Meeting the Challenge of Radio Interference in License-Exempt Bands

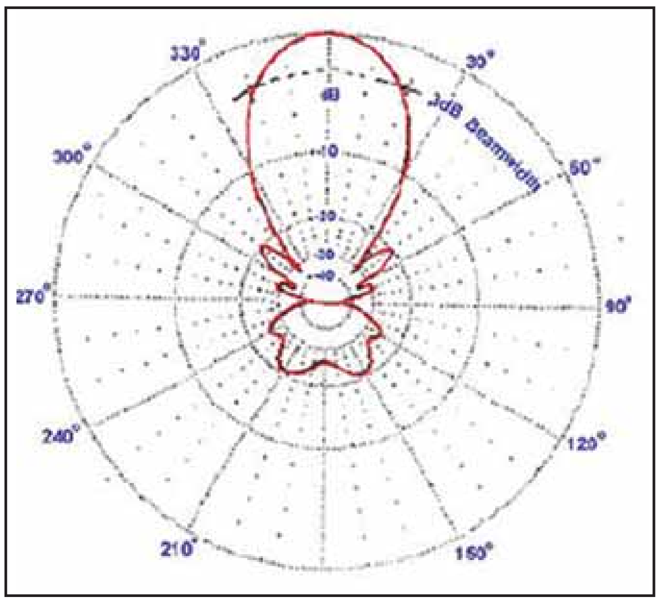
By Adi Nativ, VP of Marketing & Business Development, RADWIN

Tower Installation

With increasing numbers of service providers opting to use license-exempt radio frequency (RF) bands, the need to understand methods for overcoming the challenge of interference – and selecting solutions that implement such methods effectively – is critical. By using equipment designed specifically for delivering reliable service in license-exempt bands, service providers can overcome the challenge and deliver reliable services to their customers.

Increasingly, service providers and system integrators are taking advantage of the benefits of license-exempt bands, both for situations where it is more cost-effective and for areas where using these bands is the only viable solution. While license-exempt bands do offer the ability to deploy quickly and affordably, many environments have become crowded and services are sometimes affected by interference.

Carriers must be certain that the systems they deploy can provide reliable service in such challenging environments and use deployment strategies that allow for co-existence with similar systems operating within the same geographical area. While some sources of interference may be mitigated during installation and configuration on the day of deployment (via manual selection of the best channel at the time), new sources of interference may start to transmit at any time during the life of the product that may render unacceptable service.

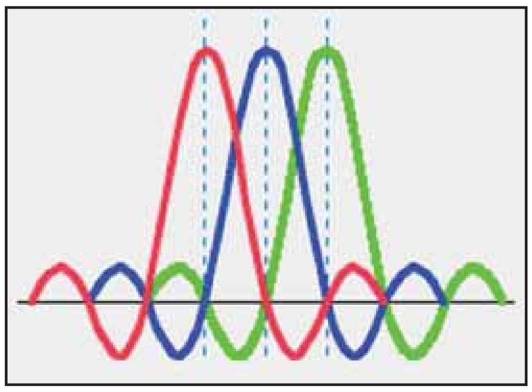


Directional Antenna Example

In license-exempt bands, sources of interference may include consumer and industrial products such as radio equipment, remote control units, motion sensors in security systems, radar installations and various RF devices. To deliver consistent service, carriers must employ a combination of intelligent planning and equipment that uses robust techniques for mitigating interference.

Advanced, high-capacity, carrier-class radio systems, such as those manufactured by Radwin, are designed to overcome the challenge of interference in license-exempt bands. By implementing advanced mechanisms and patented technologies, these systems can relay high-bandwidth traffic in interference-laden environments with carrier-grade performance.

At the core of such systems are a series of mechanisms that work together to mitigate interference and can therefore enable carrier-class TDM and Ethernet services in the license-exempt bands. These mechanisms are, as follows:



Multicarrier OFDM Example

Automatic Channel Selection: This mechanism assures that transmission is performed in the best channel by monitoring available channels and dynamically selecting the best channel in response to any interference.

Automatic Adaptive Rate: This is a method of dynamically adapting the transmitted rate by changing both the signal modulation and coding. In other words, in case the system detects interference that affects data quality, it will decrease its transmission rate to ensure higher susceptibility to noise. Automatic Adaptive Rate optimizes the data throughput according to interference conditions, to maximize data throughput while maintaining service quality.

Configurable Channel Bandwidth: Flexibility in this area enables the operator to choose between higher channel bandwidth, with a relatively large spectrum footprint, and lower channel bandwidth, with more narrow spectrum usage. In crowded environments, where interference-free spectrum is rare, the ability to configure the channel bandwidth is important for enabling optimization of the license-exempt frequency band.

Forward Error Correction (FEC): This mechanism of error control for data transmission involves adding redundant data to messages, allowing the receiver to detect and correct errors upon reception of the transmitted data. Its advantage is that retransmission of data can often be avoided, at the cost of higher bandwidth requirements. With a variety of FEC techniques available, license-exempt wireless systems must implement the FEC algorithm, which is optimized for the interference conditions prevalent in license-exempt bands to ensure low bit overhead and fast, robust and error-free communications.

Indoor/Outdoor Units of the RADWIN 2000

Advanced Automatic Repeat Request (ARQ): RF interference can damage transmissions, resulting in corrupted data at the destination, requiring an intelligent method for detecting and resending corrupted or missing data. Advanced ARQ mechanisms are designed to detect and re-send corrupted or missing data, while ensuring exceptional short delay and non-interrupted transmission, even when encountering significant levels of interference.

Non-interrupted transmission: In many situations, interference in a channel causes the radio to halt transmission until the channel re-qualifies for transmission. To meet the needs of time-critical traffic, such as TDM streams or carrier Ethernet, systems must implement mechanisms that maintain transmission and link stability even when encountering significant interference.

Hub Site Synchronization: Radios using a Time Division Duplex method can experience interference from other radios at the same site if they are transmitting and receiving according to different time patterns. The Hub Site Synchronization mechanism synchronizes the transmission pulses of all collocated systems, ensuring that packet transmission occurs at the same time for each of them, thus eliminating collocation interference.

Directional Antenna Design: Directional antennas focus signal transmission and reduce interference effects. With highly directional antennas, interfering signals from side and back lobes are suppressed, resulting in an improved C/I (carrier-to-interference) ratio.

Orthogonal Frequency Division Multiplexing (OFDM): This modulation technique enables effective transmission of large amounts of digital data over a radio link. OFDM features low overhead, low latency and high resiliency to interference. Based on the concept of redundant transmission, OFDM works by splitting the radio signal into multiple, smaller sub-signals transmitted simultaneously at different frequencies to the receiver.

Multiple In, Multiple Out (MIMO): MIMO spatial multiplexing enables a radio to increase channel capacity. With its high-rate information signal split into two lower-rate streams, each stream is transmitted from a different antenna in the same frequency channel. This technology offers significant increases in data throughput and link range without additional bandwidth or transmit power.

To achieve carrier-class radio transmission in license-exempt bands, the equipment deployed must be designed with inherent quality-enhancing mechanisms that mitigate interference and ensure robust performance and smooth transmission of services.

Adi Nativ is vice president of marketing and business development for Radwin. He has also directed business development at Actelis Networks and held various positions in an elite research and development unit of the Israeli Ministry of Defense. He has a master's degree in electronics and communications systems engineering from Tel-Aviv University.

This article is excerpted from a more detailed Radwin white paper. For more information, visit www.radwin.com.