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Spectrum Management and Telecommunications Policy

Consultation on the 24 and 38 GHz Frequency Bands: Proposed Policy and Licensing Procedures

Canada

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1. Introduction

In the Speech from the Throne on September 23, 1997, the Canadian Government reiterated its determination to place Canada at the forefront of the information revolution by making Canada the most connected nation in the world by the year 2000. Providing timely and efficient access to spectrum is one way to allow Canadian equipment manufacturers and service providers to compete and succeed in the global information economy while advancing Canada's connectedness agenda. On June 1, 1998, the Minister of Industry, recognizing that microwave broadband wireless communications is emerging as a potential competitive service offering to connect Canadians, announced that Industry Canada is launching a spectrum licensing process for the 24 GHz and 38 GHz microwave bands.

Through this discussion paper, Industry Canada initiates consultation on a competitive process to issue spectrum licences for exclusive access to spectrum blocks in the 24 GHz and 38 GHz bands in service areas across Canada. Prospective licensees are encouraged to provide comments to the Department on the various issues discussed in this consultation paper.

Following the closing date for receipt of comments to this consultation paper, copies of all the submissions will be made available to the public through Industry Canada's web site, Industry Canada libraries, and a commercial printing and copying service. We recommend that respondents provide their comments in electronic format to facilitate posting on the Department's web site.

Shortly after the close of the comment period, a reply period of approximately 21 days will follow to give the public an opportunity to respond on the initial comments. Again, the submission of comments in electronic format is strongly encouraged. After the closing date of this second period, these "reply comments" will also be made available to the public.

2. Background

2.1 Spectrum Developments

In October 1996, Canada became one of the first countries to designate broadband wireless spectrum for Local Multipoint Communications Systems (LMCS) services¹. LMCS is a wireless broadband system, in the band 25-28 GHz, that is capable of carrying basic and advanced telecommunication services. The Minister of Industry awarded LMCS licences to three companies through a comparative licensing process. It was the Department's stated intention at that time to make available for licensing, via an auction process, additional LMCS spectrum two years hence.

¹ Industry Canada, (March 2, 1996) *Local Multipoint Communications Systems (LMCS) in the 28 GHz Range: Policy, Authorization Procedures and Evaluation Criteria* (available at <http://strategis.ic.gc.ca/spectrum>). Note: This and other Industry Canada documents noted in this consultation paper are available at the above-mentioned website.

On June 1, 1998, the Minister of Industry announced that there would be a postponement in the licensing of further spectrum in the band 25-28 GHz for LMCS for at least 18 months. This deferral was in response to a number of developments which had taken place over the past two years including: a shift in the business focus for LMCS from the residential market to the business market, the licensing delay for LMCS spectrum in the U.S., and the subsequent delay in the development of equipment for this band.

The Minister also announced that in order to accommodate the increased demand for high speed local access telecommunications infrastructure, the Department would make available for licensing new spectrum in the 24 GHz and 38 GHz bands. This spectrum is aligned with that in the United States, thus Canadian service providers can take advantage of the economies of scale offered by a combined North American equipment marketplace. A number of manufacturers are developing radio equipment that can operate in these bands.

2.2 Auction Process

In February 1996, Industry Canada announced its intention to introduce the use of spectrum auctions where reliance on market forces to select licensees was in the public interest². Auctions offer a number of advantages such as:

- the ability to promote economically efficient use of spectrum;
- openness and objectivity as an assignment mechanism;
- procedural efficiency; and,
- the ability to yield an appropriate return to Canadians for the use of a public resource³.

The *Radiocommunication Act* was amended in June 1996 to give the Minister of Industry the explicit authority to use spectrum auctions. In August 1997, Industry Canada initiated a public consultation process on auction implementation issues with the publication of *Canada Gazette* Notice DGRB-003-97 announcing the availability of a document entitled *Consultation on Issues Related to Spectrum Auctioning*.⁴

It is the Department's view that in addition to the general advantages of an auction process discussed above, the following factors suggest that an auction would be the most appropriate licensing mechanism for the 24 GHz and 38 GHz bands:

- it is anticipated that the demand for spectrum in these bands will exceed the available supply, at least in some geographic areas; and,
- an auction will allow for the effective and efficient assignment of the large number of localized licences that will be made available.

² Industry Canada, (February 1996), *Review of the Comparative Selection and Radio Licensing Process: Findings*.

³ Treasury Board, (April 1997) *Cost-Recovery and Charging Policy*.

⁴ Available at <http://strategis.ic.gc.ca/SSG/sf01435e.html>.

Coincident with the release of this paper, the Department is releasing the document entitled *Framework for Spectrum Auctions in Canada*, which outlines the general framework for all the future auctions the Department may undertake. As discussed more fully in this document, the Department proposes that elements of the general framework for spectrum auctions be adopted for licensing of 24 GHz and 38 GHz spectrum. The Department encourages all respondents to this consultation paper to familiarize themselves with the *Framework* document.

3. Spectrum Policy Issues

Since the release of the spectrum policy for the 23 GHz and 38 GHz bands in September 1996⁵, wireless broadband technology in this frequency range has continued to advance. Notably, many more manufacturers have developed broadband wireless products, particularly in the 24 GHz and 38 GHz bands. New and existing telecommunication service providers are considering wireless broadband solutions for the implementation of new systems or expansion of existing networks. There are indications that point-to-point and point-to-multipoint systems operating in the 24 GHz and 38 GHz bands can offer cost effective solutions for service providers wishing to offer competitive voice, data and multi-media services.

The Department proposes to make available 700 to 900 MHz of spectrum in the 38 GHz band and 400 MHz in the 24 GHz band to foster the introduction of new broadband wireless services. In order to accomplish this objective, it is necessary to modify the existing spectrum and licensing policy for the 38 GHz band and develop a new policy for the 24 GHz band. The following sub-sections attempt to identify key frequency band structure, allocation, and eligibility issues for public comment.

3.1 Frequency Band Structure

It is recognized that the operation of broadband wireless systems in frequency bands above 20 GHz have many challenges including radio propagation at these frequencies and rapidly changing technology. Point-to-multipoint technology in particular is in the early stages of development in Canada and the United States. Taking these factors into account, the Department is of the view that the frequency band structure should align as closely as possible with other administrations to ensure the greatest availability of equipment, minimize costly customization requirements and ensure a larger equipment market for our manufacturers. In addition, sufficient spectrum should be available to service providers to permit the development of viable business plans and foster competition in the local market place. Other factors, such as the need to coordinate with other operators using adjacent frequency blocks in the same area have to be taken into account.

⁵ *Spectrum Policy and Licensing Considerations, Fixed Radio Systems in the 23 GHz and 38 GHz Frequency Bands (SP 23/38 GHz)*, September 1996.

3.1.1 The 24 GHz Band

In Canada, industry is now expressing interest in the 24 GHz band as a result of recent developments in the United States. In 1997, the U.S. opened the frequency bands 24.25-24.45 GHz and 25.05-25.25 GHz to accommodate the Digital Electronic Message Service (DEMS) which was being moved out of the 18 GHz band. This decision by the United States government was made in order to protect planned and existing satellite services in the 18 GHz band. The action resulted in the creation of a new point-to-multipoint band at 24 GHz and the assignment of part, or all, of this spectrum to the DEMS operators. Currently, these operators are working with manufacturers to develop new broadband equipment.

Against this backdrop, there has been increasing interest in Canada to open this spectrum for broadband wireless services. The Department is of the view that it would be in the public interest to allocate some spectrum for the fixed service and establish appropriate spectrum policy provisions.

The following proposals outline the essential policy provisions for broadband wireless services operating in the 24 GHz band:

1. The bands 24.25-24.45 GHz and 25.05-25.25 GHz shall be allocated to the fixed service on a primary basis (see section 3.2 for allocation proposals).
2. The fixed service use of the 24 GHz bands is intended for broadband wireless applications including point-to-point and point-to-multipoint systems.
3. The frequency blocks available for licensing shall be symmetrically paired to facilitate two-way systems; refer to Table 1.
4. Paired frequency blocks shall be assigned within a geographical area and any paired block will be assigned only once in a service area.

Table 1 - 24 GHz Frequency Block Pairs of 40+40 MHz

Paired Block	Lower Frequency Block (MHz)	Upper Frequency Block (MHz)
A/A'	24,250-24,290	25,050-25,090
B/B'	24,290-24,330	25,090-25,130
C/C'	24,330-24,370	25,130-25,170
D/D'	24,370-24,410	25,170-25,210
E/E'	24,410-24,450	25,210-25,250

This frequency block arrangement is harmonized with the spectrum designated in the United States.

Interested parties are requested to comment on the 24 GHz band plan. Any alternate band plan proposals are welcome.

3.1.2 The 38 GHz Band

Spectrum in the band 38.6-40.0 GHz was opened for point-to-point fixed systems in September 1996⁶. Since then, a number of operators have used 38 GHz radio links for a variety of applications including “last mile” connections for fibre networks and backhaul links for Personal Communications Services (PCS) cell sites. The licensing procedure allows operators to apply, on a first-come, first-served basis, for authority to utilize 50+50 MHz paired blocks in user-defined areas. Since it is possible to coordinate point-to-point systems, the paired blocks may be shared by a number of users where necessary.

The point-to-point links currently authorized in the 38 GHz band occupy five paired blocks in the major urban centers. Consequently the Department is in a position to make available **seven to nine paired blocks** in the 38 GHz band to service providers who require exclusive use of this spectrum for either point-to-point or point-to-multipoint systems. For this consultation process therefore, steps have been taken to limit current 38 GHz licensing activity to blocks A/A', B/B', L/L', M/M' and N/N' of frequency plan as described in Table 2 below.

The following are the proposed changes to accommodate existing and emerging wireless broadband service requirements in the 38 GHz band.

1. The standard frequency block size will continue to be 50 MHz throughout the frequency band 38.6-40.0 GHz.
2. The following frequency band plan options are offered for consideration:

Option 1: Set aside 700 MHz for broadband wireless services (exclusive use)

Seven spectrum blocks in the 38700-39050 MHz band and 39400–39750 MHz band (blocks C/C' to I/I' inclusive) will be assigned in 50+50 MHz block pairs, on an exclusive basis. Licensees may deploy point-to-point or point-to-multipoint systems in these spectrum blocks. The remaining seven blocks (blocks A/A', B/B' and J/J' to N/N' inclusive) will continue to be available on a shared basis for point-to-point systems only.

⁶ Industry Canada, (September 1996), *SP 23/38 GHz: Spectrum Policy and Licensing Considerations, Fixed Radio Systems in the 23 GHz and 38 GHz Frequency Bands*.

Option 2: Set aside 900 MHz for broadband wireless services (exclusive use)

Nine spectrum blocks in the 38700-39150 MHz band and 39400-39850 MHz band (blocks C/C' to K/K' inclusive) will be assigned in 50+50 MHz block pairs, on an exclusive basis. Licensees may deploy point-to-point or point-to-multipoint systems in these spectrum blocks. The remaining five blocks (blocks A/A', B/B' and L/L' to N/N' inclusive) will continue to be available on a shared basis for point-to-point systems only.

Interested parties are requested to comment on the 38 GHz band plan and proposed options.

3. Licensees are permitted to use any channelling arrangement within the assigned block(s) of spectrum.
4. The “shared” spectrum blocks will continue to be available for deployment of point-to-point systems in the band 38.6-40.0 GHz on a first-come, first-served basis⁷. The spectrum policy provisions in SP 23/38 GHz should be modified to reflect current licensing practices. A revised set of spectrum policy provisions for the first-come, first-served paired blocks can be found in Appendix A of this document.
5. With the development of high density broadband wireless systems in the band 38.6-40.0 GHz, the fixed service will be given priority over other service allocations. The authorization of frequency assignments to systems of other services would be conditional on the need to protect the operation and growth of fixed service systems.

⁷

Paired blocks A/A', B/B', L/L', M/M', and N/N' are currently available for licensing point-to-point systems on a first-come, first-served basis. Additional paired blocks may become available in the near future depending upon the frequency block structure adopted by the Department as a result of this consultation process.

Table 2 - Paired Spectrum Blocks in the Frequency Band 38.6-40.0 GHz

BLOCK	FREQUENCY LIMITS (MHz)	USAGE	LICENSING PROCESS	EXCLUSIVITY
A/A'	38600-38650 / 39300-39350	point-to-point	first-come, first-served	shared
B/B'	38650-38700 / 39350-39400	point-to-point	first-come, first-served	shared
C/C'	38700-38750 / 39400-39450	point-to-point point-to-multipoint	auction	exclusive
D/D'	38750-38800 / 39450-39500	point-to-point point-to-multipoint	auction	exclusive
E/E'	38800-38850 / 39500-39550	point-to-point point-to-multipoint	auction	exclusive
F/F'	38850-38900 / 39550-39600	point-to-point point-to-multipoint	auction	exclusive
G/G'	38900-38950 / 39600-39650	point-to-point point-to-multipoint	auction	exclusive
H/H'	38950-39000 / 39650-39700	point-to-point point-to-multipoint	auction	exclusive
I/I'	39000-39050 / 39700-39750	point-to-point point-to-multipoint	auction	exclusive
J/J'	39050-39100 / 39750-39800	to be determined	to be determined	to be determined ⁸
K/K'	39100-39150 / 39800-39850	to be determined	to be determined	to be determined ⁸
L/L'	39150-39200 / 39850-39900	point-to-point	first-come, first-served	shared
M/M'	39200-39250 / 39900-39950	point-to-point	first-come, first-served	shared
N/N'	39250-39300 / 39950-40000	point-to-point	first-come, first-served	shared

Comments are sought on the amount of spectrum that is required to support the business plans of the operators wishing to continue to deploy point-to-point systems in the shared blocks. Further, comments are sought on the spectrum policy provisions contained within Appendix A.

⁸ Refer to Options 1 and 2 in section 3.1.2.

3.2 Allocation Issues

In Canada, the 24.25-24.45 GHz and 25.05-25.25 GHz bands are not currently used by the services to which this spectrum is allocated. These services include radionavigation and feeder links for broadcasting-satellite space stations. In order to accommodate broadband fixed services in these bands, it is necessary to amend the *Canadian Table of Frequency Allocations* to include a primary allocation for the fixed service, as shown in the table below.

GHz
CANADIAN ALLOCATION TABLE

24.25 - 24.45	<u>FIXED</u> RADIONAVIGATION
24.45 - 24.65	INTER-SATELLITE 882E RADIONAVIGATION
24.65 - 24.75	INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)
24.75 - 25. <u>05</u>	FIXED-SATELLITE (Earth-to-space) 882G <u>MOD C44</u> C47
25. <u>05</u> - 25.25	<u>FIXED</u> FIXED-SATELLITE (Earth-to-space) 882G <u>MOD C44</u> C47

MOD C44

(CAN-94) Feeder links to broadcasting-satellite space stations operating in the band 17.3-17.8 GHz shall be implemented in the band 24.75-25.25 GHz. **In areas where fixed systems have been licensed using a competitive process, future earth stations (Earth-to-space) in the band 25.05-25.25 GHz will be permitted provided that such installations will not cause interference to any fixed systems to be deployed in the authorized service areas.**

* modifications indicated by bold letters and underline

Comments are sought on the proposed changes to the Canadian Table of Frequency Allocations and views on suitable sharing and coordination criteria which would facilitate the use of these bands by the fixed service and by incumbent primary services.

3.3 Eligibility

3.3.1 General Principles

One of the key advantages that has led the Department to introduce auctioning as a spectrum assignment tool is the ability of an auction mechanism to award

spectrum in an economically efficient manner. Within a competitive environment, a market-based spectrum assignment mechanism will be best able to select licensees who can most efficiently provide the wireless services most valued by Canadian consumers. To ensure that economic benefits are maximized, it is important that licensees will indeed be operating in a competitive market-place⁹.

The means available to the government to promote a competitive post-auction market-place for broadband services include disallowing the participation of certain firms in the auction and imposing aggregation limits on the amount of spectrum that any bidder may acquire. With regard to these two measures, the Department suggests that the principles listed below should be adhered to.

Principle 1 A company that currently provides telecommunications services should be restricted from holding certain licences in the following circumstances:

- (i) the company possesses market power in the supply of one or more telecommunications services in a region covered by the licence to be auctioned;
- (ii) a new entrant is likely to use the licence to provide services in competition with the company's existing services; and,
- (iii) the anti-competitive effects of the company's acquisition of a licence are not outweighed by the potential economies of scope arising from the integration of 24 GHz and 38 GHz spectrum into the company's existing network.

Principle 2 When multiple licences for the use of spectrum in a given geographic area are auctioned, and these can be used to provide closely substitutable services, limits on the amount of spectrum that any single bidder is allowed to acquire may be required to ensure competitive markets. Spectrum aggregation limits should be imposed only in the following circumstances:

- (i) a bidder that acquires a significant amount of spectrum would not face effective competition from providers of services that do not require use of the spectrum being auctioned; and,
- (ii) the anti-competitive effects arising from the acquisition of a significant amount of spectrum by a single bidder would not be

⁹ The principles that apply to merger analysis are also pertinent to the analysis regarding bidder eligibility restrictions and spectrum aggregation limits. See the document *Merger Enforcement Guidelines*, (January 24, 1997) for the framework used by the Competition Bureau for analyzing competition within a market (available at <http://strategis.ic.gc.ca/SSG/ct01264e.html>).

offset by lower costs or higher valued services resulting from holding this amount of spectrum.

3.3.2 Eligibility Requirements

Given the anticipated nature of the market-place that will be served by 24 GHz and 38 GHz licensees and with regard to the first principle stated above, the Department is of the view that no restrictions on bidder eligibility are required. Prospective bidders should note that all entities operating as common carriers must comply with the Canadian ownership and control requirements, as outlined in subsection 10(2) of the *Radiocommunication Regulations*.

As competition in the local telecommunication market begins to unfold, it is an objective of Industry Canada to foster new and enhanced services. In the case of broadband wireless spectrum, this entails striking a balance between the need to provide sufficient spectrum to support viable business plans, the need to accommodate a range of service providers and address the general principles described above. The Department believes that these objectives can be satisfied by implementation of a spectrum aggregation limit.

In 1996, Local Multipoint Communication Systems (LMCS) spectrum licences of 1000 MHz were awarded to three operators to provide service in 193 communities. Over the past two years the business focus of LMCS has shifted from the residential market to the business market with an emphasis on the provision of high speed data (Intranet/Internet) services. Also during this period, developments in the 24 GHz and 38 GHz bands indicate that competitive access providers want to expand their point-to-point operations to include point-to-multipoint systems in order to better serve the telecommunication requirements of small and medium businesses. As a result, it has become evident that there is little difference between the market focus of the 28 GHz LMCS service providers and other broadband operators using frequency bands such as the 38 GHz band.

In response to these changes, a number of manufacturers have developed, or are in the process of developing, point-to-multipoint broadband technology that can operate in a variety of frequency bands above 20 GHz, including the bands 24 GHz, 28 GHz and 38 GHz. Industry Canada is of the view that the licensing process of the 24 GHz and 38 GHz spectrum should take into account spectrum already awarded in the 28 GHz band to LMCS licensees.

In addition, the Department is concerned that anti-competitive market power could be exercised should the spectrum available to provide these services be concentrated in the hands of too few players. The Department proposes that a spectrum aggregation limit be implemented for the 24.25-24.45 GHz, 25.05-25.25 GHz, 38.70-39.05 GHz and 39.40-39.75 GHz frequency bands¹⁰ while taking into account the authorized users of the 28 GHz spectrum. Any

¹⁰ The frequency bands may be adjusted depending on the outcome of this consultation paper.

entity will be eligible to hold spectrum licences covering, in any service area, frequency assignments aggregating up to a total of 700 MHz of spectrum. This spectrum aggregation within a service area consists of:

- (i) spectrum licensed for wireless broadband services in the 24.25-24.45 GHz, 25.05-25.25 GHz, 38.70-39.05 GHz and 39.40-39.75 GHz frequency bands;
- (ii) spectrum licensed for Local Multipoint Communication Systems (LMCS) in the 27.35-28.35 GHz band; and,
- (iii) spectrum as defined in i) and ii) above that is licensed to any affiliate¹¹ of the entity.

Further information on the enforcement of spectrum aggregation limits can be found in section 6.2.10 of this document.

If an LMCS licensee does not participate in the auction or does not acquire 24 GHz or 38 GHz exclusive spectrum blocks in the secondary market in its LMCS service area, its 28 GHz licences are not affected by the proposed aggregation limit. However, should an LMCS licensee wish to acquire, either in the auction or in the secondary market, 24 GHz or 38 GHz exclusive spectrum blocks in a particular 24/38 GHz service area, and its existing LMCS coverage area overlaps the 24/38 GHz service area it is acquiring, then its LMCS spectrum assignment will be included in this spectrum aggregation limit.

The Department proposes that this limit on the aggregation of spectrum will be in effect during a term of three years following the close of this licensing process or until a subsequent licensing process is announced for other wireless broadband services, whichever comes first. The aggregation rule will also be observed when the transfer of an ownership interest in a successful applicant is effected.

Comments are sought on the eligibility requirements proposed.

4. Definition of Licences

4.1 Spectrum Licences

The authorizations that will be available for assignment will be spectrum licences which are defined in subparagraph 5(1)(a)(i.1) of the *Radiocommunication Act* as authorizations “in respect of the utilization of specified radio frequencies within a defined geographic area”.

The proposed attributes of these spectrum licences and the proposed conditions that will be attached to them are described below. The Department proposes that the elements of

¹¹ “affiliate” is defined in the same manner as in subsection 35(3) of the *Telecommunications Act*; viz. “...a person who controls the carrier, or who is controlled by the carrier or by any person who controls the carrier.”

the “common framework” for spectrum auctions laid out in the *Framework for Spectrum Auctions in Canada* document be adopted for the licensing of 24 GHz and 38 GHz spectrum.

4.2 Service Areas

The Department has established four tiers of service areas - ranging from a single national service area (Tier 1) down to a set of 162 more localized areas which cover the entire geography of Canada (Tier 4) - which it intends to use for future spectrum auctions, and perhaps in other licensing situations. These service area tiers are based on contiguous groupings of Statistics Canada’s Census Divisions and Subdivisions. A summary of these tiers is in *Appendix B* of this document. For full details of the tiers, please refer to the document *Service Areas for Competitive Licensing*¹².

The appropriate size of service areas for the licensing of spectrum in the 24 GHz and 38 GHz bands must be determined. Should the Department assign a national licence, regional licences, or licences which have smaller and more localized service areas? There are advantages and disadvantages to having a large number of small service areas or conversely, to having a small number of large service areas. In considering the trade-offs the Department considers one principle to be key: no licence should be so small, in terms of either bandwidth or geography, that on its own it could not provide a viable business opportunity for some bidders.

When the licences available are auctioned as smaller service areas, bidders are permitted greater flexibility in acquiring the precise aggregation of areas that they most prefer. As well, this allows more small players to effectively participate in the auction. However, the choice of numerous licences having small service areas also adds to the complexity of the auction by increasing the likelihood of confusion and errors. It is more difficult for bidders to monitor round-by-round bidding activity on a large number of licences than it is on a small number of licences. To compensate for the increased complexity, the pace of the auction may have to be reduced.

Auctioning numerous service areas can also increase the possibility of “stranded” bids. For example, Bidder A may have a business plan that depends on the acquisition of two adjacent service areas. If service areas X and Y are auctioned as individual licences, Bidder B may thwart Bidder A’s plan if it bids on the service area Y licence. A possible outcome for Bidder A is that it ends up being the high bidder on only the service area X licence. Thus Bidder A will not realize the desired aggregation on which its business plan depended and will also have acquired a licence for which it now has no use. Had service areas X and Y been auctioned together as part of one licence, then there would have been no possibility for Bidder A to end up with a stranded bid on the service area X licence.

Conversely, auctioning a small number of larger service areas will not allow bidders as much flexibility in completing their desired geographic aggregation. The ability of smaller players to participate in the auction may also be impeded. (By making licences divisible,

¹² Available on the Department’s Strategis Web site <http://strategis.ic.gc.ca/spectrum>

however, smaller players may be able to acquire the service areas they need from auction winners through the secondary market.) A smaller number of licences reduces the likelihood of bidder errors, allowing the pace of the auction to be quicker. Finally, the likelihood of stranded bids occurring is reduced when larger licences are auctioned.

The Department is of the view that the services likely to be offered with 24 GHz and 38 GHz spectrum would be amenable to licensing on a regional/local basis and, after considering the trade-offs discussed above, proposes that Tier 3 service areas¹³ be used for these bands.

Comments are sought on the proposal to use Tier 3 service areas for the licensing of the 24 GHz and 38 GHz bands.

4.3 Spectrum Licence Packages

The proposed frequency band structure for the 24 GHz and 38 GHz bands was discussed previously in section 3.1 of this document. Five frequency block pairs of 40+40 MHz were proposed for the 24 GHz band (for a total of 400 MHz) and between seven and nine 50+50 MHz frequency block pairs were proposed for the 38 GHz band (for a total of 700 MHz to 900 MHz).

In addition to the technical question of how the spectrum blocks should be structured, there is the crucial question of how these spectrum blocks will be "packaged" for licensing. Using the 24 GHz band as an example, should the entire 400 MHz available be offered as one licence in each geographic area, or should it be divided into a number of smaller licences which will be assigned individually? There are advantages and disadvantages to having a larger number of smaller licences (for example, five 40+40 MHz licences) and to having a smaller number of larger licences (for example, one licence for the entire 400 MHz). Once again, the Department considers one initial principle to be key: no licence should be so small, in terms of either bandwidth or geography, that on its own it could not provide a viable business opportunity for some bidders.

As with the choice of the appropriate geographic size of licences, there are trade-offs involved when choosing between a small number of licences with a large amount of bandwidth and a large number of licences with a small amount of bandwidth. Numerous licences with smaller amounts of bandwidth allow for greater flexibility and provide more opportunities for smaller players, but also add to the complexity of the auction and increase the likelihood of problems with stranded bids. Having fewer licences with larger amounts of bandwidth reduces the complexity of the auction and reduces the likelihood of stranded bids, but, as is the case with the geographic dimension, bidders will not have as much flexibility in completing their desired spectrum aggregations and the ability of smaller players to participate in the auction may be impeded. (Again, by making licences divisible, smaller players may be able to acquire the spectrum they need from auction winners through the secondary market.)

¹³ There are 59 service areas in Tier 3. The largest is Toronto with a population of 5,146,581. The smallest is Cobourg with a population of 57,326.

Proposed Spectrum Licence Packages

Having considered the trade-offs discussed above, the Department proposes that the five 80 MHz paired blocks in the 24 GHz band be packaged as a single 400 MHz spectrum licence. Also, the Department proposes that the paired blocks in the 38 GHz band be packaged as follows: one 400 MHz spectrum licence, one 300 MHz spectrum licence and one 200 MHz¹⁴ spectrum licence as indicated in Table 3 below.

Table 3 - Spectrum Licence Package Proposal

Spectrum Licence	Size (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)
A	400	24,250-24,450	25,050-25,250
B	400	38,700-38,900	39,400-39,600
C	300	38,900-39,050	39,600-39,750
D ¹⁴	200	39,050-39,150	39,750-39,850

Comments are sought on the proposed Spectrum Licence Packages.

4.4 Licence Term/Renewal Expectancy

The Department proposes that licences have a ten-year term and a high expectation of renewal at the end of the term. That is to say, the Department intends to generally renew licences for subsequent ten-year terms unless a breach of licence condition occurs, a fundamental reallocation of spectrum to a new service is required (e.g. a reallocation by the International Telecommunication Union), or an overriding policy need arises (e.g. a spectrum reallocation to address a national security issue). To provide a more stable investment climate for licensees, a consultation process will commence no later than two years prior to the end of the licence term (i.e. after year eight) if the Department foresees the possibility that a licence will not be renewed. The imposition of any renewal fees and/or amendments to licence conditions for the initial licensees in the subsequent term will also be addressed in a consultation process which will commence no later than two years prior to the end of the licence term.

In the event of bankruptcy or insolvency of a licence holder, the status and treatment of the licence will be subject to the general laws of bankruptcy and insolvency.

¹⁴ The 200 MHz Spectrum Licence may not be available depending upon the outcome of this consultation paper. (See section 3.1.2.)

4.5 Transfer and Division of Licences and Flexibility of Use

Transferability of Licences

The Department proposes that auctioned licences will be transferable subject to the following conditions and guidelines¹⁵.

- All eligibility criteria and conditions that apply to a licence, including those related to interference management, will continue to apply should the licence be transferred.
- Should an auction winner transfer its licence to another party, for example, four years into a ten-year licence term, the second party will only receive a licence term equal to the remaining six years, but will be eligible for the same licence renewal provisions as the original licensee.
- All proposed licence transfers must comply with any spectrum aggregation limits or other measures intended to preclude anti-competitive behaviour that may be in place¹⁶.
- Written notification will be required of all proposed licence transfers. The Department will also request attestations or other documentation to ensure that the points above (e.g. compliance with the eligibility criteria) have been satisfactorily addressed. Once a licence transfer has been registered, the Department will revoke the original licence and issue a new licence in its place.
- The Department will maintain a publicly accessible database listing all auctioned licences and the respective licensee and will update the database upon a licence transfer.

Should Transferability be Delayed?

For this licensing process, the Department solicits views on whether the transferability of licences should be delayed for a specific time period, for example, three years following this licensing process. A moratorium on transferability may discourage bidding for speculative purposes and would ensure that bidders participating in the auction have a genuine desire to utilize the spectrum in the markets they wish to acquire.

There are also disadvantages to this approach. Some post-auction secondary market transactions may be required to “fine-tune” the distribution of the spectrum. A moratorium on transferability will obviously not allow such transactions to occur. As well, given that the services and technologies associated with 24 GHz and 38 GHz spectrum are new and

¹⁵ More detailed information on these new procedures for transferring licences will be available in a Client Procedures Circular (CPC) to be published in the near future. Interested parties may wish to check the Department’s web-site (<http://strategis.ic.gc.ca/spectrum>) for updates.

¹⁶ It should be noted that any licence transfer could also be subject to the provisions of the *Competition Act*.

developing, bidders may face some uncertainty in determining the exact amount of spectrum they may require in various service areas. As more information about market opportunities and technology becomes available post-auction, secondary market transactions may lead to a more efficient allocation of the resource.

Comments are sought on a moratorium of up to three years on the transferability of licenses following this licensing process.

Divisibility

The Department also proposes that licensees be permitted to transfer their licences not only in whole, but also in part. Licences will therefore be divisible in both the bandwidth and geographic dimensions.

The Department does not foresee the need to impose significant limitations on licence divisibility. There is no reason to assume that both the parties involved in the division of a licence would not be interested in minimizing interference and maximizing the reliability of the services they will provide. In order to maintain compatibility with the Department's database, licences will be divisible in the geographic dimension only in terms of Spectrum Grid cells¹⁷. Thus when an auctioned licence is divided, the minimum geographic size that any one of the new divisions may take is one Spectrum Grid cell. The individual Spectrum Grid cells are sufficiently small that even with this restriction, an extremely high degree of flexibility will be available to the parties involved in determining the size and shape of sub-divided portions of a licence.

As for the bandwidth dimension, the Department will require compliance with emission limitations in the frequency blocks immediately outside and adjacent to each of the resulting frequency blocks, and with the spectrum assignment plan as defined in the final policy document and the accompanying Standard Radio System Plan (SRSP).

It should be noted that the division of a licence may increase the number of parties with whom other neighbouring licensees must communicate when attempting to minimize the potential for interference at the boundary between service areas and/or at the band edge between spectrum blocks.

In any situation, where there is a request for the transfer of a portion of a licence, the original licensee will be required to return its licence to the Department. Once the transfer has been registered, the Department can amend the original licence and issue a new licence to the transferee.

¹⁷ Spectrum Grid cells are defined in the Industry Canada (Spectrum Management) Client Procedures Circular 2-1-16 (CPC-2-1-16), *Licensing Procedure for Local Multipoint Communications Systems (LMCS)*, (February 1, 1997), available on the Strategis Web site at <http://strategis.ic.gc.ca/spectrum>. Spectrum Grid cells are six-sided figures with an area of 25 km² that fit together in an interlocking pattern over the geography of Canada.

Should Divisibility be Delayed?

For this licensing process, the Department solicits views on whether the divisibility of licences in the bandwidth dimension and the geographic dimension should be delayed for a specific time period, for example, three years following this licensing process. A moratorium on divisibility would discourage bidding for speculative purposes and would ensure that bidders participating in the auction have a genuine desire to utilize the spectrum in the markets they wish to acquire.

On the other hand, a delay in opening the secondary market following this licensing process would severely reduce the chances for smaller players to develop niche offerings as they will not be able to acquire spectrum from auction winners. For example, a small player wishing to deliver services to rural areas would not be able to acquire a sub-divided portion of the licence won by a bidder whose primary aim is to serve the urban centre within a service area.

Comments are sought on a moratorium of up to three years on the divisibility of licenses following this licensing process.

4.6 Implementation of Services

As noted in the introduction, a goal of this licensing process is to help connect Canadians. To do so requires that the spectrum assigned through this licensing process be utilized in a timely manner such that Canadians have access to new wireless broadband services. A possible method to achieve this goal is to require successful licensees to implement their services within, for example, three years. Following this period, the Department would conduct a review of the implementation of the services which could lead to a revocation of the licence without a return of payment should a licensee not have implemented service. This may prevent a licensee from acquiring the spectrum simply to block the entry of competitors into the marketplace. On the other hand, there may be reasons outside the control of the licensee which would not allow them to quickly implement service. For example, the unavailability of equipment or undesirable or unexpected market conditions could lead to a delay in the implementation of services beyond the specified implementation period. The Department recognizes that if roll-out requirements are to be a condition of licence, they must be clearly and objectively defined before the auction.

Comments are sought as to whether there should be a condition of licence that requires licensees to implement their service within a specified time period that is less than the proposed licence renewal period. Further, views are sought on the possible mechanisms that could be employed to verify the implementation of service within the stated time period.

4.7 Conditions of Licence

The conditions of licence will be clearly stipulated prior to an auction. The Department proposes the following:

1. Licensees must comply with the eligibility criteria as set out in the *Radiocommunication Act*. Licensees must notify the Minister of any change which would have a material effect on ownership or control in fact. Such notification must be made in advance for any proposed transactions.
2. Licensees must, from the inception of service, provide for and maintain lawful interception capabilities as authorized by law:
 - (a) The requirements for lawful interception capabilities are provided in the *Solicitor General's Enforcement Standards for Lawful Interception of Telecommunications* (Rev. Nov.95). These standards may be amended from time to time following consultation with the Solicitor General of Canada and the licensees.
 - (b) Licensees may request the Minister to forbear from enforcing certain assistance capability requirements for a limited period. The Minister, following consultation with the Solicitor General of Canada, may exercise his power to forbear from enforcing a requirement or requirements where, in the opinion of the Minister, the requirement(s) is (are) not reasonably achievable. Forbearance requests must include specific details and dates when compliance to requirement(s) can be expected.
3. While site specific radio licences will not be required for each radio station, licensees must ensure that:
 - radio stations are installed and operated in a manner that complies with Health Canada's limits of exposure to radiofrequency fields¹⁸;
 - where applicable, antenna structures are marked in accordance with the recommendations of Transport Canada; and
 - prior to installation of significant antenna structures, consultation with the appropriate land use authorities has taken place.
4. Licensees must comply with international coordination requirements with the United States as they are developed. While frequency assignments are not subject to site-by-site licensing, licensees may be required to furnish all necessary technical data to Industry Canada for each relevant site in order for international coordination to be effected with the United States as per the terms

¹⁸ Industry Canada (June 24, 1995), *Environmental Process, Radiofrequency Fields and Land-Use Consultation* (CPC-2-0-03).

of any existing or future sharing arrangement. Should international coordination be required, Industry Canada will identify the appropriate data elements, format and means of submission.

5. Licensees must comply with domestic and *ITU Radio Regulations* pertaining to their licenced bands.
6. Licensees must invest 2% of adjusted gross revenues in telecommunications research and development. The eligible research and development activities are those which meet the definition adopted by Revenue Canada which is outlined in the *Income Tax Regulations* made pursuant to the *Income Tax Act*. For further information concerning R&D procedures, please refer to the document *Guidelines for Compliance with the Radio and Spectrum Licence Conditions Relating to R&D*¹⁹.
7. Licensees must submit an annual report for each of the first five years indicating continued compliance with these licence conditions including:
 - an update on the implementation of wireless services - this update should include the number of hub and subscriber sites installed;
 - as noted above, an audited statement of research and development expenditures for the fiscal year covered by the report; and
 - a copy of any existing corporate annual report for the licensee's fiscal year with respect to the authorization.

The reports are to be submitted, in writing within 120 days of the licensee's fiscal year end, to the Director, Spectrum Management Operations, Radiocommunications and Broadcasting Regulatory Branch. Confidential information provided will be treated in accordance with Section 20(1) of the *Access to Information Act*.

8. Licensees must comply with the spectrum aggregation limit as described in section 3 of this document.
9. Licensees must comply with the transferability and divisibility requirements of spectrum licences as described in section 4 of this document.
10. Licensees must utilize the spectrum for bona fide wireless telecommunication services with-in three years following the close of this licensing process²⁰.

¹⁹ This document is available on the Department's Strategis web site: <http://strategis.ic.gc.ca/spectrum>.

²⁰ This condition is dependent on the outcome of consultation for Section 4.6. *Implementation of Services*.

Comments are sought on these proposed conditions.

5. Technical Considerations

The following sections discuss technical aspects to be considered when responding to the proposals contained in this document, or in submitting new proposals. Comments are solicited in areas that will influence the technical requirements for the bands.

5.1 Boundary Conditions

Boundary conditions are to be applied at the edges of licensed areas. These conditions are intended to minimize the potential for radio interference between neighbouring licensees. To the potential licensee they provide indications on the conditions beyond which radio interference may be received from or transmitted to a neighbour. A set of boundary conditions will be required for block and area implementations.

5.2 Block Area Implementation

The intent is to assign all of the spectrum within each licensed area, and to allow assigned frequency channel blocks to be subdivided and used within the licensed area, subject to the rules for interference management which will be developed in consultation with industry.

One of the attractive aspects of the block area assignment is the freedom to use the given spectrum in a particular area with a minimum number of restrictions. There is also a measure of expectation implied by a block and area licence of unencumbered access to the spectrum within the licensed area at any given time.

The block area implementation in this proposal will result in situations where licensees hold spectrum licences for an area with the knowledge that co-channel assignments may be made in directly adjacent areas and adjacent channel assignments may be made within the same service areas. Such situations may lead to interference between systems of different licensees unless some measures are taken prior to the system implementation.

Operation of co-channel systems in directly adjacent areas may be difficult without system specific communication between licensees, since the potential for one system to interfere with another system typically extends for distances much greater than the desired link length. The closer the systems are to each other, the more the interaction is required. Minimizing these constraints to increase exclusivity of operation would therefore come at a cost in either spectrum or geography. The same is true for the operation of adjacent-channel systems within the same licensed area.

The following sections discuss the various aspects to be considered to initiate communications between licensees.

5.3 Communications between Licensees

Communications between licensees can be triggered in several ways, typically using distance or power flux density (pfd) as a criterion. If the trigger criterion is distance, this distance needs to be sufficiently large to ensure minimum interference between systems. Similarly, if the trigger criterion is pfd, this pfd needs to be sufficiently low to ensure minimum interference between systems.

The most common trigger is distance. The value is typically based on worst case parameters to ensure that the possibility of interference is reduced. Radiated power level, effective antenna height, receiver sensitivity and configuration are combined to determine a distance within which there is a possibility for interference between two systems. A table of distances based on transmitter heights and powers reduces the burden of coordination for systems not operating at the maximum power level. Distance can be measured either to a specific receiver location or to an area within which receivers are likely to be deployed.

Similarly, communications between licensees can be triggered by a field strength or a power flux density at a receiver location or at the boundary of an area within which receivers will be deployed. Due to the spreading loss, the effect of a pfd calculated at an area boundary will have different interference potentials at specific receiver sites within that area, depending on the geometry between the wanted receiver and the interfering transmitter.

As with distance, the allowable pfd at a boundary to minimize interference to receivers within the area will depend on the radiated power and height. While a single value may be desirable, a table of values based on power and height would be more accurate. The calculation methods to determine the compliance with a pfd are typically based on worst case propagation conditions since the specific path profiles to all receivers are not usually known at the time a determination is made of the requirement to coordinate.

Both distance and pfd triggers must be set at appropriately conservative values to minimize the potential for interference to adjacent systems, since outside these values, licensees can operate without the requirement to communicate with neighbouring licensees. In order to provide service right up to a boundary and to allow equitable access to spectrum on an on-going basis, additional constraints to operation are normally required. An example is the current bilateral arrangement with the U.S. at 2.5 GHz, which prescribes orthogonal polarizations within 80 km of the border. For systems which intend to re-use all the available spectrum within each cell, and more particularly where the cells are to be divided into sectors based on polarization reuse, this becomes very constraining.

Practical experience for services in many frequency bands has demonstrated that once communication between licensees has been triggered, actual systems can be implemented in much closer proximity than the worst case values would indicate.

Comments are sought on a suitable trigger mechanism and the appropriate value. (The details may be developed in consultation with the Radio Advisory Board of Canada (RABC)).

5.3.1 Implementation

Operators will be expected to take full advantage of interference mitigation techniques such as antenna discrimination, polarization, frequency offset, shielding, site selection, or power control to facilitate co-existence with systems of other service providers, at both design and implementation stages. Operators within the same general area will be encouraged to enter into mutually beneficial arrangements to foster efficient spectrum use near their common boundaries. In cases where harmful interference occurs or appears likely to occur between radio systems, and where such interference cannot be resolved between licensees, it will be necessary to establish a method for interference prediction as the basis for arbitration by Industry Canada. This method should be carefully considered in establishing the appropriate boundary conditions, trigger mechanisms and values, as well as the size and locations of the service areas.

Comments and proposals are sought on the most suitable models and trigger mechanisms to be used by Industry Canada when called upon to arbitrate on an unresolved dispute resulting from interference being experienced between systems operating in these bands.

5.4 Interference Consideration

In general, there are three aspects to be taken into account when considering the potential for interference between systems:

- a) signal levels into adjacent areas using the same channel (Co-Channel, Adjacent-Area);
- b) signal levels into adjacent channels within the same service area (Adjacent-Channel, Same-Area); and,
- c) considerations for two-way and duplexing method.

As well, the intention to deploy point-to-multipoint as well as point-to-point systems will need to be closely examined.

5.4.1 Co-Channel/Adjacent-Area Systems

The potential for one system to interfere with another system typically extends for distances much greater than the desired link length. It will be extremely difficult to accommodate Co-Channel/Adjacent-Area systems in close proximity without knowing the characteristics of both systems.

For most point-to-area systems it is possible to cover an area with contiguous cells. A basic premise is that this should be attainable regardless of who actually owns or operates the individual cells. This applies particularly to systems which are similar in design, characteristics, deployment, intended service, power, spectrum use (channelization, bandwidth, frequency pairing etc.), and access scheme modulation. The situation becomes more complex where the characteristics are different, particularly in power and spectrum use. Licensees attempting to implement systems in close proximity to each other and/or to a

licence area boundary will require knowledge of both systems to allow the incorporation of mitigating design and deployment considerations to allow coexistence.

5.4.2 Adjacent-Channel/Same-Area Systems

Adjacent channel operation within the same area will have the potential for interference, particularly with respect to the near/far effect at the subscriber receiver when the transmitting hubs are not located in reasonably close proximity. Hubs receiving in adjacent spectrum could also suffer the same near/far problems as subscriber terminals especially when the hubs are not co-located. An emission limit at the channel block edges will alleviate some of the potential for interference, but not completely, especially where there is a mix of applications with different power requirements and intended service within the same licensed area.

From an interference standpoint, co-location of hub transmitters may be desirable, but differences in power requirements, intended market, or business cases may make this infeasible. The size of area will also play a major role in the complexity of coordination since the larger the area, the greater the requirement for multiple hubs to provide service.

Out-of-block emission limits will be required to minimize inter-system interference. Point-to-area systems are less constrained when the emission limits are applied to a block of spectrum rather than to individual channels within the block. Consideration should be given to the application of an absolute emission limit at the block edge, i.e. independent of carrier level and frequency tolerance.

Comments are sought on the suitability of an emission limit to reduce the occurrence of adjacent channel block interference under the current proposals for spectrum and geographic distribution.

5.4.3 Considerations for Two-way Systems

Return traffic will require some consideration for Co-Channel/Adjacent-Area interference from subscriber terminals into adjacent hubs and from hubs into adjacent subscriber terminals.

Similarly, in the case of Adjacent-Channel/Same-Area situations, consideration should be given to the following:

- Potential interference to subscriber receivers from subscribers transmitting in adjacent spectrum;
- Potential interference to subscriber receivers from hubs transmitting in adjacent spectrum;
- Potential interference to hub receivers from hubs transmitting in adjacent spectrum; and

- Potential interference to hub receivers from subscribers transmitting in adjacent spectrum.

There is the potential with two-way system implementation that Adjacent-Channel/Same-Area hubs will be receiving in spectrum in which adjacent subscribers are transmitting. Consideration may be given to common hub/sub or go/return designation; however, coexisting with adjacent channel point-to-point systems may be more difficult.

5.5 Type approval

Point-to-area implementations with ubiquitous subscriber locations lend themselves to type-approval of equipment. A certification specification will be required. The details will be developed in consultation with the RABC.

5.6 Sharing Issues at 24 GHz

The band 24.75-25.25 GHz is currently allocated to the Fixed Satellite Service (FSS) (Earth-to-space) and is intended for use by Broadcast Satellite Service (BSS) feederlinks in support of the band 17.30-17.80 GHz. As per the proposed change to footnote C44 in the *Canadian Table of Frequency Allocations*, future earth stations will be permitted, provided that such installations do not cause interference to any fixed systems operating within the authorized service areas.

5.7 International Coordination

Licensees will be expected to respect ITU *Radio Regulations* pertaining to the 24 and 38 GHz bands and abide by any future agreements established with other countries.

Bilateral arrangements with the U.S. in the 24 GHz band may include consideration of the BSS feederlink issues with respect to Fixed Service (FS) Multipoint Communications Systems.

The assignment of undertakings near the Canada/U.S. border is subject to the coordination agreements established between the two countries. Bilateral negotiations for the 24 and 38 GHz bands between Industry Canada and the Federal Communications Commission of the United States are on-going. Until an agreement has been reached, any service area within 56 km (35 miles) of the international border is considered as falling within the coordination zone which is presently applicable for 18 GHz and 23 GHz fixed systems.

6. Licensing Process

6.1 Proposed Auction Process

Auctions promote economically efficient use of spectrum, provide an open and objective assignment mechanism, are procedurally efficient, and have the ability to yield an appropriate return to the people of Canada. In addition to these general advantages, the

following factors suggest that an auction would be the most appropriate licensing mechanism for the 24 GHz and 38 GHz bands:

- it is anticipated that the demand for spectrum in these bands will exceed the available supply, at least in some geographic areas; and,
- an auction will allow for the effective and efficient assignment of the large number of localized licences that will be made available.

Comments are sought on the steps outlined below that the Department expects to utilize for the licensing process for the 24 GHz and 38 GHz bands.

6.1.1 Comment Period

After the closing date for receipt of comments to this consultation paper, copies of all the comments received will be made available to the public through Industry Canada's web site, Industry Canada libraries and a commercial printing and copying service. Respondents are strongly encouraged to provide their comments in electronic format to facilitate posting on the Department's web site.

6.1.2 Reply Comments

A reply comment period of approximately 21 days will be opened shortly after the close of the initial comment period (up to 14 days may be required to allow for publication of comments on the web). During this second period, respondents may comment on the initial comments of others. Again, the submission of comments in electronic format is strongly encouraged. After the closing date of this second period these reply comments will also be made available to the public.

6.1.3 Final Policy Paper

After having reviewed all the input received, the Minister of Industry will make final policy decisions. A Notice will be published in the *Canada Gazette* announcing the availability of the final policy paper. The following elements will be described:

- the licences to be auctioned;
- the terms and conditions attached to the licences;
- the reserve price for each licence;
- the rules of the auction; and,
- the eligibility criteria and application procedures to participate in the auction.

6.1.4 Submissions

Prospective bidders will be invited to submit the following:

- a voluntary “Notification of Interest”²¹;
- written questions asking for clarification of rules or policies; and,
- their auction application²² (including a financial deposit).

It should be noted that no “confidential” questions will be accepted. All questions submitted and the Department’s answers to them will be made public. The various deadlines for receipt of the “Notifications of Interest”, written questions, and the auction application materials (including the financial deposit), and the address to which they should be sent, will be specified in the Gazette Notice and the final policy paper. The "Notifications of Interest" and the Department’s responses to the questions received will be made public after their respective deadlines for receipt.

6.1.5 Review of Applications

Once the deadline for receipt of applications to participate in the auction has passed, all applications received will be reviewed to assess whether or not all eligibility criteria have been satisfied. (An opportunity may be provided for applicants to make minor corrections to the materials they have submitted.) Those who have submitted acceptable applications will then receive bidder packages (which will include items such as the instructions required to use the Department’s automated bidding system and the initial bidding schedule). A listing of which applicants have and have not been qualified as bidders will be made public. Should there be any licences for which only one qualified bidder has indicated an interest, then that qualified bidder will be immediately offered that licence at the specified reserve price.

6.1.6 Seminars and Mock Auctions

Seminars and/or mock auctions will be held to allow bidders to better familiarize themselves with the bidding system and software.

6.1.7 Auction

The auction will then commence and proceed until it ends according to the specified stopping rule. High bidders at the auction’s close will be issued their licences provided that their bid amounts are paid in full by the deadline specified

²¹ The Department has found in the past that the publication of a simple list of interested parties early in the licensing process has been helpful to some smaller players who may wish to investigate the formation of a lawful strategic alliance with others. A "Notification of Interest" would consist of nothing more than basic identifiers such as the name, address and phone number of the interested party.

²² It should be noted that prospective bidders may be required to make full disclosure of any communications, agreements, arrangements or affiliations which they have entered into with any other potential bidder regarding the auction in question.

in the auction rules. Should any licences remain unassigned after the auction, the Department's preferred approach will be to offer them in a subsequent re-auction within a reasonable period of time.

6.2 Auction Design

The Department proposes the use of a simultaneous multiple round auction. The auction will be run electronically and bidders will be able to participate remotely from their offices.

The rules for the simultaneous multiple round auction call for a related set of licences to be offered for sale at the same time. Bidding is organized into a series of rounds. At the beginning of each round, bidders are provided with information that includes the standing high bids on each licence and information about the bidder's own eligibility for bidding. New bids for a licence are required to exceed the standing high bid by at least some pre-established increment. In each round bidders are offered an opportunity to withdraw bids made in previous rounds, subject to a penalty. A minimum pace of bidding in the auction is established by the "activity rule," which penalizes bidders who are inactive by reducing their "bidder eligibility points". The rounds continue until there are no new bids on any licence. All these details of the auction format are discussed more fully below.

Comments are sought on the proposed auction attributes discussed below.

6.2.1 Bidder Eligibility Points

Each licence will be assigned a number of points approximately proportionate to the bandwidth and population covered by that licence. As part of the application package to participate in the auction, each prospective bidder will be asked to indicate which licences it may want to bid on during the course of the auction and to indicate the total number of "points-worth" of licences that it may wish to bid on in any round²³. This number, which will also determine the pre-auction deposit required from the bidder (i.e. the required deposit will be calculated on a dollar per point basis - see section 8.1), will define that bidder's initial level of "bidder eligibility points". The purpose of this information is to assist in the development of activity rules (discussed in more detail below) which are used to hasten the speed of the auction.

6.2.2 Activity Rule

Before the auction, each bidder will have to specify which licences it wishes to bid on (as per the discussion on bidder eligibility points above). A bidder is defined to be active on a particular licence in a given round if either it has the standing high bid from the previous round or if it submits an acceptable bid in

²³ For example, suppose that a bidder wished to be able to bid on licence X (two points), licence Y (three points), and licence Z (five points). This bidder could ask to have up to ten points-worth of initial eligibility. If the bidder knew that it would not wish to be actively bidding on all three licences at the same time, it might choose to have a lower level of initial eligibility, for example eight points, and thus be required to submit a smaller pre-auction financial deposit.

that current round. There will be three stages, each containing an unspecified number of bidding rounds. In the first stage bidders must be active on licences whose corresponding points add up to a certain percentage of the bidder's eligibility level (the Department proposes something in the range of one-half); in the second stage the percentage is increased (to three-quarters); and in the final stage bidders must be active on one-hundred per cent of their eligibility levels. If a bidder falls short of the required activity level, the bidder's eligibility point level shrinks proportionately. The auction will begin and continue in stage one until bidding activity declines to an unacceptable level (for example, three consecutive rounds in which new bids are placed on ten percent or less of the licences available). At this point, the auction will move to stage two - and similarly to stage three later in the auction.

6.2.3 Bid Withdrawals and Related Penalties

In the event that a bidder makes a bid which it later wants to change, that bidder will be given the opportunity to withdraw it. To encourage meaningful bids, however, a bid withdrawal penalty will be imposed. This penalty will correspond to the potential loss in revenue caused by the withdrawn bid. If the licence for which the bid has been withdrawn ends up selling for more than the withdrawn bid, then no penalty will be charged to the bidder. If the licence ultimately sells for less than the withdrawn bid, then the penalty will be the difference between the withdrawn bid and the eventual final selling price. As a measure to reduce the overall time of the auction, while not compromising the auction's efficiency, the Department will allow bidders to place new bids and/or withdraw previously submitted bids at the same time during a round, as opposed to having two distinct phases - one for bid submission and one for bid withdrawal - during each round.

6.2.4 Bid Increments

Bid increments, like activity rules, are necessary to help hasten the auction's progress. For a bid to be acceptable it must be larger than the current standing high bid by the bid increment. Increments will be set in percentage terms (x percent of the standing high bid) and/or in absolute dollar amounts. Bid increments will be changed during the course of the auction. For example, at the beginning of an auction when bidding activity is likely to be high, bid increments will be relatively large (for example 10% to 15%). As the pace of the bidding falls below a certain threshold, bid increments will be reduced (perhaps down to 1% by stage three). The rules for changing bid increments will be laid out with a fairly high degree of precision prior to the auction; however, to ensure the auction closes in a reasonable amount of time, there will be flexibility to "override" the rules regarding bid increments. Of course, all bidders will be given prior notice of any proposed changes to the size of the bid increments.

6.2.5 Waivers

Waivers are designed to prevent a bidder from losing eligibility when it does not satisfy the activity requirements in a given bidding stage. The purpose of waivers is to protect bidders against possible mistakes they might make during the course of the auction or to allow them to maintain eligibility in the case of technical or communication problems. Each bidder will be given five waivers.

6.2.6 Stopping Rule

The auction will close when a round goes by without any acceptable bids on any licences or any waivers having been submitted. In exceptional circumstances, and after all participants have been notified in advance, any round can be declared as the final round. Similarly, exceptional circumstances such as a natural disaster, for example, may result in the auction being delayed, suspended or cancelled.

6.2.7 Bid Forfeiture and Related Penalties

After the conclusion of the auction, any bidder who has submitted the high bid on a licence but fails to comply with the specified payment schedule will forfeit its right to have the licence issued to it. Furthermore, the bidder will be required to pay a penalty in the amount of the difference between the forfeited bid and the eventual selling price of the licence (in a subsequent re-auction), if the re-auction price is lower than the forfeited bid. An additional amount of 3% of the original forfeited bid will be charged to account for the administrative expenses incurred to reassign the licence.

6.2.8 Discretionary Versus Non-discretionary Bidding

The August 1997 consultation paper on auction implementation issues proposed the use of non-discretionary bidding. What this means is that rather than being offered the opportunity to enter any amount that exceeds the standing high bid by at least some minimum bid increment, bidders would instead have the choice of giving either a "Yes" or "No" response as to whether they wish to bid an exact amount equal to the standing high bid plus a predetermined bid increment. Non-discretionary bidding has a number of potential advantages, as outlined below.

- It drastically simplifies submission of bids, eliminating the errors that sometimes occur when a bidder must fill dozens (or even hundreds) of boxes with potentially quite large numbers.
- It allows rounds to be more brief and more frequent, both because the mechanics of entering and checking bids are simpler and because the prices, which never jump²⁴ in the revised design, are more predictable.

²⁴ Since bid levels would increase each round by only the established increment, bidders will be able to exactly forecast the maximum possible values that the price for any particular licence could reach by the end of the currently announced schedule. The bid schedule will be regularly updated so that bidders will always be able to make rolling forecasts for, for example, one or two weeks in advance.

This also reduces the need for frequent executive oversight during the bidding, saving costs for the bidders.

- It removes opportunities for bidders to send potentially collusive messages through the trailing digits of their bid amounts.

Relatively few comments were received on the issue of discretionary versus non-discretionary bidding and differing views were expressed by those who did specifically address this issue. Concerns about the use of non-discretionary bidding focused primarily on the proposed time-stamp tie-breaking rule²⁵. Some respondents felt that a time-stamp tie-breaking rule might favour those bidders who, for example, had the fastest computers²⁶. There is also the possibility that non-discretionary bidding with a time-stamp tie-breaking rule could be more susceptible to certain types of collusive behaviour.

Since the release of the August 1997 consultation paper new developments in auction theory and design have occurred and the United States Federal Communications Commission has completed both an auction featuring non-discretionary bidding²⁷ and an auction featuring “multiple increment bidding”²⁸. The multiple increment bidding format is a variation on the non-discretionary bidding format which allows bidders to increase high bids by up to, in the case of the LMDS auction, nine increments.

The multiple increment bidding format would appear to preserve the previously mentioned benefits of non-discretionary bidding while at the same time reducing the incidence of tie bids and any possible related problems. Multiple increment bidding should also lead to the faster conclusion of an auction than would single-increment non-discretionary bidding. The Department is investigating the use of multiple increment bidding and seeks the views of prospective bidders as to whether it represents a superior auction design.

6.2.9 Bidder Identities

²⁵ Under the non-discretionary bidding scenario, all bids on the same licence in a given round would, of course, be tie bids. It was proposed that the first bidder (all bids would be electronically time-stamped as they were received) to place a bid on a licence be given the status of standing high bidder on that licence for the next round. Other administrations have used the same tie-breaking rule with discretionary bidding, but the incidence of tie bids under that scenario has tended to be quite low.

²⁶ It is worth noting, however, that unless the difference between two bidders' valuations for a licence is so small as to fall within the margin of a single bid increment, the relative speed of bidders' computers or telecommunications links will be a non-factor. As bid levels rise, the bidder with the lower valuation will drop out, allowing the bidder with the higher valuation to win at a price just above the lower bidder's drop-out point.

²⁷ The 800 MHz Specialized Mobile Radio Service (SMR) Phase 1 (Upper 10MHz Block) auction which closed on December 8, 1997 featured non-discretionary, also referred to as "click-box", bidding.

²⁸ This was the Local Multipoint Distribution Service (LMDS) auction which closed on March 25, 1998.

The Department proposes that the identities of all bidders, the licences on which they are qualified to bid, and their initial eligibility levels be made public prior to the commencement of bidding. As well, the Department proposes that full information on the bids placed by all bidders be made available after each round.

6.2.10 Enforcement of Spectrum Aggregation Limits

In section 3.3 of this document, a proposal was made regarding the use of a spectrum aggregation limit for the 24 GHz and 38 GHz bands. In terms of the auction process, the aggregation limits will be enforced as described below.

- Any bidder who at the auction's close is the standing high bidder on licences such that it will exceed the aggregation limit in any market must forfeit bids on sufficient licences to bring itself into alignment with the aggregation limit before any licences will be issued to it. The forfeiture penalties discussed in section 6.2.7 will apply.
- Should an existing LMCS licensee end up at the auction's close as the standing high bidder on 24 GHz and/or 38 GHz licences such that this spectrum in addition to its LMCS holdings puts it in violation of the spectrum aggregation limit for any area, it must:
 - forfeit, subject to the forfeiture penalties discussed in section 6.2.7, all the bids on the 24 GHz and 38 GHz spectrum for that area; or,
 - return to the Department one or both (block A and/or B) of its 28 GHz licences for that area and ensure - by forfeiting, subject to the forfeiture penalties discussed in section 6.2.7, bids on 24 GHz and/or 38 GHz spectrum for that area if necessary - that its total 24 GHz, 28 GHz and 38 GHz holdings do not exceed the aggregation limit.

7. Financial Aspects of the Auction

7.1 Reserve Prices

Industry Canada has always operated on the principle that all spectrum users should contribute to covering the cost of spectrum management in Canada. This can be accomplished by establishing reserve prices which are conceptually linked to the cost of managing the spectrum in question for the whole term of the licence. The Department has calculated an estimate of the proportion of its spectrum management costs which will be attributable to the 24 GHz and 38 GHz bands.

Reserve prices are proportional to the bidder eligibility points²⁹ associated with each licence. Bidder eligibility points are related to the population and bandwidth covered by a

²⁹

See discussion of bidder eligibility points in section 6.2.1 of this document.

licence. As discussed in section 4.2, the Department proposes to use Tier 3 service areas. Table 4 below provides an example of eligibility points and reserve prices associated with some licences. For each spectrum block of 100 MHz, a population of approximately 100,000 corresponds to 1 point. Reserve prices have been calculated at \$4700 per point.

Table 4 - Examples of Reserve Prices

Service area	Population	Each 400 MHz licence at 38 GHz or 24 GHz		300 MHz licence at 38 GHz		200 MHz licence at 38 GHz	
		Points	Reserve price	Points	Reserve price	Points	Reserve price
Toronto	5,146,581	208	\$977,600	156	\$733,200	104	\$488,800
Montreal	3,667,214	148	\$695,600	111	\$521,700	74	\$347,800
Vancouver	2,141,269	88	\$413,600	66	\$310,200	44	\$206,800
Ottawa	1,194,084	48	\$225,600	36	\$169,200	24	\$112,800
Edmonton	1,149,405	48	\$225,600	36	\$169,200	24	\$112,800
Quebec	908,639	40	\$188,000	30	\$141,000	20	\$94,000
Saskatoon	516,865	24	\$112,800	18	\$84,600	12	\$56,400
Victoria	382,745	16	\$75,200	12	\$56,400	8	\$37,600
Cornwall	66,849	4	\$18,800	3	\$14,100	2	\$9,400
Cobourg	57,326	4	\$18,800	3	\$14,100	2	\$9,400

Comments are sought on the absolute and relative level of reserve prices.

7.2 Pre-auction Deposits

The Department feels that the integrity of an auction is enhanced by requiring all bidders to submit a pre-auction deposit. The deposit should be large enough to dissuade frivolous bidders from trying to enter the auction process while not so large that sincere bidders are unable to participate; additionally, the deposit should be large enough so that it covers all of a bidder's likely bid withdrawal and forfeiture penalties³⁰. A pre-auction deposit must be submitted in the form of an irrevocable letter of credit.

In their application materials to participate in the auction, bidders will be required to identify all the licences on which they may wish to bid. The total number of points associated with these licences will define the maximum level of bidder eligibility points that the prospective bidder may request. The eligibility level is the maximum number of points associated with licences on which the bidder can bid simultaneously in a given round.

The Department proposes to determine the amounts of pre-auction deposits on the basis of the reserve price per point. If, for example, a prospective bidder indicated that it wished to be able to bid on licences totalling 100 points it could ask to have an initial level of eligibility which is equal to or less than 100 bidder eligibility points. The choice of 100 bidder eligibility points would require a deposit of \$470,000 (\$4700*100) and would allow the bidder to actively bid on all the licences in which it had indicated interest. Alternatively,

³⁰

See the discussion of withdrawal and forfeiture penalties in section 6.2 of this document.

the same bidder might ask for an initial level of only 50 bidder eligibility points. This would require a deposit of only \$235,000, but would also limit the bidder to actively bidding on a maximum of only 50 points-worth of licences in a round.

For licence winners, the deposit will be credited toward payment of their winning bids. For unsuccessful participants, the deposit will be refunded less any penalties they have incurred. If the penalties exceed the deposit, any outstanding amount will be owed to the Crown.

The pre-auction deposit will be returned to any applicant that is found not to be a qualified bidder, to any applicant that provides written notification to the Department of its withdrawal from the process prior to the auction's commencement, and to any bidder whose eligibility is reduced to zero during the auction and who is not potentially liable for any withdrawal penalties.

Comments are sought on whether the proposed deposit amounts will satisfy the goals stated above.

7.3 Bid payment

Winning bidders will be required to submit 20 percent of their high bids within 10 business days of the auction's close. This payment will be non-refundable. If the winning bidder fails to make this initial payment in a timely manner then the licence will not be issued and the bidder will be subject to the applicable forfeiture penalty. The remaining 80 percent will be due within 45 business days of the auction's close. Failure by the winning bidder to make this final payment in a timely fashion will also result in the licence not being issued and again the bidder will be subject to the applicable forfeiture penalty.

It is also important to note that beyond the payment of the winning bid, no other licence fees or payments will be required for the duration of the licence term³¹.

8. Submitting Your Comments

8.1 Instructions for Filing

The instructions for filing comments are provided in the following sections. All comments submitted as part of this consultation should cite the following:

Canada Gazette Notice reference number **DGRB-003-98**

8.1.1 Format

Respondents may submit comments electronically or in written format. Interested parties are strongly encouraged to provide their comments in

³¹ As per subsection 5(1)(1.3) of the *Radiocommunication Act*.

electronic format to facilitate posting on the Department's web site. The Department requests that electronic submissions be in one of the following formats if possible: WordPerfect; Microsoft Word; Adobe PDF; or ASCII TXT. Please indicate in the covering note the software format used, the version number and the operating system.

8.1.2 Address

Comments submitted via the Internet are to be sent to the following e-mail address:

24ghz.38ghz@ic.gc.ca

Written comments, or comments on a diskette or CD ROM are to be sent to:

Consultation on 24 GHz and 38 GHz
Radiocommunications and Broadcasting Regulatory Branch
Industry Canada
Room 1559 D - Jean Edmonds Tower North
300 Slater Street
Ottawa, Ontario
K1A 0C8

8.1.3 Deadlines

Comments

To ensure that all **comments** are duly considered, submissions must be received at one of the above addresses no later than December 4, 1998. Comments submitted should be prefaced by the statement "Comments in response to the consultation on 24 GHz and 38 GHz".

Every effort will be made to post all **comments** on the Industry Canada spectrum web site by December 18, 1998. Copies of all written submissions will be available for viewing at the locations indicated in section 8.2.

Reply Comments

To ensure that all **reply comments** are duly considered, submissions must be received at one of the above addresses no later than January 15, 1999. Reply comments submitted should be prefaced by the statement: "Reply comments in response to the consultation on 24 GHz and 38 GHz".

Every effort will be made to post all **reply comments** on the Industry Canada spectrum web site shortly after the close of the reply comments period. Copies of all written submissions will be available for viewing at the locations indicated in section 8.2.

8.2 Public Access

All submissions received in response to this consultation paper will be made available for viewing on the Internet, at the following address:

<http://strategis.ic.gc.ca/spectrum>

The responses will also be available for viewing by the public during normal business hours at the Industry Canada Library, 235 Queen Street, West Tower, Third Floor, Ottawa, Ontario, and at the offices of Industry Canada in Moncton, Montreal, Toronto, Winnipeg and Vancouver, for a period of one year from the close of comments.

Printed copies of submissions may also be obtained from: ByPress Printing and Copy Centre Inc. 300 Slater Street, Unit 101A, Ottawa, Ontario, K1P 6A6 Tel.:613-234-8826 Fax.:613-234-9464 (Reasonable costs of duplication will be charged.)

9. Further Information

9.1 Related Documents

Links to all documents quoted in this discussion paper will be displayed on our Spectrum Web site at <http://strategis.ic.gc.ca/spectrum>, under the “Spectrum Auctions” heading.

9.2 Departmental Contact

For further information concerning the process outlined in this document or related matters, contact the Wireless Networks Manager at 613-998-3780 or by facsimile at 613-991-3514.

Appendix A

Spectrum Utilization Policy Provisions for Point-to-Point Systems Authorized on a First-Come First-Served Basis

- 1.1 A full description of the relationship between bands and services, as contained in related international and domestic footnotes, can be found in the *Canadian Table of Frequency Allocations*.
- 1.2 The use of the bands 38.6-38.7 GHz, 39.3-39.4 GHz, 39.05-39.3 GHz and 39.75-40.0 GHz by the fixed service³²:

1.2.1 The spectrum is assigned on a paired block basis as follows:

Block A/A'	38 600-38 650 MHz	39 300-39 350 MHz
Block B/B'	38 650-38 700 MHz	39 350-39 400 MHz
Block J/J'	39 050-39 100 MHz	39 750-39 800 MHz ³³
Block K/K'	39 100-39 150 MHz	39 800-39 850 MHz ³³
Block L/L'	39 150-39 200 MHz	39 850-39 900 MHz
Block M/M'	39 200-39 250 MHz	39 900-39 950 MHz
Block N/N'	39 250-39 300 MHz	39 950-40 000 MHz

- 1.2.2 These bands are designated for point-to-point microwave systems.
- 1.2.3 Paired frequency blocks are assigned within a geographical area, on a first-come first-served basis and any paired block may be shared with other operators.
- 1.2.4 Licensees are permitted to use any channelling arrangement within the assigned block(s) of spectrum.
- 1.2.5 Aggregation of paired spectrum blocks is permitted; however, licensees are limited to a maximum of two (2) paired blocks in any given area.
- 1.2.6 One way systems are not permitted.
- 1.2.7 Radio systems using analogue transmission are not permitted in these bands.
- 1.2.8 The permitted transmission capacity, as defined in SP 1-20 GHz, is low, medium and high capacity.
- 1.2.9 The Geographical Differences Policy, as outlined in SP 1-20 GHz, does not apply.

- 1.3 The use of the band 38.4-38.6 GHz by the fixed service.

³² The frequency bands may be adjusted depending on the outcome of this consultation paper.

³³ Paired Blocks J/J' and K/K' may not be available for point-to-point systems on a first-come first-served basis depending on the outcome of this consultation process.

- 1.3.1 The frequency band 38.4-38.6 GHz is designated for one-way, point-to-point and one-way, multipoint communications systems (MCS).
- 1.3.2 The permitted transmission capacity, as defined in SP1-20 GHz, is low and medium capacity.
- 1.3.3 The spectrum is assigned on a block basis as follows:
- Block A 38 400-38 450 MHz
 - Block B 38 450-38 500 MHz
 - Block C 38 500-38 550 MHz
 - Block D 38 550-38 600 MHz
- 1.3.4 Frequency blocks are assigned within a geographical area, on a first-come first-served basis and any paired block may be shared with other operators.
- 1.3.5 Licensees are permitted to use any channeling arrangement within the assigned block(s) of spectrum.
- 1.3.6 Licensees are limited to one (1) block in a given area. A second block may be granted to a licensee on a case-by-case basis.
- 1.3.7 Radio systems using analogue transmission are not permitted in these bands.
- 1.3.8 The Geographical Differences Policy, as outlined in SP 1-20 GHz, does not apply.

Comments are requested on the policy provisions outlined in this attachment.

Appendix B

Service Areas/Zones de service

Tier 1³⁴/Niveau 1³⁴

#	Service Area Name/Nom de la zone de service	Population
1-01	Canada	28,846,761

Tier 2/Niveau 2

#	Service Area Name/Nom de la zone de service	Population
2-01	Newfoundland & Labrador/Terre-Neuve & Labrador	551,792
2-02	Nova Scotia & Prince Edward Island/Nouvelle-Écosse & Île-du-Prince-Édouard	1,043,839
2-03	New Brunswick/Nouveau-Brunswick	738,133
2-04	Eastern Quebec/Québec-Est	1,609,690
2-05	Southern Quebec/Québec-Sud	5,035,827
2-06	Eastern Ontario & Outaouais/Ontario-Est & Outaouais	2,047,352
2-07	Northern Quebec/Québec-Nord	194,810
2-08	Southern Ontario/Ontario-Sud	8,179,887
2-09	Northern Ontario/Ontario-Nord	824,802
2-10	Manitoba	1,115,900
2-11	Saskatchewan	980,770
2-12	Alberta	2,704,291
2-13	British Columbia/Colombie-Britannique	3,724,500
2-14	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut	95,168

³⁴ For this table and all subsequent tables 'Population' refers to the population of the service area based on the 1996 Census.

³⁴ Pour ce tableau et tous les suivants 'Population' désigne la population de la zone de service d'après le recensement de 1996.

Tier 3/Niveau 3

#	Service Area Name/Nom de la zone de service	Population
3-01	Newfoundland & Labrador/Terre-Neuve & Labrador	551,792
3-02	Prince Edward Island/Île-du-Prince-Édouard	134,557
3-03	Mainland Nova Scotia/Nouvelle-Écosse continentale	751,011
3-04	Cape Breton/Cap Breton	158,271
3-05	Southern New Brunswick/Nouveau-Brunswick-Sud	171,361
3-06	Western New Brunswick/Nouveau-Brunswick-Ouest	209,200
3-07	Eastern New Brunswick/Nouveau-Brunswick-Est	357,572
3-08	Bas du fleuve/Gaspésie	311,501
3-09	Québec	909,256
3-10	Chicoutimi-Jonquière	388,933
3-11	Eastern Townships/Cantons de l'Est	503,748
3-12	Trois-Rivières	743,176
3-13	Montréal	3,682,384
3-14	Outaouais	106,519
3-15	Ottawa	1,193,489
3-16	Pembroke	112,948
3-17	Abitibi	194,810
3-18	Cornwall	66,849
3-19	Brockville	83,985
3-20	Kingston	160,574
3-21	Belleville	183,250
3-22	Cobourg	57,326
3-23	Peterborough	188,931
3-24	Huntsville	69,701
3-25	Toronto	5,146,581
3-26	Barrie	550,912
3-27	Guelph/Kitchener	560,682
3-28	Listowel/Goderich/Stratford	127,423
3-29	Niagara-St. Catharines	353,605
3-30	London/Woodstock/St. Thomas	742,833
3-31	Chatham	109,518
3-32	Windsor/Leamington	351,986
3-33	Strathroy	166,646
3-34	North Bay	124,950
3-35	Sault Ste. Marie	140,395
3-36	Sudbury	184,488
3-37	Kirkland Lake	130,650
3-38	Thunder Bay	244,319

#	Service Area Name/Nom de la zone de service	Population
3-39	Winnipeg	938,812
3-40	Brandon	177,088
3-41	Regina	359,584
3-42	Moose Jaw	109,722
3-43	Saskatoon	511,464
3-44	Edmonton	1,149,185
3-45	Medicine Hat/Brooks	134,724
3-46	Lethbridge	150,228
3-47	Calgary	944,382
3-48	Red Deer	176,376
3-49	Grande Prairie	149,396
3-50	Kootenays	134,973
3-51	Okanagan/Columbia	355,904
3-52	Vancouver	2,138,533
3-53	Victoria	382,745
3-54	Nanaimo	159,657
3-55	Courtenay	105,968
3-56	Thompson/Cariboo	173,967
3-57	Prince George	210,420
3-58	Dawson Creek	62,333
3-59	Yukon, Northwest Territories & Nunavut/Yukon, Territoires du Nord-Ouest & Nunavut	95,168

Tier 4/Niveau 4

#	Service Area Name/Nom de la zone de service	Population
4-001	St. John's	193,783
4-002	Carbonear	57,740
4-003	Gander/Grand Falls/Windsor	179,081
4-004	Corner Brook/Stephenville	91,998
4-005	Labrador	29,190
4-006	Charlottetown	85,846
4-007	Summerside	48,711
4-008	Yarmouth	64,812
4-009	Bridgewater/Kentville	141,495
4-010	Halifax	372,001
4-011	Truro	55,955
4-012	Amherst	37,559
4-013	Antigonish/New Glasgow	79,189

#	Service Area Name/Nom de la zone de service	Population
4-014	Sydney	158,271
4-015	Saint John	144,026
4-016	St. Stephen	27,335
4-017	Fredericton	150,457
4-018	Moncton	147,023
4-019	Miramichi/Bathurst	175,530
4-020	Grand Falls	29,665
4-021	Edmundston	29,078
4-022	Campbellton	35,019
4-023	Matane	126,219
4-024	Mont-Joli	43,984
4-025	Rimouski	52,677
4-026	Rivière-du-Loup	88,621
4-027	La Malbaie	29,918
4-028	Chicoutimi-Jonquière	223,248
4-029	Montmagny	60,714
4-030	Québec	770,868
4-031	Sainte-Marie	47,756
4-032	Saint-Georges	66,540
4-033	Lac Mégantic	23,614
4-034	Thetford Mines	45,272
4-035	Plessisville	21,317
4-036	La Tuque	16,517
4-037	Trois-Rivières	257,201
4-038	Louiseville	22,595
4-039	Asbestos	30,455
4-040	Victoriaville	49,830
4-041	Coaticook	13,085
4-042	Sherbrooke	208,974
4-043	Windsor	16,362
4-044	Drummondville	94,035
4-045	Cowansville	28,299
4-046	Farnham	29,567
4-047	Granby	84,058
4-048	St-Hyacinthe	79,713
4-049	Sorel	65,845
4-050	Joliette	123,212
4-051	Montréal	3,652,817
4-052	Sainte-Agathe-des-Monts	58,730
4-053	Hawkesbury	61,651

#	Service Area Name/Nom de la zone de service	Population
4-054	Mont-Laurier/Maniwaki	47,789
4-055	Ottawa	1,131,838
4-056	Pembroke	81,064
4-057	Arnprior/Renfrew	31,884
4-058	Rouyn-Noranda	61,650
4-059	La Sarre	22,586
4-060	Amos	25,565
4-061	Val D'Or	45,402
4-062	Roberval/Saint-Félicien	63,861
4-063	Baie-Comeau	52,298
4-064	Port-Cartier/Sept-Îles	49,526
4-065	Chibougamau	39,607
4-066	Cornwall	66,849
4-067	Brockville	70,974
4-068	Gananoque	13,011
4-069	Kingston	160,574
4-070	Napanee	39,829
4-071	Belleville	143,421
4-072	Cobourg	57,326
4-073	Peterborough	147,737
4-074	Lindsay	41,194
4-075	Minden	17,764
4-076	Toronto	5,146,581
4-077	Alliston	98,133
4-078	Guelph/Kitchener	535,736
4-079	Fergus	24,946
4-080	Kincardine	175,390
4-081	Listowel/Goderich	80,982
4-082	Fort Erie	27,183
4-083	Niagara-St. Catharines	326,422
4-084	Haldimand/Dunnville	34,599
4-085	London/Woodstock/St. Thomas	593,670
4-086	Brantford	114,564
4-087	Stratford	46,441
4-088	Chatham	78,128
4-089	Windsor/Leamington	351,986
4-090	Wallaceburg	31,390
4-091	Sarnia	126,423
4-092	Strathroy	40,223
4-093	Barrie	234,902

#	Service Area Name/Nom de la zone de service	Population
4-094	Midland	42,487
4-095	Gravenhurst/Bracebridge	51,937
4-096	North Bay	105,484
4-097	Parry Sound	19,466
4-098	Elliot Lake	30,205
4-099	Sudbury	184,488
4-100	Kirkland Lake	37,807
4-101	Timmins/Kapuskasing	92,843
4-102	Kenora/Sioux Lookout	63,732
4-103	Sault Ste. Marie	110,190
4-104	Thunder Bay	157,424
4-105	Fort Frances	23,163
4-106	Steinbach	44,334
4-107	Winnipeg	767,149
4-108	Morden/Winkler	36,530
4-109	Brandon	133,448
4-110	Portage la Prairie	20,385
4-111	Dauphin	43,640
4-112	Creighton/Flin Flon	25,152
4-113	Thompson	45,262
4-114	Estevan	47,616
4-115	Weyburn	23,121
4-116	Moose Jaw	60,784
4-117	Swift Current	48,938
4-118	Yorkton	71,002
4-119	Regina	217,845
4-120	Saskatoon	251,532
4-121	Battleford	89,351
4-122	Prince Albert	141,479
4-123	Lloydminster	31,668
4-124	Northern Saskatchewan/Saskatchewan-Nord	29,102
4-125	Medicine Hat/Brooks	81,509
4-126	Lethbridge	150,228
4-127	Stettler/Oyen/Wainwright	53,215
4-128	High River	44,070
4-129	Strathmore	34,451
4-130	Calgary	865,861
4-131	Red Deer	134,729
4-132	Wetaskiwin/Ponoka	41,647
4-133	Camrose	33,071

#	Service Area Name/Nom de la zone de service	Population
4-134	Vegreville	14,461
4-135	Edmonton	870,340
4-136	Edson/Hinton	44,083
4-137	Bonnyville	71,270
4-138	Whitecourt	25,493
4-139	Barrhead	22,305
4-140	Fort McMurray	36,494
4-141	Peace River	80,807
4-142	Grande Prairie	68,589
4-143	East Kootenay/Kootenay-Est	56,366
4-144	West Kootenay/Kootenay-Ouest	78,607
4-145	Penticton	88,331
4-146	Vancouver	2,054,062
4-147	Victoria	382,745
4-148	Nanaimo	159,657
4-149	Courtenay	105,968
4-150	Powell River	30,156
4-151	Squamish/Whistler	54,315
4-152	Kelowna	215,589
4-153	Kamloops	107,492
4-154	Salmon Arm	51,984
4-155	Williams Lake	41,196
4-156	Quesnel/Red Bluff	25,279
4-157	Skeena	69,804
4-158	Prince George	140,616
4-159	Dawson Creek	62,333
4-160	Yukon	30,766
4-161	Nunavut	25,153
4-162	Northwest Territories/Territoires du Nord-Ouest	39,249