two bands. The 92-95 GHz portion in the U.S. band plan is segmented into 92-94 GHz and 94.1-95 GHz. The European plan for 92-95 GHz has not been fully developed.

##### Option 1 – U.S. Band Plan



##### Option 2 – CEPT-recommended Band Plan

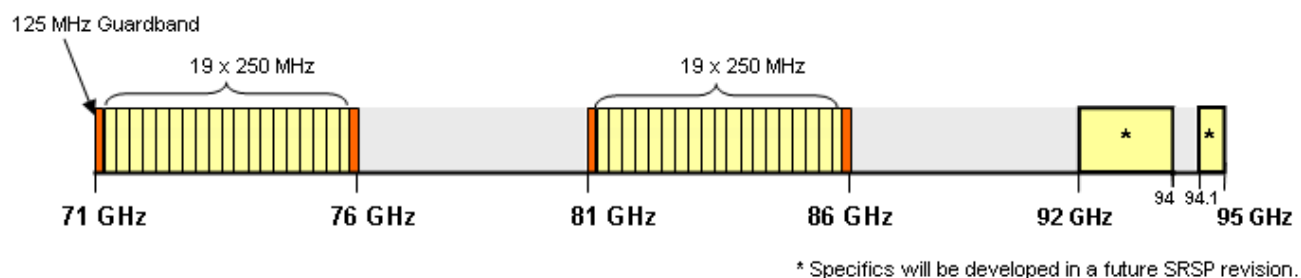


**Figure 1 – SMSE-010-11 Proposed Band Plan Options**

All comments regarding the 71-76 GHz and 81-86 GHz band plans supported the CEPT-recommended band plan, Option 2, comprised of 250 MHz channels with 125 MHz guardbands on either end of the bands. However, respondents expressed the desire for added flexibility through the aggregation of channels within the bands 71-76 GHz and 81-86 GHz, to support higher capacities when necessary. Apart from Siklu’s recommendation that the maximum aggregated channels be limited to 2 GHz, there were no other comments regarding maximum channel size. In general, accommodating greater throughput is seen as fundamentally important in these bands to facilitate upgrades in capacity as requirements and needs evolve.

As for the band 92-95 GHz, there were few comments and responses, with both Rogers and the RABC indicating a lack of sufficient technical specifications to provide informed responses. Given the general support for the introduction of FS into the bands 71-76 GHz, 81-86 GHz and 92-95 GHz, the Department is hereby designating all three bands for use by the FS. That said, the specific details of the 92-95 GHz portion of the band plan will be established in a future Standard Radio System Plan (SRSP)

revision, considering the overall maturity of the band and the comments received. Consequently, the general band plan shown below in Figure 2 will be adopted.



**Figure 2 – Adopted Band Plan**

**The Department is hereby designating the bands 71-76 GHz, 81-86 GHz and 92-95 GHz (92-94 GHz and 94.1-95 GHz) for use by the fixed service.**

**The Department is hereby adopting a 71-76 GHz and 81-86 GHz band plan that consists of 250 MHz channels and 125 MHz guardbands. Specifics of the 92-95 GHz band plan will be subject to a future revision of the SRSP.**

In addition to support for channel aggregation, overall comments supported the introduction of frequency division duplex (FDD) systems within the bands; however, both TeraGo and Siklu suggested that it would be beneficial to also incorporate the provision for time division duplex (TDD) systems. In support of technology-neutral use of these bands, the Department may allow TDD systems; however, these systems would be expected to operate within the envelope of technical rules of FDD systems. All systems would be expected to conform to the technical specifications in the SRSP and Radio Standards Specifications (RSS) to be developed by the Department, in consultation with the RABC.

With responses for the band 92-95 GHz indicating a lack of sufficient technical specifications, and given limited sharing studies with radar operations in the band and limited equipment availability, it may be premature to develop technical parameters and a band plan for the band 92-95 GHz at this time. As the band matures, these considerations will be subject to a future revision of the SRSP.

**The Department will allow point-to-point fixed radio systems to be deployed in the bands 71-76 GHz and 81-86 GHz, with a mix of FDD and TDD operations. Radio systems may be structured in a variety of ways, including single hop, multiple hop and hub site configurations. Specific details, including channel aggregation, will be established during the development of the SRSP.**

**For the band 92-95 MHz, apart from its previous designation permitting the use of the band by indoor licence-exempt devices, the Department will allow its use by fixed radio systems upon establishing the appropriate technical specifications in a future revision of the SRSP. The Department will continue to monitor international developments and usage of the band 92-95 GHz.**

## 4. Technical Considerations

### 4.1 Technical Requirements

In the SMSE-010-11 consultation, Industry Canada proposed the following technical specifications, which are similar to those of the U.S. Federal Communications Commission (FCC).

**Table 1: U.S. Technical Specifications for Operation in the 70 and 80 GHz Bands**

Band	71-76 GHz	81-86 GHz	92-94 GHz	94.1-95 GHz
Maximum power limit	5 dBW			
Maximum equivalent isotropically radiated power (e.i.r.p.)	55 dBW			
Automatic transmit power control (ATPC)	Optional			
Transmitter maximum power spectral density (PSD)	150 mW/100 MHz			
Minimum antenna gain	50 dBi			
Provision for reduced gain with reduced power	Reduced to minimum of 43 dBi, provided that the e.i.r.p. is reduced by 2 dB per 1 dB reduction in gain			
Minimum spectral efficiency	0.125 bits/s/Hz			

In the context of this consultation, all respondents, apart from Alliance Corporation, expressed interest in harmonizing with the European technical specifications, as outlined in Table 2. Their preference is likely a consequence of equipment availability and the desire to protect adjacent band services such as EESS passive in the band 86-92 GHz.

**Table 2: ETSI EN 302 217-3 v1.3.1, European Technical Specifications for Operation in the 70 and 80 GHz Bands**

Band	71-76 GHz	81-86 GHz
Maximum power (dBW)	5 dBW	
Maximum e.i.r.p. (dBW)	55 dBW	
Automatic transmit power control (ATPC)	Optional	
Transmitter maximum power spectral density (PSD)	-15 dBW/MHz, <sup>a,b</sup> Offset (0-20% of aggregated channel)	
Minimum antenna gain	38 dBi	
Provision for reduced gain with reduced power	$\leq 55$ dBW for $G_{\text{ant}} \geq 55$ dBi $\leq 55 - (55 - G_{\text{ant}})$ dBW for $55 \text{ dBi} > G_{\text{ant}} \geq 45$ dBi $\leq 45 - 2 \times (45 - G_{\text{ant}})$ dBW for $45 \text{ dBi} > G_{\text{ant}} \geq 38$ dBi	

<sup>a</sup> The output power spectral density, at antenna port, falling outside the edges of the band 71-76 GHz or below the lower edge of the band 81-86 GHz shall be further limited to a maximum of -55 dBW/MHz.

- <sup>b</sup> For the protection of passive services, in particular the EESS passive, the unwanted emissions of FS systems shall respect, at the antenna port, the limit mask provided by  $-41$  dBW/100 MHz at 86 GHz and reducing to  $-55$  dBW/100 MHz at 87 GHz.

In line with the European ETSI EN 302 217-3 requirements, both the RABC and Siklu Communication supported a minimum antenna gain of 38 dBi. They indicated that this reduction of antenna gain would enable the deployment of smaller, less expensive antennas while maintaining the narrow “pencil beam width” signal characteristics of the band. A reduction in antenna gain from 43 dBi to 38 dBi will increase the beam width by roughly 1 degree, or approximately a 1.6 degree increase when compared to a 50 dBi antenna gain. In general, as most links do not operate at maximum power, a reduction in antenna gain will reduce frequency reuse capabilities; however, it will enable the use of smaller antennas in high-density deployment situations where tower loading may be considered a critical factor.

Industry Canada received several comments regarding the need for a minimum spectral efficiency to ensure that the spectrum is used in an efficient manner. Suggestions ranged from a minimum of 0.125 bits/s/Hz to 1 bit/s/Hz, with Alliance Corporation and the RABC recommending efficiencies of 0.5 bits/s/Hz and 1 bit/s/Hz respectively, given the increased capacity requirements and demand for short-range backhaul. Although capable of data throughputs of 1 gigabit per second or greater, most of the current equipment employs simple modulation schemes. Greater spectrum efficiencies are possible with the use of higher order modulation schemes; however, this may increase cost and may also prevent certain users from accessing the spectrum based on their required data rates.

The Department will consider the comments received on the above technical parameters in the development of an SRSP with appropriate technical specifications to ensure the efficient use of spectrum.

To take advantage of readily available equipment and access to a wider range of services and applications developed on a global basis, the Department will consider establishing similar requirements to those adopted by Europe, which also minimize the impacts to adjacent band services.

**The Department will identify technical requirements through the development of an applicable SRSP and/or RSS, similar to requirements adopted in Europe, in consultation with the RABC.**

## 4.2 In-Band Interference

A variety of services, including fixed, fixed-satellite (space-to-Earth), mobile, mobile-satellite (space-to-Earth), broadcasting-satellite and radio astronomy, are allocated on a primary basis in portions of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz. In an effort to prevent and minimize instances of harmful interference, Industry Canada requested comments on technical parameters for satellite systems, specific requirements to facilitate sharing between services, and on the feasibility of uncoordinated deployment of fixed systems and the likelihood of interference.

Comments received confirmed that technical parameters for satellite systems in the bands 71-76 GHz and 81-86 GHz are not yet available. However, given the potential for high-density deployments of FS and that these bands are shared on a primary basis, the RABC suggested that FS systems could be first deployed in the range 71-74 GHz to accommodate future FSS in the upper portion. The Department will

consider initially encouraging FS use of the lower portion of the band. In terms of specific sharing criteria for FS and FSS, satellite systems in these bands would need to mature in order to determine the appropriate technical parameters for sharing. These considerations may be addressed in a future revision to the appropriate SRSP.

**Sharing criteria or parameters for FS and FSS in the bands 71-76 GHz and 81-86 GHz may be developed in the future and incorporated into the SRSP.**

#### 4.3 Adjacent-Band Interference

Industry Canada requested comments on sharing between services in adjacent bands. A variety of services, including radio astronomy, radiolocation, space research (space-to-Earth), amateur, amateur-satellite and EESS passive, are allocated in portions of the bands 76-81 GHz and 86-92 GHz. Environment Canada, EUMETNET and the WMO were strongly opposed to the FS emission mask defined by the FCC, preferring that of Europe, as defined by the European Telecommunications Standards Institute. They point to various studies conducted within Europe and the ITU which indicate that the FCC limits, in certain instances, may not offer adequate protection to EESS in the band 86-92 GHz. Environment Canada favours a constant FS unwanted emission level of  $-50$  dBW/100MHz, whereas EUMETNET and the WMO prefer the European mask of  $-41$  dBW/100 MHz at 86 GHz, decaying to  $-55$  dBW/100 MHz at 87 GHz, and its mirror image from 91 to 92 GHz.

Given the significance and role of the National Meteorological and Hydrological Services in providing information to predict severe weather, analyze climate changes and their impacts through EESS, there is a requirement to ensure that there will be minimal impact or degradation of data in the band 86-92 GHz. As such, the Department will take the views of the EESS community into consideration when developing technical standards with respect to unwanted emissions for incorporation in the associated SRSP and RSS. It is expected that such standards would be similar to those established in Europe.

**Appropriate levels for adjacent-band emissions will be identified in the technical specifications of the applicable SRSP and/or RSS.**

## 5. Licensing

Industry Canada seeks to facilitate the deployment of new wireless applications while minimizing regulatory interventions associated with use of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz. The following section outlines the decisions that will apply to licensing of these bands going forward. In the near future, a Client Procedures Circular will be established to provide applicants with the details on the licensing process to be followed and the specific conditions that will apply.



It should also be noted that a public consultation will be launched regarding the establishment of an appropriate spectrum licence fee for use of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz. Once a corresponding fee order has been established, licensees will be required to pay the annual spectrum licence fees.

### 5.1 Type of Authorization and Licensing Mechanism

The consultation paper proposed several options, including radio licences, spectrum licences and licence exemption. Comments received indicated strong interest in a licensed versus a licence-exempt model to facilitate inter-user coordination. Comments also supported use of spectrum licensing rather than radio licensing in order to provide licensees with the flexibility to deploy additional links in a timely manner.

The consultation also sought comments as to what licensing mechanism should be used should the licence-exempt model not be selected. Options included either first-come, first-served (FCFS) licensing or an auction process. Comments were strongly in favour of the FCFS process as being appropriate for licensing of these bands and supported licensing on a non-exclusive basis to maximize the availability of the spectrum to multiple users.

The consultation also sought comments on possible use of band managers to manage third party access to these frequencies. Respondents did not support this approach.

In light of the above considerations, spectrum licences will be issued through an FCFS process. Licensees will be required to share the spectrum with other licensees in a given area. In order to facilitate coordination between the users, licensees will be required to upload site-specific station technical information to an Industry Canada specified database prior to installation or modification of a fixed station. Using this data, new licensees will be required to coordinate with existing licensees to resolve technical issues.

**The Department will issue spectrum licences in the bands 71-76 GHz, 81-86 GHz and 92-95 GHz. Licensing for all areas will be on an FCFS basis and all licensees will have shared access to the spectrum.**

### 5.2 Service Areas

Comments received in response to the consultation supported licensing on an area basis (spectrum licensing rather than radio licensing), noting that the spectrum licence provides the operator flexibility to deploy quickly within the licensed area. Although a national licence would maximize that flexibility, it is noted that smaller service areas facilitate inter-user coordination.

As a result, Tier 4 service areas will be used for licensing of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz. Additional information and descriptions of the service areas used by Industry Canada can be found on the departmental website at [http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h\\_sf01627.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01627.html).

**Spectrum licences in the bands 71-76 GHz, 81-86 GHz and 92-95 GHz will be issued on a Tier 4 service area basis.**

### **5.3 Interim Licensing**

Until respective technical specifications and standards have been developed and published in an RSS and SRSP, and appropriate licensing procedures have been formally implemented, spectrum licence applications will not be accepted. In the interim, applications can be submitted for site-specific licences on a non-standard basis. Once the RSS and SRSP have been developed, any system authorized under the interim licensing process will be required to meet all requirements set out therein.

As noted, a public consultation will be launched regarding the establishment of an appropriate spectrum licence fee for use of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz. Once a corresponding fee order has been established, licensees will be required to pay the annual spectrum licence fees.

## **6. Coordination**

### **6.1 Domestic Coordination**

Frequency coordination is intended to enable licensees to confirm that proposed radio systems are planned and designed so that harmful interference does not occur. Most respondents indicated that although interference issues would be minimal within the fixed service, there is a need for frequency coordination of links prior to activation, given the significant potential impact upon networks resulting from any harmful interference affecting potentially large amounts of traffic. Comments received favoured a frequency coordinated approach as opposed to uncoordinated deployments.

Respondents presented different approaches to coordination between systems. Specifically, TeraGo, Rogers and the RABC recommended inter-operator coordination whereby the installing licensee would be responsible for notifying and coordinating directly with all concerned licensees in the general area of the proposed or modified link. Both the RABC and Rogers suggested that the Department develop a set of coordination criteria or technical requirements for frequency coordination purposes. Although Silku did not specifically suggest a coordination method, it indicated that licensees prefer licensed bands due to the lack of interference issues.

Given the propagation characteristics of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz, and the highly directive antenna radiation envelope, the likelihood of harmful interference is limited if frequency coordination is undertaken. Consequently, licensees will be responsible for ensuring that their installation(s) and modification(s) to their radio system(s) do not cause harmful interference. To protect existing licensed radio stations from interference, the Department will require licensees to successfully complete frequency coordination prior to operating a new or modified system which has the potential to cause interference. Although interference conflicts may still occur, the Department expects that they can be sufficiently managed and resolved through mutual cooperation and good faith discussions between licensees. As such, Industry Canada will not be involved in coordinating radio links or in resolving interference issues between FS systems.

For coordination purposes and to facilitate inter-user cooperation, at a future date, all licensees will be required to electronically enter and accurately maintain technical information and site-specific station and link data, as well as contact information, via an Industry Canada specified database prior to deploying and activating any station links. When this database is made available, the Department will encourage licensees to regularly consult the Spectrum Direct website (<http://www.ic.gc.ca/eic/site/sd-sd.nsf/eng/home>) for the location and technical specifications of active links for the purposes of inter-user coordination, general spectrum planning, potential interference resolution and mitigation. In addition, licensees will also be required to respect primary frequency allocation users which may include frequency coordination with future satellite systems or other radio services operating within the same 71-76 GHz, 81-86 GHz and 92-95 GHz bands.

**The Department will require, at a future date, that licensees enter site-specific technical data, contact information, and any additional information outlined in a future Client Procedures Circular, into an Industry Canada specified database. Licensees will be required to ensure that this information is kept up-to-date. Note that the Department will not be involved in coordinating radio links or in resolving FS interference issues. Licensees are expected to cooperate to identify and resolve possible interference themselves.**

**Inter-user domestic frequency coordination must be successfully completed prior to the activation of links. Licensees establishing new links or modifying existing links must resolve any technical issues with licensees of previously coordinated links. Technical requirements for coordination will be established in the development of the relevant SRSP.**

## 6.2 International Coordination

The use of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz near the United States border is not currently subject to a cross-border arrangement. However, the Department is in discussions with the United States with a view to developing a coordination agreement for the bands. Licensees will be subject to future agreements regarding use of these bands in the border regions, which may include obtaining departmental approval prior to operation.

**The Department will carry out due diligence in the establishment of a cross-border arrangement with the United States for the use of the bands 71-76 GHz, 81-86 GHz and 92-95 GHz to ensure protection of fixed systems in the border area. FS licensees will be subject to all future international agreements.**

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