



# Licensed Versus Unlicensed Wireless



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## Introduction

Although licensed- and unlicensed-band equipment can operate cooperatively to serve the wide variety of applications for wireless communications, there has been a long-standing debate over which is the better technology. Now this licensed-versus-unlicensed debate should be reconsidered in light of new technologies that provide high-availability links in the unlicensed spectrum.

Radio technology has changed dramatically in the last 20 years. Many of the wireless technologies available today have been developed – or declassified by the military – since only the mid-1980s. As is typical with most innovation, these technologies have already delivered price-performance benchmarks unmatched by traditional products, and continue to deliver improvements in price-performance each year. In addition to significant increases in speed, the last 20 years have brought tremendous improvements in interference mitigation, spectrum management, compression, complex modulation and receiver techniques. All of these improvements have made performance for equipment that operates in the unlicensed band significantly better...making the *“licensed is better”* point-of-view more myth than reality.

Licensed-band wireless Ethernet operates within the part of the radio spectrum (e.g., 6.0 GHz in the U.S. as well as 50 MHz of the 4.9 band available for public safety) designated by government regulators to be reserved for individual license holders. Licensed operators are permitted exclusive use of part of the band over an assigned geographic area. With exclusive rights, a license holder should be able to operate without interference or spectrum crowding caused by other operators transmitting over the same frequency in the same geographic area. Less interference should translate into higher throughput and better link performance.

The unlicensed part of the spectrum (e.g., 5.4 and 5.8 GHz in the U.S.) does not promise exclusive use of the band. However, it does eliminate the delay and expense of obtaining a license. Unlicensed equipment (radios and antennas) also tends to be much less expensive to buy and install. In addition, unlicensed links are not restricted to a specific geographic area. Typically, they can be deployed at the owner's discretion, offering greater flexibility for today's providers and telecoms to serve mobile and virtual enterprises.

Even with all the technological improvements in unlicensed systems, many service providers, utilities, and other organizations remain partial to licensed microwave links, largely based on three assumptions:

### **Assumption #1:**

#### **A license protects me from interference.**

Licensed band frequencies require the user of that frequency to secure and maintain an FCC license. Because the license holder is granted exclusive rights to a portion of the band in a given geographic area, the belief is that communications will be free from interference and problems.

### **Assumption #2:**

#### **I'll get better performance with licensed-band systems.**

Licensed band equipment has traditionally been high-end equipment with high prices, which, in turn, have been associated with high reliability.

### **Assumption #3:**

#### **I'll get better service and support from a vendor of licensed systems.**

The providers of licensed band equipment typically sell directly to end users and, as a result, the perception is that they provide better service and support.

Let's consider each of these beliefs in turn.

### **Assumption #1: A License Protects Me from Interference.**

Although many organizations have successful, interference-free wireless operations – both licensed and unlicensed – challenges can occur. As an example, one manufacturer of licensed-band equipment reported that they could identify existing licenses for only a percentage of their licensed-band equipment. While there may be a variety of reasons why certain installations are not registered, the point is that the mechanisms for tracking licensed links are insufficient.

Furthermore, the responsibility for addressing any confusion or problems associated with operations in a licensed band lies with the owner of the frequency. That owner must identify the specific problem and the offending party. Having a license simply means that the owner has recourse in the courts in the event of problems. In such situations, the owner has no assurance that complaints will be resolved quickly and must bear the cost of resolving disputes.

Rather than the lengthy, costly legal battles which licensed operators can face, license-free operators rely on the wireless equipment's ability to work in noisy environments and in proximity to other products. Such reliance has been a key driver in the development of technologies to improve the performance of unlicensed products.

In the drive to improve unlicensed performance, Motorola's point-to-point (PTP) solutions have demonstrated outstanding success due to a combination of innovative technologies that is unique among license-free products, including:

#### **Spectrum Efficiency**

The Motorola PTP 600 Series Point-to-Point Wireless Ethernet Bridges use only 30 MHz of bandwidth to carry up to 300 Mbps because the systems are more spectrally efficient than comparable products. This is like making the unlicensed band considerably larger, resulting in much less crowding in the band and much less chance for interference to get in the way of data.

#### **Interference Mitigation**

When Motorola point-to-point radios do encounter interference, they automatically apply multiple mitigation techniques to reduce the effects of interference on the signal:

- **Advanced Spectrum Management with *Intelligent Dynamic Frequency Selection (i-DFS)*** – Motorola point-to-point solutions self-select the frequency over which they can sustain the highest data rate at the highest availability
- **Adaptive Modulation** – Motorola point-to-point solutions self-select the modulation scheme over which they can sustain the highest data rate (64QAM, 16QAM, BPSK, QPSK, Single FEC, Multiple FEC)
- **Automatic Interference Polarization Rejection** – The systems will automatically reject a strong interferer received on one polarization

#### **MIMO and *Intelligent OFDM***

Motorola is the only provider to combine MIMO (Multiple-Input Multiple-Output), OFDM (Orthogonal Frequency Division Multiplexing) and advanced signal-processing algorithms in its point-to-point systems. This unique combination allows Motorola to create simultaneous parallel signals between pairs of transceivers without losing spectrum efficiency. In adverse conditions, the parallel links can be used redundantly to vastly increase the likelihood data will get through. In clear line-of-sight conditions, Motorola's PTP 600 Series solutions can transmit different data over the parallel links to double throughput.

#### **Variable Power Output**

When conditions permit, Motorola point-to-point radios will decrease radio output power while still maintaining link availability. This is done to decrease the total radio energy in a deployment area and lower the ambient noise floor for all radios operating in the area.

**Assumption #2: Licensed-band systems deliver better performance.**

Licensed-band radio equipment can be much more expensive than unlicensed equipment, in some cases, as much as 10 times more. Although high-cost once correlated to high performance, this is no longer true.

In three years, Motorola's digital platform and high-performance architecture has led to major improvements in the throughput of its family of unlicensed point-to-point solutions – improving speeds from 14 Mbps to 300 Mbps. Few radio platforms can deliver as much performance or such dramatic improvements in such a short time. Because much of Motorola's point-to-point performance advantage is software-based, customers can continue to upgrade performance without the cost of buying or deploying new hardware.

Motorola's point-to-point solutions combine technologies in a design that is greater than the sum of its parts. Implementing features like Multiple-Input Multiple-Output (MIMO) and Advanced Spectrum Management with *intelligent* Dynamic Frequency Selection, and integrating them with a true software-defined radio, enables breakthrough digital processing and filtering capabilities in unlicensed wireless radios.

**Assumption #3: Licensed vendors provide better customer service.**

Because many manufacturers of licensed equipment provide direct support to customers, the belief is that the service is better. While vendor-direct support is always valuable, the quality of support from value-added resellers (VARs) and solution providers (SPs) has significantly improved over the past 20 years. Conversely, as some vendors have had to reduce direct-support staffing costs, the quality of service has diminished. In response to these business trends, VARs and SPs have been trained and certified by vendors to provide quality support services. In fact, many major technology vendors have come to rely on their channel partners to bridge the support gap. Motorola, like many vendors, is one that sells through a network of trained VARs and SPs.

Motorola's customer-service excellence is evidenced by its commitment to:

- **Best-of-Breed Solutions:** Motorola has invested a huge effort in acquiring best-of-breed point-to-point, point-to-multipoint and Mesh solutions to provide its partners and customers with a comprehensive portfolio of licensed and unlicensed wireless broadband solutions. This portfolio allows network operators to combine licensed and unlicensed systems without compromising performance and reliability. With its promise of Seamless Mobility, Motorola provides an end-to-end network of complementary products, services and solutions that enable service providers, governments and enterprises to deploy the most advantageous solution, or combination of solutions, to meet their coverage needs.
- **24/7 Support:** Motorola provides free 24/7 technical support for its unlicensed and licensed point-to-point products – a service that is often not available from other vendors.
- **Partner Support:** Motorola supports its distributors, VARs and SPs with second- and third-tier support, and can provide on-site support for special projects and critical requirements. Plus Motorola-trained VARs and SPs are a local resource for the customer and often can be on site on short notice.
- **Reduced Total Cost of Ownership:** Motorola's PTP products – both licensed and unlicensed – can be deployed very quickly and easily, thereby, reducing installation costs. The comprehensive web-based management system allows operators to remotely manage, monitor and optimize performance, helping to reduce overall operating costs.

**Conclusion**

The reality is that today's radio spectrum is increasingly crowded – and even a license does not guarantee interference-free operation. Unlicensed equipment can tolerate an increasingly crowded spectrum while delivering superior performance, offering an excellent option to extend network capabilities as an addition to, or replacement for, licensed equipment. When a best-of-breed solution, such as Motorola's solution, provides a lower cost of ownership and quality customer service, the customer wins.



The Motorola Point-to-Point Wireless Ethernet Bridges – PTP 400 and PTP 600 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.



800-377-2929  
[info@ersdatasolutions.com](mailto:info@ersdatasolutions.com)



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