International Benchmarking: Canada

700 MHz

History of the band

Spectrum licences in the 700 MHz band (698-787 MHz) were allocated through two allocations in 2014, 2015 and 2018 for mobile broadband.

In 2012, Industry Canada announced the release of spectrum for both the 700 MHz and 2500 MHZ bands.[1]

Industry Canda cited that the competitive landscape in the Canadian mobile services sector had significantly changed since the 2008 Advanced Wireless Services (AWS) to enable additional companies and incumbents to quickly start providing wireless services. In consultation, respondents noted a scarcity of sub-1 GHz spectrum for new entrants would impact their ability to compete with incumbents in the 700 MHz band (Rogers, Bell, TELUS, SaskTel and MTS Allstream).

Respondents noted several benefits of the 700 MHz spectrum included excellent propagation and in-building penetration, making it suitable for supporting urban and rural deployment at a lower cost than higher frequency spectrum.

Industry Canada also set spectrum for public safety broadband use in response to demand from public safety agencies (763–768 MHz and 793–798 MHz).

In 2015, Industry Canada held an auction of residual licences in the 700 MHz and AWS-3 bands. At the conclusion of the auction, three licences in the 700 MHz band remained unassigned.

In 2018, Industry Canada held an auction of residual licences in the 700 MHz, 2500 MHz, 2300 MHz and PCS-G bands. At the conclusion of the auction, three licences in the 700 MHz were all assigned to winning bidders.

2014 initial spectrum auction of the 700 MHz band

Industry Canada made several policy decisions on the conditions of the licences being auctioned:[2]

- The licences will be auctioned using tier 2 services areas (14 services areas – large regional or provincial service areas)
- A total of five blocks of paired spectrum and two blocks of unpaired spectrum will be available in all areas.
- 98 licences will be offered.

[1] Policy and Technical Framework Mobile Broadband Services (MBS) - 700 MHz Band Broadband Radio Service (BRS) - 2500 MHz.
[2] Licensing Framework for Mobile Broadband Services (MBS) — 700 MHz Band (canada.ca).

- Each licence will have a term of 20 years with a high expectation that a new licence will be issued unless a breach of the licence conditions occurred, the spectrum is reallocated, or an overriding policy need arises.
- Licencees may apply in writing to transfer the licence or issue a subordinate licence (third-party authorization)

Auction results

In this auction, all tier 2 area licences except one 10 MHz lot that covers Yukon, Northwest Territories, and Nunavut (a remote area covering a population of 107,215).

The three largest auction winners (TELUS, Bell, Rogers) won 83% of the available licences. Rogers licences cover most of the lower part of the band. TELUS and Bell licences cover paired spectrum in the upper part of the band and most of the unpaired spectrum. All three winners have a minimum holding of 24 MHz in all Canadian service areas in the 700 MHz band.

The other winners (Feenix, Bragg, MTS, and Sasktel) acquired licences in the specific lot[3]. The remaining winners won 14% of the available licences. The other winners have licences demonstrate the following trends:

- Bragg's licences mostly cover eastern Canada.
- Videotron's licences mostly cover Quebec and Ontario.
- Feenix, MTS, and Sasktel only won lots in single provincial areas.

Table 1: final results from the 2014 auction of the 700 MHz band.[4]

Licence winners	# of licences won	Frequency assignments (MHz)	Total holdings (MHz)
Feenix	2 paired	782–787/751–756	20 MHz
MTS	1 paired	777–782/746–751	10 MHz
Bragg	4 paired	777–782/746–751	40 MHz
TELUS	16 paired 14 unpaired	698–704/728–734 704–710/734–740 710–716/740–746 716–722 722–728 782–787/751–756	295 MHz
Videotron	7 paired	777–782/746–751	70 MHz
Bell	17 paired 14 unpaired	698–704/728–734 704–710/734–740 710–716/740–746	260 MHz

[3] Most auction winners acquired holdings in the C1 auction lot (777–782/746–752 MHz).
[4] Final Results — 700 MHz Auction (2014) (canada.ca).

		716–722 722–728 782–787/751–756	
Sasktel	1 paired	777–782/746-751	10 MHz
Rogers	22 paired	698–704/728–734 704–710/734–740	264 MHz

2018 auction of residual spectrum licences in multiple bands

In this auction, all 3 licences were allocated to two auction winners. These licences were allocated a tier 4 level service area (suitable for localised deployments).

Industry Canada split the 2014 auction lot, Yukon/Northwest Territories/Nunavut into tier 4 services areas (Yukon, Northwest Territories and Nunavut separately).

Iris and Ecotel did not acquire spectrum in the initial release of the 700 MHz band in 2014.

Table 2: final results from the 2018 residual spectrum licence auction of multiple bands[5]

Licence winners	# of licences won	Frequency assignments (MHz)	Total holdings (MHz)	Final Price
Iris	1 paired	777–782/746–751	10 MHz	$100,607
Ecotel	2 paired	777–782/746–751	10 MHz	$137,500

850 MHz

History of the band

ISED has not held a specific auction process for this band, and licences have presumably been administratively allocated to facilitate cellular services and the evolution for advanced services.

In 1982, Industry Canada (previously the Department of Communications at the time) released the band in two sub-allocations.[6] One sub-allocation was reserved for regulated telecommunications common carriers to provide cellular mobile radio telephone services within areas they provide public switched telephone service. A second sub-allocation was reserved for other applicants to provide similar services.

Recently, the spectrum for some carriers have been refarmed from the aging 3G networks for the purposes of 4G LTE transmission.[7]

[5] Auction of Residual Spectrum Licences in the 700 MHz, 2500 MHz, 2300 MHz and PCS-G Bands – Final Results (canada.ca).
[6] A Brief History of Cellular and PCS Licensing (canada.ca).
[7] Everything you need to know about 4G LTE in Canada | Android Central.

Current assignments of the band (1980s onwards)

The band has multiple localised telephone services areas for public telephone networks. The table below will show allocations of tier 2 services (major regional).

Rogers was allocated all spectrum in sub-band A with spectrum holdings of 13 MHz across Canada.

The remaining tier 2 service areas in sub-band B were allocated to some national companies (TELUS and Bell). The sub-band is heavily made up of local area telecommunications providers with coverage over a regional town[8].

Table 3: Allocations of tier 2 service area spectrum licences in 850 MHz band

Licence winners	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
Rogers	14	824–825/869–880 845–846.5/890–891.5	175 MHz
Sasktel	1	835–845/846.5–849 880–890/891.5–894	12.5 MHz
TELUS	2	835–845/846.5–849 880–890/891.5–894	12.5 MHz
Bell	4	835–845/846.5–849 880–890/891.5–894	50 MHz

Table 4: Allocations of TEL area spectrum licences

Licence winners	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
Local area providers	18	835–845/846.5–849 880–890/891.5–894	225 MHz
TELUS	2	835–845/846.5–849 880–890/891.5–894	25 MHz
TBayTel – Mobility	5	835–845/846.5–849 880–890/891.5–894	62.5 MHz
Sogetel Mobile	6	835–845/846.5–849 880–890/891.5–894	75 MHz
Bragg Communications	2	835–845/846.5–849 880–890/891.5–894	25 MHz

[8] Area TEL-043 is an example of the coverage provided: Licence Area Information.

NexiCom Inc	2	835–845/846.5–849 880–890/891.5–894	25 MHz
Bell	18	835–845/846.5–849 880–890/891.5–894	225 MHz

1800 MHz, 2 GHz (PCS/AWS)

History of the band

ISED has several allocations that cover parts of the spectrum that are comparable to Australia's 1800 MHz and 2 GHz expiring spectrum licence bands largely utilised for Wireless Broadband Use.[9]

There have been multiple allocations conducted over the last 20 years to facilitate Advanced Wireless Services (AWS) and Personal Communication Services (PCS):

- Auction of additional PCS Spectrum in 2 GHz frequency range in 2001 (1865–1990 MHz).[10]
- Auction for spectrum licences for AWS and other spectrum in the 2 GHz range in 2008 (1710–1755/2110–2155 MHz).[11]
- Auction for spectrum licences for AWS-3 band in 2015 (1755–1780/2155–2180 MHz).[12]
- Spectrum licence renewal process for AWS-1 and other spectrum in the 2 GHz range in 2018.[13]
    - AWS-1 band (1710–1755/2110–2155 MHz)
    - PCS band (1910–1915/1990–1995 MHz)

AWS bands[14]

The AWS bands was originally released in 2002 and is widely used for 4G mobiles services in the Americas. The bands are predominantly used for 4G, but operators have not promoted these bands as promising for 5G. The bands are commonly re-purposed for LTE services and support voice and data services.

PCS band[15]

[9] The 1800 MHz band covers the frequency range of 1710–1785/1805–1880 MHz. The 2 GHz band covers the frequency range of 1920–1908/2110–2170 MHz.
[10] Auction of Additional PCS Spectrum in the 2 GHz Frequency Range (canada.ca).
[11] Policy Framework for the Auction for Spectrum Licences for Advanced Wireless Services and other Spectrum in the 2 GHz Range (canada.ca).
[12] Auction of Spectrum Licences for Advanced Wireless Services in the Bands 1755-1780 MHz and 2155-2180 MHz (AWS-3) (canada.ca).
[13] Spectrum Licence Renewal Process for Advanced Wireless Services (AWS-1) and Other Spectrum in the 2 GHz Range (canada.ca).
[14] See AWS Bands (2023).
[15] See AWS-2 or H-Block.

The PCS band is harmonized with the AWS-2 or H Block spectrum as grouped by United States' Federal Communication Commission (FCC). It is considered an extension of the AWS-1 band, used for 3G and 4G services.

Current assignments in the PCS, AWS-1 and AWS-3 bands

Assignments in the AWS-1 band

Most assignments are allocated with Tier 2 area groupings, covering large regional areas and provinces. Block A (1710–1720/2110–2120 MHz) has licences allocated in tier 3 areas, localized services, which are mostly assigned to Rogers.[16]

Blocks B-F with tier 2 areas have mixed assignments with no discernible groupings (e.g. a company acquires mostly rural licences).

TELUS, Rogers, and Bell have acquired licences that are approximately 70% of the total MHz holdings.

Videotron, Freedom Mobile Inc, and Bragg Communication Inc have acquired licences that are approximately 25% of the total MHz holdings.

TbayTel – Mobility and Sasktel have acquired licences that are approximately 3% of the total MHz holdings.

Assignments in the AWS-3 band

The AWS-3 band has largely been allocated to tier 2 service areas with some subdivisions for specific licences.

TELUS and Bell have acquired licences that are approximately 58% of the total MHz holdings.

Videotron, Freedom Mobil Inc, and Bragg Communications Inc have acquired licences that are approximately 41% of the total MHz holdings.

Assignments in the PCS band

All assignments are allocated to tier 2 areas.

TELUS, Rogers, Fido Solutions, and Bell have acquired licences that are approximately 94% of the total MHz holdings.

SSI Micro Ltd, Sasktel, Ecotel Inc have acquired licences that are approximately 5% of total MHz holdings.

Table 5: Current licences in the AWS-1 band (1710–1755/2110–2155 MHz)

Licensees	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
TELUS	35	1710–1720/2110–2120 1720–1730/2120–2130	430 MHz

[16] ISED has segmented the band into frequency blocks for the AWS-1 band.

		1735–1740/2130–2135 1740–1745/2140–2145 1745–1755/2145–2155	
Rogers	61	1710–1720/2110–2120 1720–1730/2120–2130	1220 MHz
Bell	57	1710–1720/2110–2120 1720–1730/2120–2130 1730–1735/2130–2135 1735–1740/2135–2140 1740–1745/2140–2145 1745–1755/2145–2155	630 MHz
Videotron	20	1710–1720/2110–2120 1720–1730/2120–2130 1730–1735/2130–2135 1735–1740/2135–2140 1740–1745/2140–2145 1745–1755/2145–2155	240 MHz
TBayTel – Mobility	1	1720–1730/2120–2130	20 MHz
Sasktel	7	1720–1730/2120–2130 1730–1735/2130–2135 1735–1740/2130–2135 1740–1745/2140–2145	90 MHz
Freedom Mobile Inc	33	1720–1730/2120–2130 1730–1735/2130–2135 1735–1740/2130–2135 1745–1755/2145–2155	340 MHz
Bragg Communication Inc	15	1720–1730/2120–2130 1730–1735/2130–2135 1735–1740/2130–2135 1740–1745/2140–2145 1745–1755/2145–2155	230 MHz

Table 6: Current licences in the AWS-3 band (1755–1780/2155–2180 MHz)

Licensees	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
Videotron	12	1755–1760 1760–1765/2155–2160 1765–1770/2170–2175	60 MHz
Telus	24	1755–1760 1760–1765/2155–2160 1765–1770/2170–2175 1770–1775/2170–2175 1775–1780/2175–2180	120 MHz
Freedom Mobile Inc	9	1755–1760 1760–1765/2155–2160 1765–1770/2170–2175 1770–1775/2170–2175 1775–1780/2175–2180	45 MHz

Bell	22	1755–1760 1760–1765/2155–2160 1765–1770/2170–2175 1770–1775/2170–2175 1775–1780/2175–2180	110 MHz
Bragg Communications Inc	12	1755–1760 1760–1765/2155–2160 1765–1770/2170–2175	60 MHz

Table 7: Current licences in the PCS band (1850–1915/1930–1995 MHz)

Licensees	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
Fido Solutions	14	1850–1865/1930–1945	210 MHz
Telus	52	1865–1870/1945–1950 1870–1875/1950–1955 1875–1880/1955–1960 1880–1885/1960–1965 1885–1890/1965–1970 1910–1915/1990–1995	260 MHz
SSI Micro Ltd	4	1865–1870/1945–1950 1885–1890/1965–1970 1895–1900/1975–1980 1905–1910/1985–1990	20 MHz
Bell	38	1865–1870/1945–1950 1875–1880/1955–1960 1880–1885/1960–1965 1885–1890/1965–1970 1895–1900/1975–1980 1900–1905/1985–1980 1905–1910/1985–1990 1910–1915/1990–1995	190 MHz
Rogers	37	1865–1870/1945–1950 1885–1890/1965–1970 1890–1895/1970–1975 1895–1900/1975–1980 1900–1905/1985–1980 1905–1910/1985–1990	185 MHz
Sasktel	4	1895–1900/1975–1980 1900–1905/1985–1980 1905–1910/1985–1990 1910–1915/1990–1995	20 MHz
Ecotel Inc	2	1865–1870/1945–1950	10 MHz

2.5 GHz

History of the band

In 2006, ISED adopted a policy designating the band for mobile, fixed and broadcasting use.

Current assignments of the band

Licences were allocated in a mix of tier 3 and tier 4 services areas with that cover smaller regional geographies with some localised deployments.

Bell and Rogers have acquired licences that are approximately 76% of the total MHz holdings in the band.

Telus, Videotron, Bragg Communications Ltd, and Corridor Communications Ltd have acquired licences that are approximately 17% of total MHz holdings in the band

MTS, Sasktel, SSI Micro, Xplore Inc, and Tbaytel have acquired licences that are approximately 5% of the total MHz holdings in the band.

Table 8: Current assignments of paired spectrum blocks in the 2.5 GHz band[17]

Licensees	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
Bell	123	2500–2510/2620–2630 2510–2520/2630-2640 2520–2530/2640–2650 2530–2540/2660–2670 2540–2550/2660–2670 2550–2560/2670–2680 2560–2570/2680–2690	1230 MHz
MTS	2	2500–2510/2620–2630	20 MHz
Sasktel	9	2500–2510/2620–2630 2510–2520/2630-2640	90 MHz
SSI Micro	4	2500–2510/2620–2630 2510–2520/2630-2640	40 MHz
Rogers	110	2510–2520/2630-2640 2520–2530/2640–2650 2530–2540/2660–2670 2540–2550/2660–2670	1100 MHz
Videotron	18	2520–2530/2640–2650 2530–2540/2660–2670 2540–2550/2660–2670 2560–2570/2680–2690	180 MHz
Telus	122	2530–2540/2660–2670 2540–2550/2660–2670 2550–2560/2670–2680 2560–2570/2680–2690	122 MHz
Bragg Communications Ltd	11	2560–2570/2680–2690	110 MHz
Corridor Communications Ltd	13	2560–2570/2680–2690	130 MHz

[17] These assignments do not reflect any holdings in guardbands or unpaired blocks (see 2500 MHz Auction — Final Results (canada.ca)).

Xplorenet	1	2560–2570/2680–2690	10 MHz
Tbaytel	2	2560–2570/2680–2690	20 MHz

2.3 GHz (WCS)

History of the band

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Current assignments

All licences were allocated to service a tier 4 area which is optimal for localised deployments.

Telus has acquired licences that are approximately 68% of the total MHz holdings in the band.

Xplore Inc and Orion Wireless Partnership have acquired licences that are approximately 28% of the total MHz holdings in the band.

Canadian Spectrum Holding Corporation and Bell have acquired 3% of the total MHz holdings.

Table 9: Assignments in the 2.3 GHz band

Licensees	# of licences	Frequency assignments (MHz)	Total holdings (MHz)
Bell	1	2305–2320 MHz	15 MHz
Canadian Spectrum Holding Corporation	5	2305–2320 MHz	75 MHz
Orion Wireless Partnership	38	2305–2320 MHz	570 MHz
Telus	114	2305–2320 MHz	1710 MHz
Xplore Inc	9	2305–2320 MHz	135 MHz

3500 MHz band

History of the band

Comparable to the 3.4 GHz band as part of the ESL process, Canada has assigned the 3500 MHz and (3450 MHz – 3650 MHz) for flexible use.

In 2013, ISED indicate the intention to reserve 100 to 175 MHz of spectrum for commercial mobile services by 2017.[18] ISED predicted that traffic for commercial mobile networks was expected to increase fifteen-fold between 2011 and 2017. In conclusion, ISED aimed to allocate a total of 750 MHz of spectrum for commercial mobile services across multiple bands.[19]

[18] Commercial Mobile Spectrum Outlook (canada.ca)
[19] Refer to figure 10.

In 2013, ISED made decisions concerning the policy of renewing of licences in the 3500 MHz band.[20] In response to stakeholder views on a renewal process, ISED had the following points:

- 3500 MHz is identified as a source for commercial mobile spectrum to provide additional capacity for meeting consumer demand, particularly in urban areas.
- Consultation highlighted a demand for mobile broadband services in urban areas and demand for fixed wireless broadband services in rural areas.
- 3500 MHz spectrum characteristics render services unable to cover larger areas without significant infrastructure. It is considered well suited to meeting demand in urban areas and less attractive for mobile services in rural areas. Contrastingly, the spectrum is well suited to meet the needs for fixed services in rural areas. ISED's view was to conduct a further consultation to address fundamental reallocation of the and to mobile services in urban areas while permitting continued fixed operation in rural areas.
- The Department decided not to issue any new long-term licences in the band pending potential mobile allocation. Licences were to be renewed on one-year licence terms and eligible for ongoing one-year renewals. These renewals will be eligible for existing fixed wireless licensees.
- In discussion on future consultation, ISED anticipated high demand for mobile services in Large Urban areas, subjecting existing operations to a transition policy. It anticipated limited demand for mobile services in rural areas and operations for fixed services will likely continue for a long time.

In 2014, ISED previously indicated its intention to consult on the possibility of an allocation of the band.[21] ISED's decisions on the allocation for commercial mobile spectrum in the 3500 MHZ band are as follows:

- For incumbent licensees, ISED considered that allowing the continuation of existing fixed wireless access (FWA) services was suitable. However, FWA systems would be subject to an eventual transition to a new flexible use band. Existing FWA licensees would be eligible for continued renewal until a new band was finalized.
- ISED indicated that it would reallocate the 3500 MHz band to allow mobile services throughout the band.

In 2019, ISED announced its decision on revisions to the band to accommodate flexible use (mobile and fixed wireless).[22] ISED made the following decisions and observations that are of interest:

- ISED noted that the 3500 MHz band was identified for 5G technology development and deployment. It anticipated 5G equipment for the band will be available in 2019 internationally.

[20] Decisions Concerning the Renewal of 2300 MHz and 3500 MHz Licences (canada.ca)
[21] Decisions Regarding Policy Changes in the 3500 MHz Band (3475–3650 MHz) and a New Licensing Process (canada.ca)
[22] Decision on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Decisions on Changes to the 3800 MHz Band (canada.ca)

- ISED noted that the 3100-3500 MHz band is allocated to radiolocation (radar/detection use) however, that radiolocation is not used in the 3475-3500 MHz portion of the band. Radiolocation use in the 3300-3450 was limited to government use. The 3400-3475 MHz portion of the band was reserved for aeronautical/maritime radars with limited use. The 3745-3650 MHz band is primarily used to provide fixed wireless internet services, often in rural and remote communities with first licences auctioned in 2004 and 2009. Prior to 2004, ISED administratively licensed spectrum for FWA systems in rural areas to 12 licensees.
- ISED decided to transition existing fixed use licensees in the band on a 'where and when necessary' principle where existing licensees would be allowed to continue operating if they do not prevent deployment from new flexible use licensees (auction winners).

In 2021, ISED conducted an auction of 3500 MHz auction citing it as a key milestone in the deployment of 5G services (see Table 10).

In 2022, ISED posted a notice of an upcoming auction of residual spectrum licences.[23] A total of 25 licences, or 250 MHz, in the 3500 MHz band (and other bands) was made available for prospective licensees in Quebec, Manitoba, and the North. The auction occurred in 2023 (see table 11).

In 2024, ISED is intending to auction 18 licences in Northern Ontario, Nunavut, the Northwest Territories, and Yukon.[24]

Current assignments

2021 auction of the 3500 MHz band

All licences were allocated in tier 4 services areas which cover localised areas across Canada. All licences were allocated in 10 MHz lots, with a total of 3440 licences assigned in the band.

Bell, Cogeco Connexion Inc, Rogers, TELUS, Videotron, and Xplornet have acquired licences that are approximately 93% of the band's total MHz holdings.

Bragg Communications, Broadpoint, Comcentric Networking, Sakatchewan Telecommunications, Sogetel, and TBayTel have acquired licences that are approximately 5% of the band's total MHz holdings.

Ecotel, Iristel, SSI Micro, Star Solutions, Thomas Communications, Valley Fiber, Vianet and WIRE IE have acquired licences that are approximately 0.9% of the band's total MHz holdings.

The amount of unsold lots are approximately 0.02% of the band's total MHz holdings.

2023 residual licence auction of the 3500 MHz band

The 2023 auction offered 25 residual licences in tier 4 services areas which cover localised areas.

[23] 2023 Auction of Residual Spectrum Licences (canada.ca)
[24] 2024 Notice of Upcoming Auction of Residual Spectrum Licences (canada.ca)

Rogers, Bell, and Videotron have acquired each licences that are approximately between 15-20% of the total MHz holdings available.

Sogetel Inc have acquired licences that are approximately 8% of the total MHz holdings available.

Table 10: results from the 2021 auction of the 3500 MHz band[25]

Licensees	# of licences	Frequency assignments (MHz)		Total holdings (MHz)
Bell Mobility Inc.	761	3450–3460 3460–3470 3470–3480 3480–3490 3490–3500 3500–3510 3510–3520 3520–3530 3530–3540 3540–3550	3550–3560 3570–3580 3580–3590 3590–3600 3600–3610 3610–3620 3620–3630 3630–3640 3640–3650	7610 MHz
Bragg Communications Inc	50	3500–3510 3510–3520 3520–3530 3530–3540 3540–3550 3590–3600	3600–3610 3610–3620 3620–3630 3630–3640 3640–3650	500 MHz
Broadpoint	16	3450–3460 3460–3470 3470–3480 3480–3490 3490–3500 3500–3510 3560–3570	3570–3580 3600–3610 3610–3620 3620–3630 3630–3640 3640–3650	160 MHz
Cogeco Connexion Inc	118	3490–3500 3500–3510 3510–3520 3520–3530 3530–3540 3540–3550 3550–3560 3560–3570	3570–3580 3580–3590 3590–3600 3600–3610 3610–3620 3620–3630 3630–3640	1180 MHz
Comcentric Networking Inc	15	3600–3610 3610–3620 3620–3630	3630–3640 3640–3650	150 MHz
Ecotel Inc	2	3510–3520 3640–3650		20 MHz
ISED (unsold)	9	3510–3520 3520–3530 3530–3540	3600–3610 3610–3620 3620–3630	90 MHz

[25] 3500 MHz Auction — Final Results (canada.ca)

Iristel Inc	8	3580–3590 3630–3640 3640–3650		80 MHz
Rogers Communications Canada Inc	834	3450–3460 3460–3470 3470–3480 3480–3490 3500–3510 3510–3520 3520–3530 3530–3540	3540–3550 3550–3560 3560–3570 3570–3580 3580–3590 3590–3600 3600–3610 3610–3620	8340 MHz
SSI Micro	5	3550–3560 3560–3570 3570–3580 3580–3590 3590–3600		50 MHz
Saskatchewan Telecommunications	68	3450–3460 3460–3470 3470–3480 3480–3490 3490–3500 3500–3510	3510–3520 3520–3530 3530–3540 3540–3550 3550–3560 3560–3570	680 MHz
Sogetel Inc.	28	3480–3490 3490–3500 3500–3510	3510–3520 3520–3530 3530–3540	280 MHz
Star Solutions International Inc.	2	3620–3630 3630–3640		20 MHz
TBayTel	19	3500–3510 3510–3520 3520–3530 3530–3540	3540–3550 3550–3560 3560–3570	190 MHz
TELUS Communications Inc.	228	3510–3520 3520–3530 3530–3540 3540–3550 3550–3560 3560–3570 3570–3580	3580–3590 3590–3600 3600–3610 3610–3620 3620–3630 3630–3640 3640–3650	2280 MHz
Thomas Communications Ltd.	4	3510–3520 3520–3530		40 MHZ
Valley Fiber Ltd	6	3620–3630 3630–3640 3640–3650		60 MHz
Vianet	5	3500–3510 3510–3520 3520–3530	3530–3540 3540–3550	50 MHz
Videotron	299	3450–3460 3460–3470 3470–3480 3480–3490	3550–3560 3560–3570 3570–3580 3580–3590	2990 MHZ

		3490–3500 3500–3510 3510–3520 3520–3530 3530–3540 3540–3550	3590–3600 3600–3610 3610–3620 3620–3630 3630–3640 3640–3650	
Wire IE	2	3510–3520 3520–3530		20 MHz
Xplorenet Communications Inc.	961	3450–3460 3460–3470 3470–3480 3480–3490 3490–3500 3500–3510 3510–3520 3520–3530 3530–3540 3540–3550	3550–3560 3560–3570 3570–3580 3580–3590 3590–3600 3600–3610 3610–3620 3620–3630 3630–3640 3640–3650	9610 MHz

Table 11: results from the 2023 residual auction of the 3500 MHz band

Licensees	# of licences	Frequency assignments (MHz)		Total holdings (MHz)
Sogetel Inc	2	3560–3570 3570–3580		20 MHz
Videotron	5	3600–3610 3610–3620 3620–3630	3630–3640 3640–3650	50 MHz
Bell Mobility Inc	4	3490–3500 3500–3510	3490–3500 3500–3510	40 MHz
Rogers Communications Canada Inc	5	3450–3460 3460–3470 3470–3480	3480–3490 3490–3500	50 MHz
ISED	9	3510–3520 3520–3530 3530–3540 3600–3610 3610–3620	3620–3630 3510–3520 3520–3530 3530–3540	90 MHz

Market Environment

Current/Future trends

In its current Spectrum Outlook, ISED highlighted five policy themes it considered to inform the future direction of its spectrum management activities:

1. Spectrum as an economic driver and enabler of Industry 4.0
2. Rural connectivity in the wake of COVID-19
3. Indigenous connectivity

4. Spectrum, wireless technology and climate change
5. Competition and wireless affordability

1. *Spectrum as an economic driver and enabler*

ISED observed that the Canada's telecommunications industry reported revenues of $55 billion in 2021 (up 23%), with mobile wireless revenues accounting for $29 billion of that total.

ISED also observed several emerging uses for wireless connectivity. Canadians are increasingly relying on products that feature built-in Bluetooth and wifi radios, including the increasing use of smart-home devices (21%) which is expected to rapidly grow.

Drone manufacturers and operators have highlight interested in using different bands, including commercial mobile bands (Drones are permitted in certain licence-exempt bands such as 2.4 GHz and 5GHz). ISED has flagged further consultation on the use of drones in additional bands.

ISED is considering a future consultation on the use of commercial mobile bands to support the integration of satellite and terrestrial use, such as incorporating MSS bands into smartphones for emergency communications. It also noted emerging partnerships between satellite and terrestrial service providers.

ISED noted that initial deployments of 5G focused on coverage and that future deployments are expected to focus on generating higher data transfer rates, improved connectivity and higher system capacity.

ISED also made comments on the World Economic Forum's predictions on Industry 4.0 and its capacity to optimise future manufacturing process and supply chains through automation and massive data exchange capabilities. Specifically, ISED noted that various industry sectors such as advanced manufacturing, precision agriculture, transportation and public safety are increasingly relying on wireless technologies to enhance productivity, develop innovative goods and services, and foster efficient delivery to end-users. In response to Industry 4.0, ISED has flagged the importance for spectrum policy to address the need of industry verticals and private networks. It flagged its plan to make locally licensed spectrum available for flexible use through a non-competitive licensing framework in the 3900-3980 MHz band, and portions of the 26, 28, and 38 GHz bands.

2. *Rural connectivity in the wake of COVID-19*

During the COVID-19 pandemic, ISED applied measures as part of the Government's response which included a number of emergency spectrum-sharing arrangements and authorisations in which service providers accessed additional spectrum to meet increased network demand. Specifically, ISED issued special authorizations for temporary access to the spectrum in the 5.9 GHz band. ISED indicates that it will continue to consider short-term authorisations and fast-track sharing arrangements to address acute situations as they arise.

The Canadian government has outlined a Connectivity Strategy which sets out a goal of universal access to broadband speeds of 50/10 Mbps and to improve mobile cellular access across the country including along major highways and trash. ISED noted mobile coverage

covers 99.4% of the Canadian population and 87.4% of major roads and highways, with gaps in connectivity predominantly found in rural, remote and Indigenous communities.

In July 2019, ISED introduced smaller tier 5 licence areas to make it easier for smaller regional providers to acquire spectrum and serve rural and remote areas. ISED indicates that smaller licence areas will provide greater flexibility when design frameworks for addressing emerging service needs and technologies.

For spectrum pricing, ISED's approach is to make spectrum available at a lower cost or cost-free, including providing additional spectrum for licence-exempt applications such as Wi-Fi and white space.

ISED notes that spectrum deployment requirements which serve a 'use it or lose it' function. Traditionally, licensees could meet deployment requirements by serving more urban areas, however, ISED has indicated that strengthening deployment requirements to require licensees to utilise auctioned spectrum more promptly, and potentially introducing requirements related to coverage for roads and highways will provide more accessible services and improve public safety responses.

ISED also outlined a number of steps that it undertook to make spectrum available for rural and remote regions, including licensing efforts to support subordinate licensing in rural/remote areas and a non-competitive licensing framework to encourage deployment in smaller, targeted areas across the country.

On spectrum access, ISED notes that small and regional providers often cite the lack of access to quality spectrum and the lack of readily available information on available spectrum as impediments to deployment. ISED noted the changed framework for subordinate licensing and indicated that it will explore additional approaches to spectrum sharing, especially in rural areas.

ISED also noted that emerging technologies, such as LEO-sat deployment could be optimal for improve broadband services in rural and remote communities. ISED noted that for satellite deployment in recently made the decision to grant co-primary status for geostationary orbit and non-geostationary orbit fixed satellite service licensees in the 18.8-19.3 GHz and 28.6-29.1 GHz bands with intention to increase the potential for new and innovative services to be deliver in rural and remote areas.

3. Indigenous Connectivity

The Canadian government has indicated that reconciliation with Indigenous Peoples is a Government-wide directive. ISED has noted that it has a role to play on economic reconciliation and advocates are calling for ISED to develop policy inclusive of Indigenous priorities. For mobile coverage, ISED notes the Candaian Radio-television and Telecommunications Commission (CRTC) 2021 market report that states 90.3% of First Nations reserves and 98.9% of people in the North had access to reliable to reliable mobile, however, only 43.3% of First Nations reserves reported access to high-speed Internet at 50/10 Mbps and some Indigenous Peoples continue to lack access to essential cellphone service.

ISED notes that most unconnected Indigenous communities in rural/remote areas are challenging to connect with traditional wire solutions and that wireless solutions will be important to reach 100% connectivity. ISED noted that access to spectrum is crucial for accelerating connectivity.

To support this, ISED's new Access Licensing Framework is designed to support takeup and use of spectrum for service providers identified spectrum bands are not being used by incumbent licensees. ISED is consulting on the settings on the inclusion of an indigenous priority access window to support the takeup of spectrum from indigenous organisations.

4. Spectrum, wireless technology and climate change

ISED has emphasised support for the United Nations' Sustainable Development Goals, noting that the wireless technology sector's impact on the environment is relatively small in terms of greenhouse gas emission, but it is expected to increase as the demand for wireless technologies grows.

ISED has indicated that the sector will face a green challenge where 5G demand will require increased electricity consumption. ISED has notes two suitable approaches to risk mitigation for energy efficiency: grid decarbonization and network improvements.

ISED notes that that Canada is well position to capitalise on comparative advantages for environmentally sustainable economic growth with respect to grid decarbonization. ISED notes that 83% of Canadian electricity comes from sources that do not emit greenhouse gases and the government is aiming to reach 100% net-zero emitting electricity system by 2035.[26]

ISED also notes that European regulators are monitoring the energy efficiency of wireless equipment and promoting energy efficiency metrics and targets.

On a broader scale, ISED also reflected on the potential for responsible digitalisation to improve energy efficiency across economic sectors with wireless technologies possibly reducing emissions by 20% by 2050 while being responsible for less than 2% of the global carbon footprint.[27]

5. Competition and wireless affordability

Specifically to spectrum, the Canadian Government has utilised two types of competitive measures: spectrum set-aside reserve and spectrum aggregation limits. ISED has routinely reserved approximately 40% of spectrum in auctions which has increased total mobile spectrum holdings by more than 50% for small and regional providers.

ISED has indicated that there is three MNOs' high levels of market concentration an profitability provide barriers to entry for downstream market operators. ISED also notes that exploring

[26] See Canada launches consultations on a Clean Electricity Standard to achieve a net-zero emissions grid by 2035 - Canada.ca

[27] See 5G_Role_In_Fight_Against_Climate_Change.pdf (canadatelecoms.ca) and Climate Scenarios - Digital Transformation (weforum.org)

options to allow firms in industry verticals provide more freedom of choice in how verticals meet their connectivity needs.

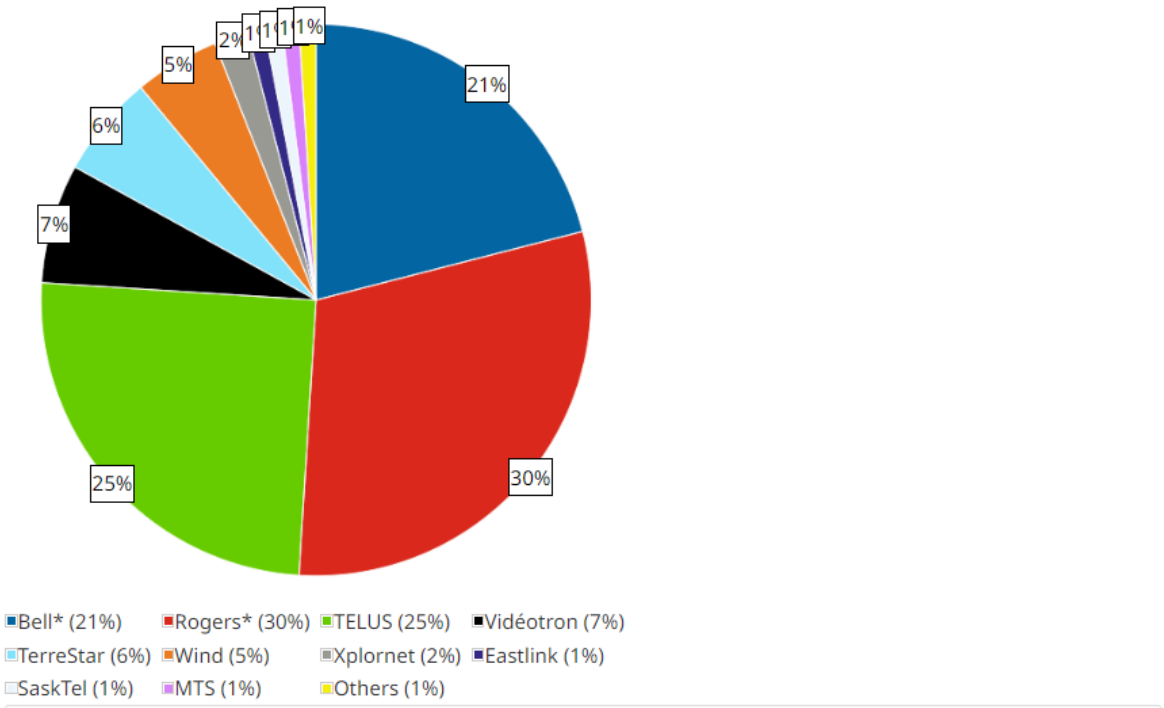
MNOs/market structure[28]

Canada's market is currently comprised of three major commercial mobile providers: Bell, Rogers, and TELUS. Shaw Communications and its subsidiary Wind/Freedom Mobile was considered a fourth player, however, Shaw was acquisitioned by Rogers in 2023.[29]

As indicated in the band histories above, many bands have a diversified range of licensees including a history of localised mobile and wireless network providers that service specific provinces as well as MNOs/MVNOs servicing a national market (see Appendix A). The major players (Rogers, Bell, Telus) notionally 75% of the total MHz holdings (see figure 1).[30]

In regards to market share that the MNOs hold, Canada's top three MNOs hold a share percentage of 88% and 67% of wireless and wireline subscribers while Australia's MNOs hold 100% and 71% respectively.[31]

[28] Note that this section will attempt to identify the most recent market settings.
[29] Rogers and Shaw to Proceed with Transformative Merger - About Rogers
[30] Note that band allocations post-2016 indicate that the MNOs acquired approximately 70-80% of available licences.
[31] Page 17, Canada Telecommunications Association/PWC report.



▼ Figure 1 — Share of National Commercial Mobile Spectrum Licence Holdings by Percentage - Table

Figure 1 — Share of National Commercial Mobile Spectrum Licence Holdings by Percentage

Bell*	Rogers*	TELUS	Vidéotron	TerreStar	Wind	Xplornet	Eastlink	SaskTel	MTS	Others
21 %	30%	25%	7%	6%	5%	2%	1%	1%	1%	1%

Figure 1: Spectrum licence holdings for commercial mobile operators[32]

MNO highlights: Rogers

As previously mentioned, Rogers is one of three major operators providing commercial mobile services to Canadian consumers. In 2022, Rogers held the largest share of the retail mobile market, accounting for 30.8%. [33]

In FY24, Rogers acquired a revenue of $19 billion with its wireless services generating a revenue of $10 billion, its cable services generating a revenue of $7 billion, and its media services generating a revenue of $2 billion. Rogers' mobile ARPU is currently $57.86.[34]

In FY24, Rogers has a total of 11.6 million mobile phone subscribers, 4.1 million internet subscribers, and 4.4 million subscribers for related phone/internet services.[35]

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[32] These holdings are reflective of Cellular, PCS, AWS, 700 MHz, 2500 MHz, 2300 MHz bands. The 3500 MHz band holdings are presumably not included in these figures from ISED. (National Holdings for Commercial Mobile Spectrum Licences (canada.ca)). These figures may not be accurately reflective of smaller MNOs at present.
[33] Canada: retail mobile market share 2022 | Statista
[34] Page 17, 2023 Annual report (rogers.com).
[35] Ibid.

Rogers holds multiple subsidiaries that provide wireless services. This includes Fido Solutions, the recently acquired Shaw Communications Inc (Rogers also has multiple media related subsidiaries)

MNO highlights: Bell

Bell is one of the three major operators providing mobile services. In 2022, Bell accounted for 29% of mobile revenue.[36]

In FY24, Bell had a revenue of $24.6 billion. Bell's communication/technology services generated a revenue of $21.9 billion and Bell's media services generated a revenue of $3.1 billion. Bell's mobile phone ARPU is $59.08.[37]

In FY24, Bell had approximately 10.2 million mobile phone subscribers, 4 million internet subscribers, and 7.4 million subscribers for TV/other services.[38]

MNO highlights: Telus

Telus is one of the three major operators providing mobile services. In 2022, Telus accounted for 27% of mobile revenue.[39]

In FY24, Telus had a revenue of $20 billion. Telus' technology solutions(mobile/fixed services) had a revenue of $17.2 billion and Telus International (digital solutions/managed services) had a revenue of $3.6 billion. Telus' mobile phone ARPU is $58.78.[40]

In FY24, Telus had approximately 10 million phone subscribers, 2.6 million internet subscribers, and 6.6 million subscribers for TV/other services.

Secondary Market: Subordinate licensing/Licence Transfer

Canada's spectrum licence framework facilitates the transfer of licences and authorisation of third party use, facilitating a healthy secondary spectrum market.

In 2013, ISED established a framework for the transfers, divisions or subordination for commercial mobile spectrum. From 2013 to 2024, ISED has made 194 decisions on requests for transfer/authorisation.

Appendix A: Overview of tier 2 spectrum licensees across all bands[41]

Company	Parent Company?	Notes

[36] Canada: retail mobile market share 2022 | Statista
[37] Page 107, BCE 2023 Annual integrated report
[38] Ibid.
[39] Canada: retail mobile market share 2022 | Statista
[40] Page 34, People purpose passion - 2023 ANNUAL REPORT (ctfassets.net)
[41] Note that these licensees do not include operators that hold subordinate licences.

Feenix	N/A	• Presumably an international telecommunications company located in New Zealand. •
MTS	Bell	• Formerly Manitoba Telecom Services, a government business that was privatized in the 1990s. Acquired by Bell in 2017. • Currently services Manitoba (province).
Bragg Communications	N/A	• Trading as Eastlink, Bragg Communications Inc is a cable television/telecommunications company. • Provides cable internet and tv and wireless services. Presumed to operate predominantly in Nova Scotia and Eastern Canada.
Videotron	Quebecor	• Fourth largest telecommunications company providing cable television, and phone and wireless internet services. • Services approximately 1.7 million subscribers for internet services.
Sasktel	Government of Saskatchewan	• Government-owned corporation provides wireline and wireless communicstions services (landline telephone, mobile networks, broadband internet). Based in Saskatchewan province. • Subsidiary, SaskTel International works on telecom infrastructure projects for other countries.
Iris	N/A	• Private network provider with focus on tech solutions for the retail industry.
Ecotel	N/A	• Cellular operator with focus on service remote areas and process automation for industrial customers
TBayTel	City of Thunder Bay	• Municipally owned corporation servicing Thunder Bay and

		Northern Ontario. Provides internet services and operates Northern Ontario's largest 4G network (300,000km^2)
Sogetel Mobile	N/A	• Independent provider, servicing multiple areas, mostly rural, in Quebec. • Provides cellular and landline phone, internet and television services.
NexiCom Inc	N/A	• Local provider for telephone, internet and television in Central Ontario.
Freedom Mobile/Wind Mobile	Quebecor	• Formerly owned by Shaw Communications. Divested in Shaw/Rogers merger • Internet/phone provider mostly servicing urban areas in Ontario, British Columbia, and Alberta
Fido Solutions	Rogers	• Acquisitioned by Rogers in 2004, MVNO using Rogers Wireless network.
SSI Micro Ltd	N/A	• Wireless broadband ISP primarily serving remote areas lacking terrestrial service options (Northwest territories, Yukon, and Nunavut provinces)
Corridor Communications Inc	Xplorenet	• Operating as CCI Wireless, focus on providing internet to rural communities. • Operations in Alberta, Manitoba, and Saskatchewan
Xplorenet	Stonepeak Partners LP	• Largest rural ISP in Canada. • In 2021, announced launch of Canada's first rural 5G standalone network.
Canadian Spectrum Holding Corporation	N/A	• No information on company but has multiple licenses for wireless communication services in Ontario • Presumed to be private network provider
Orion Wireless Partnership	N/A	• Known as Ontario Research and Innovation Optical Network

		(ORION), is private network provider for education and research institutions (hospitals, universities, research centres). • Established in 2001 by the Ontario Government as non-profit organisation.
Broadpoint	N/A	• Managed service provider for IT/software/development/staffing.
Cogeco Connexion Inc	Gestion Audem Inc	• Cogeco Connexion Inc is part of Cogeco Inc, alongside two other branches that provide cable and media services. • Primarily provides broadband services to Quebec and Ontario (as well as 13 US states)
Iristel	N/A	• Competitive Local Exchange Carrier with focus on providing consumer and wholesale business communications services. • Also operates in several international markets (US, Romania, Moldova, Kenya)
Comcentric Networking	N/A	• Corporation comprised of multiple localised service providers servicing Western Ontario
Star Solutions International	N/A	• Mobile network infrastructure provider. • Has deployed cellular networks in multiple countries such as Argentina, Australia, Falkland Islands, India, USA and more
Thomas Communications	N/A	• Operates as CP Electronic, broadband wireless service provider
Valley Fiber Ltd	Dutch Infrastructure Fund BV/DIF Capital Partners	• Rural internet provider for Manitoba
Wire IE	N/A	• Private network provider servicing mining/oil/gas operations, government operations (rural service

		branches), business enterprise, indigenous communities, international markets