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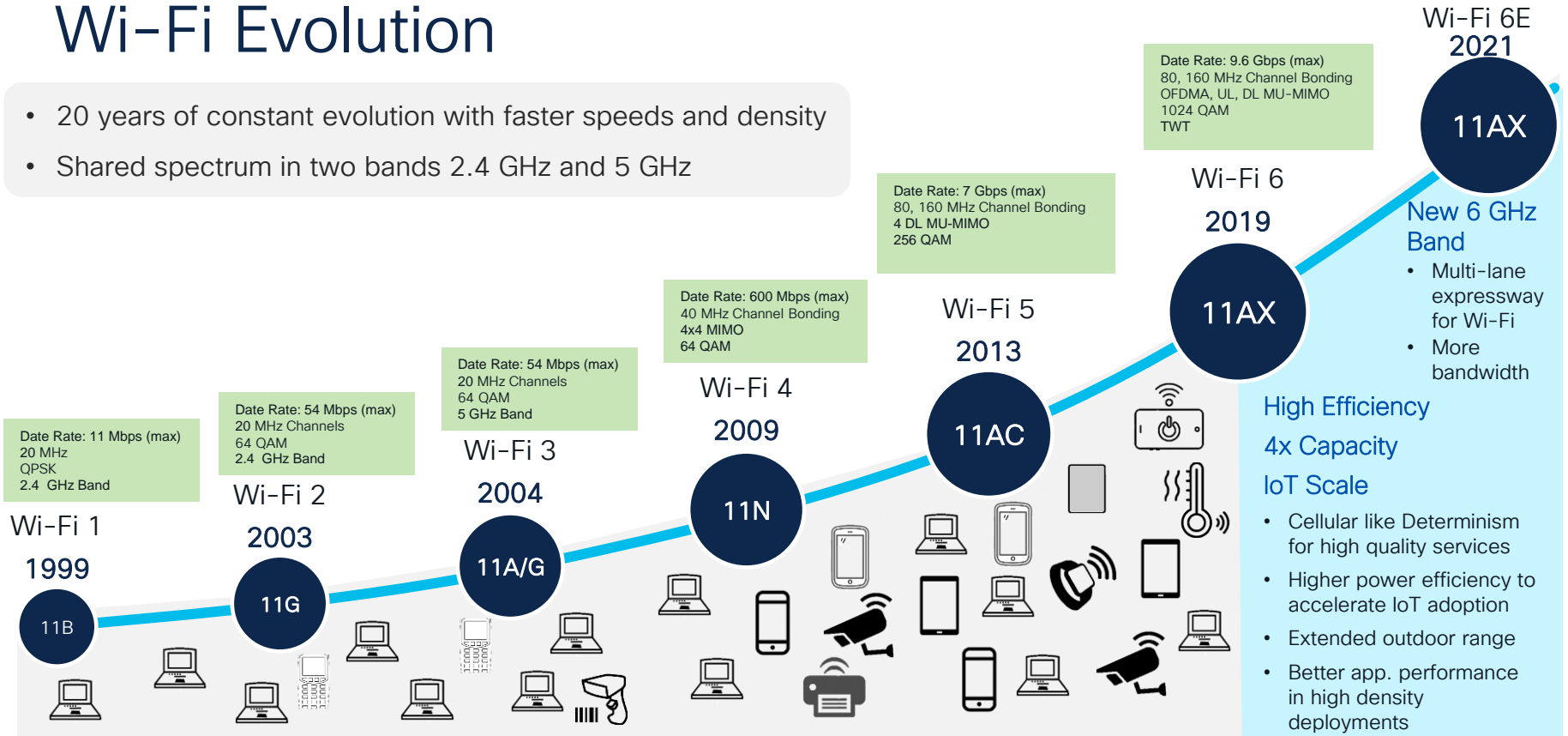https://ciscolive.ciscoevents.com/ciscolivebot/#BRKEWN-2024

3
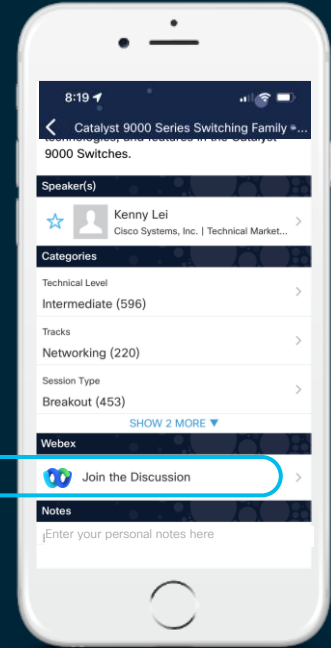
Agenda

- Why Wi-Fi 6E?

- 6 GHz Around the world

- Device Classes and Regulations

- 6 GHz AP Discovery

- Security in Wi-Fi 6E World

- Client Interoperability

- Catalyst Wi-FI 6E Access Points

- Migration and Deployment

Wi-Fi Evolution

- 20 years of constant evolution with faster speeds and density
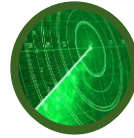- Shared spectrum in two bands 2.4 GHz and 5 GHz

Date Rate: 9.6 Gbps (max)
80, 160 MHz Channel Bonding
OFDMA, UL, DL MU-MIMO
1024 QAM
TWT

Wi-Fi 6E
2021
11AX

Date Rate: 7 Gbps (max)
80, 160 MHz Channel Bonding
4 DL MU-MIMO
256 QAM

Wi-Fi 6
2019
11AX

New 6 GHz Band
- Multi-lane expressway for Wi-Fi
- More bandwidth

Date Rate: 600 Mbps (max)
40 MHz Channel Bonding
4x4 MIMO
64 QAM

Wi-Fi 5
2013
11AC

High Efficiency

4x Capacity

IoT Scale

Date Rate: 54 Mbps (max)
20 MHz Channels
64 QAM
5 GHz Band

Wi-Fi 4
2009
11N

- Cellular like Determinism for high quality services
- Higher power efficiency to accelerate IoT adoption
- Extended outdoor range
- Better app. performance in high density deployments

Date Rate: 54 Mbps (max)
20 MHz Channels
64 QAM
2.4 GHz Band

Wi-Fi 3
2004
11A/G

Date Rate: 11 Mbps (max)
20 MHz
QPSK
2.4 GHz Band

Wi-Fi 2
2003
11G

Wi-Fi 1
1999
11B

Why is Wi-Fi Bad ?

6

Why is Wi-Fi Bad ?

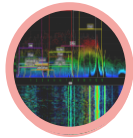Too Many Devices

DFS Channels

Shared Spectrum – Interferes

Channel Congestion

Legacy Devices

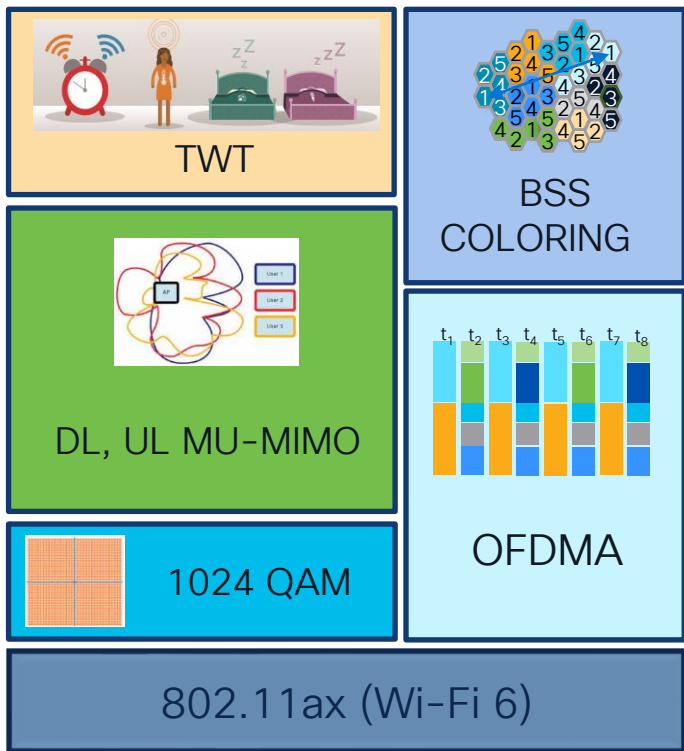Limited Re-usable Channels

Before Wi-Fi – 6E ......

Wi-Fi 6E
Wi-Fi 6 and 6GHz are friends!

TWT

BSS COLORING

DL, UL MU-MIMO

OFDMA

1024 QAM

802.11ax (Wi-Fi 6)

+

1 Additional Spectrum
1200 MHz (5.925 to 7.125 MHz) – US
500 MHz (5.925 to 6.425) – EU

2 Security Upgrade
WPA3 and OWE Mandatory

3 Clean RF
(Fixed Mobile Service Operators in UNI-5 and UNI-7)

4 No Legacy (Slow) Devices
Improves performance

5 6 GHz WLAN Discovery
Airtime Efficiency
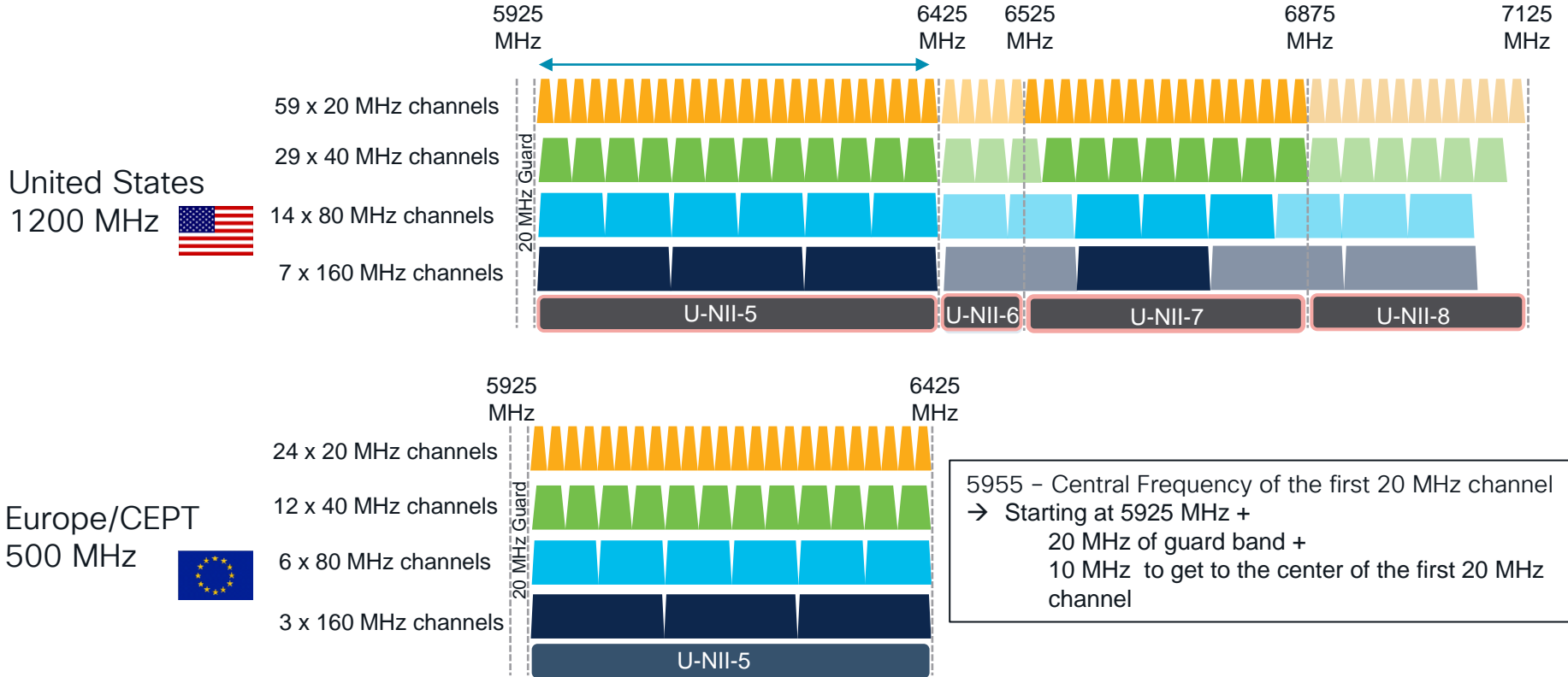
6 Wider RF Channels
80 MHz channels are now a reality

With Wi-Fi – 6E …..

Wi-Fi 6E – 6GHz Around the World

Global availability of 6 GHz band for Wi-Fi
(https://www.wi-fi.org/countries-enabling-wi-fi-6e)

Legend:
- 1200 MHz
- 1200 MHz Consultation
- 500 MHz
- 500 MHz Consultation
- TBD (early in process)
- No activity

* Australia, Japan, UK, HongKong and Qatar considering 1200 MHz

The new 6 GHz band :

United States
1200 MHz

- 59 x 20 MHz channels
- 29 x 40 MHz channels
- 14 x 80 MHz channels
- 7 x 160 MHz channels

5925 MHz · 6425 MHz · 6525 MHz · 6875 MHz · 7125 MHz

20 MHz Guard

U-NII-5 · U-NII-6 · U-NII-7 · U-NII-8

Europe/CEPT
500 MHz

- 24 x 20 MHz channels
- 12 x 40 MHz channels
- 6 x 80 MHz channels
- 3 x 160 MHz channels

5925 MHz · 6425 MHz

20 MHz Guard

U-NII-5

5955 – Central Frequency of the first 20 MHz channel
→ Starting at 5925 MHz +
    20 MHz of guard band +
    10 MHz to get to the center of the first 20 MHz channel

The new 6 GHz band – Channel Numbering

Channel Width:
- 20 MHz
- 40 MHz
- 80 MHz
- 160 MHz

6 GHz – New Device Classes

Wi-Fi 6E introduces new device classes for optimized capability

Low Power Indoor AP

- Indoor Only
- Integrated Antenna Required
- Can use the full 1200 MHz
- Wired Power

Standard Power AP

- Indoor or Outdoor
- Integrated or External Antenna
- UNII-5 and UNII-7 Only (US)
- Requires AFC

Very Lower Power AP

- Mobile Indoor or Outdoor
- Limited Range
- Can use the full 1200 MHz
- Does not require AFC

Client Devices

- Indoor or Outdoor
- Only Indoor under control of LPI AP
- 6 dBm lower power than AP

Regulations vary by country

External(SP)/Outdoor Antenna Wi-Fi 6E Status

AFC
Not Regulatory
approved

SP
Regulatory
approved
(UNII 5 and UNII7
Only)

AFC Certification
not available

AFC
Not Regulatory
approved

AFC
Not Regulatory
approved

AFC
Not Regulatory
approved

AFC
Not Regulatory
approved
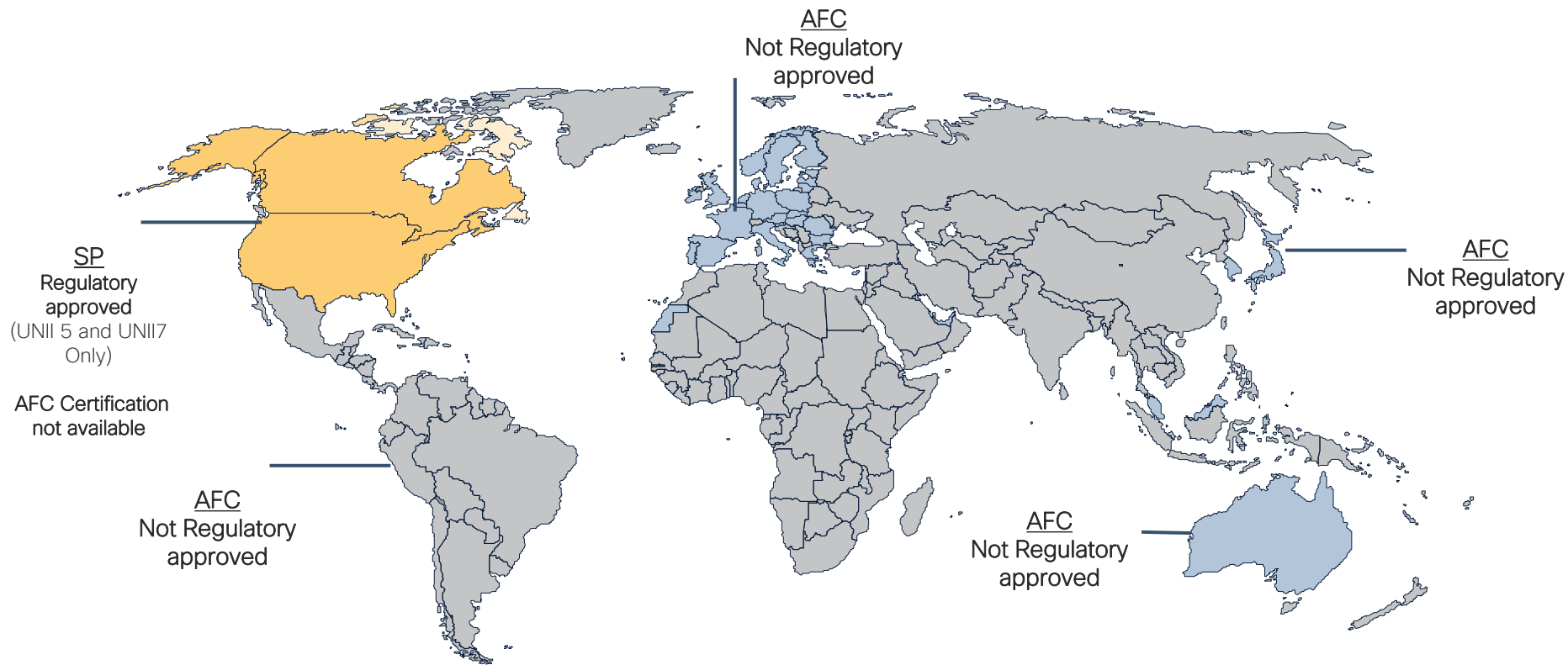
AFC approval is in-progress only in North America

The new power levels

	5925 MHz		6425 MHz	6525 MHz		6875 MHz		7125 MHz

Standard Power (indoor-outdoor)
36 dBm EIRP with AFC (500 MHz) ← → 36 dBm EIRP with AFC (350 MHz) ← →

Automatic Frequency Control

Low Power (indoor)
5 dBm / MHz (Max EIRP – 30 dBM) ←——————————————→

Very Low-Power Devices (indoor-outdoor)
(under evaluation) -8 dBm / MHz ←——————————————→

Clients
6 dB lower than the AP (LPI: 24 dBM, SP : 30 dBM) ←——————————————→

U-NII-5   U-NII-6   U-NII-7   U-NII-8
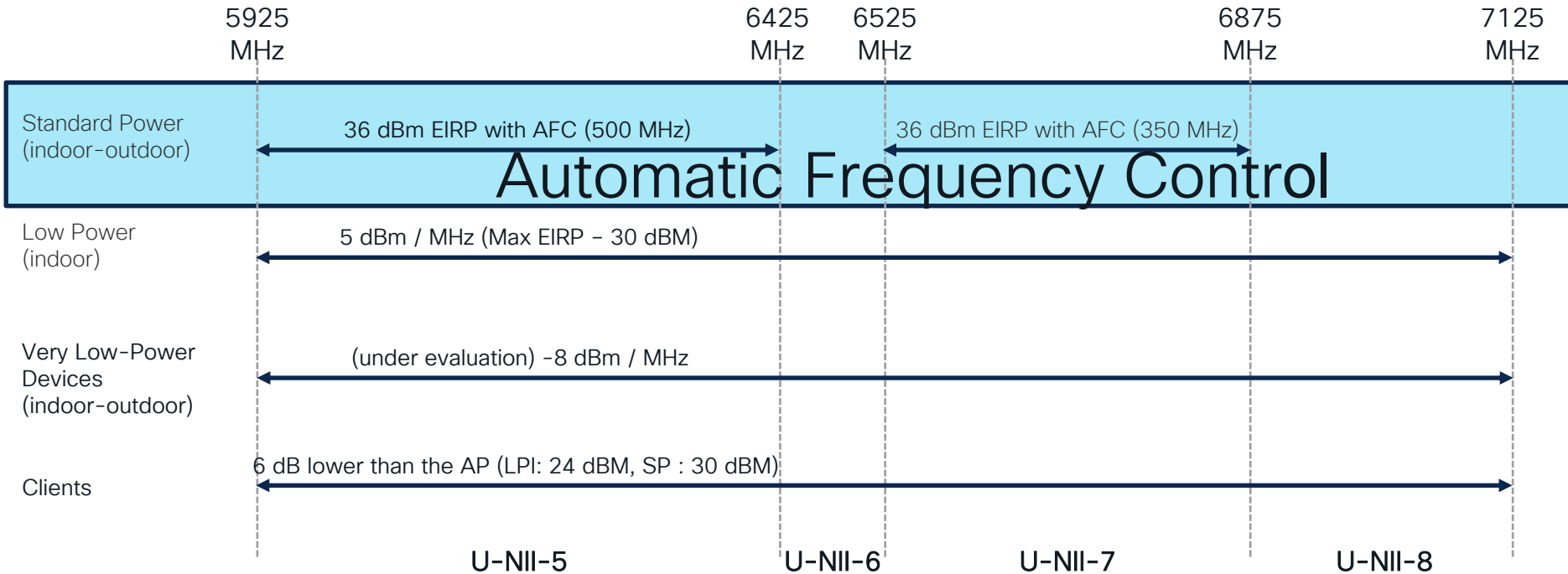
Low-Power Access Points (indoor)

| | 5925 MHz | | 6425 MHz | 6525 MHz | | 6875 MHz | 7125 MHz |

Low Power Indoor (LPI)

5 dBm / MHz

U-NII-5   U-NII-6   U-NII-7   U-NII-8
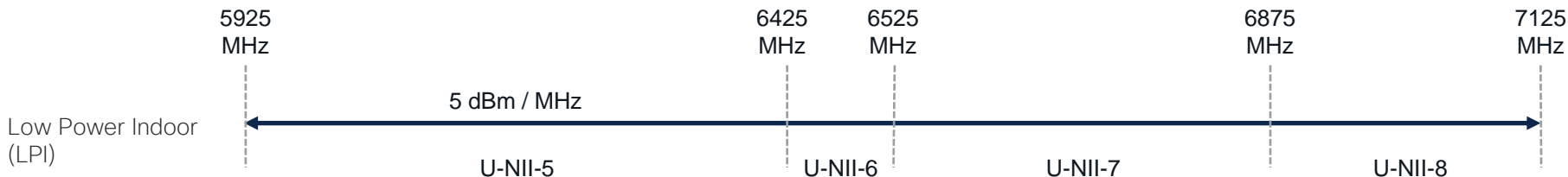
6 GHz power is measured as **Power Spectral Density (PSD)** a Maximum of 5 dBm/MHz is permitted for LPI

5 dBm = 3.162278 mW

3.162278 mW x 20 MHz = 63.24556 mW = 18 dBm
3.162278 mW x 40 MHz = 126.4911 mW = 21 dBm

Client power also has a PSD rule of 6 dB less than the AP's max EIRP

Channel BW	AP EIRP	Client EIRP
20 MHz	18 dBm	12 dBm
40 MHz	21 dBm	15 dBm
80 MHz	24 dBm	18 dBm
160 MHz	27 dBm	21 dBm

Note: Indoor AP's with an external antenna, must operate under the Standard Power rules, LPI only applies to I models

Bonded Channels and Noise 5 GHz vs 6 GHz

- A wider channel creates more noise

- Increased noise – decreases SNR

- In 5 GHz, every doubling of a channel width takes a corresponding 3 dB hit in SNR,

- A 3 dB reduction in SNR is equivalent to a 3 dB decrease in the RSSI performance wise

- Wi-Fi 6 E power rules in PSD of 5 dBm/MHz increases the EIRP as the channel gets wider

- This off-sets the corresponding SNR loss

- Comparing Effective EIRP – 6 GHz favors wider channels
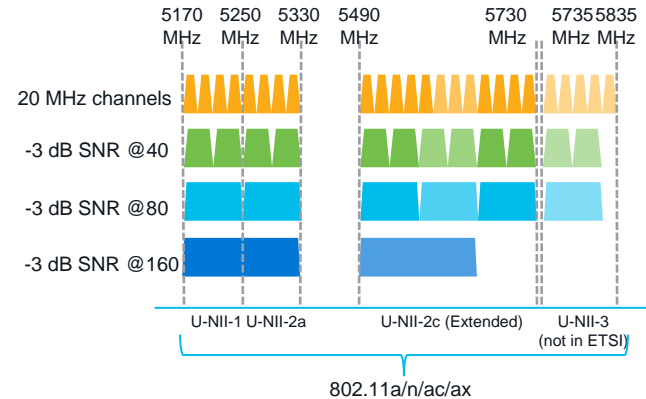
	Effective EIRP Remains Constant in 6 GHz			
Channel Width	20 MHz	40 MHz	80 MHz	160 MHz
5 GHz, U-NII-1	23 dBm	20 dBm	17 dBm	14 dBm
6 GHz. U-NII-5 (PSD - 5 dBm/MHz)	18 dBm	21 dBm	24 dBm	27 dBm
Noise Floor		+3 dB	+6 dB	+9 dB
Effective EIRP (6GHz, U-NII-5)	18 dBm	18 dBm	18 dBm	18 dBm

Automatic Frequency Co-ordination

Incumbent Fixed Service
UNII 5 and 7 Bands

Transmitter

Receiver

Access Points

WLC

AFC
Operator

Spectrum License
Updates

Fixed Mobile
Operators
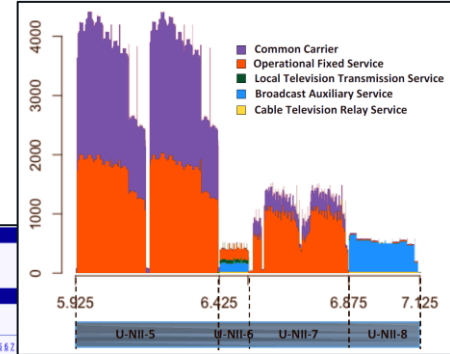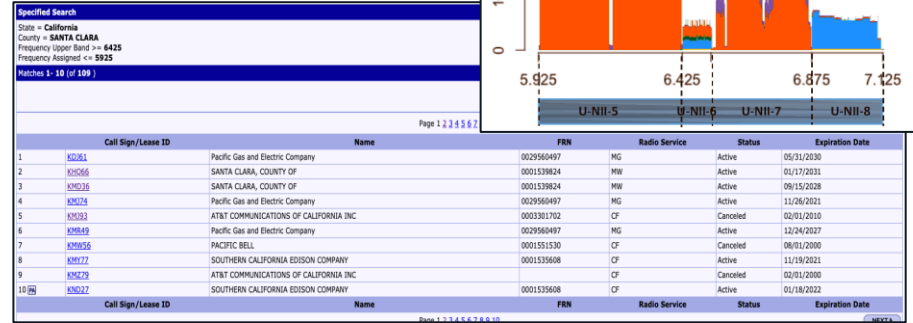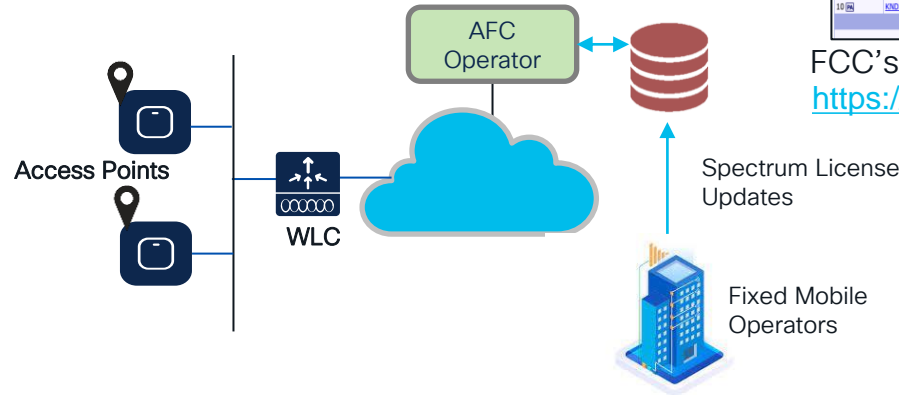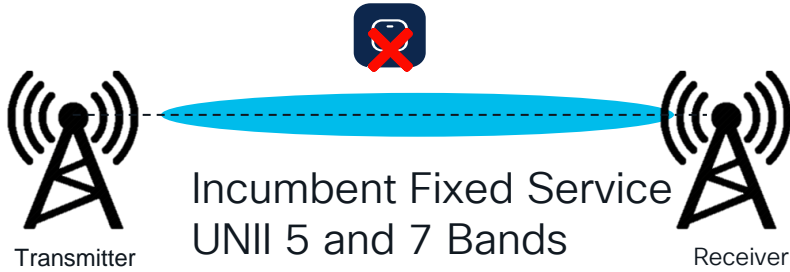
FCC's Universal Licensing System:
https://wireless2.fcc.gov/UlsApp/UlsSearch/searchGeographic.jsp

Automated Frequency Coordination (AFC):
Central database of frequencies, which are
available in the AP's same geographical location,
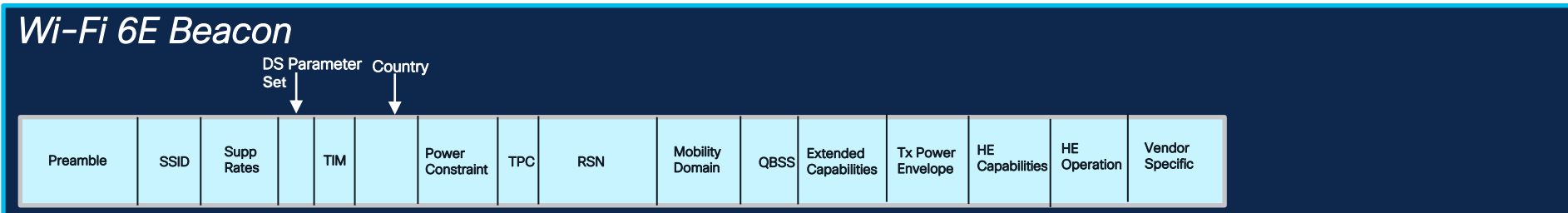and where the AP does not risk to interfere with
other systems (e.g. fixed satellites)

Wi-Fi 6E –
Protocol Optimizations

Wi-Fi 6E Beacon Changes
Legacy HT/VHT Information Element Removed

Wi-Fi 6 Beacon

DS Parameter Set

Country

HE Capabilities

| Preamble | SSID | Supp Rates | | TIM | | Power Constraint | TPC | RSN | Mobility Domain | QBSS | HT Capabilities | HT Operation | Extended Capabilities | VHT Capabilities | VHT Operation | | HE Operation | Vendor Specific |
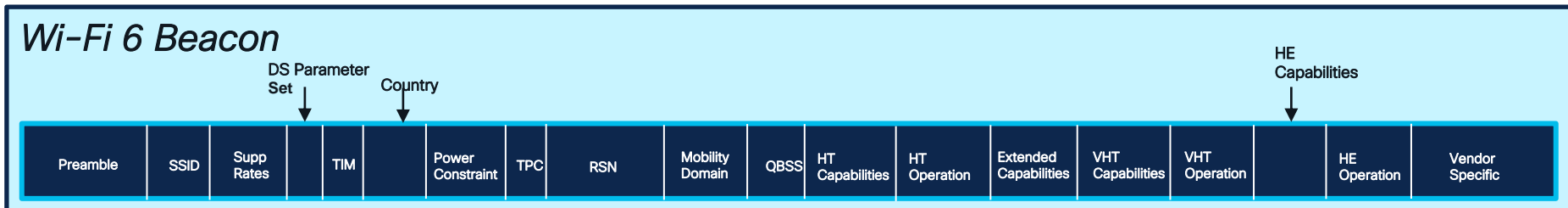
Comparison of Wi-Fi 6 and Wi-FI 6E Beacon Frame

Wi-Fi 6E Beacon

DS Parameter Set

Country

| Preamble | SSID | Supp Rates | | TIM | | Power Constraint | TPC | RSN | Mobility Domain | QBSS | Extended Capabilities | Tx Power Envelope | HE Capabilities | HE Operation | Vendor Specific |

Reduced Beacon Size

Multiple BSSID

- Capability originally specified in 802.11v

- Combines multiple SSID information in a single beacon frame
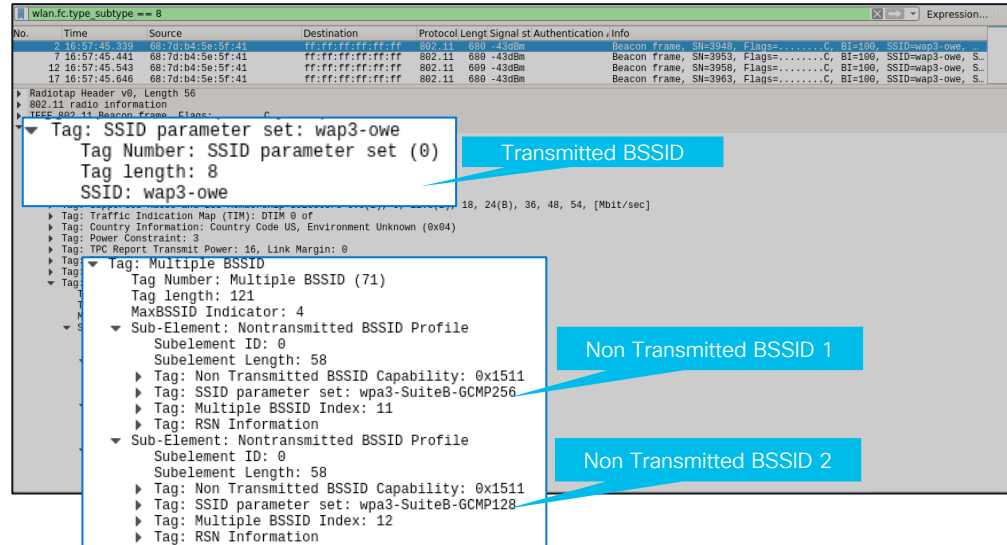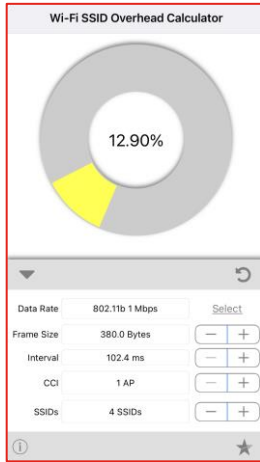
- Conserves Air Time

- Mandated in Wi-Fi 6E

Wi-Fi 6E –
AP Discovery

AP Discovery by Wireless Clients – Legacy Methods

- Hunt and seek method to scan Basic Service Sets or for APs
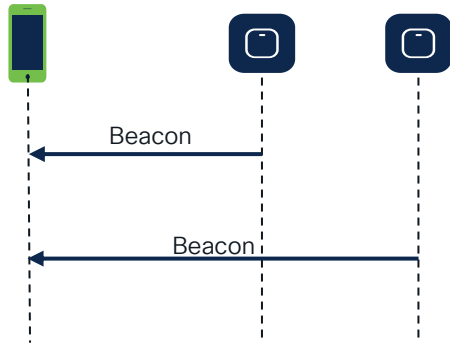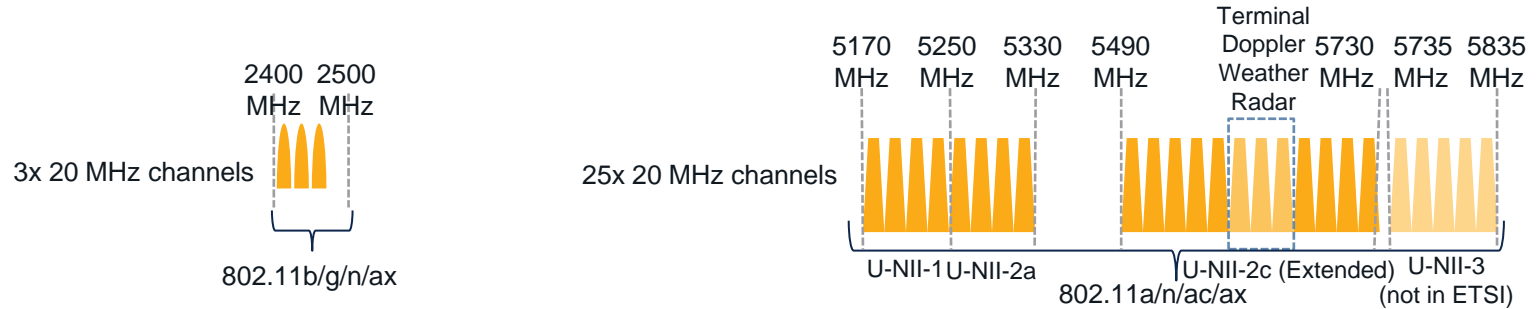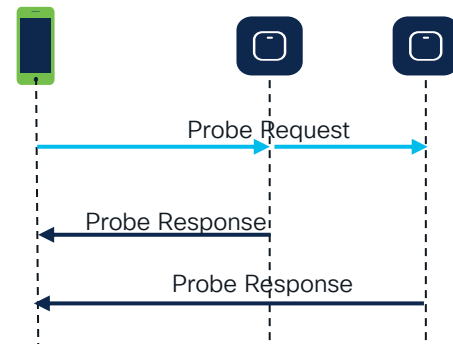
Why won't Legacy Scanning Methods scale in 6 GHz ?

5925 MHz   6425 MHz   6525 MHz   6875 MHz

U-NII-5   U-NII-6   U-NII-7   U-NII-8
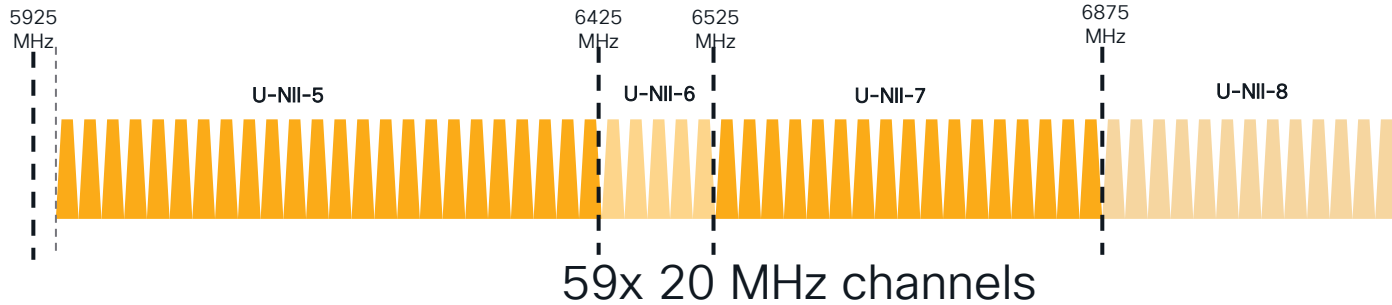
59x 20 MHz channels

- A Whopping 59 x 20 MHz Channels!

- Wi-FI Clients can send only Probe Requests on 20 MHz Channels

- 6 seconds to passive scan all 59 channels.

Wi-Fi 6E – New AP Discovery Mechanisms

Out of Band

Reduced Neighbor Report
Co-located Discovery

In Band

Passive Scan:
Fast Link Setup (FILS) Discovery Frames
Unsolicited Probe Response Frames

Active Scan:
Preferred Scanning Channels (PSC)

Reduced Neighbor Report

Co-located "Neighbor" 6 GHz radio information in Beacon and Probe Response of 2.4 and 5 GHz radios.

SSID: blizzard
5GHz Channel: 36
2.4GHz Channel: 1

Probe Request

Probe Response: blizzard
RNR :
   blizzard_wpa3
   channel 69 (6 GHz)

SSID: blizzard_wpa3
6GHz Channel: 69

Wi-Fi 6E Inband AP Discovery

Fast Initial Link Setup (FILS)

- Part of IEEE 802.11ai Standard
- Addresses Improvement in :
  - Network and BSS Discovery
  - Authentication and Association
  - DHCP and IP address setup

DISTRIBUTION SYSTEM

AP2   AP N-1

AP1   ESS   AP N

Client 1   Client 2   Client N

Scanning Clients

Entering and leaving an ESS
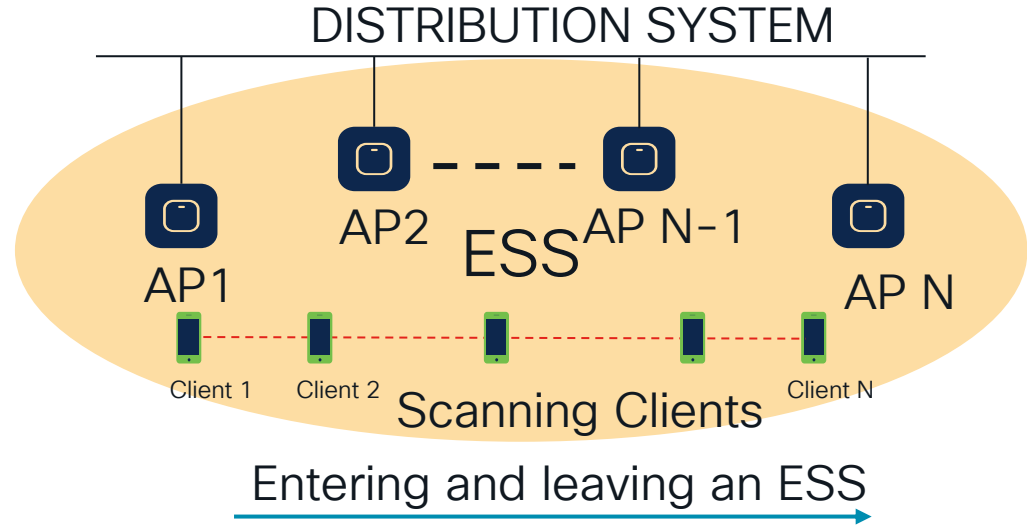
802.11ax in 6 GHz adopted FILS Discovery Frame to speed up AP

FILS Discovery Frames helps AP Discovery Faster

SMALLER BEACONS THAT IS TRANSMITTED MORE FREQUENTLY (APPROX. 20 MSEC), CONSUMES LESS AIR TIME.
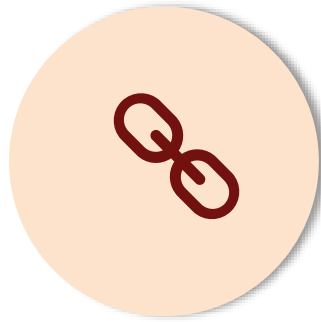
CONTAINS INFORMATION FOR THE CLIENT TO DECIDE ON THE AP TO CONNECT (SHORT SSID, CHANNEL, TBTT ETC)

REDUCES PROBE REQUEST OVERHEAD

Reduces Air Time Utilization by Management Frames

Fast Initial Link Setup (FILS) Discovery Frames

100 msec

20 msec

AP 1

AP 2

Client

Dwell Start

Discover AP1
Short SSID of Interest
Schedule listen at
TBTT

Discover AP2
Short SSID not of
Interest

Sleep, return to home channel or Probe Start

Dwell End   TBTT Listen Start

TBTT Listen End

Dwell finished in ~20 msec

FILS Discovery Frame   Beacon Frame
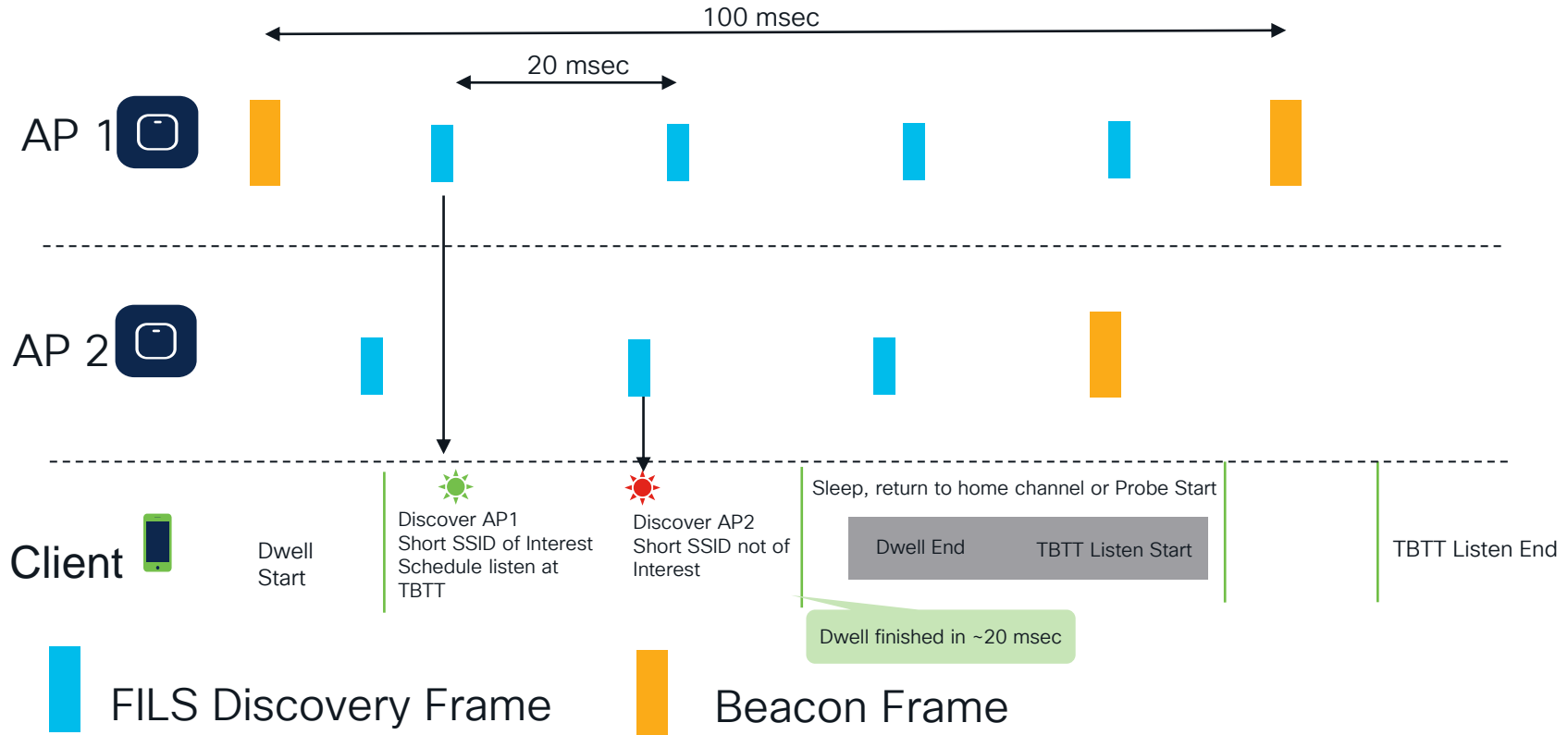
FILS Discovery Frame – Packet Capture

Broadcast Action Frames

Contains Short SSID, Channel, TBTT etc

Transmitted every 20 msec

Unsolicited Broadcast Probe Response

Reduces Probe Request Overhead

Broadcast probe response every 20 msec

Contains detailed information as a Beacon

Helps Avoid Probe Storm

Unsolicited Broadcast Probe Response – Packet Capture

Apply a display filter ... <Ctrl-/>   Expression...

No.	Time	Source	Destination	Pro...	...	stre Info
1	16:36:27.556	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599 -36dBm	Beacon frame, SN=2635, Flags=........C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...
2	16:36:27.577	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2636, Flags=........C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
3	16:36:27.597	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2637, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
4	16:36:27.618	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2638, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
5	16:36:27.638	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2639, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
6	16:36:27.659	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599 -36dBm	Beacon frame, SN=2640, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...
7	16:36:27.679	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2641, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
8	16:36:27.700	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2642, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
9	16:36:27.720	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2643, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
10	16:36:27.741	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2644, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
11	16:36:27.761	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599 -36dBm	Beacon frame, SN=2645, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...
12	16:36:27.782	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2646, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
13	16:36:27.802	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2647, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
14	16:36:27.822	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2648, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
15	16:36:27.843	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	550 -36dBm	Probe Response, SN=2649, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=w...
16	16:36:27.863	68:7d:b4:5e:d2:f8	ff:ff:ff:ff:ff:ff	802.11	599 -36dBm	Beacon frame, SN=2650, Flags=.......C, BI=100, SSID=wpa3-sae, SSID=GCMP256, SSID=wpa...

Broadcast

Sent every 20 ms

```
▶ Frame 2: 550 bytes on wire (4400 bits), 550 bytes captured (4400 bits) on interface 0
▶ Radiotap Header v0, Length 56
▶ 802.11 radio information
▶ IEEE 802.11 Probe Response, Flags: ........C
▼ IEEE 802.11 wireless LAN
  ▶ Fixed parameters (12 bytes)
  ▼ Tagged parameters (454 bytes)
    ▶ Tag: SSID parameter set: wpa3-sae
    ▶ Tag: Supported Rates and BSS Membership Selectors 6.0(B), 9, 12.0(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
    ▶ Tag: Country Information: Country Code US, Environment Unknown (0x04)
    ▶ Tag: Power Constraint: 6
    ▶ Tag: TPC Report Transmit Power: 23, Link Margin: 0
    ▶ Tag: Extended Supported Rates and BSS Membership Selectors BSS requires support for direct hashing to elements in SAE, [Mbit/sec]
    ▶ Tag: QBSS Load Element 802.11e CCA Version
    ▶ Tag: Multiple BSSID
    ▶ Tag: RM Enabled Capabilities (5 octets)
    ▶ Tag: Extended Capabilities (11 octets)
    ▶ Ext Tag: HE Capabilities (IEEE Std 802.11ax/D2.0)
    ▶ Ext Tag: HE Operation (IEEE Std 802.11ax/D2.0)
    ▶ Ext Tag: 6GHz Band Capabilities
    ▶ Ext Tag: Spatial Reuse Parameter Set
    ▶ Ext Tag: MU EDCA Parameter Set
    ▶ Tag: Vendor Specific: (null): WMM/WME: Parameter Element
    ▶ Tag: Vendor Specific: (null): Unknown
    ▶ Tag: Vendor Specific: (null)
```

Broadcast frames

Transmitted every 20ms

Carry Multiple BSSID

Contains all information needed for association

New Probe Restrictions in 6 GHz Band

Clients cannot do blind probing.
(Broadcast destination address using Wildcard SSID and BSSID not allowed)

Clients must wait at least the duration of minimum probe delay interval (approx. 20 msec)

Probe responses are always broadcast.

Broadcast probe requests and probes with wildcard SSID create probe storm and impacts performance

Preferred Scanning Channels (PSC)

- Every fourth 20MHz channel designated for active probing by Wi-Fi 6E Clients; restricts scanning to 15 channels, instead of 59.

- PSC channels serve as the primary channel for channel bonding in 80 MHz
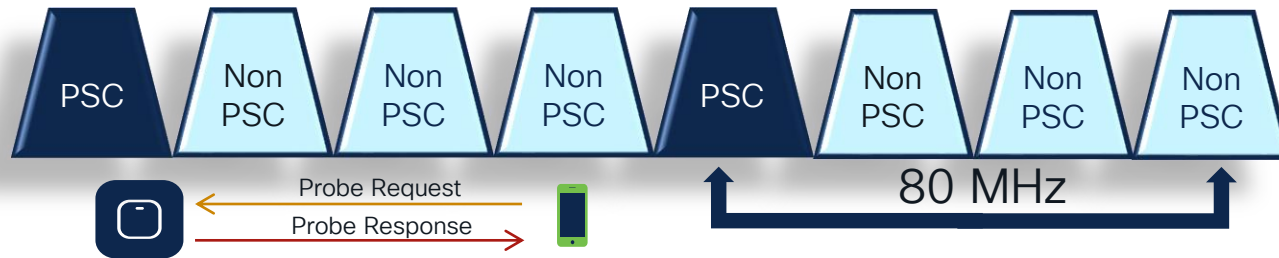
PSC Channel List:
5, 21, 37, 53, 69, 85, 101, 117, 133, 149, 165, 181, 197, 213 and 229

Key Takeaways

RNR
(Out-of-Band)

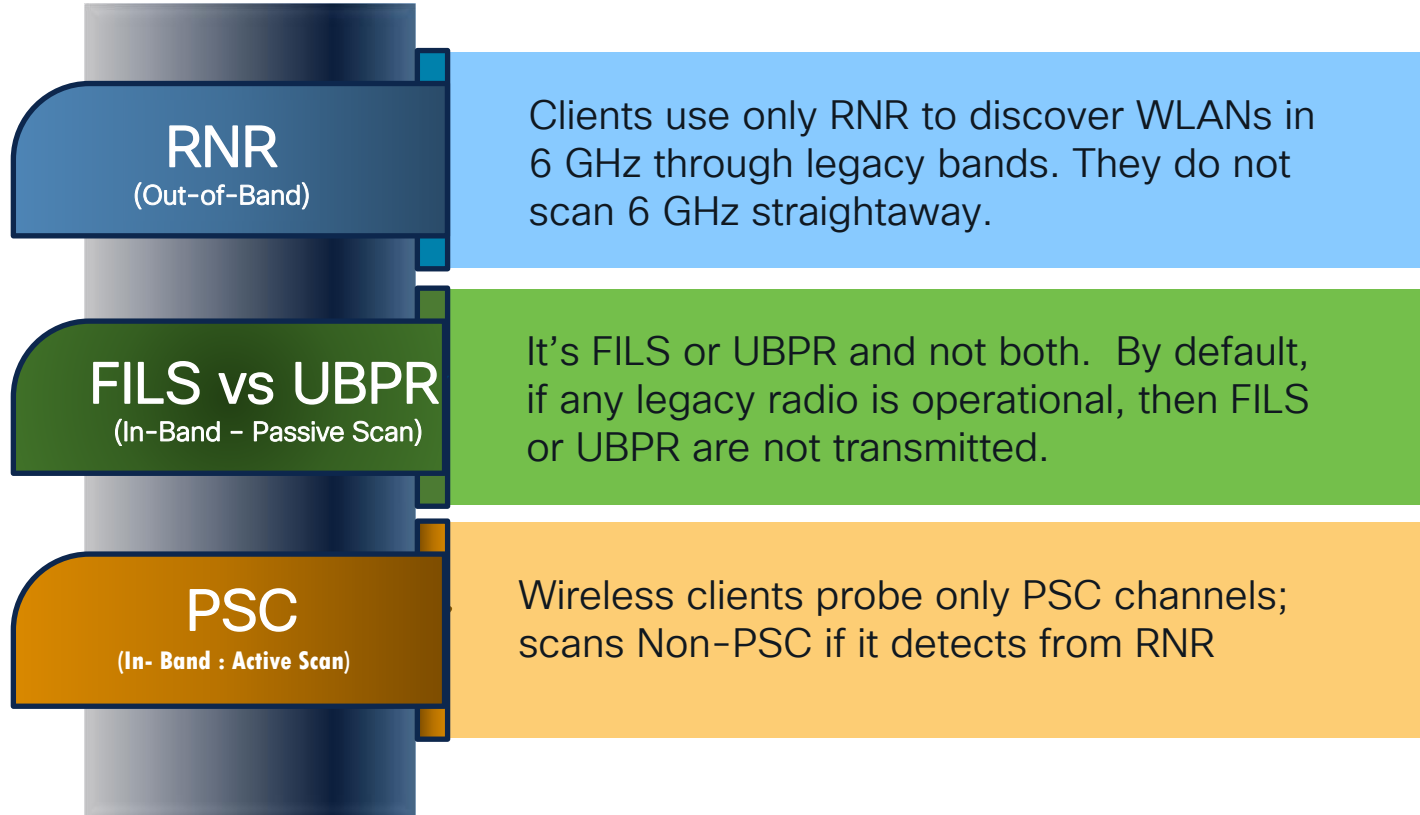Clients use only RNR to discover WLANs in 6 GHz through legacy bands. They do not scan 6 GHz straightaway.

FILS vs UBPR
(In-Band – Passive Scan)

It's FILS or UBPR and not both. By default, if any legacy radio is operational, then FILS or UBPR are not transmitted.

PSC
(In- Band : Active Scan)

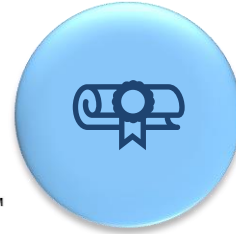Wireless clients probe only PSC channels; scans Non-PSC if it detects from RNR

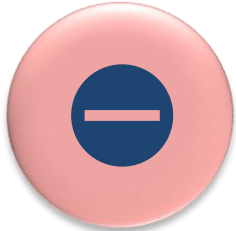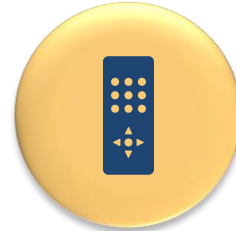# Wi-Fi 6E Security

Wi-Fi 6E uplevels security with WPA3 and OWE

WPA3 and Enhanced Open Security made mandatory for Wi-Fi 6E certification.

Wi Fi™
WPA3

No backward compatibility with Open and WPA2 Security.

Requires Protected Management Frame (PMF) in both AP and Clients.

6GHz WLAN Design Considerations

6GHz SSID Requirements

- WPA3 L2 Security: **OWE, SAE or 802.1x-SHA256**
- Protected Management Frame (**PMF**) enabled
- Any other L2 security method is not allowed – **no mixed mode possible**

What options would you have?

1. "ALL-IN" option: Reconfigure the existing WLAN to WPA3, one SSID for all radio policies (2.4/5/6 GHz) – Most unlikely

2. "One SSID" option: Configure multiple WLANs with the same SSID name, different security settings – Most conservative

3. "Multiple SSIDs" option: Redesign your SSIDs, adding specific SSID/WLAN with specific security settings – Most flexible

Most likely your current SSID configuration would prevent it from being broadcasted on 6GHz
Note: as 17.9.1, there is a limit of 8 SSIDs broadcasted on 6GHz radio

Opportunistic Wireless Encryption (OWE)
Simultaneous Authentication of Equals (SAE)
Secure Hash Algorithm (SHA) 256 bit

Wi-Fi 6E Security Deployment Considerations

- Layers of Wi-Fi Security
  - Clients with WPA2/WPA/Open continue to operate in 2.4 and 5 GHz bands.
  - 6 GHz operates exclusively with WPA3 and Enhanced Open Security

- Use of different SSIDs for 6 GHz band

2.4 & 5 GHz Bands

SSID: employees
   (WPA2-Enterprise)
SSID: guest
   (WPA2-Personal)
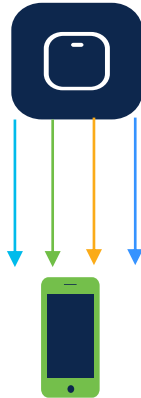
6 GHz Band

SSID: employees-wpa3
   (WPA3-Enterprise)
SSID: guest-wpa3
   (WPA3-Personal/H2E *)

*Note: Only H2E is the supported SAE in 6GHz Band

Wi-Fi 6E/WPA3 Client Security Matrix

Protocol	Encryption	AKM	Intel AX210	Qualcomm HSPv2 WCN6855	Samsung /Google Android
OWE	AES-CCMP128	OWE	Supported	Supported	Supported
SAE	AES-CCMP128	SAE 6GHz: H2E Only	Supported: H2E only SAE-FT: Windows does not support. SAE-FT: Linux supports it. *(No limitation on AX210)*	Supported	Supported: H2E only SAE-FT: Galaxy S21 Ultra, Galaxy Z Fold 3 has capable to support, but currently it is disabled. Can be enabled by usermode fw on protos only.

Note: Client Security Matrix with AP Mode as Local

Wi-Fi 6E/WPA3 Client Security Matrix

Protocol	Encryption	AKM	EAP Method	FT-OTA	FT-ODS	Adaptive	Intel AX210	Qualcomm HSPv2 WCN6855	Samsung / Google Android
Enterprise	AES-CCMP128	802.1x-SHA256	PEAP/FAST/TLS	Supported	Supported	Supported	Supported: SHA256 & FT-OTA Not-Supported: EAP-FAST, FT-ODS,	Supported	Supported: SHA256 & FT-OTA Not-Supported: EAP-FAST Not-Supported: FT-ODS
Enterprise	GCMP128	SuiteB-1X	PEAP/FAST/TLS			Not Supported	Not-Supported	Not-Supported	Not-Supported
Enterprise	GCMP256	SuiteB-192	TLS				Supported: GCMP256 Not-Supported: EAP-FAST & FT(both FT-OTA & FT-ODS)	Supported: GCMP256	Supported: GCMP256 & FT-OTA Not-Supported: FT-ODS

Note: Client Security Matrix with AP Mode as Local

Wi-Fi 6E – Client Eco System

Wi-Fi 6E Client Device Eco System

Wide range of client support ..

SAMSUNG

G Pixel

Xiaomi

ASUS

MOTOROLA

Samsung Galaxy
Ultra S21/S22

Samsung Galaxy Z Fold

Google Pixel 6 /Pro

Xiaomi Mi 11 /Ultra

ASUS Zenfone 8 and 8 Flip

Motorola Edge (2021)

Samsung Galaxy Tab S8, S8+

REDMAGIC

Wi-Fi 6E Chipsets

intel.
Wi-Fi 6E
Gig+

MEDIATEK

Infineon
AIROC™
Wi-Fi/Bluetooth®
Combo

Qualcomm
networking pro
series platforms

BROADCOM
BCM4389

ON
QCS-AX2

Redmagic 6s Pro

with more coming soon …..

Laptops with Intel AX210/AX211/AX411 Chipset

CISCO *Live!*

Catalyst Wi-Fi 6E Access Points

Cisco Wi-Fi innovations
For every major change in WLAN over the last 20+ years

Common Hardware

FastLocate and HyperLocation – Third radio

Cisco RF ASIC

Flexible Radio Assignment (Dual 5GHz)

Hyperlocation

WSM Module

Unified Wireless Architecture (WLC & APs)

CleanAir: interference detection and mitigation

WSSI Module

Connected mobile experiences

Application visibility and control

Autonomous Access Points

Wi-Fi 6 802.11ax
Intelligent capture and real-time telemetry

CleanAir Pro

Wi-Fi 6E 6 GHz

Wi-Fi 5 802.11ac wave 2

802.11ac wave 1

802.11n

AP1130 AP1240
AP3500
AP3600
AP3700
AP3700i
AP3800
AP4800
C9100AX
CW916X

| 1999 | 2005 | 2010 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 201 | 202 |

One Product – Two personas

DNA Persona
C9800 & DNAC Stack

Meraki Persona
MR Dashboard Stack

Cisco Wi-Fi 6E Portfolio
Common Platforms will have CW PIDs

MR and C series APs are not convertible

One Product – Two Personas

CW9162

- 2x2 + 2x2 + 2x2
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- Scanning Radio
- IoT ready + Bluetooth 5.x
- Standard Bracket

CW9164

- 2x2, 4x4, 4x4
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- Scanning Radio
- IoT Ready + Bluetooth 5.x
- Standard Bracket

CW9166

- 4x4 + 4x4, 4x4 (XOR 5/6)
- 5 Gbps mGig
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Scanning Radio
- Environmental Sensor
- Common XOR Architecture
- Standard Bracket

MR57

- 4x4 + 4x4, 4x4 (XOR 5/6)
- Dual 5 Gbps mGig with failover
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Scanning Radio
- XOR Architecture (High/Low band)
- Standard Bracket

C9136

- 4x4 + 8x8 + 4x4 or 4x4+4x4+4x4+4x4
- Dual 5 Gbps mGig with failover
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Scanning Radio
- Environmental Sensor
- XOR Architecture (macro/meso)
- Standard Bracket

Cisco Catalyst Wireless 6E Access Points

Ideal for Small to Medium-sized deployments ❯		Best In Class, Flexibility ❯	Mission Critical, Performance

CW9162
NEW — Common HW

- 2x2 + 2x2 + 2x2
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Partial iCAP
- USB – 4.5 W

🟢 Available with IOS-XE 17.9.2

CW9164
NEW — Common HW

- 2x2, 4x4, 4x4
- 2.5 Gbps mGig
- Power Options: PoE, DC Power
- IoT Ready + Bluetooth 5.x
- Partial iCAP
- USB- 4.5 W

CW9166
NEW — Common HW

- 4x4 + 4x4 + 4x4 (XOR 5/6)
- 5 Gbps mGig
- Power Options: PoE, DC Power
- IoT ready + Bluetooth 5.x
- Environmental Sensor
- Full Packet Capture (iCAP)
- Zero-Wait DFS*
- USB – 4.5W

C9136

- 4x4, 8x8, 4x4 (or) 4x4, 4x4+4x4, 4x4
- Dual 5 Gbps mGig, active fail over
- PoE Redundancy
- IoT ready
- Bluetooth 5.x
- Environmental Sensor
- Full Packet Capture (iCAP)
- Zero-Wait DFS*
- USB – 9W

Available in Future

Full radio capability (6 GHz @ LPI) on single 30W PoE+

Dedicated Radio for CleanAir Pro	Same Bracket, Industrial Design	AP Power Optimization	USB

Conversion overview

 Done from C9800 WLC

 Call Meraki Support (Needs license)

Wi-Fi 6E Migration and Deployment Guidelines & Pointers

Deploying and Migrating to Wi-Fi 6E
Recommendations, Tips and Tricks

BRKEWN-2038
Wi-Fi 6E is Here! Are you Ready ?
June 14th – 10.30 A.M
By Simone Arena

BRKEWN-3005
Cisco Catalyst Wi-FI, Understanding Wi-Fi 6/6E and Beyond
June 13th – 2:30 P.M
By Jim Florwick

Power Considerations

Recommendation: 802.3bt (UPoE) is the suggested power input used.

Note: CW LP APs have full radio capability with at power.
802.3at (PoE+) and 802.3af (PoE) are also supported by Catalyst Access Points.

Migrating to 6GHz

Top of Mind: For Brownfield, 1:1 AP replacement. For Greenfield, coverage areas per AP is now 1,500-2,000 sq ft.

Legacy clients must still be considered.
Shorter Distance = Better Data Rate

mGig Switching

Recommendation: To use mGig switch with 5 Gbps capability.

Better user experiences with speeds beyond 1 Gbps on Cat 6/6A Cables.
Cat 5e supports upto 2.5 Gbps

BRKEWN-2038
Wi-Fi 6E is Here! Are you Ready ?
June 14th – 10.30 A.M
By Simone Arena

Security Requirements

Mandatory: WPA3 is required for Wi-Fi 6E Networks to be enabled.

WPA3 was not required for prior Wi-Fi generations; hence, must be top of mind.

Standard Power AP

Note: Only US and Canada has the authorized the use of SP APs and needs AFC

AFC Certification is not yet available.
Note: Other countries have not yet authorized the use of SP APs

BRKEWN-2038
Wi-Fi 6E is Here! Are you Ready ?
June 14th – 10.30 A.M
By Simone Arena

Note: AP Device Pack is not available for IOS XE 17.6, 17.7+ is needed to adopt 6 GHz

Backup Slides

Wi-Fi 6E 6GHz Restrictions

6 GHz LPI operation: US/Canada and EU

US and Canada

"<u>Access points</u> operating under the provisions of paragraphs (a)(5)* and (a)(6) of this section must employ a permanently attached integrated antenna."

FCC 15.407(a)(9)

*Indoor access point operating in the 5.925-7.125 GHz band...5 dBm/MHz/30 dBm EIRP (LPI operation)

"Low-Power Indoor Access Point--limited to indoor use. Must not have a weatherized enclosure..."

FCC 987594 DO3 U-NII 6 GHz Q&A v01 p.1

Indoor access point: An access point operating in locations completely enclosed by walls and a ceiling. Indoor access points: have a permanent antenna; ...and do not have a weatherized enclosure.

Canada RSS-248 Section 3, p2

European Union/CEPT nations

LPI WAS/RLAN devices shall comply with the.. conditions below: Category of device: An LPI access point or bridge that is supplied power from a wired connection, has an integrated antenna and is not battery powered.

CEPT report 75 A1.2 Table 1

LPI AP/bridge sub-category devices shall be designed with one or more integral antenna(s) as a fixed part of the equipment, i.e., without externally accessible connectors to prevent the connection of another antenna by a user.

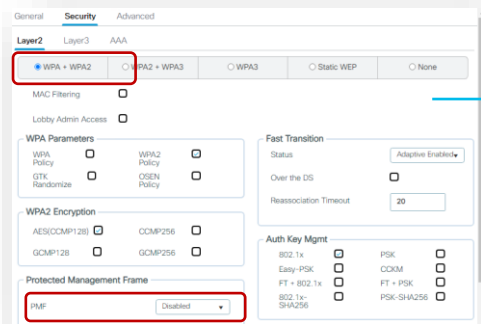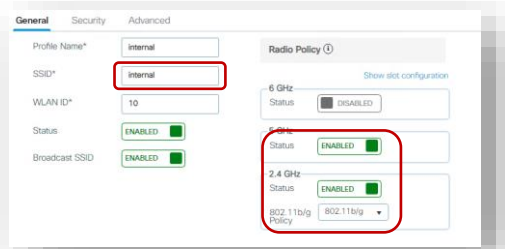ETSI EN 303 687 V0.0.14 (draft) 4.3.9.2.2

F. Anderson 14 Feb 2022
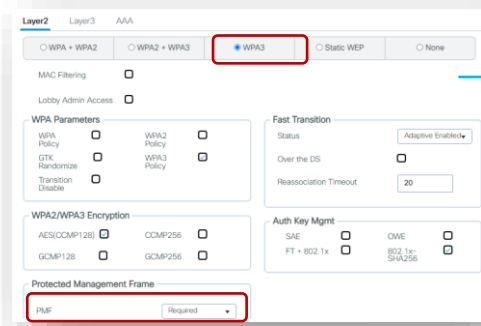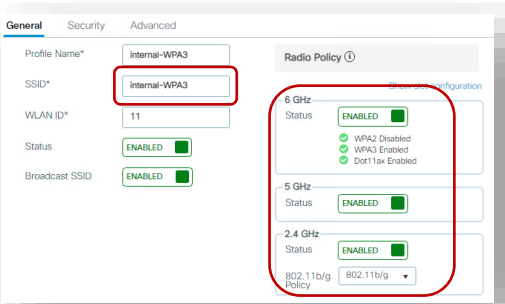
Wi-FI 6E WLAN Configuration – Example 1

Add a separate WLAN with different SSID name for WPA3 and broadcast it in all bands. Leave the existing WLAN/SSID untouched.

Legacy SSID

Existing WPA/WPA2 SSID in 2.4 and 5GHz for legacy clients

New SSID

Dedicated SSID for WPA3 capable clients in all bands. This is the SSID for 6GHz

Wi-FI 6E WLAN Configuration – Example 2

Redesign the WLANs, reserving each band for a specific device/use case

2.4GHz dedicated to specifc devices. These could be legacy devices or IoT devices. If IoT will be mostly PSK

5GHz dedicated to majority of existing clients

WPA3 on 6GHz only for the newest clients

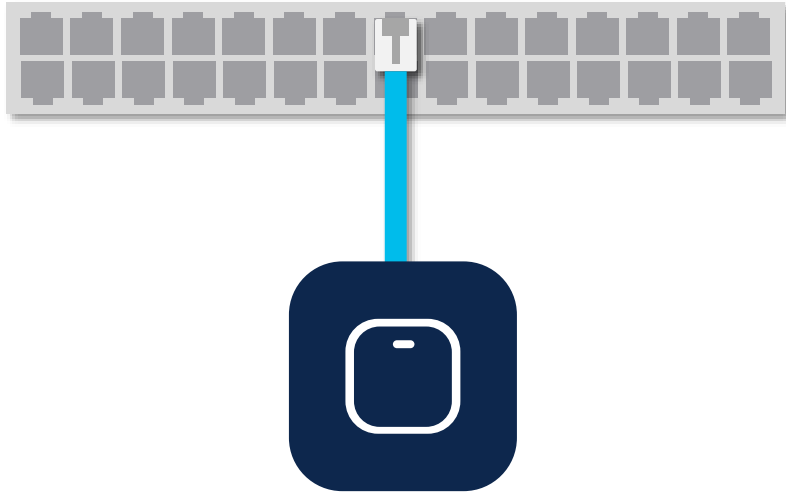# Wi-FI 6E WLAN Design Considerations

Pros

- Cleanest option from a client compatibility point of view

- More secure options as clients can adopt WPA3 security

- WPA3 clients can roam across different bands

Cons

- Additional SSIDs to manage and broadcast

- Need to manage additional SSID profiles on clients
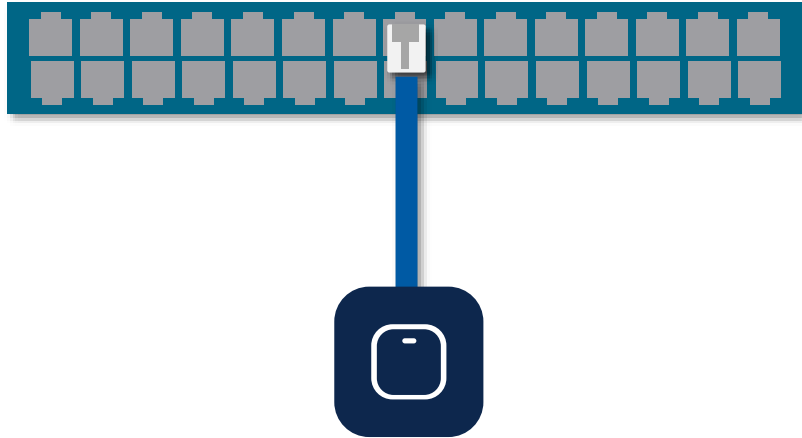
Catalyst AP to Switch connection

AP negotiates power, speed and duplex at boot time via CDP/LLDP

MGig switchport is recommended as Wi-Fi 6/6E speed may exceed 1 Gbps

Cabling: Cat 6/6A recommended. Cat 5e can support up to 5Gbps

Apply the recommended switchport settings for AP in Local or Flex mode

AP Power Consumption

PoE Power Negotiation happens at boot time through CDP/LLDP

Power allocation is what you need to consider for power budget

Actual Power consumption is dependent on the AP operation

Power Allocated

48.3 W

Power Consumed

16.5 W

Networking

Wi-Fi 6/6E

Learn from experts on wireless topics such as WiFi6 an WiFi6E standards enhancements. You will understand what you need to know about designing for 6GHz, migrating from AireOS to Catalyst 9800, and what you need to know about 5G and WiFi6E coexistence.

START

June 15 | 10:30 a.m.
BRKEWN-1742
7 Ways to Fail - on Wi-Fi 6(E)

June 14 | 10:30 a.m.
BRKEWN-2038
Wi-Fi 6E is Here! Are You Ready?

June 13 | 9:30 a.m.
BRKEWN-2024
Architecting Next Generation Wireless Network with Catalyst Wi-Fi 6E Access Points

June 16 | 8:00 a.m.
BRKEWN-2030
WiFi6 and Private 5G for the Enterprise – a 'Better Together' Journey

June 15 | 4:00 p.m.
BRKEWN-2338
Catalyst Wireless - How to Successfully Migrate to Catalyst 9800

June 13 | 2:30 p.m.
BRKEWN-3005
Cisco Catalyst Wi-Fi, Understanding Catalyst Wi-Fi 6/6E and Beyond

FINISH

June 12 | 9:00 a.m.
LTREWN-2015
Cisco Catalyst Wireless Mobility Lab

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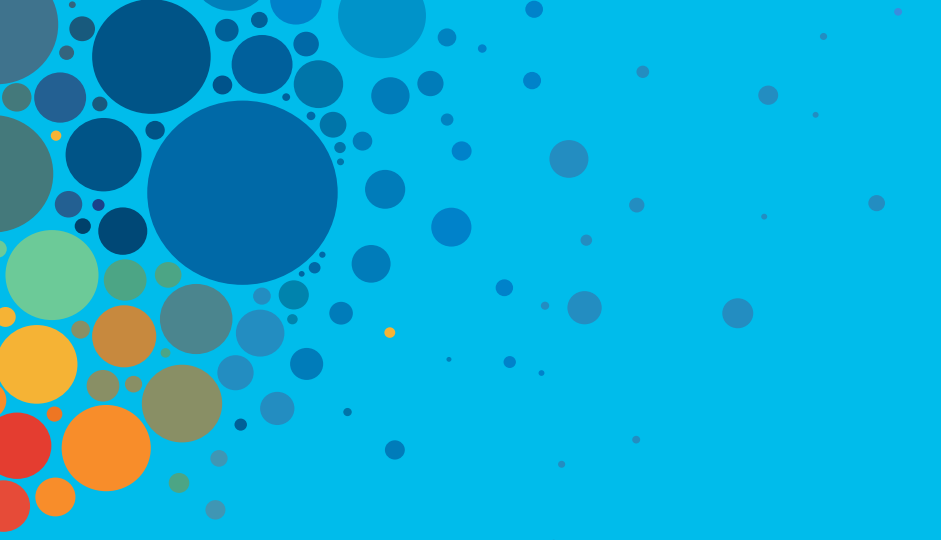
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