ATIS-0700051

ATIS Standard on -

North American Microwave Spectrum Bands (United States, Canada, and Mexico)

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Alliance for Telecommunications Industry Solutions

Approved October 25, 2021

Abstract

This document is a consolidation/tabulation of the various microwave spectrum bands for the United States and Canada (both licensed and unlicensed). It is intended to be a single point of reference for microwave radio engineers involved in the planning and operation/modification of current and future communications links. The current plans include regularly updating this document with the eventual inclusion of the microwave spectrum band plans for Mexico.

Foreword

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Wireless Technologies and Systems Committee (WTSC) develops and recommends standards and technical reports related to wireless and/or mobile services and systems, including service descriptions and wireless technologies. WTSC develops and recommends positions on related subjects under consideration in other North American, regional, and international standards bodies.

The mandatory requirements are designated by the word shall and recommendations by the word should. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages. The word may denotes an optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, WTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, WTSC, which was responsible for its development, had the following leadership:

M. Younge, WTSC Chair (T-Mobile)
D. Zelmer, WTSC Vice-Chair (AT&T)
E. Ehrlich, WTSC RAN Chair (InterDigital)
B. Christian, WTSC RAN Vice Chair (T-Mobile US)

G. Hirvela, Technical Editor (AT&T)

The RAN subcommittee was responsible for the development of this document.

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1 Scope, Purpose, & Application

1.1 Microwave Spectrum (900 MHz – 300 GHz)

This document investigates the microwave spectrum (900 MHz to 300 GHz) which is used for Fixed, point-to-point operation. Fixed, point-to-point operation as referred to systems employing a fixed transmitter transmitting to a fixed remote location.

1.2 Fixed Service

1.2.1 Backhaul

Backhaul refers to a point-to-point link to carry communications traffic from an access node.

1.2.2 Fixed Wireless Access

Fixed wireless refers to using a point-to-point link used to serve broadband access (i.e., Internet).

2 Definitions, Acronyms, & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < http://www.atis.org/glossary >.

2.1 Definitions

Broadcast Auxiliary Service. Broadcast Auxiliary stations are used for relaying broadcast aural and television signals. They can be used to relay signals from the studio to the transmitter, or between two points, such as a main studio and an auxiliary studio. The Broadcast Auxiliary services also include mobile TV pickups and remote pickup stations which relay signals from a remote location, back to the studio.

Cable Television Relay Service. CARS stations are point-to-point or point-to-multipoint microwave systems used by cable and other MVPD operators. CARS stations cannot be used to distribute programming directly to subscribers.

Common carrier fixed point-to-point microwave service. A common carrier public radio service rendered on microwave frequencies by fixed and temporary fixed stations between points that lie within the United States or between points to its possessions or to points in Canada or Mexico.

Digital Electronic Message Service. A two-way end-to-end fixed radio service utilizing digital termination systems for the exchange of digital information in the frequency bands 10,550-10,680 MHz, 18,820-18,920 MHz, and 19,160-19,260 MHz. This service may also make use of point-to-point microwave facilities, satellite facilities or other communications media to interconnect digital termination systems to comprise a network.

Direct Broadcast Satellite (DBS) Service. A radiocommunication service in which signals transmitted or retransmitted by Broadcasting-Satellite Service space stations in the 12.2-12.7 GHz band are intended for direct reception by subscribers or the general public. For the purposes of this definition, the term direct reception includes individual reception and community reception.

Emerging Technologies. In 1993, the Commission reallocated portions of the 2 GHz band from fixed microwave service (FMS) to emerging technology (ET) services, including the personal communications services (PCS).

Fixed-Satellite Service (FSS). A radiocommunication service between earth stations at given positions, when one or more satellites are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service; the Fixed-Satellite Service may also include feeder links of other space radiocommunication services. (RR)

Industrial, scientific, and medical (ISM). Equipment or appliances designed to generate and use locally RF energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunication. Typical ISM applications are the production of physical, biological, or chemical effects such as heating, ionization of gases, mechanical vibrations, hair removal and acceleration of charged particles.

Instructional Television Fixed Service. The Educational Broadband Service (EBS) was formerly known as the Instructional Television Fixed Service (ITFS).

Local television transmission service. A public radio communication service for the transmission of television material and related communications.

Microwave frequencies. As used in this part, this term refers to frequencies of 890 MHz and above.

Microwave link. A link is defined as a simplex communications circuit between two points utilizing a single frequency/polarization assignment. A duplex communications circuit would require two links, one link in each direction.

Multiple address system (MAS). A point-to-multipoint or point-to-point radio communications system used for either one-way or two-way transmissions that operates in the 928/952/956 MHz, the 928/959 MHz or the 932/941 MHz bands in accordance with §101.147.

Multipoint Distribution Service. Multichannel Multipoint Distribution Service (MMDS), formerly known as Broadband Radio Service (BRS) and also known as Wireless Cable, is a wireless telecommunications technology, used for general-purpose broadband networking or, more commonly, as an alternative method of cable television programming reception

Operational fixed station. A private fixed station not open to public correspondence.

Private Operational Fixed Point-to-Point Microwave Service. A private radio service rendered by fixed and temporary fixed stations on microwave frequencies for the exclusive use or availability for use of the licensee or other eligible entities for communication between two or more designated points. Service may be provided between points within the United States, points within United States possessions, or between the United States and points in Canada or Mexico.

Personal Communications Service. Radio communications that encompass mobile and ancillary fixed communication that provide services to individuals and businesses and can be integrated with a variety of competing networks.

Paging and Radiotelephone Service. A radio service in which common carriers are authorized to offer and provide paging and radiotelephone service for hire to the general public. This service was formerly titled Public Land Mobile Service.

2.2 Acronyms & Abbreviations

ATIS	Alliance for Telecommunications Industry Solutions
BAS	Broadcast Auxiliary Service — (Part 74)
CARS	Cable Television Relay Service — (Part 78)
CC	Common Carrier Fixed Point-to-Point Microwave Service — (Part 101, Subparts C & I)
DBS	Direct Broadcast Satellite — (Part 100)
DEMS	Digital Electronic Message Service — (Part 101, Subpart G)
DFS	Dynamic Frequency Selection
EIRP	Effective Isotropic Radiated Power
ET	Emerging Technologies (per ET Dkt. No. 92-9, not yet assigned)
F	Fixed
FCC	Federal Communications Commission (United States)
FSS	Fixed Satellite Service

ISM	Industrial, Scientific & Medical — (Part 18)
ISED	Innovation, Science and Economic Development (Canada)
ITFS	Instructional Television Fixed Service — (Part 74)
LMDS	Local Multipoint Distribution Service
LTTS	Local Television Transmission Service — (Part 101, Subpart J)
M	Mobile
MAS	Multiple Address System — (Part 101)
MDS	Multipoint Distribution Service — (Part 21)
MVDDS	Multichannel Video Distribution and Data Service
NGSO	Non-Geostationary-Satellite Orbit (NGSO)
OFS	Private Operational Fixed Point-to-Point Microwave Service — (Part 101, Subparts C & H)
PCS	Personal Communications Service — (Part 24)
PET	Emerging Technologies (per ET Dkt. No. 92-9)
POFS	Private Operational Fixed Service
PRS	Paging and Radiotelephone Service — (Part 22, Subpart E)
RSS	Radio Standards Specification
SAT	Fixed Satellite Service — (Part 25)
SP	Spectrum Utilization Policies (Canada)
SRSP	Standard Radio System Plan
TF	Temporary Fixed
TPC	Transmit Power Control
U-NII	Unlicensed National Information Infrastructure

3 United States Point-to-Point Microwave Background

Private Operational Fixed Microwave

In 1963 the FCC reallocated certain microwave bands to the Safety and Special Radio Services, ending the necessity for private users to share those frequencies with common carriers. Provisions for microwave operations were added to the rule parts governing Marine, Aviation, Public Safety, Industrial, and Land Transportation Radio Services. The FCC consolidated and updated those provisions into Part 94 in 1975, creating the Private Operational-Fixed Microwave Service. In 1996, the Private Operational-Fixed Microwave Service was combined with the Common Carrier Microwave Service to form Part 101.

The Private Operational-Fixed Microwave Service can be used by persons eligible under Parts 80, 87 or 90 for communications related to their activities. Stations in this service are called operational-fixed to distinguish them from common carrier and public fixed stations. The licensee may use an operational-fixed station, for communications related to the licensee's commercial, industrial, or safety operations, may share the station on a for profit or not for profit basis with other entities who are eligible under Part 80,87 or 90, or may lease its facilities to common carriers.

Private operational-fixed microwave systems serve many different purposes. They are meant to carry or relay voice, teletype, telemetering, facsimile and digital communications associated with Aviation, Marine, Public Safety, Industrial, and the Land Transportation Radio Services. For example, these systems are used to operate unattended equipment; open and close switches or valves; record data like pressure, temperature, or speed of machines; telemeter voltage and current in power lines; and perform other control or monitoring functions. Microwave systems are especially useful for controlling and monitoring various operations along installations like pipelines, railroads, and highways.

Common Carrier Microwave
Common Carrier microwave stations are generally used in a point-to-point configuration for long-haul backbone connections or to connect points on the telephone network which cannot be connected using standard wire line or fiber optic because of cost or terrain. These systems are also used to connect cellular sites to the telephone network, and to relay television signals.
Common Carrier microwave stations are licensed to applicants who intend to provide communications service to the public. Whereas, Private Operational Fixed stations are licensed to applicants for their own internal communications requirements.

Microwave Relocation
Fixed Microwave Service (FS) operations from the 2160-2175 MHz band and modified existing relocation procedures. Relocation procedures for some portions of these bands (early PCS bands) have sunset while relocation procedures for the AWS bands are on-going. More information about relocation, negotiation periods, permissible modifications, etc. are contained in Sections 101.69 - 101.82 of the Commission's Rules. Additional information can also be found in the Commission’s orders in ET Docket 00-258, WT Docket No 02-353, ET Docket No. 10-142, and GN Docket No. 13-185.

Millimeter Wave 70/80/90 GHz Service
On October 16, 2003, the Commission adopted a Report and Order establishing service rules to promote non-Federal Government development and use of the “millimeter wave” spectrum in the 70/80/90 GHz bands on a shared basis with Federal Government operations, and subsequently modified the Report and Order with a Memorandum Opinion and Order (FCC 05-45) (pdf). The Commission adopted a flexible and innovative regulatory framework for the 70/80/90 GHz bands, allowing links to be registered with third party database managers after they are issued a geographic nationwide license by the Commission. The interference protection afforded to a link is based on the date and time that link (new or modified) was submitted to a third party database manager.

On October 16, 2003, the Commission adopted a Report and Order establishing rules to promote non-Federal Government development and use of the “millimeter wave” spectrum in the 71-76 GHz, 81-86 GHz and 92-95 GHz (70/80/90 GHz) bands on a shared basis with Federal Government operations. In the Report and Order, the Commission adopted rules for both unlicensed (Part 15) and licensed (Part 101) use of portions of these bands, which involves all of the bands except for 100 megahertz of spectrum at 94.0-94.1 GHz. For convenience, the FCC refers to the licensed spectrum herein as the “70/80/90 GHz bands”; such references do not include 94.0-94.1 GHz.

The Commission adopted a flexible and innovative licensing framework for the 70/80/90 GHz bands that does not require separate FCC license applications for most links or traditional frequency coordination among non-Federal Government users. Rights with regard to specific links are established based upon the date and time of link registration.

A license (FCC authority) to operate a link in the Millimeter Wave 70-80-90 GHz Radio Service consists of two parts: (1) a non-exclusive nationwide license (see below), combined with (2) registration of each link.

4 Below 3 GHz Licensed Allocations

4.1 United States 900 MHz, 1 GHz, 2 GHz Licensed Bands

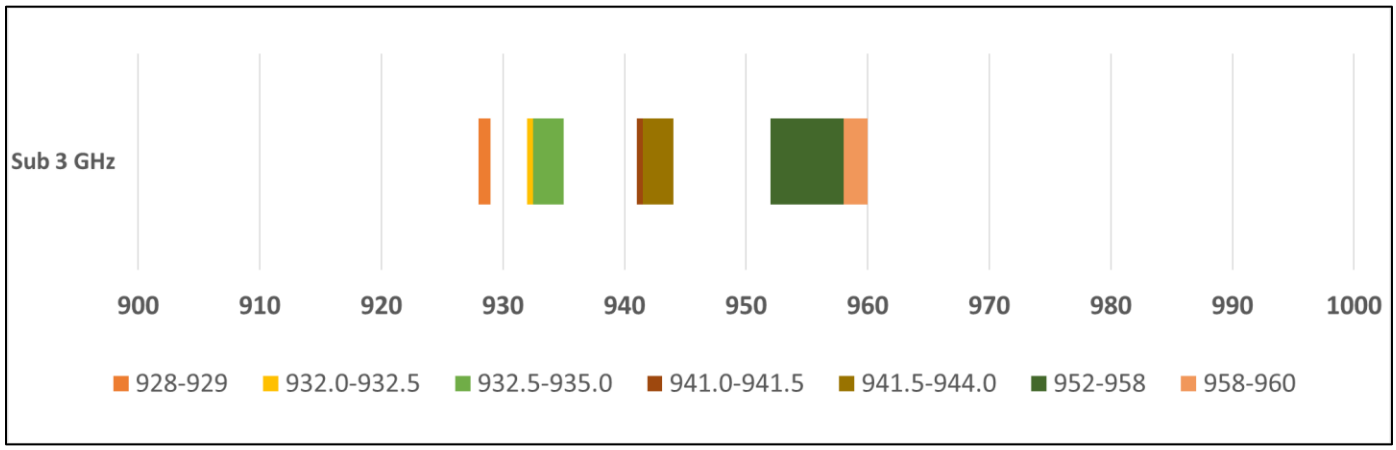

Figure 1 – United States Licensed Microwave Bands: Below 3GHz

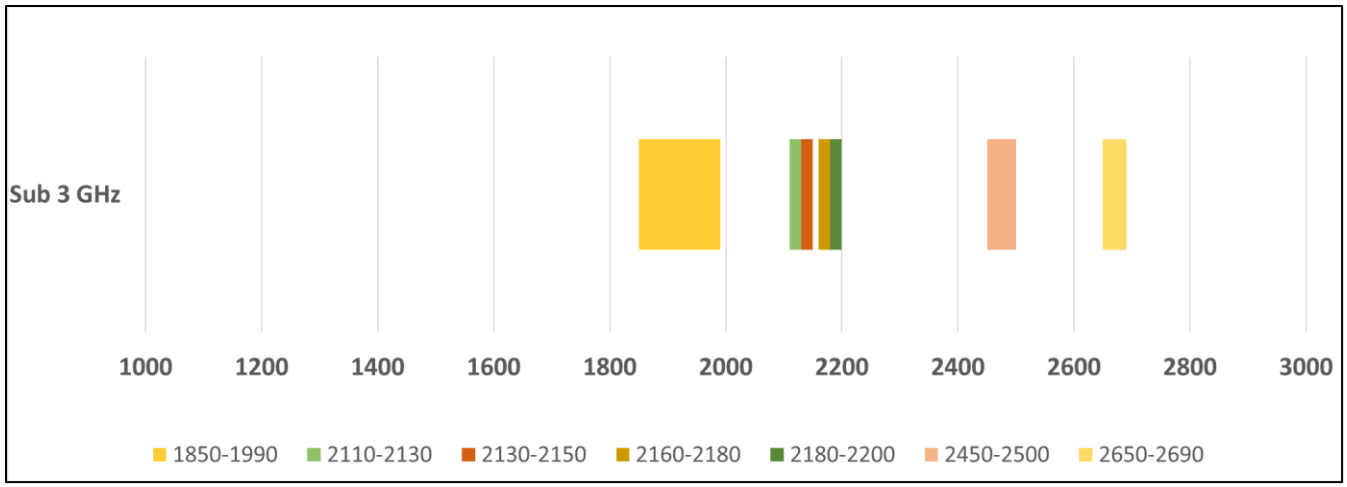

Figure 2 – United States Licensed Microwave Bands: Below 3 GHz

Table 1 – United States Microwave Frequency Availability: Below 3 GHz Licensed

Frequency band (MHz)	Radio service				
	Common carrier (Part 101)	Private radio (Part 101)	Broadcast auxiliary (Part 74)	Other (Parts 15, 21, 22, 24, 25, 74, 78 & 100)	Notes
928-929	MAS	MAS		PRS	
932.0-932.5	MAS	MAS		PRS	
932.5-935.0	CC	OFS			(1).
941.0-941.5	MAS	MAS		PRS	

941.5-944.0	CC	OFS	Aural BAS		(1).
952-958		OFS/MAS		PRS	
958-960	MAS	OFS			
1850-1990		OFS		PCS	
2110-2130	CC			PET	
2130-2150		OFS		PET	
2160-2180	CC			ET	
2180-2200		OFS		PET	
2450-2500	CC	OFS	TV BAS	ISM	F/M/TF
2650-2690		OFS		MDS/ITFS	

4.1.1 Authorized Bandwidth: Below 3 GHz Licensed

Table 2 – United States Maximum Authorized Bandwidth: Below 3 GHz Licensed

Frequency band (MHz)	Maximum authorized bandwidth
928 to 929	25 kHz[1 3 4]
932 to 932.5, 941 to 941.5	12.5 kHz[1 3 4]
932.5 to 935, 941.5 to 944	200 kHz[1]
952 to 960	200 KHz[1 3 4]
1,850 to 1,990	10 MHz[1]
2,110 to 2,130	3.5 MHz
2,130 to 2,150	800 or 1600 KHz[1]
2,150 to 2,160	10 MHz
2,160 to 2,180	3.5 MHz
2,180 to 2,200	800 or 1600 KHz[1]
2,450 to 2,483.5	625 KHz[2]
2,483.5 to 2,500	800 KHz

Note 1: The maximum bandwidth that will be authorized for each particular frequency in this band is detailed in the appropriate frequency table in §101.147. If contiguous channels are aggregated in the 928-928.85/952-952.85/956.25-956.45 MHz, the 928.85-929/959.85-960 MHz, or the 932-932.5/941-941.5 MHz bands, then the bandwidth may exceed that which is listed in the table.

Note 2: 1250 KHz, 1875 KHz, or 2500 KHz on a case-by-case basis.

Note 3: A 12.5 kHz bandwidth applies only to frequencies listed in §101.147(b)(1) through (4).

Note 4: For frequencies listed in §101.147(b)(1) through (4), consideration will be given on a case-by-case basis to authorizing bandwidths up to 50 kHz.

4.1.2 Transmitter Power: Below 3 GHz Licensed

Table 3 – United States Transmitter Power: Below 3 GHz Licensed

Frequency band (MHz)	Maximum allowable EIRP[1][2]	
	Fixed[1][2] (dBW)	Mobile (dBW)
928.0-929.0	17	
932.0-932.5	17	
932.5-935.0	40	
941.0-941.5	30	14
941.5-944.0	40	
952.0-960.0(2)	40	14
1,850-1,990	45	
2,110-2,150	45	
2,150-2,180[3]	45	
2,180-2,200	45	
2,450-2,500	45	
2,500-2,686		
2,686-2,690	45	

Note 1: Per polarization.

Note 2: For multiple address operations, see §101.147. Remote alarm units that are part of a multiple address central station projection system are authorized a maximum of 2 watts.

Note 3: When an omnidirectional antenna is authorized in the 2150-2160 MHz band, the maximum power shall be 60 dBm.

4.2 Canada Below 3 GHz Licensed Bands

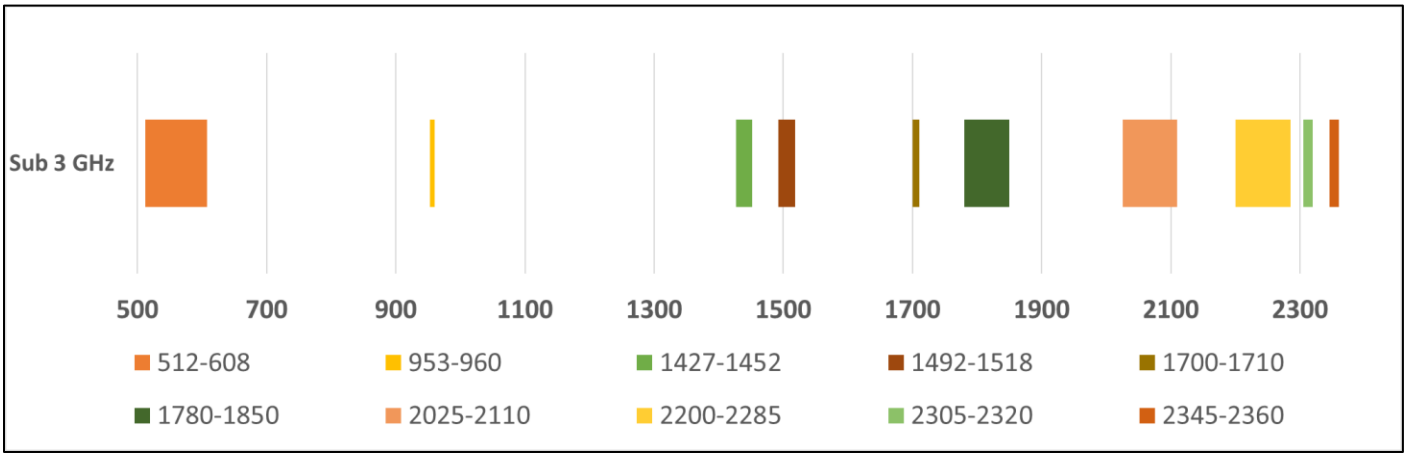

Figure 3 – Canada Licensed Microwave Spectrum Bands: Below 3 GHz

4.2.1 Authorized Bandwidth: Below 3 GHz

Table 4 – Canada Maximum Authorized Bandwidth: Below 3 GHz Licensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
512-608	300.512	PtMP	Private	RRBS[1]		6	6
953-960	300.953	PtP and PtMP	Private	STL and FWA or WLL[2]		0.125	0.125
1,427-1,452 and 1,492-1,518	301.4	PtP and PtMP	Private	subscriber radio systems		3.5	3.5
1,700-1,710 and 1,780-1,850	301.7	PtP and PtMP	Private	Electrical Supply		10	1
2,025-2,110 and 2,200-2,285	302.0	PtP and PtMP	Private	subscriber radio systems		10	50kHz
2,305-2,320 and 2,345-2,360	302.3	PtP	Private	Rescinded April 2014. See SRSP.516,			

[1] RRBS stands for “Remote Rural Broadband System”

[2] STL stands for “Studio-to-transmitter link”, FWA stands for “Fixed Wireless Access” and WLL stands for “Wireless Local Loop”

4.2.2 Transmitter Power: Below 3 GHz

Table 5 – Canada Transmitter Power: Below 3 GHz Licensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW per MHz)	Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)	ANSI or ETSI?
512-608	300.512	PtMP	Private	RRBS		26.9	6			
953-960	300.953	PtP and PtMP	Private	STL and FWA or WLL		7				
1,427-1,452 and 1,492-1,518	301.4	PtP and PtMP	Private	subscriber radio systems		10				
1,700-1,710 and 1,780-1,850	301.7	PtP and PtMP	Private	Electrical Supply		3-10				
2,025-2,110 and 2,200-2,285	302.0	PtP and PtMP	Private	subscriber radio systems		0-10				ANSI
2,305-2,320 and 2,345-2,360	302.3	PtP	Private	Rescinded April 2014. See SRSP.516,						

5 Below 3 GHz Unlicensed Allocations

5.1 United States 900 MHz, 2 GHz Unlicensed Bands

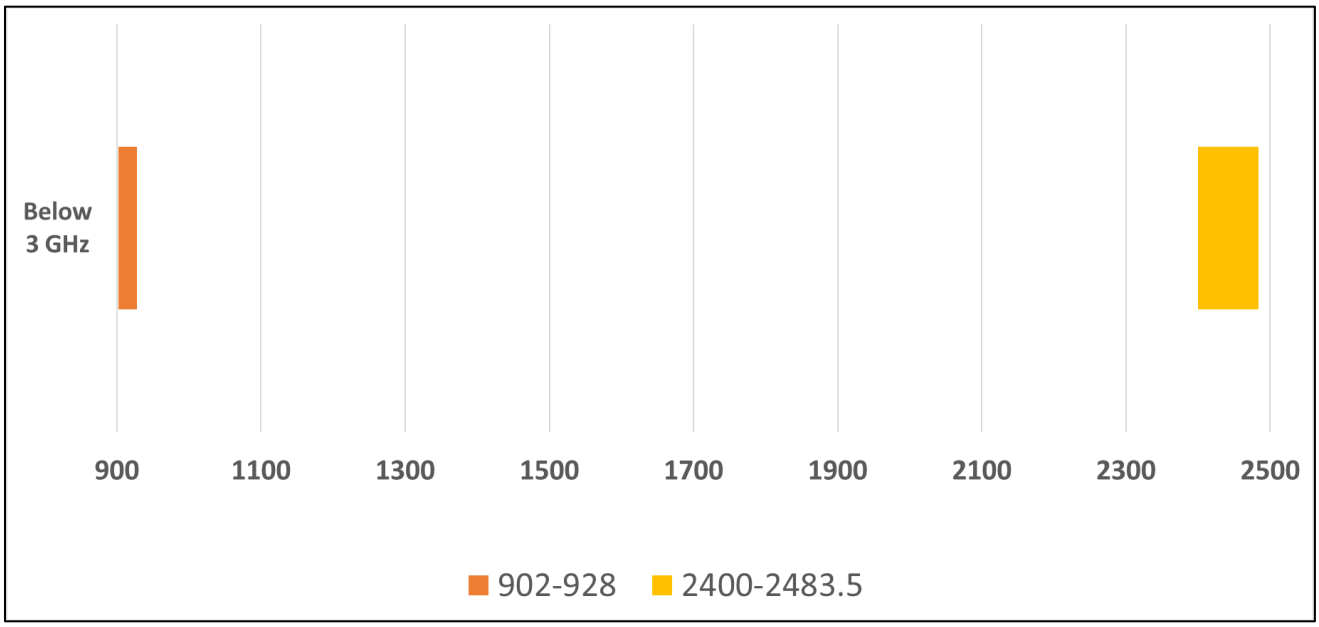

Figure 4 – United States Unlicensed Microwave Bands: Below 3 GHz

5.1.1 Authorized Bandwidth: Below 3 GHz Unlicensed

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.2 Transmitter Power: Below 3 GHz Unlicensed

The maximum peak conducted output power in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 watt

Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

The *maximum conducted output power* is the highest total transmit power occurring in any mode.

The conducted output power limit specified is based on the use of antennas with directional gains that do not exceed 6 dBi.

if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values:

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Canada 900 MHz, 2 GHz Unlicensed Bands

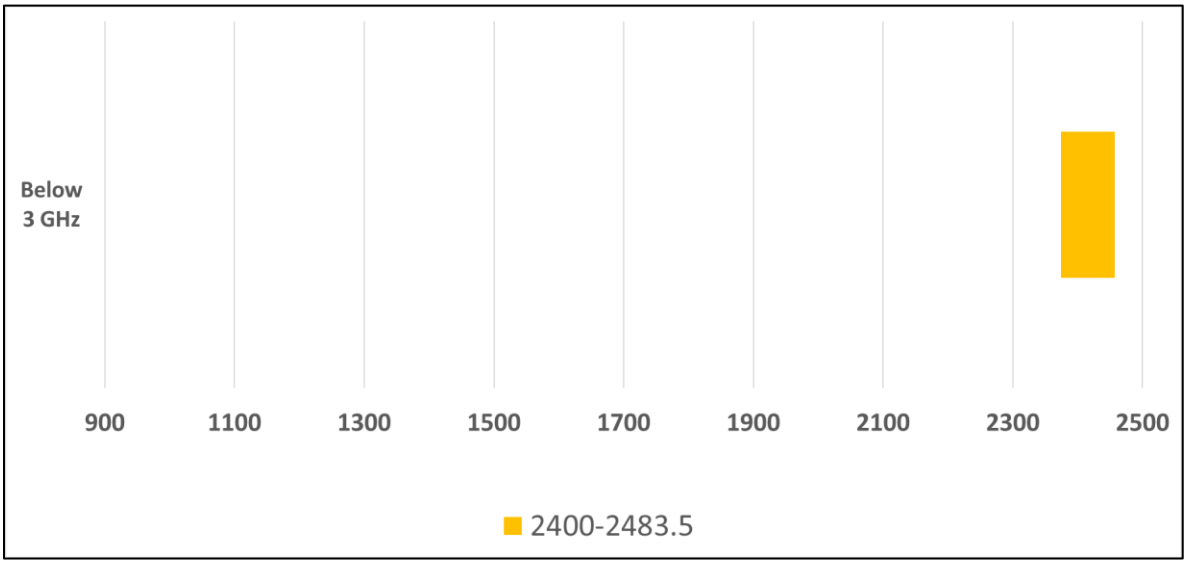

Figure 5 – Canada Unlicensed Microwave Bands: Below 3 GHz

5.2.1 Authorized Bandwidth: 2 GHz Unlicensed

Table 6 – Canada Maximum authorized bandwidth: 2 GHz Unlicensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
2400-2483.5	RSS-247	PtP and PtMP	Private	Unlicensed		not specified	not specified

5.2.2 Transmitter Power: 2 GHz Unlicensed

Table 7 – Canada Transmitter Power: 2 GHz Unlicensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW per MHz)	Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)	ANSI or ETSI?
2400-2483.5	RSS-247	PtP and PtMP	Private	Unlicensed		6 (see below)	n/a	not specified	n/a	

Fixed point-to-point systems in the band 2400-2483.5 MHz is permitted to have an Effective Isotropic Radiated Power (EIRP). higher than 4 W (6 dBW) provided that the higher EIRP. is achieved by employing higher gain directional antennas and not higher transmitter output powers, which is limited to 1 W (0 dBW).

Although hub station of point-to-multipoint systems are prohibited from exceeding an EIRP of 4 W, remote stations of point-to-multipoint systems shall be permitted to operate at an EIRP greater than 4 W under the same conditions as for point-to-point systems.

Transmitters operating in the band 2400-2483.5 MHz may employ antenna systems that emit multiple directional beams simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers, provided that the emissions comply with the following:

- Different information must be transmitted to each receiver.
- If the transmitter employs an antenna system that emits multiple directional beams, but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device (i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc., and summed across all carriers or frequency channels) shall not exceed the maximum peak conducted output power of 1 W. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.
- If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the maximum peak conducted output power of 1 W. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the EIRP limit of 4 W. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the EIRP limit of 4 W. by more than 8 dB.

6 3 GHz to 10 GHz Licensed Allocations

6.1 United States 4 GHz, 6 GHz Licensed Bands

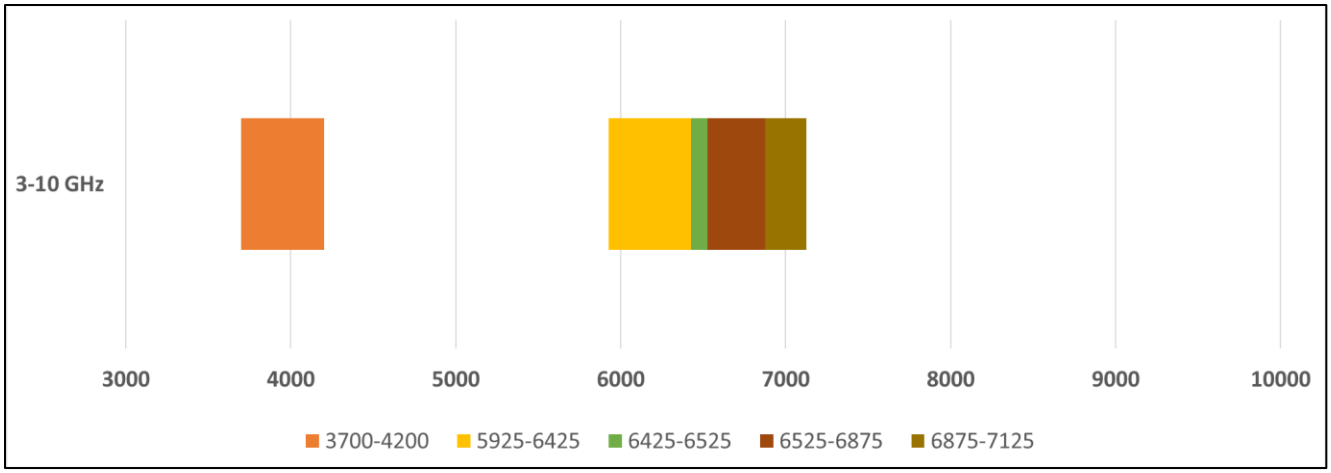

Figure 6 – United States Licensed Microwave Bands: 3 GHz to 10 GHz

Table 8 – United States Microwave Frequency Availability: 3 GHz to 10 GHz Licensed

Frequency band (MHz)	Radio service				
	Common	Private	Broadcast	Other	Notes

	carrier	radio	auxiliary	(Parts 15, 21, 22, 24, 25, 74, 78 & 100)	
	(Part 101)	(Part 101)	(Part 74)		
3700-4200	CC LTTS	OFS		SAT	
5925-6425	CC LTTS	OFS		SAT	
6425-6525	LTTS	OFS	TV BAS	CARS	M.
6525-6875	CC	OFS			
6875-7125	CC	OFS	TV BAS	CARS	

6.1.1 Authorized Bandwidth: 3 GHz – 10 GHz Licensed

Table 9 – United States Maximum Authorized Bandwidth: 3 GHz to 10 GHz Licensed

Frequency band (MHz)	Maximum authorized bandwidth
3,700 to 4,200	20 MHz
5,925 to 6,425	60[1] MHz
6,425 to 6,525	25 MHz
6,525 to 6,875	30 MHz.[1]
6,875 to 7,125	25 MHz[1]

Note 1: The maximum bandwidth that will be authorized for each particular frequency in this band is detailed in the appropriate frequency table in §101.147. If contiguous channels are aggregated in the 928-928.85/952-952.85/956.25-956.45 MHz, the 928.85-929/959.85-960 MHz, or the 932-932.5/941-941.5 MHz bands, then the bandwidth may exceed that which is listed in the table.

6.1.2 Transmitter Power: 3 GHz – 10 GHz Licensed

Table 10 – United States Transmitter Power 3 GHz to 10 GHz Licensed

Frequency band (MHz)	Maximum allowable EIRP[1][2]	
	Fixed[1][2] (dBW)	Mobile (dBW)
3,700-4,200	55	
5,925-6,425	55	
6,425-6,525		35

6,525-6,875	55	
6,875-7,125	55	

Note 1: Per polarization.

Note 2: For multiple address operations, see §101.147. Remote alarm units that are part of a multiple address central station projection system are authorized a maximum of 2 watts.

6.2 Canada 3 – 10 GHz Licensed Bands

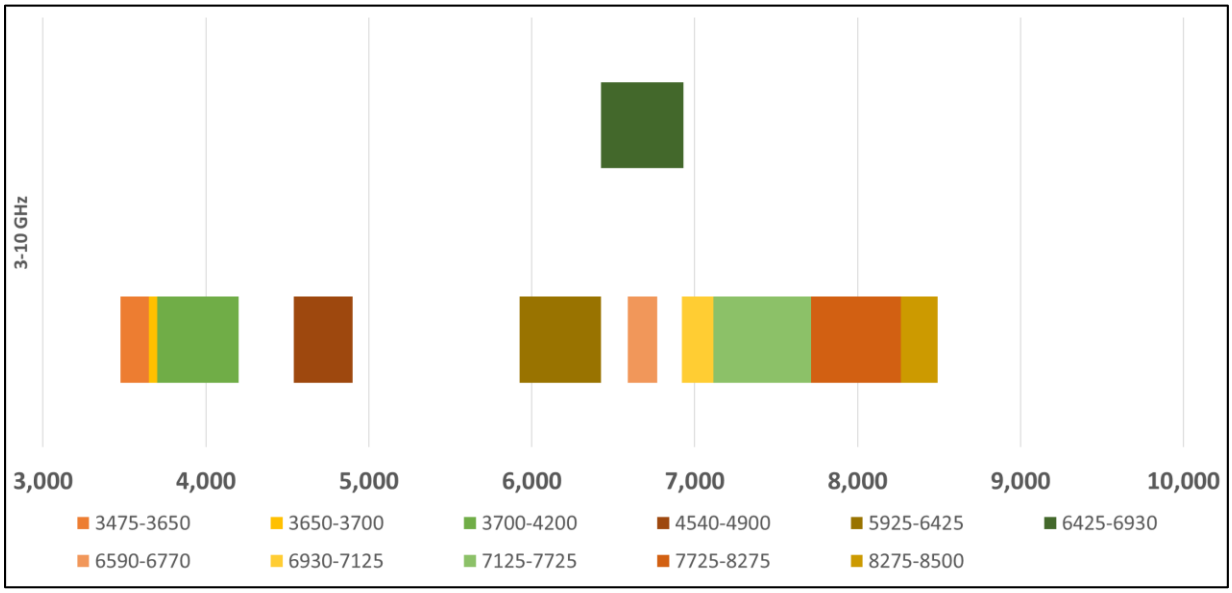

Figure 7 – Canada Microwave Spectrum Bands: 3 - 10 GHz

6.2.1 Authorized Bandwidth: 3 GHz – 10 GHz

Table 11 – Canada Maximum Authorized Bandwidth: 3 GHz to 10 GHz Licensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
3,475-3,650[3]	303.4	PtP and PtMP	Private	Fixed Wireless Access		25	na

[3] As per ISED decision SLPB-001-19, there is a moratorium on new applications for first-come, first-served spectrum licenses in the 3475-3650 MHz band in the Band 3475-3650 MHz

3,650-3,700	303.65	PtP, PtMP and PtA	Private	Wireless Broadband Service		25	na
3,700-4,200	303.7	PtP	Private			40	20
4,540-4,900	304.5	PtP	Private	Rescinded March 2013. See (SP 3–30 GHz).			
5,925-6,425	305.9	PtP	Private			30	2.5
6,425-6,930	306.4	PtP	Private			30	1.25
6,590-6,770 and 6,930-7,125	306.5	PtP	Private	Preference for TV auxiliary service	6590-6770 and 6930-7125	20	20
7,125-7,725	307.1	PtP	Private	Preference for electrical power utility		30	2.5
7,725-8,275	307.7	PtP	Private			30	1.25
8,275-8,500	308.2	PtP	Private	Preference for video		18.75	18.75

6.2.2 Transmitter Power: 3 GHz – 10 GHz

Table 12 – Canada Transmitter Power: 3 GHz to 10 GHz Licensed

Frequency Range (MHz)	**SRSP No.**	**PtP and/or PtMP**	**Radio Service**	**Notes**	**Frequency Sub-Band**	**Fixed Max EIRP (dBW)**	**Mobile[transportable?] Max EIRP (dBW)**	**Fixed Max Power Spectral Density (dBW per MHz)**	**Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)**	**ANSI or ETSI?**
3,475-3,650[4]	303.4	PtP and PtMP	Private	Fixed Wireless Access		32	32			

[4] Refer to footnote in Clause 7.2.1

3,650-3,700	303.65	PtP, PtMP and PtA	Private	Wireless Broadband Service		32	32			
3,700-4,200	303.7	PtP	Private			13	na		na	ANSI
4,540-4,900	304.5	PtP	Private	Rescinded March 2013. See (SP 3–30 GHz)						
5,925-6,425	305.9	PtP	Private			10	na	0.01	na	ANSI
6,425-6,930	306.4	PtP	Private			10	na	0.01	na	ANSI
6,590-6,770 and 6,930-7,125	306.5	PtP	Private	Preference for TV auxillary service	6590-6770 and 6930-7125	0	na	-13.01	na	
7,125-7,725	307.1	PtP	Private	Preference for electrical power utility		10	na	3.02	na	ANSI
7,725-8,275	307.7	PtP	Private			10	na	0.01	na	ANSI
8,275-8,500	308.2	PtP	Private	Preference for video		7	na	-5.73	na	

7 3 GHz to 10 GHz Unlicensed Allocations

7.1 United States 5150 to 7125 MHz Unlicensed Bands

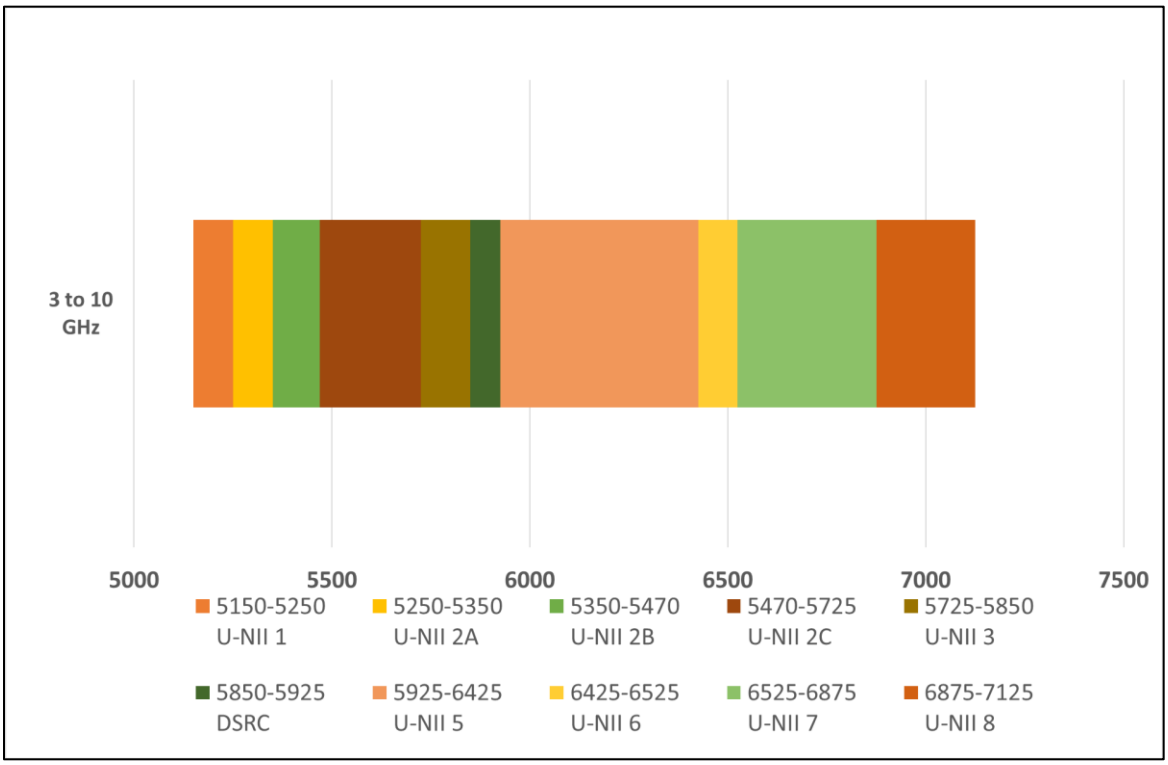

Figure 8 – United States Unlicensed Microwave Bands: 3 GHz to 10 GHz

The 5925-7125 MHz U-NII devices are covered under part 15E in which U-NII Bands fall in two basic categories:

1.Indoor devices -Phase 1
- •Access Points (AP)
- •Associated Clients

2.Standard devices _Phase 2-Database Managed -Automated Frequency Coordination (AFC)
- •Access Points (AP)
- •Associated Clients

There are seven equipment classes for the 5925 – 7125 MHz U-NII device certifications:

1. 6ID: 15E 6 GHz Low power indoor access point.

2. 6PP: 15E 6 GHz Subordinate indoor device. These devices are under control of a Low power indoor access point (P1).

3. 6XD: 15E 6 GHz Low power Indoor client. These devices are under control of a low power indoor access point (P1).

4. 6SD*: 15E 6 GHz Standard power access point. These devices are managed by the Automatic Frequency Coordination (AFC) system.

5. 6CD*: 15E 6 GHz Dual client. These devices are under control of either a low power indoor access point (6ID) (P1) or Standard power access point (P2).*

6. 6FX*: 15E 6 GHz Standard client. These devices are under control of a Standard power access point (P2).

7. 6FC*: 15E 6 GHz Fixed client. These devices are associated with a standard power access point (P3).

Note: * denotes phase 2.

Current Applications for phase 2 U-NII devices have not been accepted by the FCC.

7.1.1 Authorized Bandwidth: 3 GHz – 10 GHz Unlicensed

Unlicensed National Information Infrastructure (U-NII) devices are allowed to operate in the 5.15-5.35 GHz, 5.47-5.725 GHz, 5.725-5.85 GHz, and 5.925-7.125 GHz bands.

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 MHz.

7.1.2 Transmitter Power: 3 GHz – 10 GHz Unlicensed

Table 13 – United States Maximum Authorized Bandwidth for 3 GHz – 10 GHz Unlicensed

U-NII BAND	EIRP Std. Pwr. (dBm)	EIRP Low Pwr. (dBm)
5150-5250 U-NII 1	30	n.a
5250-5350 U-NII 2A	24	n.a
5350-5470 U-NII 2B	24	n.a
5470-5725 U-NII 2C	24	n.a
5725-5850 U-NII 3	30	n.a
5850-5925 DSRC	n.a	n.a
5925-6425 U-NII 5	36/30	30/24
6425-6525 U-NII 6	n.a	30/24
6525-6875 U-NII 7	36/30	30/24
6875-7125 U-NII 8	n.a	30/24

For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth

in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

7.1.2.1 Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS).

U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an EIRP of less than 500 mW.

U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum EIRP of 200 mW to 1 W is −64 dBm. For devices that operate with less than 200 mW EIRP and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is −62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

Device Security. All U-NII devices must contain security features to protect against modification of software by unauthorized parties.

Manufacturers must take steps to ensure that DFS functionality cannot be disabled by the operator of the U-NII device.

7.2 Canada 5150 to 7125 MHz Unlicensed Bands

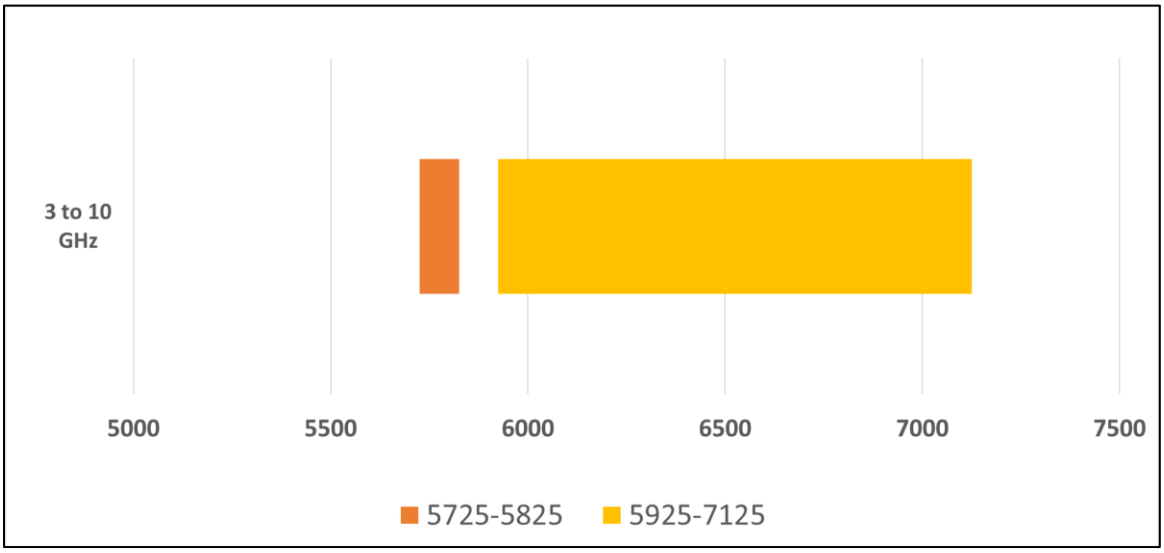

Figure 9 – Canada Unlicensed Microwave Bands: 3 GHz to 10 GHz

7.2.1 Authorized Bandwidth: 3 GHz – 10 GHz Unlicensed

Table 14 – Canada Maximum Authorized Bandwidth for 3 GHz – 10 GHz Unlicensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
5725-5850	RSS-247	PtP and PtMP	Private	Unlicensed		not specified	0.5[5]

Table on Canada Maximum Authorized Bandwidth for 5925-7125 MHz Unlicensed will be added once Innovation, Science and Economic Development (Canada) (ISED) publishes rules for that frequency range.

7.2.2 Transmitter Power: 3 GHz – 10 GHz Unlicensed

As per RSS-247, fixed point-to-point systems is permitted in 5725-5850 MHz with the following rules:

- the maximum conducted output power shall not exceed 1 W
- the output power spectral density shall not exceed 30 dBm in any 500 kHz band
- it may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power
- it is permitted to have an EIRP higher than 4 W provided that the higher EIRP is achieved by employing higher gain directional antennas and not higher transmitter output power

Fixed point-to-point operation exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information, although remote stations of point-to-multipoint systems shall be permitted to operate at EIRP greater than 4 W under the same conditions as for point-to-point systems.

[5] Referred to as a minimum 6 dB bandwidth

As per ISED document SMSE-006-21 “Decision on the Technical and Policy Framework for License-Exempt Use in the 6 GHz Band”, license-exempt RLAN devices will be allowed in 5925-7125 MHz as follow:

- Standard-power RLANs under the control of an AFC system will be permitted to operate on a license-exempt basis in the 5925-6875 MHz
- Low-power indoor-only RLANs will be permitted to operate on a license-exempt basis within 5925-7125 MHz band with the use of a contention-based protocol
- Indoor and outdoor very low-power RLAN devices will be permitted to operate on a license-exempt basis within 5925-7125 MHz band with the use of a contention-based protocol

Rules for device use in 5925-7125 MHz has not been released yet. ISED is expected to publish first rules for low-power indoor-only RLANs, followed later by standard-power and indoor and outdoor very low-power RLAN devices.

Canadian AFC rules will include a requirement to protect licensed fixed service systems operating in 5925-7125 MHz.

8 10 GHz to 24 GHz Licensed Allocations

8.1 United States 10, 11, 12, 13, 14, 18, 19, 21, 22 GHz Licensed Bands

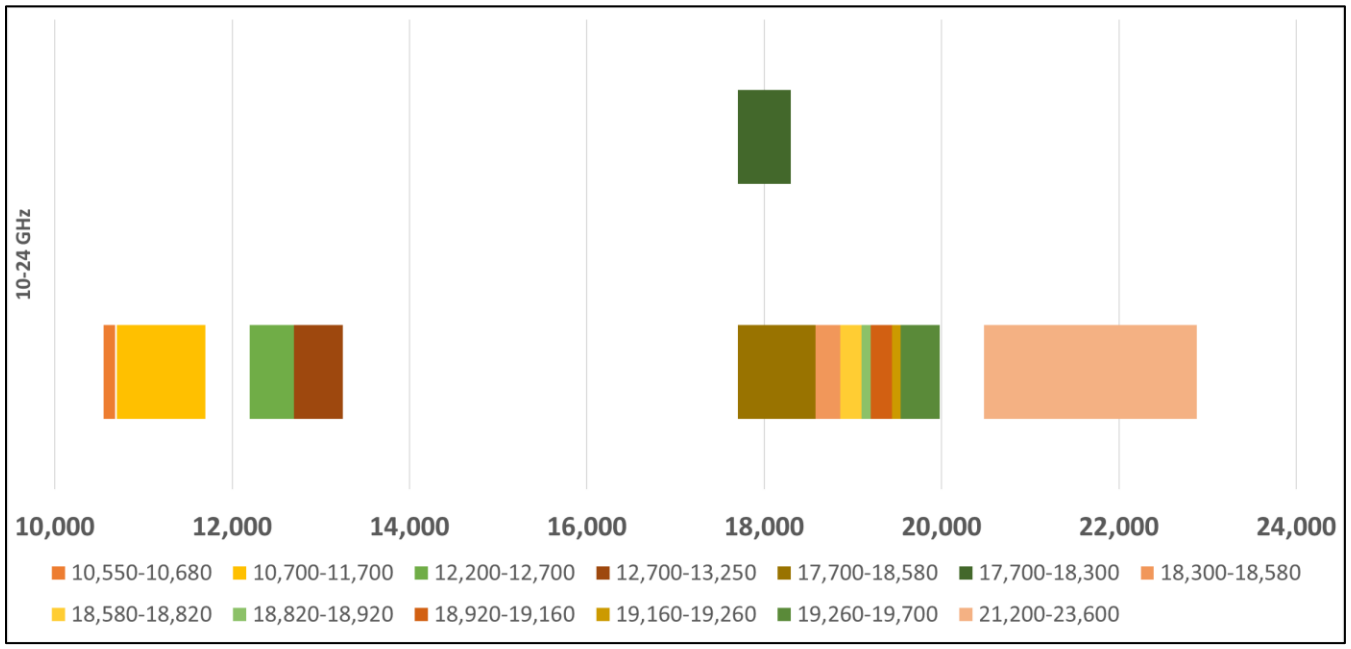

Figure 10 – United States Licensed Microwave Bands: 10 GHz to 24 GHz

Table 15 – United States Microwave Frequency Availability: 10 GHz to 24 GHz Licensed

Frequency band (MHz)	Radio service				
	Common	Private	Broadcast	Other	Notes
	carrier	radio	auxiliary	(Parts 15, 21, 22, 24, 25, 74, 78 & 100)	
	(Part 101)	(Part 101)	(Part 74)		

10,550-10,680	CC	OFS DEMS			
10,700-11,700	CC	OFS		SAT	
12,200-12,700	MVDDS	MVDDS, POFS		DBS, NGSO FSS	
12,700-13,250	CC LTTS	OFS	TV BAS	CARS	F/M/TF.
17,700-18,580	CC	OFS	TV BAS	SAT CARS	
17,700-18,300	CC	OFS	TV BAS	CARS	
18,300-18,580	CC	OFS	TV BAS	CARS SAT	
18,580-18,820	CC	OFS	Aural BAS	SAT	
18,820-18,920	CC	OFS		SAT	
18,920-19,160	CC	OFS	Aural BAS	SAT	
19,160-19,260	CC	OFS		SAT	
19,260-19,700	CC	OFS	TV BAS	CARS SAT	
21,200-23,600	CC LTTS	OFS			TF.

8.1.1 Authorized Bandwidth: 10 GHz – 24 GHz Licensed

Table 16 – United States Maximum Authorized Bandwidth: 10 GHz to 24 GHz Licensed

Frequency band (MHz)	Maximum authorized bandwidth
10,550 to 10,680	5 MHz[1]
10,700 to 11,700	80[1]
12,200 to 12,700[8]	500 megahertz
12,700 to 13,150	50 MHz
13,200 to 13,250	25 MHz
17,700 to 18,140	220 MHz[1]
18,140 to 18,142	2 MHz
18,142 to 18,580	6 MHz
18,580 to 18,820	20 MHz[1]
18,820 to 18,920	10 MHz
18,920 to 19,160	20 MHz[1]
19,160 to 19,260	10 MHz

19,260 to 19,700	220 MHz[1]
21,200 to 23,600	50 MHz[1 2]

Note 1: The maximum bandwidth that will be authorized for each particular frequency in this band is detailed in the appropriate frequency table in §101.147. If contiguous channels are aggregated in the 928-928.85/952-952.85/956.25-956.45 MHz, the 928.85-929/959.85-960 MHz, or the 932-932.5/941-941.5 MHz bands, then the bandwidth may exceed that which is listed in the table.

Note 2: For exceptions, see §101.147(s).

8.1.2 Transmitter Power: 10 GHz – 24 GHz Licensed

Table 17 – United States Transmitter Power: 10 GHz to 24 GHz Licensed

Frequency band (MHz)	Maximum allowable EIRP[1 2]
	Fixed[1 2] (dBW)
10,550 to 10,600[4]	55
10,600 to 10,680[4]	40
10,700-11,700	55
12,200-12,700[7]	50
12,700-13,200[3]	50
13,200-13,250[3]	55
14,200-14,400[8]	45
17,700-18,600	55
18,600-18,800[5]	35
18,800-19,700	[5]55
21,200-23,600[6]	55

Note 1: Per polarization.

Note 2: For multiple address operations, see §101.147. Remote alarm units that are part of a multiple address central station projection system are authorized a maximum of 2 watts.

Note 3: Also see Title 47 Part §101.145.

Note 4: The output power of a DEMS System nodal transmitter shall not exceed 0.5 watt per 250 kHz. The output power of a DEMS System user transmitter shall not exceed 0.04 watt per 250 kHz. The transmitter power in terms

of the watts specified is the peak envelope power of the emission measured at the associated antenna input port. The operating power shall not exceed the authorized power by more than 10 percent of the authorized power in watts at any time. Frequencies from 10,600-10,680 MHz are subject to footnote US265 in the Table of Frequency Allocations in §2.106 of the Commission's Rules. Stations authorized prior to April 1, 2003 to exceed the 40 dBW limit may continue to operate at their authorized output power level indefinitely, provided that neither end point of the relevant link is relocated.

Note 5: Maximum power delivered to the antenna shall not exceed −3 dBw.

Note 6: See Title 47 §101.147(s).

Note 7: The EIRP for MVDDS stations is limited to 14.0 dBm per 24 MHz (−16.0 dBW per 24 MHz). Incumbent point-to-point stations may use up to + 50 dBW except for low power systems which were licensed under §101.147(q).

Note 8: Beginning March 1, 2005, no new LTTS operators will be licensed and no existing LTTS licensees will be renewed in the 14.2-14.4 GHz band.

8.2 Canada 10 - 24 GHz Licensed Bands

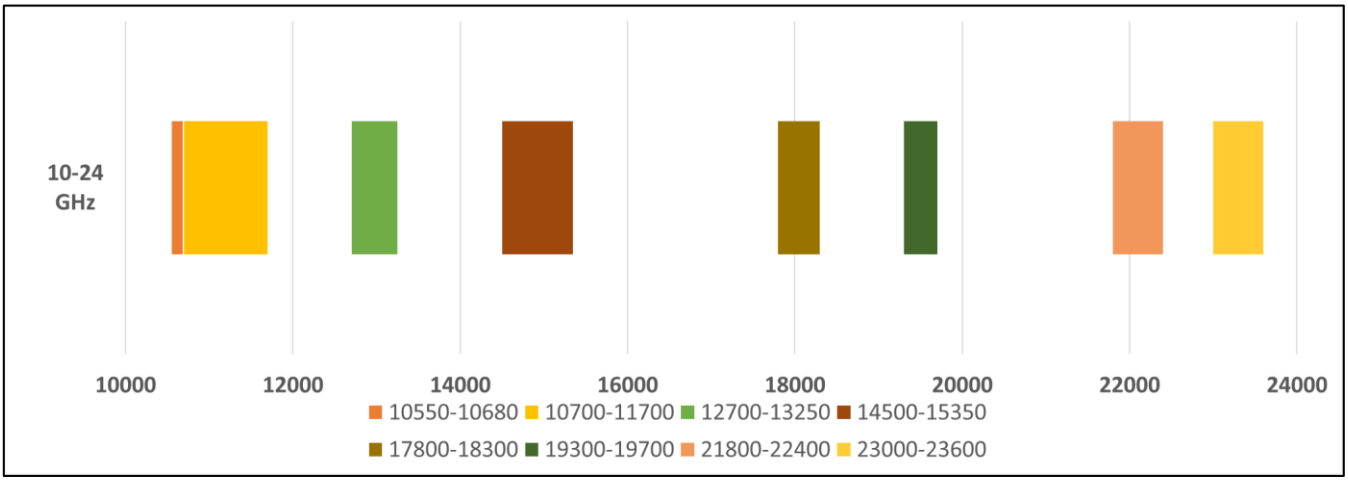

Figure 11 – Canada Licensed Microwave Bands: 10-24 GHz

8.2.1 Authorized Bandwidth: 10 GHz – 24 GHz

Table 18 – Canada Maximum Authorized Bandwidth: 10 GHz to 24 GHz Licensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
10,550-10,680	310.5	PtP and PtMP	Private	Supports MCS	10.55-10.6 and 10.6-10.68 GHz	5	1.25
10,700-11,700	310.7	PtP	Private			80	10
12,700-13,250	312.7	PtP	Private	VHCM and TV auxillary serivice; Shared with FSS	12.7-13.15, 13.15-13.2, and 13.2-13.25 GHz	56	7

14,500-15,350	314.5	PtP	Private			50	5
1780,0-18,300 GHz and 19,300-19,700	317.8	PtP	Private		17.8-18.3 GHz and 19.3-19.7 GHz	50	2.5
21,800-22,400 and 23,000-23,600	321.8	PtP	Private		21.8-22.4 GHz and 23.0-23.6 GHz	50	2.5

8.2.2 Transmitter Power: 10 GHz – 24 GHz

Table 19 – Canada Transmitter Power: 10 GHz to 24 GHz

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW per MHz)	Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)	ANSI or ETSI?
10,550-10,680	310.5	PtP and PtMP	Private	Supports MCS	10.55-10.6 and 10.6-10.68 GHz	40[6]				ANSI
10,700-11,700	310.7	PtP	Private			55[7]	na		na	ANSI
12,700-13,250	312.7	PtP	Private	VHCM and TV auxillary serivice; Shared with FSS	12.7-13.15, 13.15-13.2, and 13.2-13.25 GHz	55[2, 8,9]	na		na	ETSI

[6] Maximum power delivered to the antenna for point-to-point shall not exceed 0 dBW. For point-to-multipoint, in 10.55-10.6 GHz, maximum power delivered to the antenna shall not exceed -3 dBW, while in 10.6-10.68 GHz, maximum power delivered to the antenna shall not exceed -7 dBW for the hub station and -8 dBW for the remote station.

[7] Maximum power delivered to the antenna shall not exceed 10 dBW

[8] Maximum EIRP of +55 dBW is for VHCM. Maximum EIRP for point-topoint is +50 dBW and +45 dBW for TV pick-upchannel.

[9] As far as practicable, sites for transmitting terrestrial stations in the fixed service, employing maximum values of EIRP exceeding +45 dBW in the frequency band 12.7-13.25 GHz, should be selected so that the direction of maximum radiation of any antenna will be at least 1.5° away from the geostationary-satellite orbit, taking into account the effect of atmospheric refraction

14,500-15,350	314.5	PtP	Private			55[2, 10]	na		na	ANSI
1780,0-18,300 GHz and 19,300-19,700	317.8	PtP	Private		17.8-18.3 GHz and 19.3-19.7 GHz	55[11]	na		na	ANSI
21,800-22,400 and 23,000-23,600	321.8	PtP	Private		21.8-22.4 GHz and 23.0-23.6 GHz	55[2]	na		na	ANSI

9 10 GHz to 24 GHz Unlicensed Allocations

9.1 United States 10 GHz to 24 GHz Band

No unlicensed use of spectrum allocated in the 10 – 24 GHz allowed.

9.1.1 Authorized Bandwidth: 10 GHz – 24 GHz Unlicensed

Not applicable.

9.1.2 Transmitter Power: 10 GHz – 24 GHz Unlicensed

Not applicable.

9.2 Canada 10 GHz to 24 GHz Band Unlicensed

No unlicensed use of spectrum allocated in the 10 – 24 GHz allowed.

9.2.1 Authorized Bandwidth: 10 GHz – 24 GHz Unlicensed

Not applicable.

9.2.2 Transmitter Power: 10 GHz – 24 GHz Unlicensed

Not applicable.

10 24 GHz to 71 GHz Licensed Allocations

10.1 United States 24, 29, and 31 GHz Licensed Bands

[10] As far as practicable, sites for transmitting terrestrial stations operating in the fixed service and employing a maximum EIRP value exceeding +45 dBW in the frequency band 14.5-14.8 GHz, should be selected so that the direction of maximum radiation of the antenna will be pointed at least 1.5° away from the geostationary satellite orbit, taking into account the effect of atmospheric refraction

[11] Maximum power delivered to the antenna shall not exceed 5 dBW

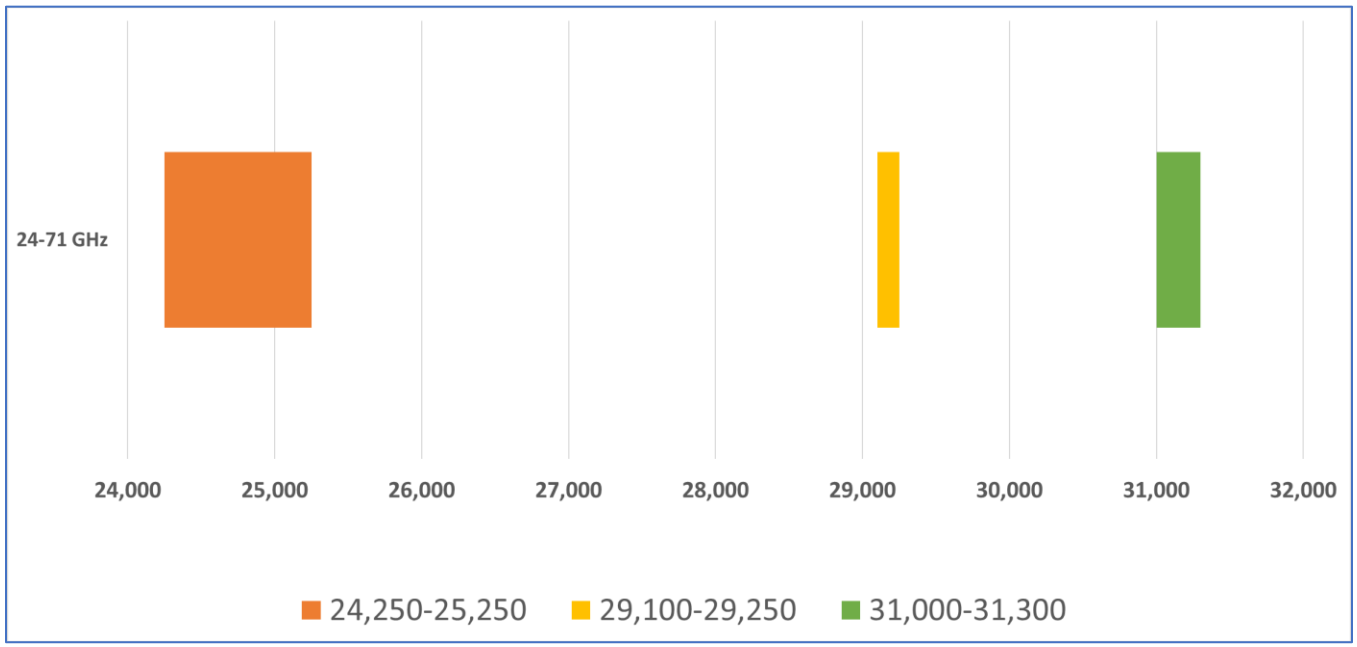

Figure 12 – United States Licensed Microwave Bands: 24 GHz to 71 GHz

Table 20 – United States Microwave Frequency Availability: 24 GHz to 71 GHz Licensed

Frequency band (MHz)	Radio service				
	Common carrier (Part 101)	Private radio (Part 101)	Broadcast auxiliary (Part 74)	Other (Parts 15, 21, 22, 24, 25, 74, 78 & 100)	Notes
24,250-25,250	CC	OFS			
29,100-29,250	LMDS	LMDS		SAT	
31,000-31,300	CC LMDS LTTS	OFS LMDS			F/M/TF.

10.1.1 Authorized Bandwidth: 24 GHz – 71 GHz Licensed

Table 21 – United States Maximum authorized bandwidth: 24 GHz to 71 GHz Licensed

Frequency band (MHz)	Maximum authorized bandwidth
24,250 to 25,250	40 MHz[12]

[12] Unwanted emissions shall be suppressed at the aggregate channel block edges based on the same roll-off rate as is specified for a single channel block in §101.111(a)(1) or in §101.111(a)(2)(ii) and (iii) as appropriate.

29,100 to 29,250	150 MHz
31,000 to 31,075	75 MHz
31,075 to 31,225	150 MHz
31,225 to 31,300	75 MHz

Note 1: For channel block assignments in the 24,250-25,250 MHz band, the authorized bandwidth is equivalent to an unpaired channel block assignment or to either half of a symmetrical paired channel block assignment. When adjacent channels are aggregated, equipment is permitted to operate over the full channel block aggregation without restriction.

10.1.2 Transmitter Power: 24 GHz – 71 GHz Licensed

Table 22 – United States Transmitter Power: 24 GHz to 71 GHz Licensed

Frequency band (MHz)	Maximum allowable EIRP[1 2]	
	Fixed[1 2] (dBW)	Mobile (dBW)
24,250-25,250	[3]+ 55	
29,100-29,250	See note 4	
31,000 to 31,075[5 6]	30 dBW/MHz	30 dBW/MHz
31,075 to 31,225[5 6]	30 dBW/MHz	30 dBW/MHz
31,225 to 31,300[5 6]	30 dBW/MHz	30 dBW/MHz

Note 1: Per polarization.

Note 2: For multiple address operations, see §101.147. Remote alarm units that are part of a multiple address central station projection system are authorized a maximum of 2 watts.

Note 3: The output power of a DEMS System nodal transmitter shall not exceed 0.5 watt per 250 kHz. The output power of a DEMS System user transmitter shall not exceed 0.04 watt per 250 kHz. The transmitter power in terms of the watts specified is the peak envelope power of the emission measured at the associated antenna input port. The operating power shall not exceed the authorized power by more than 10 percent of the authorized power in watts at any time. Frequencies from 10,600-10,680 MHz are subject to footnote US265 in the Table of Frequency Allocations in §2.106 of the Commission's Rules. Stations authorized prior to April 1, 2003 to exceed the 40 dBW limit may continue to operate at their authorized output power level indefinitely, provided that neither end point of the relevant link is relocated.

Note 4: See Title 47 §101.113(c).

Note 5: For stations authorized prior to March 11, 1997, and for non-Local Multipoint Distribution Service stations authorized pursuant to applications refiled no later than June 26, 1998, the transmitter output power shall not exceed 0.050 watt.

Note 6: For subscriber transceivers authorized in these bands, the EIRP shall not exceed 55 dBw or 42 dBw/MHz.

10.2 Canada 24 – 71 GHz Licensed Bands

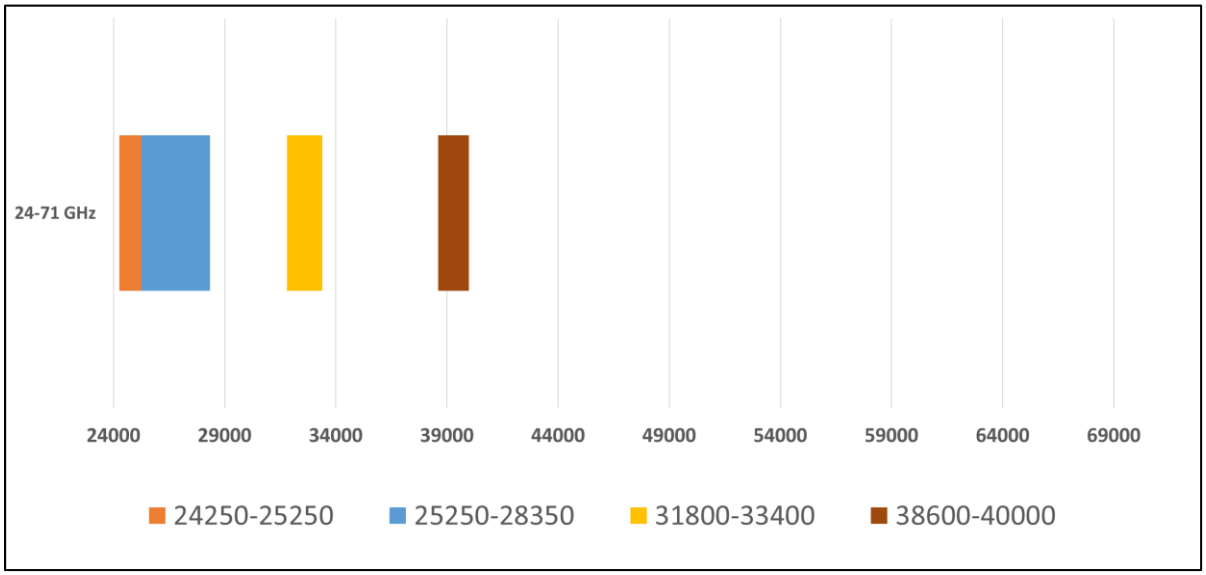

Figure 13 – Canada Licensed Microwave Bands: 24-71 GHz

10.2.1 Authorized Bandwidth: 24 GHz – 71 GHz

Table 23 – Canada Maximum authorized bandwidth: 24 GHz to 71 GHz[13]

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
24.25-25.25 GHz	324.25	PtP	Private		24.25-24.45 GHz and 25.05-25.25 GHz	40	
25.25-28.35 GHz	325.25	PtP	Private		25.25-26.5 GHz and 27.5-28.35 GHz	50	10
31.8-33.4 GHz	331.8	PtP	Private			224	14
38.6-40 GHz	338.6	PtP	Private			50	na
~~57-71 GHz~~	~~RSS-210 Annex J~~	~~PtP~~	~~Private~~	~~Unlicensed~~	-	~~not specified~~	~~not specified~~

10.2.2 Transmitter Power: 24 GHz – 71 GHz

[13] There is a moratorium on new fixed systems in 24.25-25.25 GHz, 25.25-28.35 GHz and 38.6-40 GHz in anticipation of new flexible use licensing as per ISED SLPB-003-19 “Decision on Releasing Millimetre Wave Spectrum to Support 5G”

Table 24 – Canada Transmitter Power: 24 GHz to 71 GHz

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW per MHz)	Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)	ANSI or ETSI?
24.25-25.25 GHz	324.25	PtP	Private		24.25-24.45 GHz and 25.05-25.25 GHz	55[14]		30/14[15]		ANSI
25.25-28.35 GHz	325.25	PtP	Private		25.25-26.5 GHz and 27.5-28.35 GHz	55		30[16]		ANSI
31.8-33.4 GHz	331.8	PtP	Private			55	na	-1.46	na	ETSI
38.6-40 GHz	338.6	PtP	Private			55[8]				
~~57-71 GHz~~	~~RSS-210 Annex J~~	~~PtP~~	~~Private~~	~~Unlicensed~~	-	~~52 (EIRP)~~	~~na~~	~~not specified~~	~~na~~	~~?~~

11 24 GHz to 71 GHz Unlicensed Allocations

11.1 United States 24 GHz to 71 GHz Unlicensed

[14] Transmitter power into the antenna must not exceed +10 dBW.

[15] This apply to point-to-multipoint, where maximum EIRP density is +30 dBW/MHz for subscriber station and +14 dBW/MHz for hub station.

[16] For point-to-multipoint, maximum EIRP density is +30 dBW/MHz for subscriber station and +14 dBW/MHz for hub station. In addition, for systems operating in the band 25.25-26.5 GHz and having the main beam of the transmitter within a 1.5° angle (taking into account the effect of atmospheric refraction) of the direction of any geostationary-satellite orbit (GSO) location, the EIRP density limit must be lowered to +24 dBW/MHz for point-to-point and subscriber stations in point-to-multipoint, and +8 dBW/MHz for hub station in point-to-multipoint systems. Finally, for hub station having an elevation angle θ greater than 20°, the EIRP density limit must be lowered to +14 – 10 log10(θ/5) dBW/MHz

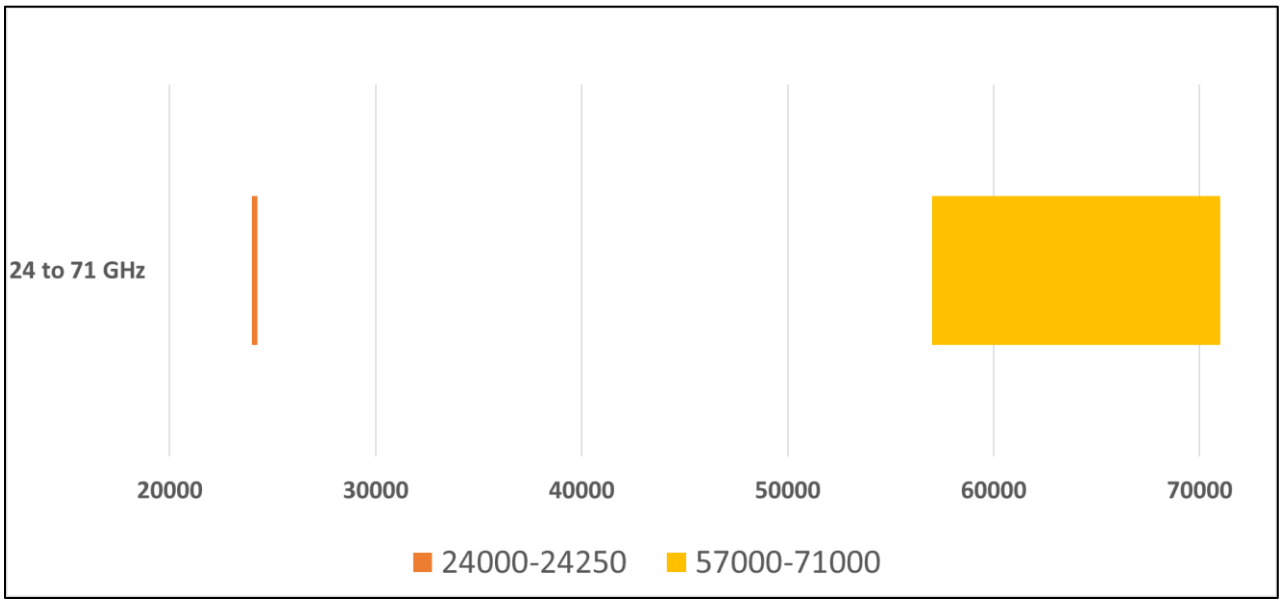

Figure 14 – United States Unlicensed Microwave Bands: 24 GHz to 71 GHz

11.1.1 Authorized Bandwidth: 24 GHz – 71 GHz Unlicensed

No rules are specified on the bandwidth.

11.1.2 Transmitter Power: 24 GHz – 71 GHz Unlicensed

Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location.

Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.
(2) Field strength limits are specified at a distance of 3 meters.

Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):

Products other than fixed field disturbance sensors and short-range devices for interactive motion sensing shall comply with one of the following emission limits, as measured during the transmit interval:

The average power of any emission shall not exceed 40 dBm and the peak power of any emission shall not exceed 43 dBm; or

For fixed point-to-point transmitters located outdoors, the average power of any emission shall not exceed 82 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The peak power of any emission shall not exceed 85 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The provisions for reducing transmit power based on antenna gain shall not require that the power levels be reduced below the limits of 40 dBm average / 43 dBm peak.

11.2 Canada 24 GHz to 71 GHz Unlicensed

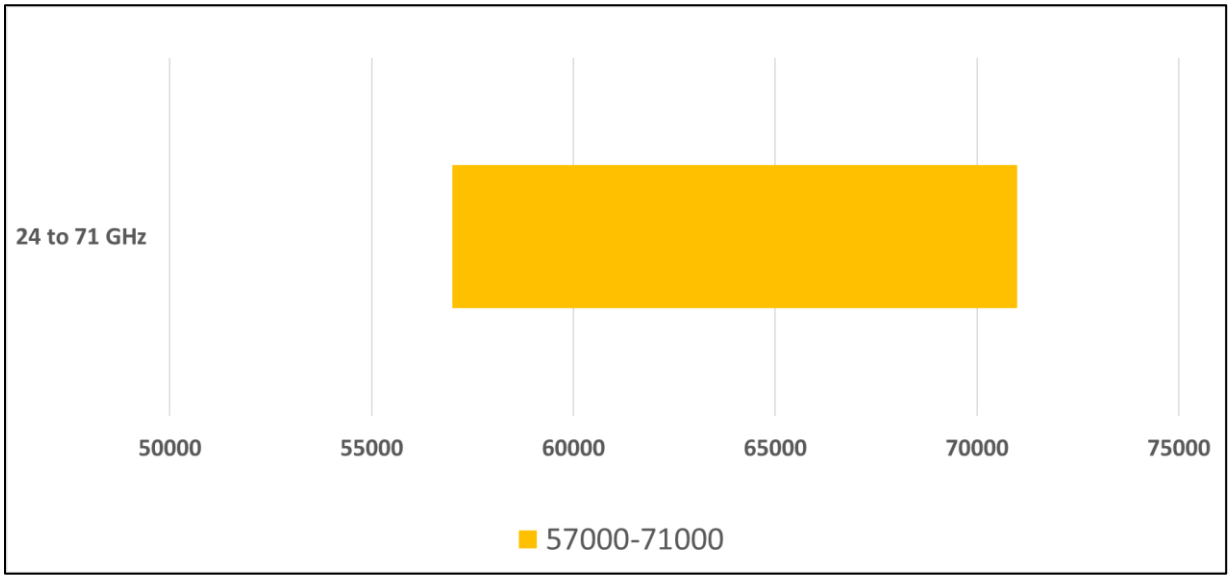

Figure 15 – Canada Unlicensed Microwave Bands: 24 GHz to 71 GHz

11.2.1 Authorized Bandwidth: 24 GHz – 71 GHz Unlicensed

Table 25 – Authorized Bandwidth: 24 GHz – 71 GHz Unlicensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
57-71 GHz	RSS-210 Annex J	PtP	Private	Unlicensed		not specified	not specified

11.2.2 Transmitter Power: 24 GHz – 71 GHz Unlicensed

Table 26 – Transmitter Power: 24 GHz – 71 GHz Unlicensed

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW per MHz)	Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)	ANSI or ETSI?
57-71 GHz	RSS-210 Annex J	PtP	Private	Unlicensed		52 (EIRP)	na	not specified	na	

12 71 GHz to 100 GHz Licensed Allocations

12.1 United States 71, 80, 90 GHz Licensed Bands

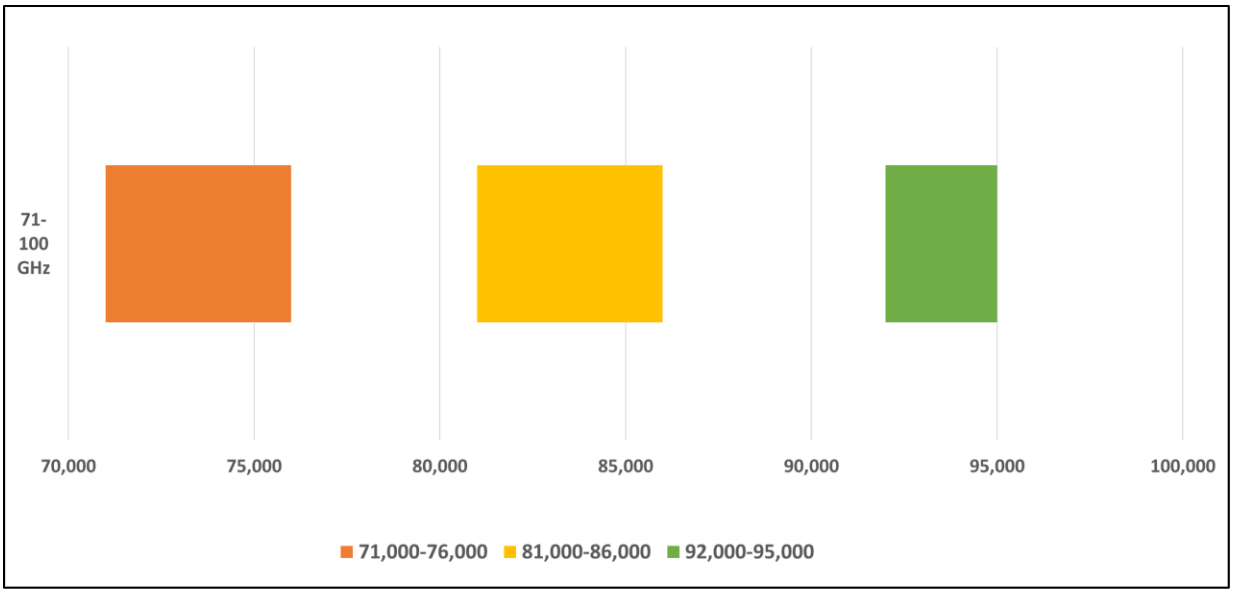

Figure 16 – United States Licensed Microwave Bands: 71, 80, 90 GHz

Table 27 – United States Microwave Frequency Availability: 71, 80, 90 GHz

Frequency band (MHz)	Radio service				
	Common carrier (Part 101)	Private radio (Part 101)	Broadcast auxiliary (Part 74)	Other (Parts 15, 21, 22, 24, 25, 74, 78 & 100)	Notes
71,000-76,000	CC	OFS		25	F/M/TF
81,000-86,000	CC	OFS		25	F/M/TF
92,000-95,000	CC	OFS		15	F/M/TF.

12.1.1 Authorized Bandwidth: 71 GHz – 100 GHz Licensed

Table 28 – United States Maximum Bandwidth: 71, 80, 90 GHz Licensed

Frequency band (MHz)	Maximum authorized bandwidth
71,000 to 76,000	5000 MHz

81,000 to 86,000	5000 MHz
92,000 to 95,000	Note 1

Note 1: To be specified in authorization. For the band 92 to 95 GHz, maximum bandwidth is licensed in one segment of 2 GHz from 92-94 GHz and one 0.9 GHz segment from 94.1 to 95 GHz, or the total of the loaded band if smaller than the assigned bandwidth.

12.1.2 Transmitter Power: 71 GHz – 100 GHz Licensed

Table 29 – United States Transmitter Power: 71, 80, 90 GHz Licensed

Frequency band (MHz)	Maximum allowable EIRP[1][2]	
	Fixed[1][2] (dBW)	Mobile (dBW)
71,000-76,000[3]	55	55
81,000-86,000[3]	55	55
92,000-95,000	55	55

Note 1: Per polarization.

Note 2: For multiple address operations, see §101.147. Remote alarm units that are part of a multiple address central station projection system are authorized a maximum of 2 watts.

Note 3: The maximum transmitter power is limited to 3 watts (5 dBW) unless a proportional reduction in maximum authorized EIRP is required under §101.115. The maximum transmitter power spectral density is limited to 150 mW per 100 MHz.

The power of transmitters that use Automatic Transmitter Power Control shall not exceed the power input or output specified in the instrument of station authorization. The power of non-ATPC transmitters shall be maintained as near as practicable to the power input or output specified in the instrument of station authorization.

12.2 Canada 71 - 100 GHz Licensed Bands

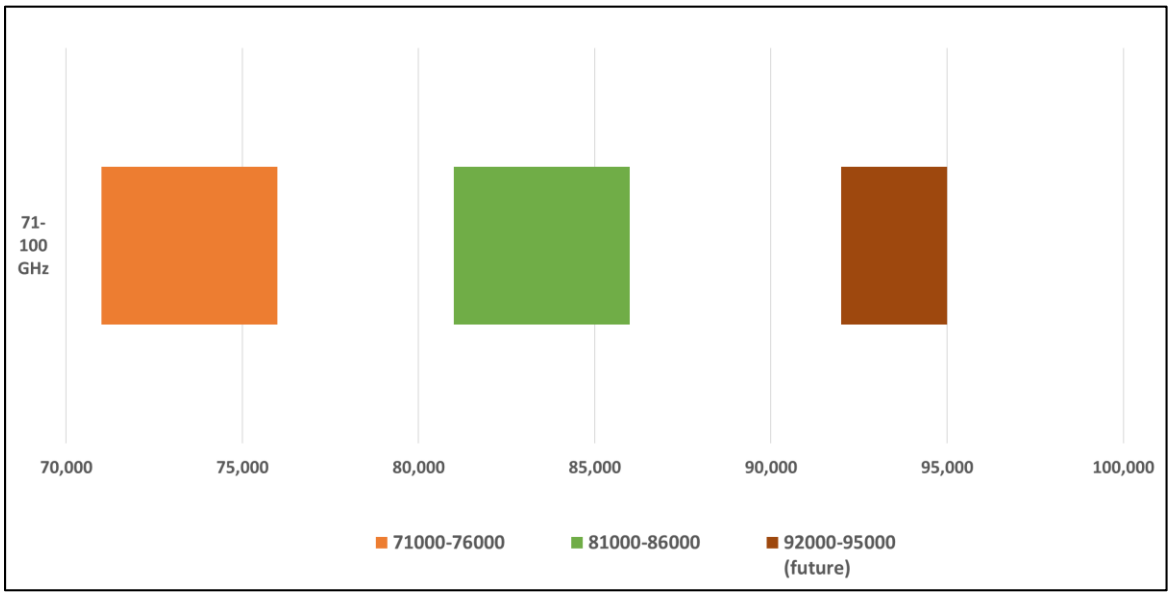

Figure 17 – Canada Licensed Microwave Bands: 71, 80, 90 GHz

12.2.1 Authorized Bandwidth: 71 GHz – 100 GHz

Table 30 – Canada Maximum Bandwidth: 71 - 100 GHz

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
71-76 GHz and 81-86 GHz	371.0	PtP	Private			4500	250
W -Band (90 GHz; future)							

12.2.2 Transmitter Power: 71 GHz – 100 GHz

Table 31 – Canada Transmitter Power: 71 - 100 GHz

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW per MHz)	Mobile [Transportable?] Max Power Spectral Density (dBW per MHz)	ANSI or ETSI?
71-76 GHz and 81-86 GHz	371.0	PtP	Private			-10	na	-33.98	na	ETSI

W -Band (90 GHz; future)										

Note: *The specific data for these sections is anticipated (future) pending Canadian regulatory approval. This is subject to change but is shown to be informative to the reader of potential spectrum changes.*

13 71 GHz to 100 GHz Unlicensed Allocations

13.1 United States 71 - 100 GHz Unlicensed

No unlicensed use of spectrum allocated in the 71 to 100 GHz

13.1.1 Authorized Bandwidth: Above 100 GHz Licensed

Not applicable.

13.1.2 Transmitter Power: Above 100 GHz Licensed

Not applicable.

13.2 Canada 71 - 100 GHz Unlicensed

No unlicensed use of spectrum allocated in the 71 to 100 GHz

13.2.1 Authorized Bandwidth: Above 100 GHz Licensed

Not applicable.

13.2.2 Transmitter Power: Above 100 GHz Licensed

Not applicable.

Note: *The specific data for these sections is anticipated (future) pending Canadian regulatory approval. This is subject to change but is shown to be informative to the reader of potential spectrum changes.*

14 Above 100 GHz Licensed Allocations

14.1 United States Above 100 GHz Licensed

No licensed spectrum allocations are currently allowed above 100 GHz.

14.1.1 Authorized Bandwidth: Above 100 GHz Licensed

Not applicable.

14.1.2 Transmitter Power: Above 100 GHz Licensed

Not applicable.

Note: *The specific data for these sections is anticipated (future) pending Canadian regulatory approval. This is subject to change but is shown to be informative to the reader of potential spectrum changes.*

14.2 Canada Above 100 GHz Licensed Bands[17]

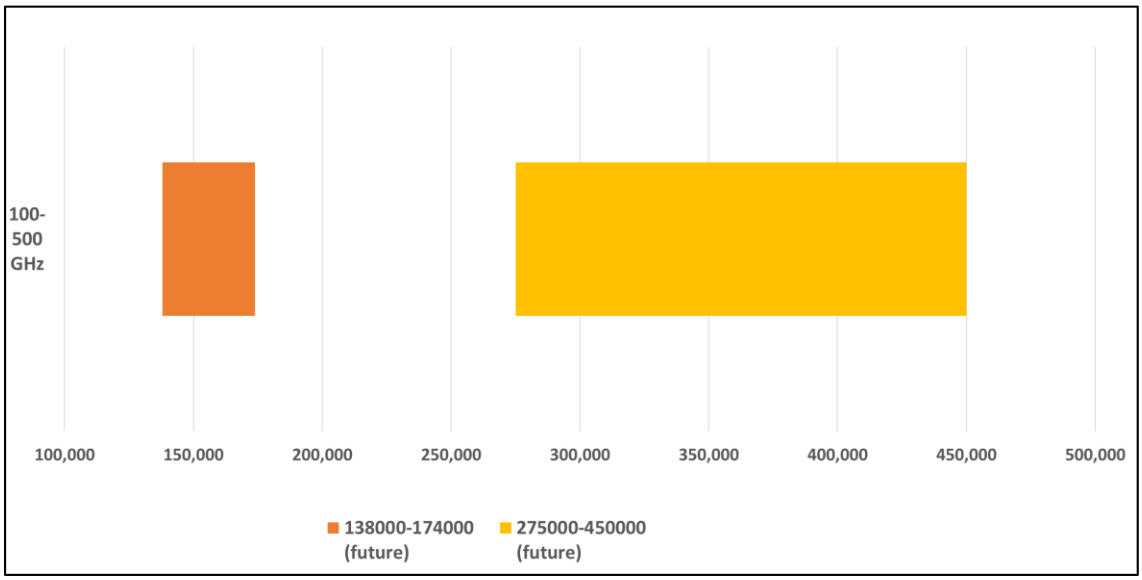

Figure 18 - Canada Microwave Bands: Above 100 GHz Licensed

14.2.1 Authorized Bandwidth: Above 100 GHz

Table 32 – Canada Maximum Bandwidth >100 GHz

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Maximum Bandwidth (MHz)	Minimum Bandwidth (MHz)
D-Band (138-174 GHz; future)							
275-450 GHz (future)							

14.2.2 Transmitter Power: Above 100 GHz

Table 33 – Canada Transmitter Power: >100 GHz

Frequency Range (MHz)	SRSP No.	PtP and/or PtMP	Radio Service	Notes	Frequency Sub-Band	Fixed Max EIRP (dBW)	Mobile[transportable?] Max EIRP (dBW)	Fixed Max Power Spectral Density (dBW	Mobile [Transportable?] Max Power Spectral Density	ANSI or ETSI?

[17] ISED did not publish yet any decision on use of frequency range above 100 GHz for fixed service and whether it would be licensed or unlicensed. Canada is participating on ITU-R WP5C activities developing band usage recommendations in 92-114.25 GHz and 130-174.8 GHz. Recommendation on band usage for 275-450 GHz is for future work in ITU-R.

								per MHz)	**(dBW per MHz)**	
D-Band (138-174 GHz; future)										
275-450 GHz (future)										

15 Above 100 GHz Unlicensed Allocations

15.1 United States Above 100 GHz Unlicensed

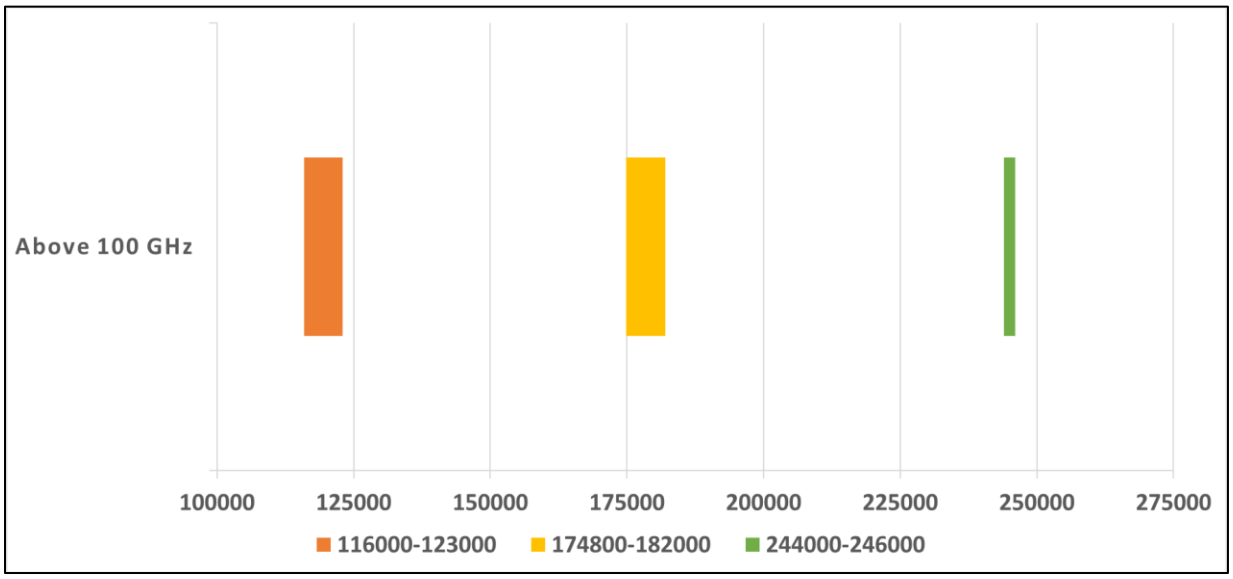

Figure 19 – United States Unlicensed Microwave Bands: Above 100 GHz

15.1.1 Authorized Bandwidth: Above 100 GHz Unlicensed

Transmitters with an emission bandwidth of less than 100 MHz must limit their peak radiated power to the product of the maximum permissible radiated power (in milliwatts) times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (*e.g.,* for frequency hopping devices).

15.1.2 Transmitter Power: Above 100 GHz Unlicensed

(a) Operation on board an aircraft or a satellite is prohibited.

(b) Emission levels within the 116-123 GHz, 174.8-182 GHz, 185-190 GHz and 244-246 GHz bands shall not exceed the following equivalent isotropically radiated power (EIRP) limits as measured during the transmit interval:

(1) The average power of any emission shall not exceed 40 dBm and the peak power of any emission shall not exceed 43 dBm; or

(2) For fixed point-to-point transmitters located outdoors, the average power of any emission shall not exceed 82 dBm and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The peak power of any emission shall not exceed 85 dBm and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The provisions in this paragraph (b)(2) for reducing transmit power based on antenna gain shall not require that the power levels be reduced below the limits specified in paragraph (b)(1) of this clause.

(3) The peak power shall be measured with a detection bandwidth that encompasses the entire occupied bandwidth within the intended band of operation, *e.g.,* 116-123 GHz, 174.8-182 GHz, 185-190 GHz or 244-246 GHz. The average emission levels shall be measured over the actual time period during which transmission occurs.

15.2 Canada Above 100 GHz Unlicensed

At this time, ISED (Canadian spectrum regulator) has not indicated its intent to open the frequency range above 100 GHz and whether it would be licensed or unlicensed. Please refer to Clause 15.2 for more information.

15.2.1 Authorized Bandwidth: Above 100 GHz Unlicensed

Not applicable.

15.2.2 Transmitter Power: Above 100 GHz Unlicensed

Not applicable.