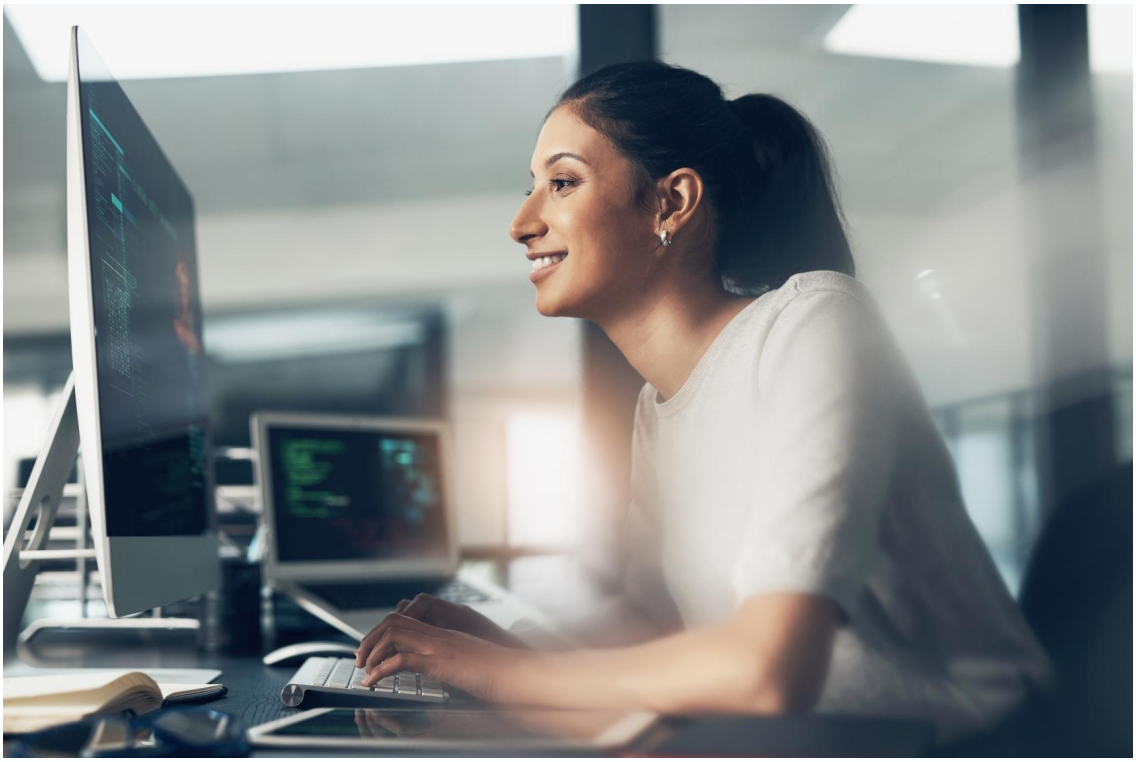
Navigating the RF spectrum



Understanding the foundational technologies of wireless communication—including the latest Wi-Fi 6E standard that supports the 6 GHz RF band—is essential to excel in the wireless field.

Each RF band's unique characteristics influence your network implementation, performance, and security.

By learning the capabilities of these bands, you can make informed decisions when deploying your wireless networks. You can ensure these networks meet the needs of different environments while maintaining high security and efficiency standards.

RF bands

Manipulating your RF settings can improve the efficiency of your wireless network. **Select each tab** to learn more about signal interference, speed constraints, coverage range, and network security for the 2.4, 5, and 6 GHz RF bands.

Signal interference

- **2.4 GHz:** Devices often use the 2.4 GHz frequency band so it is commonly congested, forcing you to contend with significant interference.

The 2.4 GHz band, including channels 1, 6, and 11.
2.4 GHz band

- **5 GHz:** Although less crowded than the 2.4 GHz band, the 5 GHz band can still experience interference on wireless channels from devices operating at the same frequency, such as certain types of radar systems and other high-bandwidth digital systems. These affected channels are mitigated by using a feature specific to 5 GHz: Dynamic Frequency Selection (DFS).

The 5 GHz RF band supports nine non-overlapping 20 MHz channels after omitting DFS channels that may be s
5 GHz band

- **6 GHz:** An important aspect of the 6 GHz band operation is the Automated Frequency Coordination (AFC) system. Unlike DFS in the 5 GHz band, the AFC system in the 6 GHz band protects incumbent services, such as fixed microwave links, from interference.

The 6 GHz RF band supports multiple non-overlapping channels based on channel width, such as 59 20 MHz cl
6 GHz band

Speed limitations

- **2.4 GHz:** Generally offers a smaller channel width of 20 MHz with reduced data throughput.

- **5 GHz:** The 5 GHz band allows you to operate the wider channels of 40 MHz, 80 MHz, and even 160 MHz for increased data throughput. The wider channels (like wider lanes on a highway) allow more data to pass through simultaneously, giving you faster connection speeds.

- **6 GHz:** With access to a wider frequency range and more available channels, Wi-Fi 6E can support maximum data rates of up to 9.6 Gbps on a single 160 MHz channel, offering dramatic speed improvements. (There are seven separate 160 MHz channels available in Wi-Fi 6E, and none overlap!)

2.4 and 5 GHz are congested, and must support old clients. 6 GHz is twice as wide as 5 GHz and only allows ne

Coverage vs. performance

- **2.4 GHz:** Provides extensive coverage because it can penetrate walls and other objects, but the transmission rate diminishes as the distance from the access point increases.

- **5 GHz:** When many 5 GHz devices operate on the same or overlapping channels, they compete, which slows down network speed and can degrade overall wireless performance. Overlap occurs more often with wider channels (80 MHz or 160 MHz) as they overlap with more potential 20 MHz and 40 MHz channels. For example, operating a single 80 MHz channel will overlap with four 20 MHz channels.

- **6 GHz:** The 6 GHz RF band provides up to 59 non-overlapping 20 MHz channels, effectively tripling the number of available channels compared to the 5 GHz band. This abundance of non-overlapping channels helps you significantly reduce the potential cross channel interference (CCI), enabling more simultaneous nearby high-speed, client-to-access-point connections.

The 2.4 GHz band offers only three non-overlapping channels. In contrast, the 5 GHz band offers more non-ove

Network security

- **2.4 GHz:** Legacy devices that only support the 2.4 GHz RF band may not be compatible with the latest security protocols.

- **5 GHz:** Devices operating on the 5 GHz RF band are more likely to be compatible with updated security protocols such as WPA-3 or OWE, making them an ideal choice for installations requiring secure connections.

- **6 GHz:** Operating within the 6 GHz band requires 802.11w compatibility, also known as PMF (Protected Management Frames), a security feature that secures our wireless management frames from attack.

Using 5 GHz to enable 6 GHz

An intriguing feature of the 6 GHz operation involves its initial connection with the 5 GHz RF band. To facilitate the integration of 6 GHz devices into current networks, the first communication between a 6 GHz client device and a Wi-Fi 6E access point typically happens within the 5 GHz band. Once your access point identifies the client device as 6 GHz compatible, the communication can shift from the 5 GHz to the 6 GHz band.

Now you’re prepared to apply RF concepts in your Meraki dashboard. It’s time to “channel” your inner IT wizard and turn these RF concepts into practical application. The adventure awaits!

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