



THE WI-FI PERFORMANCE COMPANY

The Leader in Wireless Network Monitoring

About Jim Vajda

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- Experience in healthcare, K12, higher ed, non-profit, MSP, more
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What is Wi-Fi 6E?

- The Wi-Fi Alliance marketing term for 802.11ax *extended* into the 6 GHz band
- Wi-Fi 6 (802.11ax in 2.4/5 GHz) has been available since 2018
- FCC opened 6 GHz to unlicensed operation in 2020 in USA

Branding	Standard	Spectrum
Wi-Fi 6E	802.11ax	6 GHz
Wi-Fi 6	802.11ax	2.4 GHz, 5 GHz
Wi-Fi 5*	802.11ac	5 GHz
Wi-Fi 4*	802.11n	2.4 GHz, 5 GHz
	802.11g	2.4 GHz
	802.11b	2.4 GHz
	802.11a	5 GHz
	802.11	2.4 GHz, IR

2.4GHz 80MHz

5GHz 500MHz

6GHz 6GHz - 1,200MHz

Real World Benefits of 802.11ax

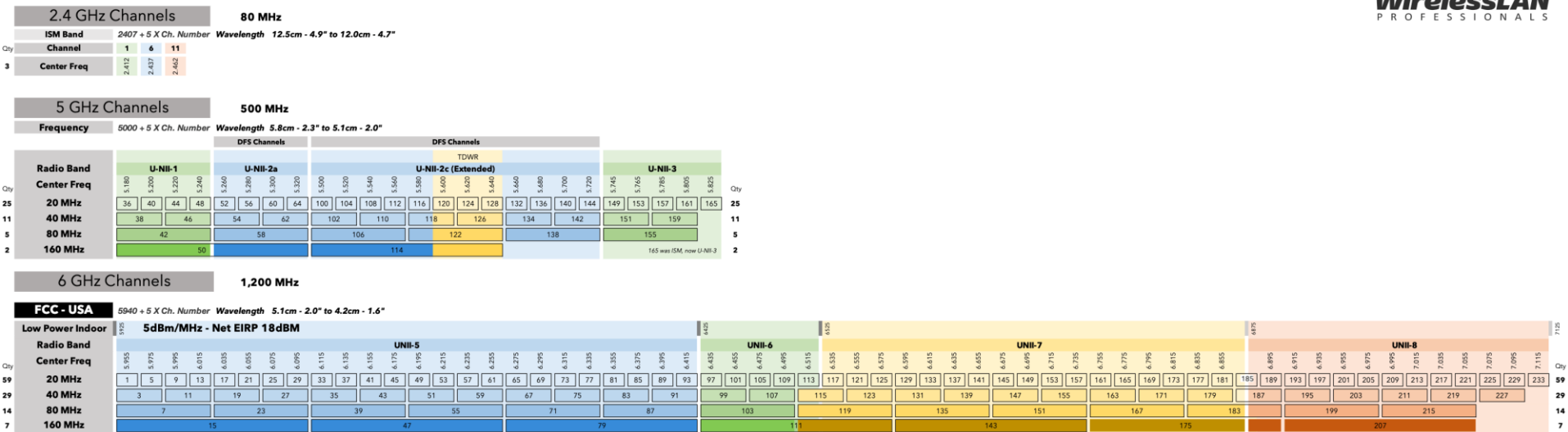
- OFDMA (but still TBD)
- 1024 QAM
- 8 Spatial Stream AP's



6 GHz Spectrum



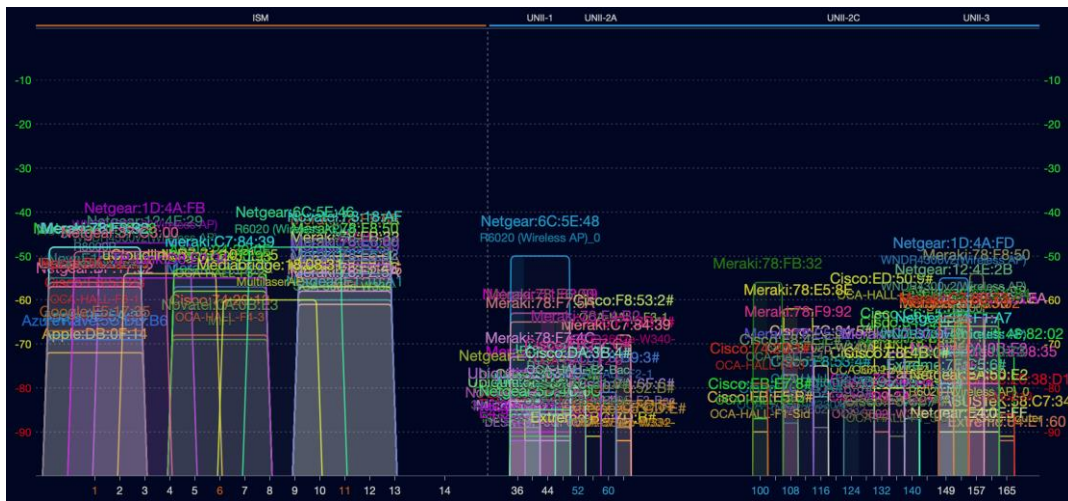
Unlicensed Spectrum and Channel Allocations



- 1200 MHz of new unlicensed spectrum in the US!
- 500-1200 MHz in other countries
- 59 x 20 MHz wide channels for Wi-Fi
- Low-power indoor AP's (most AP's) have no incumbent avoidance rules like 5 GHz DFS channels

Real World Use-Cases

- High Density and Large Public Venues WLAN's
- Dense Residential Areas (MDU)
- Anywhere RF congestion is a problem
- Anywhere high throughput is desired in typical AP densities (20 Mbps+)
- **Not:** Uncompressed video streaming, AR/VR, or IoT



The Road Ahead

- Consumer Wi-Fi 6E AP's and clients are available now
 - Samsung Galaxy S21 Ultra
 - iPhone 13?
- Enterprise Wi-Fi 6E AP's will be released in the second half of 2021
- Enterprise Wi-Fi 6E clients are available now, more coming soon
 - Intel AX210 released in 2020



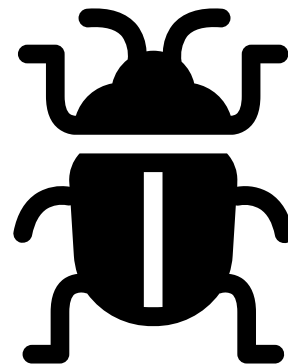
Wi-Fi 6E Considerations

- Wi-Fi 6E AP's will cost substantially more
 - 3 radios, all of which support 802.11ax modulation
 - 5 GHz and 6 GHz radios will be up to 8 spatial streams
 - High CPU/memory requirement to handle the throughput
- Can your switches and cabling keep up?
 - 60 watt PoE++ 802.3bt
 - Multigigabit Ethernet 802.3bz NBASE-T uplinks
- Multiple radio configurations
 - Tri-radio 2.4/5/6 GHz radios
 - Dual radio with SDR 2.4/5 GHz radio and SDR 5/6 GHz radio



There Will Be Bugs

- It takes AP vendors time to release production-ready, stable code *after* a new product is released and sold
- The first generation of Wi-Fi 6E AP may be rushed to market and short lived
- The second generation may have a longer lifespan and be of higher quality overall

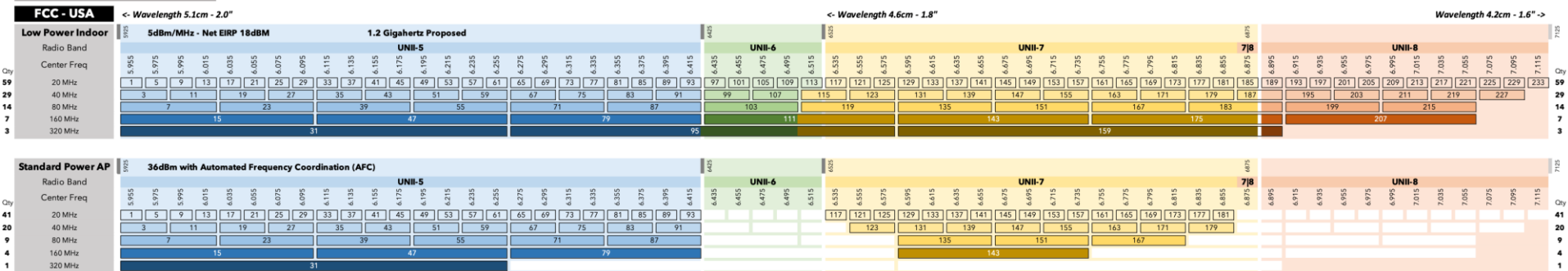


Technical Differences with Wi-Fi 6

Wi-Fi 6	Wi-Fi 6E
2.4 and 5 GHz	6 GHz
DFS in 5 GHz	AFC in outdoor/higher power use
WPA2 and open security	WPA3 and OWE-only
20, 40, 80, 160 MHz channel widths	80, 160 MHz channel widths-only
RTS/CTS protection is needed	RTS/CTS is not needed
AP Discovery on all channels	AP Discovery via 2.4/5 GHz scanning or 6 GHz Preferred Scanning Channels (PSC's)

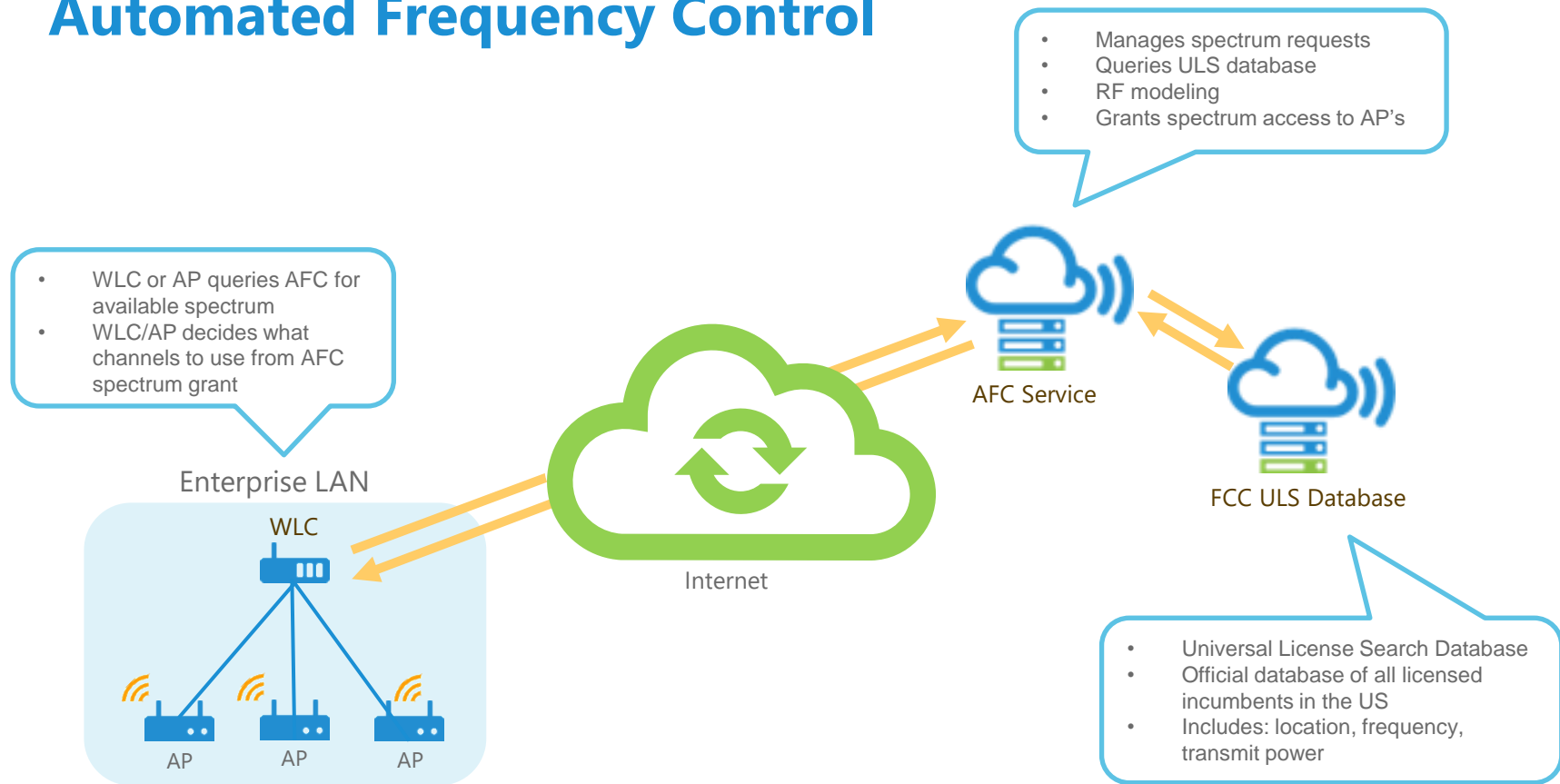
FCC 6 GHz Rules

6 GHz Channel Allocations



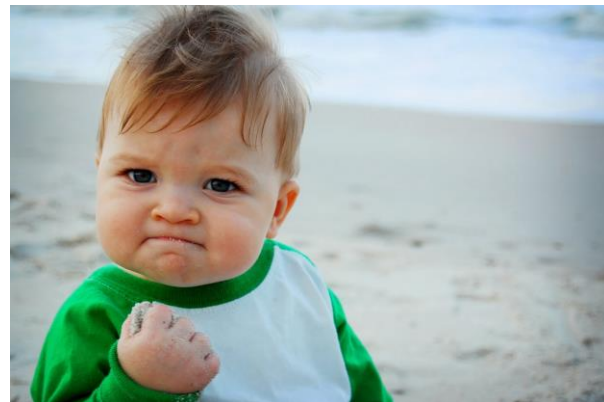
- Most 6 GHz AP's can use the spectrum without any AFC requirement
 - These are called low-power indoors AP's (LPI)
 - Indoor operation only
 - 18 dBm in 20 MHz channel width (this ceiling may increase)
 - Integrated antennas only
- AP's installed outside or AP's that use higher Tx power must follow AFC
 - These are called standard power AP's
 - 36 dBm maximum Tx power (4 watts!)
- Like DFS, clients are under the control of AP's
- No "blind probing" in 6 GHz, clients must hear AP Tx on the channel first
- No mobile hotspots

Automated Frequency Control



AFC Benefits Compared to DFS

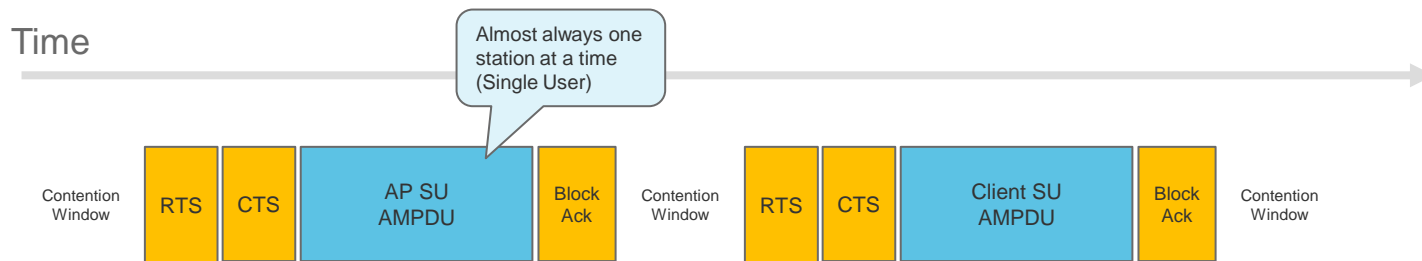
- **Spectrum availability certainty**
- No false-positives
- No disruptive silent periods
- Not used for typical indoor AP's



Potential for Spectral Efficiency Gains Over Wi-Fi 6

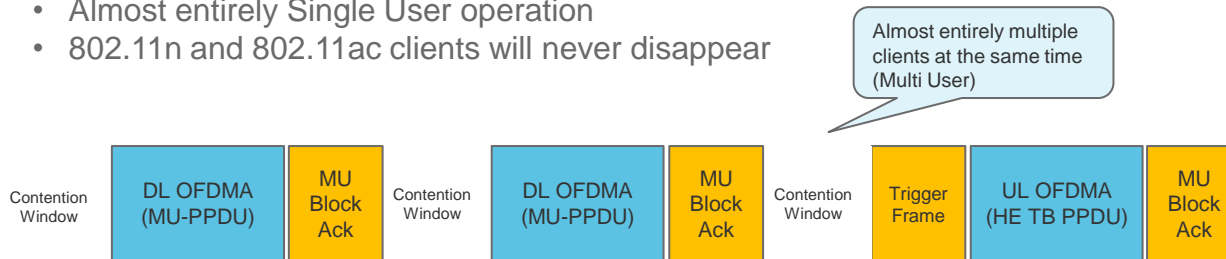
Wi-Fi 6	Wi-Fi 6E
AP contends with all stations equally to win TXOP	AP can win TXOP more often through EDCA parameters biasing
Slow RTS/CTS protection to reserve TXOP with legacy stations present	RTS/CTS unnecessary, TXOP is reserved via HE preamble
Fewer opportunities for OFDMA	More opportunities for OFDMA
Spatial Reuse penalizes legacy stations	Spatial Reuse works as intended

Best Case Efficiency Comparison on Busy Channels



- The AP contends with all stations equally, wins less often
- Almost entirely Single User operation
- 802.11n and 802.11ac clients will never disappear

***Not to scale**



- The AP has priority during contention, wins more often
- Almost entirely Multi User operation via OFDMA
- No legacy station protection necessary

A group of six people, three women and three men, are sitting on a brown leather couch. They are all looking down at their devices: laptops or smartphones. The person on the far left is a woman with blonde hair and glasses, wearing a grey top and a patterned cardigan, using a laptop. Next to her is a woman in a green top and blue jeans, also using a laptop. In the center is a man in a tan blazer and light blue jeans, using a laptop. To his right is a woman in a blue top and blue jeans, using a tablet. Next is a woman in a red top and black jeans, using a smartphone. On the far right is a man in a light blue shirt and dark jeans, using a tablet. The background is a plain, light-colored wall. The floor is made of dark wooden planks.

QUESTIONS AND ANSWERS



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Thank you!

go.7signal.com/tour
Every Friday at 12 pm Eastern