

The 4.9 GHz Spectrum and Municipal Utilities

**A Technology Brief
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Although the Federal Communications Commission (FCC) has not allocated radio spectrum specifically to utilities it does allow municipal utilities to share the licensed 4.9 GHz Public Safety band. This Technical Brief provides an overview of the 4.9 GHz spectrum and presents some of Tropos Networks' solutions that are available for this band. It also covers how a municipal utility can take advantage of this valuable resource for Smart Grid communications.

The Utility Telecom Council (UTC) recently proposed a number of changes to the FCC that would make it much easier for utilities to use the 4.9 GHz band. But even without rule changes, a municipal utility can obtain access to this licensed spectrum.

Licensed Spectrum

Before the introduction of modern signal processing technologies the only method for ensuring that radio spectrum users would be free from the effects of interference was to assign individual users an exclusive right to the spectrum through a process called licensing. In the United States the FCC grants licenses to spectrum users in many ways, but common examples of licensed spectrum are broadcast radio and television, cellular phone service and most microwave radio. These licenses often have high costs through auctions and fees. In the past there was simply no way to overcome interference other than segregation of the spectrum users. Modern radio technology offers many techniques that allow for many users to share the same spectrum, overcoming the impact of interference. These techniques have enabled the widespread use of unlicensed spectrum in the 902-928 MHz, 2.4 GHz and 5.8 GHz bands. For example, Wi-Fi communications as we know it would not be possible without the advanced signal processing that is used to avoid interference.

But having licensed spectrum does give the user some assurance that spectrum will be available. For this reason public safety organizations have been granted licenses at a number of frequencies, one of which is 4.9 GHz.

About the 4.9 GHz Frequency Band

The FCC has allocated the 4.9 GHz band to public safety services (as defined in Part 90 rule section 90.523). All state and local government entities in the United States are eligible for licenses, including municipal utilities. The 4.9 GHz band comprises 50 MHz of spectrum from 4.940 GHz to 4.990 MHz.

Use of the band is open to voice, data and video communications and must be related to the protection of life, health and property. The primary uses of this band are:

- ❖ Point-to-multipoint
- ❖ Hot spots
- ❖ Temporary fixed point-to-point

Permanent fixed point-to-point systems are permitted as secondary users.

The FCC defines the channelization of the band into 18 channels (8 5 MHz channels and 10 1 MHz channels). These channels can be aggregated to allow channel bandwidths of 5, 10, 15 or 20 MHz. The output power allowed by the FCC varies with the size of the channel being used, but is typically one to two watts (30 to 33 dBm) EIRP. This power level is adequate for most types of communications equipment and is especially good for mesh communications technologies.

The 4.9 GHz band is channelized as follows:

Licensing is accomplished through a simple on-line process and there are no charges for a license.

channel	bandwidth (MHz)	center frequency (MHz)	channel	bandwidth (MHz)	center frequency (MHz)
1	1	4940.5	10	5	4967.5
2	1	4941.5	11	5	4972.5
3	1	4942.5	12	5	4977.5
4	1	4943.5	13	5	4982.5
5	1	4944.5	14	1	4985.5
6	5	4947.5	15	1	4986.5
7	5	4952.5	16	1	4987.5
8	5	4957.5	17	1	4988.5
9	5	4962.5	18	1	4989.5

There are, however, some geographical restrictions on the use of the band. The U.S. Navy uses frequencies that are adjacent to the 4.9 GHz band for Cooperative Engagement Capability (CEC) operations in narrow areas along the east, west and gulf coasts and in the entire state of Hawaii. The effect of this is that a licensee may experience interference in the lower channels of the band. Additionally, there are a small number of radio astronomy sites throughout the U.S. These sites must be protected from interference although most terrestrial uses of the 4.9 GHz band for public safety and smart grid applications will not interfere with radio astronomy applications.

Tropos Solutions for the 4.9 GHz Band

Tropos Networks has been manufacturing products with 4.9 GHz radios for over 5 years. Our line of 4.9 GHz products include fixed and mobile wireless routers and Point-to-Point (PTP) and Point-to-Multipoint (PTMP) directional radios that are used primarily by public safety agencies today. The 4.9 GHz band offers an excellent alternative for building private smart grid communication networks for municipal utilities that desire to use licensed spectrum.

The Tropos GridCom network architecture for the smart grid is a multi-use, broadband foundation that delivers extremely low latencies, often in the range of one millisecond, and high bandwidth for a wide range of applications such as:

- ❖ AMI data backhaul from AMI collectors
- ❖ Distribution Automation
- ❖ Demand Response
- ❖ Substation Automation
- ❖ Video Security
- ❖ Mobile Workforce

Tropos offers one of its two-radio fixed mesh routers, the 7320, in a 4.9 GHz version, the 7329 Mesh Router. This router uses a 4.9 GHz radio in place of the 5.8 GHz radio normally installed in a 7320. With these routers a mesh network can be built that uses both the 4.9 GHz licensed and the 2.4 GHz unlicensed bands for router-to-router communications, with the routers dynamically choosing the best path based on signal strength, packet loss, hop count to a gateway and other parameters. The 2.4 GHz band is retained to provide better non-line-of-sight coverage and connectivity to authorized Wi-Fi wireless clients. The 4.9 GHz band provides licensed router-to-router communications paths that a utility can rely on to be free from interference at times of critical operation.

The Tropos 4329 Mobile Mesh Router provides mobile connectivity, extending the Tropos mesh. A 4329 installed in a utility vehicle allows the crew to have access to the network through the mobile router, overcoming the limitations of low-power Wi-Fi devices such as laptop computers. The 4329 is capable of reporting GPS coordinates from an optional GPS receiver over the network for vehicle location purposes.

Tropos Point-to-Point and Point-to-Multipoint (PTP/PTMP) Directional Radio products are also available for use in the 4.9 GHz band. Tropos PTP/PTMP radios can be used for high bandwidth PTP applications such as connectivity to substations. They can be used in PTMP configurations to provide connectivity to mesh clusters and to smart grid devices such as reclosers, capacitor bank controllers and voltage regulators.

Conclusion

Networks built using 2.4 GHz and 4.9 GHz offer extremely high bandwidth and low latency and have the added benefit of having a large portion of their available bandwidth protected from interference through licensing. The actions of the FCC give municipal utilities a unique advantage with low cost access to licensed spectrum for smart grid networks – an advantage that can be acted on now with available products using proven technology. Tropos Networks has installed smart grid networks at a number of municipal utilities and is ready to help others achieve the goals of their smart grid strategy.

Tropos understands the licensing process and can help municipal utilities obtain licenses and effectively deploy systems.



555 Del Rey Avenue • Sunnyvale, CA 94085 • tel 408.331.6800 • fax 408.331.6801 • www.tropos.com • sales@tropos.com