

# WiFi Spectrum



- WiFi services operate in the 2.4 GHz and 5 GHz frequency spectrum.
- This is allocated for ISM industrial, scientific, and medical use
- A radio operator's license is not required.
- ISM devices do not have regulatory protection against interference from other users of the band.

# IEEE 802.11 Standards

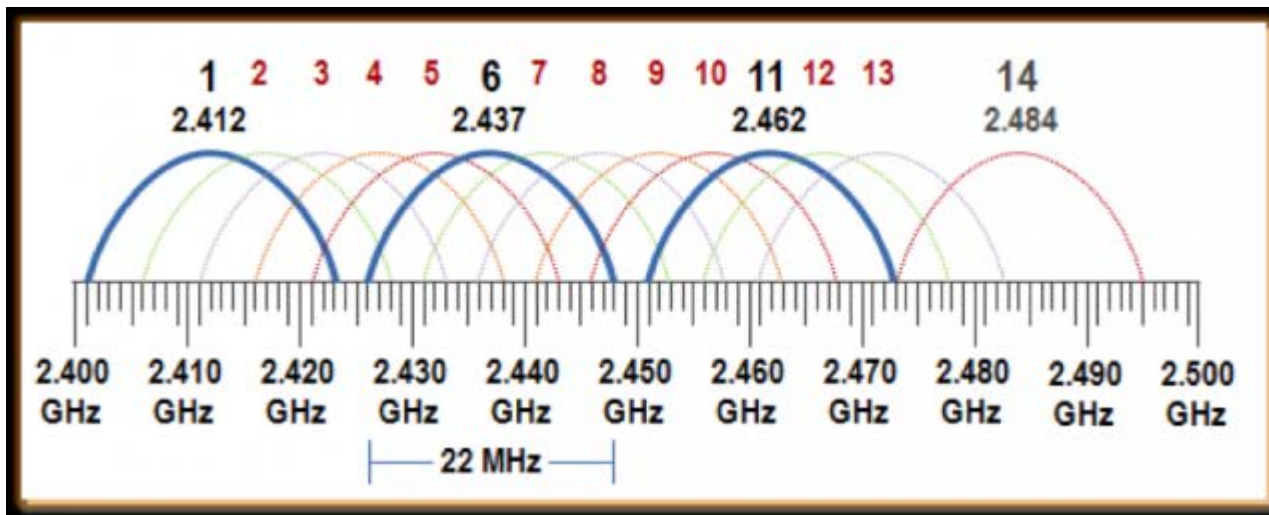


	802.11	802.11a	802.11b	802.11g	802.11n	802.11ac	802.11ax (Wi-Fi6)
Year	1997	1999	1999	2003	2009	2013	2019
Frequency	2.4 GHz	5 GHz	2.4 GHz	2.4 GHz	2.4 & 5 GHz	5 GHz	2.4, 5, 6 GHz
Data Rate in Mbps	1, 2	6, 9, 12, 18, 24, 36, 48, 54	1, 2, 5.5, 11	1, 2, 5.5, 11  6, 9, 12, 18, 24, 36, 48, 54	Up to 600	Up to 3500	Up to 9608

- Cisco Access Points support all standards
- You can choose which you want to enable per WLAN
- Each amendment is backward compatible at the same frequency.  
This enables you to replace APs but still keep older clients

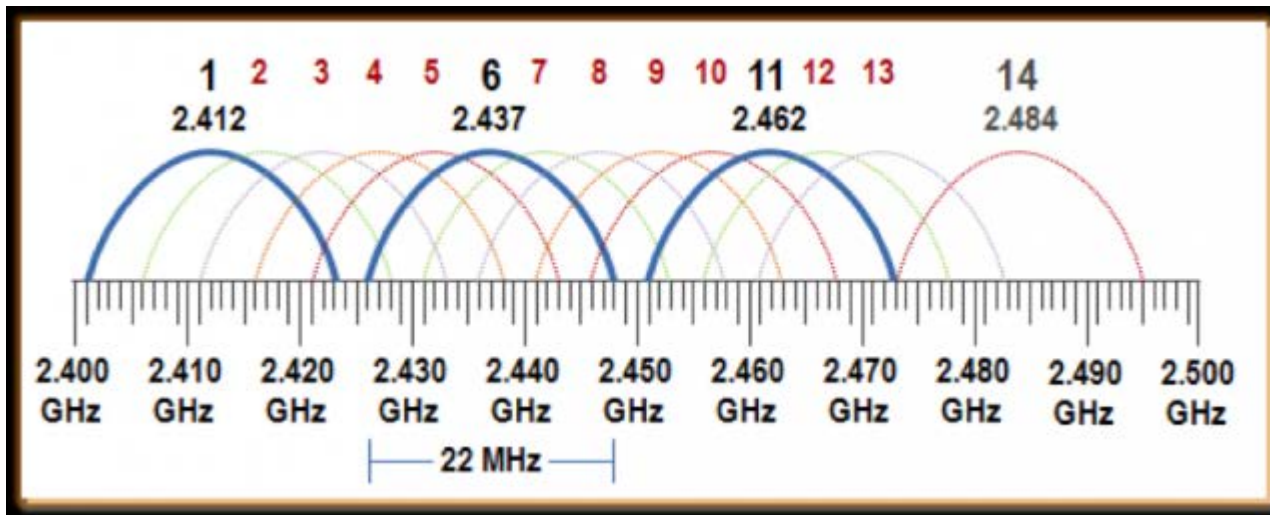
# 2.4 GHz Spectrum

- The 2.4 GHz ISM spectrum ranges from 2.4 to 2.4835 GHz
- (2.4 to 2.497 GHz in Japan)
- The spectrum is divided into smaller (22 MHz) ranges of frequencies called channels



# 2.4 GHz Spectrum

- Each AP operates in one channel
- Some channels overlap and can cause interference with each other
- Access Points with overlapping service areas should use non-overlapping channels

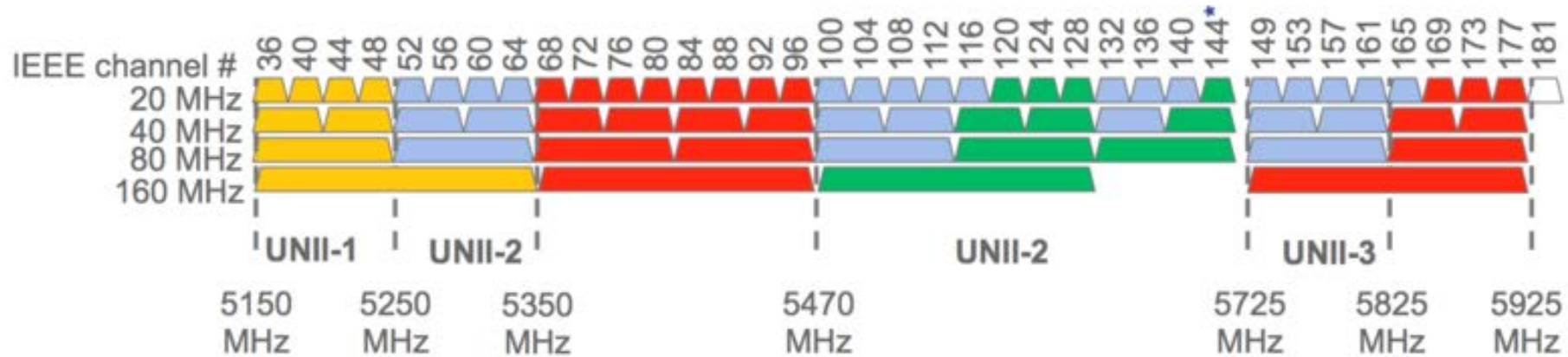


# 5 GHz Spectrum



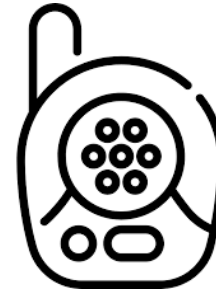
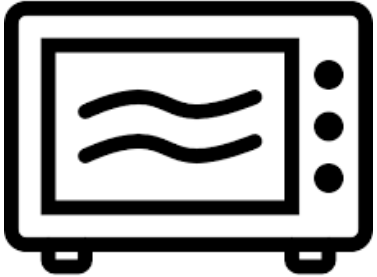
- 2.4 GHz channels are 22 MHz wide
- 5 GHz channels are 20 MHz wide
- They have less overlap than 2.4 GHz channels
- Neighboring APs should be separated by at least one channel
- Channels can be bonded (40, 80 or 160 MHz wide) to multiply data rates by 2, 4 or 8x

# 5 GHz Spectrum



# 2.4 GHz Interference

- The ISM band is unlicensed
- Many devices can cause interference in the 2.4 GHz range



# 2.4 vs 5 GHz



- 2.4 GHz has greater range and better propagation through obstacles
- 2.4 GHz is more crowded
- 5 GHz 802.11ac has higher throughput than is available with 2.4 GHz
- Your client stations may only be compatible with 2.4 GHz



# Site Surveys



- Site surveys should be carried out for WiFi networks
- The purpose is to find the best placement of Access Points for maximum coverage of the required area, and minimum leakage outside it
- It should also discover potential sources of interference
- A WLC can manage channel allocation and power levels of APs

