Point-to-Point Connectivity in the 4.9 GHz Public Safety Band

CONTENTS

FCC and the Interference-Free Public Safety RF Band

In 2003, the US Federal Communications Commission (FCC) authorized a 50-MHz radio frequency spectrum from 4940 to 4990 MHz for non-commercial use by state and local governments and public safety organizations that are dedicated to the protection of life, health or property. By specifying licensed use of the band only for authorized government and non-government public safety groups (police, fire, search and rescue teams, EMS squads, private ambulance companies, municipal utilities, etc.), the FCC ensured a space in the airways free from interference by corporate or general public communications.

The FCC categorized approved use of the 4.9 GHz band into two definitions:

- Primary, which allows unattended and continuous use of the band for voice, data and video communications and mobile operations – hot spots, point-to-multi-point, base/mobile/portable operations, temporary fixed point-to-point
- Secondary, which allows operation of permanent (more than a year) point-to-point links, and which comes with requirements to mitigate interference to primary uses

Use of the 4.9 GHz band in aircraft, normally restricted to protect radio astronomy observatories from interference, can be permitted under a special waiver. There are also some quiet zones in which 4.9 GHz operation is not allowed – typically border areas and some military sites. For specific locations, consult the FCC Rules Part 2, Section 106, under Footnote US311 for Radio Astronomy Quiet Zones.

Qualified Licensees and Uses

All communications over the 4.9 GHz Public Safety band are limited to protection of life, health or property. The FCC assigned the 4940-4990 MHz frequency band for use by the following public safety agencies:

- Cities, towns and municipalities
- Counties
- States
- Non-governmental entities (NGOs) sponsored by a qualified government agency, such as private ambulance companies
- Organizations with a critical infrastructure, such as power companies and pipelines, only under a public safety entity's license and under a Memorandum of Understanding (MOU).

Frequency Coordination

Due to the critical nature of communications in public safety applications, the federal provisions were designed specifically to reduce or eliminate interference, both "externally" (blocking interference from commercial entities and the general public) and "internally" (reducing interference through a carefully orchestrated process of coordination among public safety organizations within a specified region). FCC regulations clarify the issue of interference as follows:

> **§ 90.1209 Policies governing the use of the 4940–4990 MHz band:**
>
> (a) Channels in this band are available on a shared basis only and will not be assigned for the exclusive use of any licensee.
>
> (b) All licensees shall cooperate in the selection and use of channels in order to reduce interference and make the most effective use of the authorized facilities.

Within a region, the 50 MHz of the spectrum is shared among the licensees. Thus, an FCC-mandated frequency coordination process was put in place to reduce spectrum interference among the public safety agencies themselves. While the FCC established Regional Planning Committees across the country with the authority to draft a Regional Plan, licensees within an area have the option of forming ad-hoc committees or appointing local band coordinators to manage the frequency coordination process in that area. Regardless of who manages coordination, the FCC stresses that licensees must cooperate in the selection and use of channels within the public safety spectrum to reduce interference and make efficient use of the band.

FCC Licensing Information

NOTE: The following information is excerpted from Subpart Y – Regulations Governing Licensing and Use of Frequencies in the 4940–4990 MHz Band. SOURCE: FCC Rules Part 90, Subpart Y, 90.1207.

(c) A 4940–4990 MHz band license gives the licensee authority to operate base and mobile units (including portable and handheld units) and operate temporary (1 year or less) fixed stations.

(d) A 4940–4990 MHz band license does not give the licensee authority to operate permanent fixed point-to-point stations. Licensees choosing to operate such fixed stations must license them individually on a site-by-site basis. Such fixed operation will be authorized only on a secondary, non-interference basis to base, mobile and temporary fixed operations.

Permanent and temporary fixed stations are subject to the requirements of paragraph (b) of this section (relative to environmental impact on wilderness areas, wildlife preserves, endangered species, historic sites, Indian religious sites, flood plains, etc., as well as ERP limits, quiet zones, international border zones, FAA tower restrictions, military training areas, etc.)

Obtaining a License

Qualified users can obtain a license at no cost via the online Universal Licensing System (ULS) website which is operated by the FCC. The application process can be completed at: http://wireless.fcc.gov/uls/

Network operators will need an FCC Registration Number (FRN) to login to the FCC site. Operators can apply for an FRN at: https://svartifoss2.fcc.gov/coresWeb/publicHome.do

The 4.9 GHz licensing application process is done within a Java application. Each page is validated before allowing the applicant to continue to the next section. Because each applicant's situation and requirements are unique, the steps to complete an application will vary on a case-by-case basis. In addition, the FCC's application process can change at any time without notice. If you have any questions about the FCC rules, the ability of a specific user to hold a 4.9 GHz license and/or the FCC licensing process for 4.9 GHz stations and systems, contact your Motorola Government Relations Office (GRO) representative or one of the many FCC licensing preparation firms for assistance.

Typically, applicants receive licenses within a few days from the date that the application is submitted. The license grant covers all channels within the 4.9 GHz Public Safety band and is valid for 10 years.

The Case for Point-to-Point Deployments in Public Safety

Because many public safety applications employ point-to-multipoint and mesh solutions, and because the FCC places restrictions on permanent point-to-point operations, at first glance it may appear that there is no role for a point-to-point solution in public safety. However, there are several applications that are cost-effectively and reliably served by point-to-point wireless systems, including:

- Backhaul for point-to-multipoint and Mesh networks
- Backhaul for network voice, video and data traffic in general
- Rapid deployment of temporary networks for events
- Temporary hot spots for emergencies and disasters
- Redundancy and additional capacity for leased lines

In fact, point-to-point wireless is an ideal solution as an immediate response to a crisis. Under a primary license-holder's authority, a temporary deployment (less than a year for a PTP link) can be completed in a matter of hours. If the operation will last more than one year, a fixed PTP license is required on a link-by-link basis. In such cases, the user can immediately deploy the point-to-point links, establishing the necessary backhaul, hot-spot communications or redundancy, and have up to a year to complete the licensing process. Permanent fixed point-to-point stations that are licensed on a site-by-site basis must be placed in operation within 18 months of the licensing grant date or the authorization for that station cancels automatically.

Because of the 4.9 GHz Public Safety licensing process, the outside world cannot share the band. As a result, a licensed point-to-point wireless solution will reduce interference from the "outside" world – those outside the band won't crowd traffic in the band. If such a solution is also spectrally efficient, it will require less channel bandwidth and, therefore, greatly reduce the amount of impact within the 50 MHz of shared spectrum

Motorola Point-to-Point Wireless Ethernet Bridges in Public Safety

Operating in the 4.9 GHz band, Motorola's MOTOwi4 Point-to-Point PTP 49400 wireless Ethernet bridges are designed to support a variety of public safety applications, providing up to 99.999% availability, even in non-line-of-sight environments, across long distances, over open terrain or water and through extreme weather conditions.

Like the other point-to-point products in the Motorola MOTOwi4 portfolio of wireless solutions, the PTP 49400 system offers a combination of field-proven advanced technologies which are unique in the industry. Advanced Spectrum Management with *intelligent* Dynamic Frequency Selection, automatic power control and proactive e-mail and SNMP notifications of channel changes due to interference all provide the means for users to comply with the FCC's channel usage rules while greatly reducing interference to base, mobile and temporary operations.

Even when placed within clusters of radio links, such as in a video surveillance situation, the MOTOwi4 PTP 49400 units are highly tolerant to interference because of the following technology:

- **Small Channel Size:** Motorola's PTP 49400 radios require only 10 MHz of channel space to operate.

- **Advanced Spectrum Management with *Intelligent* Dynamic Frequency Selection** allows the PTP 49400 systems to self-select the frequency over which they can sustain the highest data rate at the highest availability.

  Channel frequencies can be set either manually or dynamically. The Motorola PTP 49400 monitors all available radio channels – 500 times a second – and dynamically selects the frequency over which it can sustain the highest data rate at the best quality. This means the unit is very likely to find a clear channel (without operator intervention) even in a crowded space.

  In the Fixed Frequency mode, the operator can preset (lock in) link frequency so that the module stays within the best channel known to be available.

- **Automatic Power Control:** The higher the bandwidth, the more the transmitter power increases, impacting radiation emissions into the environment. Therefore, the FCC specifies a sliding scale for power limits. The MOTOwi4 PTP 49400 bridges have an automatic power control feature that keeps the units operating within the defined ranges of the sliding scale.

  To be specific, the scale allows 20 dBm (100 mW) for a 1 MHz signal up to 33 dBm (2 watts) for a 20 MHz signal, with a directional antenna gain limit of 9 dBi. For point-to-point operations, the maximum allowable antenna gain is 26 dBi. The PTP 49400's transmit power is adaptive, varying between -10 and 23 dBm according to selected modulation and radio path (gain and maximum transmit power may vary based on regulatory domain), with an integrated antenna gain of 22 dBi or an external ("Connectorized") antenna gain up to 28 dBi.

Regulatory Impact on MOTOwi4 PTP 49400 Deployments

Point-to-point systems may operate under a *temporary* or *permanent* basis. *Temporary* links are ones which operate for one year or less. Point-to-point links are excellent solutions for temporary hot spots and temporary fielded networks. All temporary links must operate under a primary license-holder's authority and, in such cases, no separate license is required.

Permanent links are ones which will operate for more than one year in the same location. These links are excellent for backhaul, redundancy and leased-line replacements. All permanent point-to-point links require a secondary license on a link-by-link basis with up to six sites per call sign. The license for point-to-point fixed links is free of charge and is valid for 10 years. Permanent links must be placed in operation within 18 months of the licensing grant date. Because the Motorola PTP 49400 systems can be deployed very quickly – typically, in a matter of hours – losing authorization due to the length of time required to deploy a system is not an issue.

Public safety agencies can deploy a PTP 49400 solution immediately and have up to one year to complete the site licensing application for operation. However, as soon as it is decided that a point-to-point link will remain, or is intended to remain, at the same location for more than one year, the fixed site must be licensed on a secondary basis. Permanent fixed operations are secondary to mobile operations in the 4.9 Public Safety band.

FCC Plan for the 4.9 GHz Band

The following channel center frequencies are permitted, per FCC rules (90.1213), to be aggregated to channel bandwidths of 5, 10, 15 or 20 MHz, with 20 MHz as the maximum bandwidth of a 4.9 GHz channel

CENTER FREQUENCY (MHZ)	CHANNEL NOS.	CHANNEL BANDWIDTH
4940.5	1	1 MHz
4941.5	2	1 MHz
4942.5	3	1 MHz
4943.5	4	1 MHz
4944.5	5	1 MHz
4947.5	6	5 MHz
4952.5	7	5 MHz
4957.5	8	5 MHz
4962.5	9	5 MHz
4967.5	10	5 MHz
4972.5	11	5 MHz
4977.5	12	5 MHz
4982.5	13	5 MHz
4985.5	14	1 MHz
4986.5	15	1 MHz
4987.5	16	1 MHz
4988.5	17	1 MHz
4989.5	18	1 MHz

End-to-End Wireless Solution in the Public Safety Band

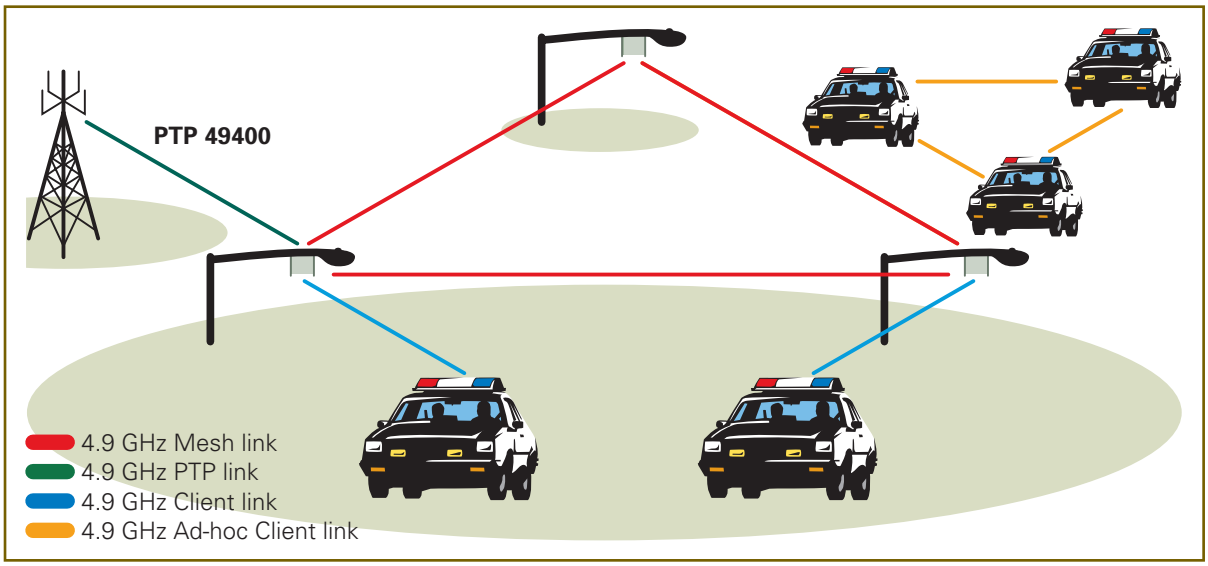
With the introduction of Motorola's MOTOwi4 PTP 49400 wireless Ethernet bridges, mission critical, end-to-end communication has now become a reality. Because the PTP 49400 systems are fully compatible with other public safety products in the MOTOwi4 portfolio, the bridges can seamlessly integrate with Motorola's 4.9 GHz MOTOMESH products to provide backhaul capacity for high-bandwidth voice and video applications.

As shown in the following diagram, Motorola also offers Vehicle Mounted Modems and ML900 laptops with integrated 4.9 GHz Wireless Modem Cards for instant communication with the MOTOMESH 4.9 GHz infrastructure and Ad-Hoc communication with other 4.9 GHz wireless modem-card-equipped laptops. In addition, customers can be assured that their sensitive data always stays within the licensed band throughout the network.

Summary

The 4.9 GHz public safety spectrum allows authorized entities to deploy critical services without interference, including permanent "hot-spot" systems in high-interference RF areas or temporary incident command centers at ground-zero sites.

The Motorola MOTOwi4 PTP 49400 bridges can provide immediate, intelligent interoperability across agencies, regions and networks and can seamlessly integrate with Motorola's Point-to-Multipoint and Mesh solutions. PTP 49400 systems offer up to 35 Mbps data throughput, delivering high-bandwidth voice, video and data traffic for government agencies and first responders alike. Typically, the return on investment is less than one year – faster than the required licensing time for permanent point-to-point installations.



MOTOWI4

The Motorola Point-to-Point Wireless Ethernet Bridges – PTP 400 Series – are part of Motorola's MOTOwi4 portfolio of innovative wireless broadband solutions that create, complement and complete IP networks. Delivering IP coverage to virtually all spaces, the MOTOwi4 portfolio includes Fixed Broadband, WiMAX, Mesh and Broadband-over-Powerline solutions for private and public networks.

APPENDICES

Appendix A: Filing for a 4.9 GHz License

Eligible entities can apply for a 4.9 GHz license using the FCC's online application system, the Universal Licensing System. Eligible entities interested in obtaining 4.9 GHz licenses can either apply online or contact one of the many FCC licensing preparation firms for assistance.

Eligibility for a 4.9 GHz license is limited to public safety entities, and communications on the band must be limited to the protection of life, health or property. Cities, towns, counties, states and municipal utilities are all eligible to hold 4.9 GHz licenses. Certain non-governmental entities (NGOs), such as private ambulance companies, can be licensed to operate in the 4.9 GHz band but must be sponsored by a qualified government agency. In addition, organizations with a critical infrastructure, such as power companies and pipelines, can utilize the band under a public safety entity's license and under a Memorandum of Understanding (MOU).

Each 4.9 GHz license is granted for the entire 50 MHz available in the band and all primary licensees share the band equally – there are no exclusive assignments. Licenses in the 4.9 GHz band are granted to cover the licensee's legal jurisdiction, e.g., citywide, countywide and statewide.

All 4.9 GHz stations and systems require an FCC license, and some operate on a secondary non-interfering basis to other users. If the applicant is licensing a permanent fixed point-to-point system (whose operations are secondary to other operations in the band), then each permanent fixed site must be listed individually on the license application giving complete information about the site.

The application process can be completed at: http://wireless.fcc.gov/uls/

Network operators will need an FRN to login to the FCC site. Operators can apply for an FRN at: https://svartifoss2.fcc.gov/coresWeb/publicHome.do

Because each applicant's specific situation is unique, the steps to complete an application will vary on a case-by-case basis. The FCC assigns each application a file number for tracking purposes. Network operators will receive a granted license within a short period of time. Typical response time is in a matter of days.

The above information reflects FCC rules in effect at the time of publication. Please contact your Motorola Government Relations Office (GRO) representative or an FCC licensing preparation firm if you have questions about the FCC rules, the ability of a specific user to hold a 4.9 GHz license, and/or the FCC licensing process for 4.9 GHz stations and systems.

Appendix B: Informational Resources

- FCC website – www.fcc.gov
- National Public Safety Telecommunications Council – www.npstc.org