SparkLan WiFi6 series

2020/5/15
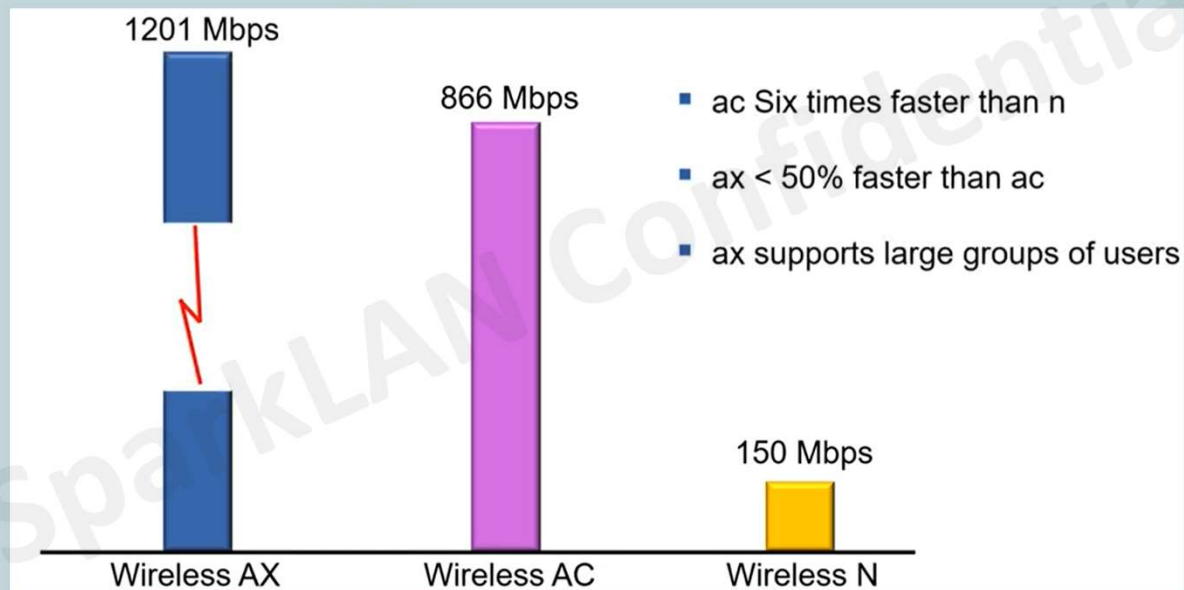
Presenter: Emily Wang

Agenda

- Wifi standard progress
  - What's different from 11ac and 11ax?
  - What's good about 11ax?
- Chipset vendor readiness
- What SparkLan has? And what's special about SparkLan's 11ax?
- End application recommendation
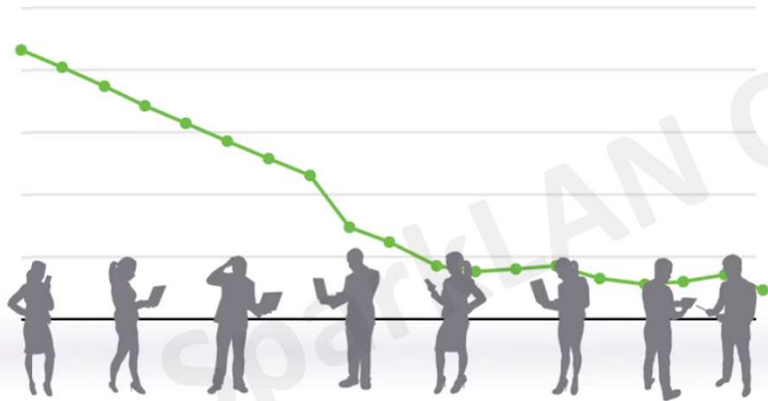
Before we start...

- WiFi4/5/6 throughput comparation:

Source: Spirent

Before we start…

- Why you should consider WiFi6

Source: Cisco

Wifi Standards Evolution

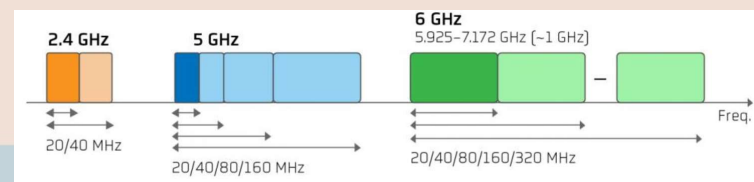|	802.11 (Legacy)	802.11b (Legacy)	802.11a (Legacy)	802.11g (Legacy)	802.11n (HT)	802.11ac (VHT)	802.11ax (HE)
Year Ratified	1997	1999	1999	2003	2009	2014	2019
operating Band	2.4GHz	2.4GHz	5GHz	2.4GHz	2.4/5GHz	5GHz	2.4/5GHz
Channel BandWidth	20MHz	20MHz	20MHz	20MHz	20/40MHz	20/40/80MHz 160(wave2)MHz	20/40/80/160MHz
Peak PHY Rate	2Mbps	11Mbps	54Mbps	54Mbps	150Mbps (1 stream/40MHz) 600Mbps (full speed)	433Mbps (1 stream/80MHz) 866Mbps (1stream/160MHz, Wave2) 6.8Gbps (full speed)	600Mbps (1 stream/80MHz) 1.2Gbps (1stream/160MHz) 9.6Gbps (full speed)
Max # SU streams	1	1	1	1	4	8	8
Max # MU streams	N/A	N/A	N/A	N/A	N/A	4 (DL only)	8 (UL & DL)
Modulation	DSSS, FHSS	DSSS, CCK	OFDM	OFDM	MIMO-OFDM	MIMO-OFDM	MIMO-OFDM, OFDMA
Max Constellation	DQPSK	CCK	64-QAM	64-QAM	64-QAM	256-QAM	1024 QAM
Approximate range - indoor	20 m (66 ft)	35 m (115 ft)	35 m (115 ft)	38 m (125 ft)	70 m (230 ft)	35 m (115 ft)	30 m (98 ft)
Approximate range - outdoor	100 m (330 ft)	140 m (460 ft)	120 m (390 ft)	140 m (460 ft)	250 m (820 ft)		120 m (390 ft)

Source: Wiki

Key word about 11ax/WiFi6

**** High efficiency Wi-Fi for high density connectivity ****

- Increase speed on both 2.4GHz and 5GHz
- Modulation scheme improved 4 times, 256QAM → 1024QAM
- Spatial stream, 8x8
- Channel bounding, 80MHz and 160MHz
- **Airtime efficiency**
  - OFDMA (reduce waste space, sub-channels)
  - BSS coloring (reduce waiting time, grouping)
- Target wakeup time
- 6GHz frequency, 5.925GHz~7.172GHz

SparkLan Website resource page:
https://www.sparklan.com/wifi-6-fast-speed-optimized-capacity-iot-now/

256-QAM increase to 1024-QAM modulation
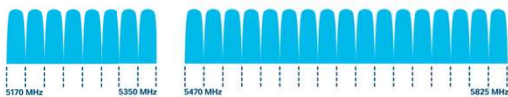

1024 QAM
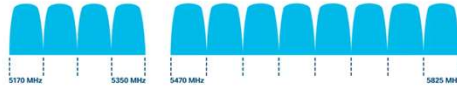256 QAM   1024 QAM
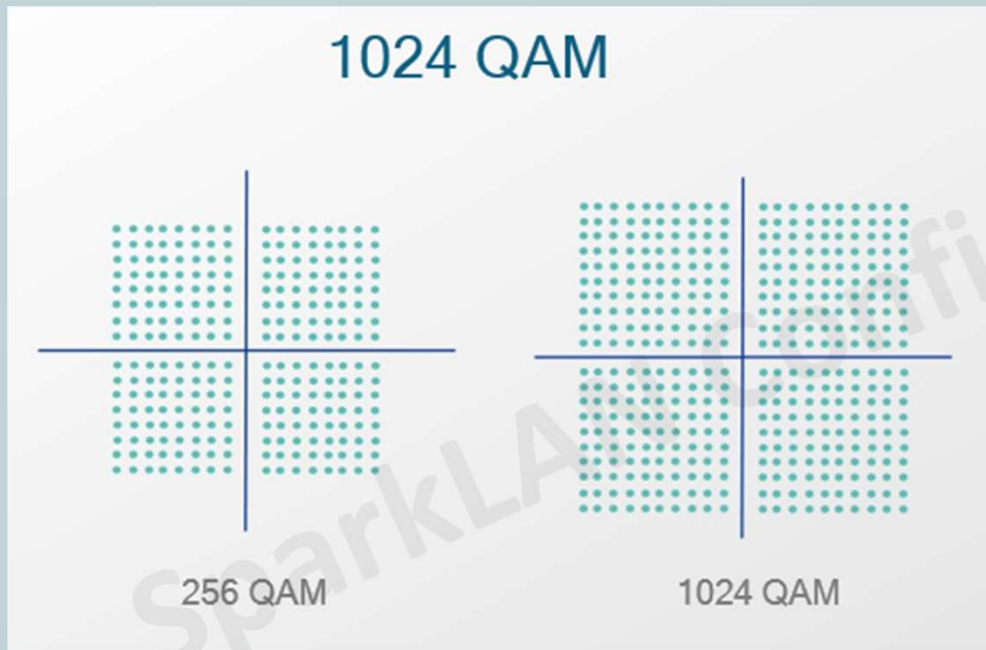
Higher data capacity

- 10 bits per symbol
- Up to 25% higher capacity
- Faster data trasaction

Channel bounding

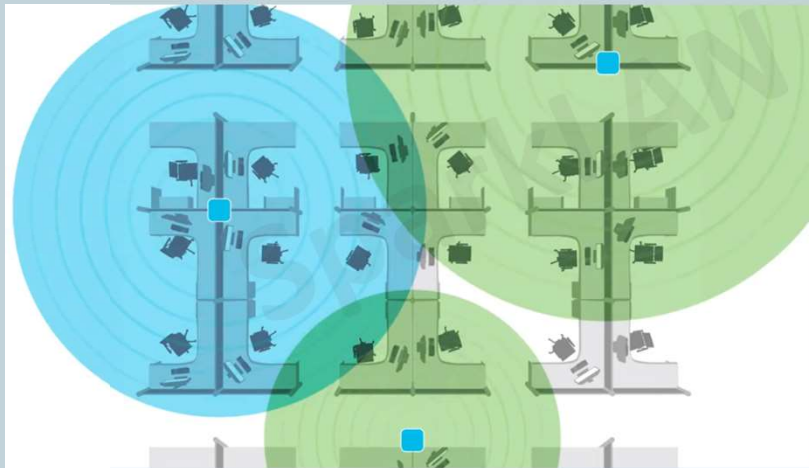| 25 Channels @ 20 MHz *U.S. Only | 12 Channels @ 40 MHz *U.S. Only | 6 Channels @ 80 MHz *U.S. Only | 2 Channels @ 160 MHz *U.S. Only |

- Number of channels means how many "road/access" could transmit data
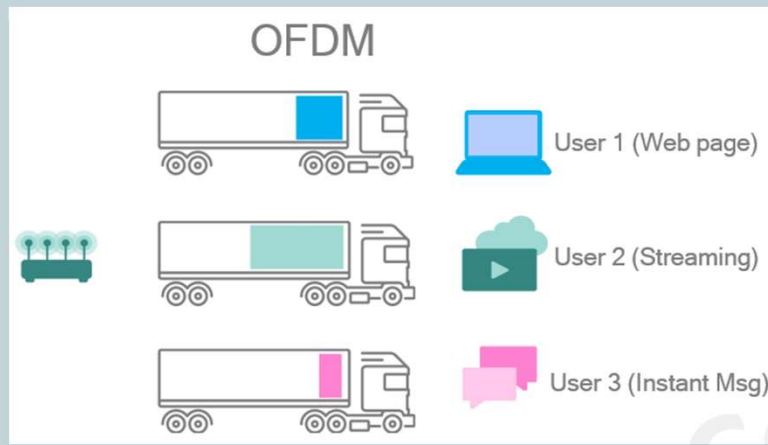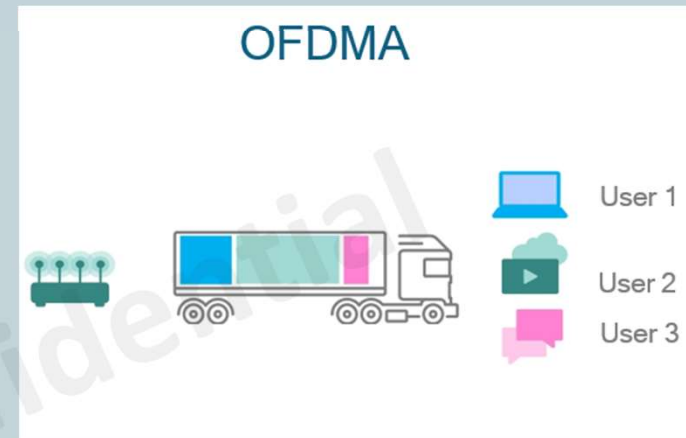- 20MHz~160HMz refers to data transmit capacity of each "road/access"

- Channel bonding reduce the available use channel, so for enterprise they use multiple routers in one area to cover as more channels you could get, but it also increase interference

OFDMA

OFDM

User 1 (Web page)
User 2 (Streaming)
User 3 (Instant Msg)

Wi-Fi 5 OFDM one user per one data package, not efficient and latency.

OFDMA

User 1
User 2
User 3

Wi-Fi 6 OFDMA one data package can include multiple user, improve efficient and reduce latency.

Wasted Space
350 Bytes

Source: Cisco

OFDMA Resource Units (sub-channels)

26
26
106
26
52

OFDMA Resource Units (sub-channels)

26
26
52
52
26
52
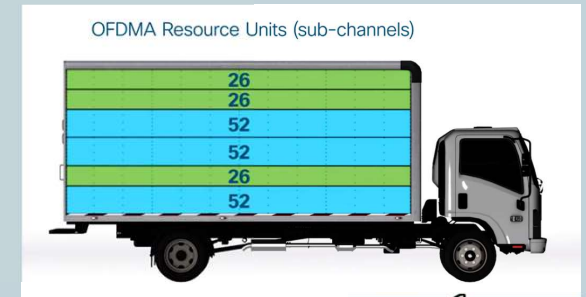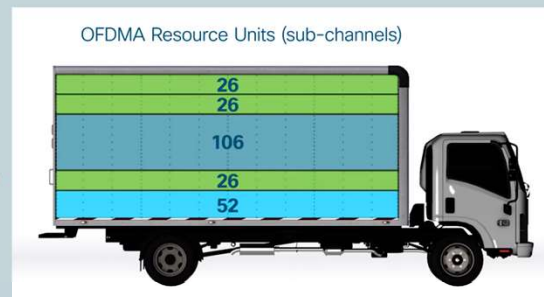
SparkLAN
Connections Made Easy
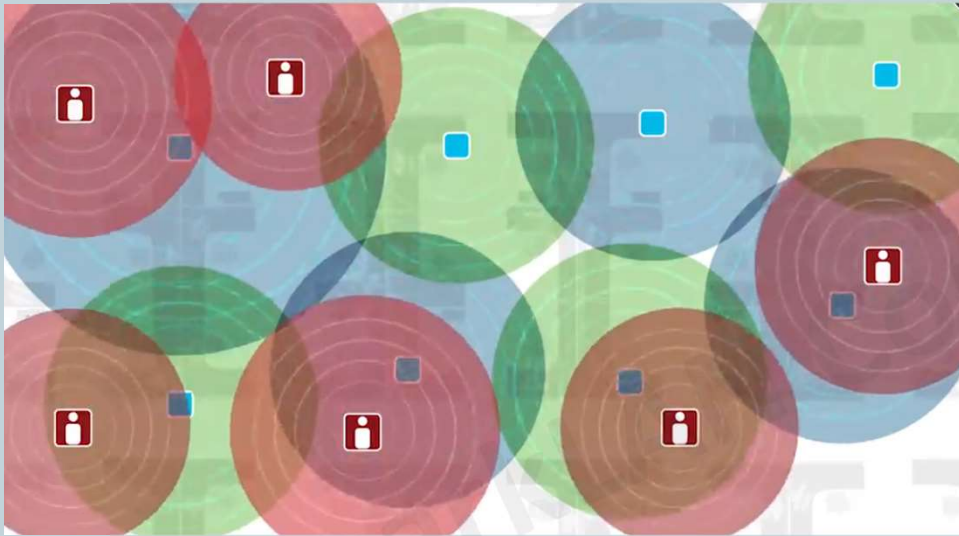
BBS Coloring

Figure: BSS Coloring
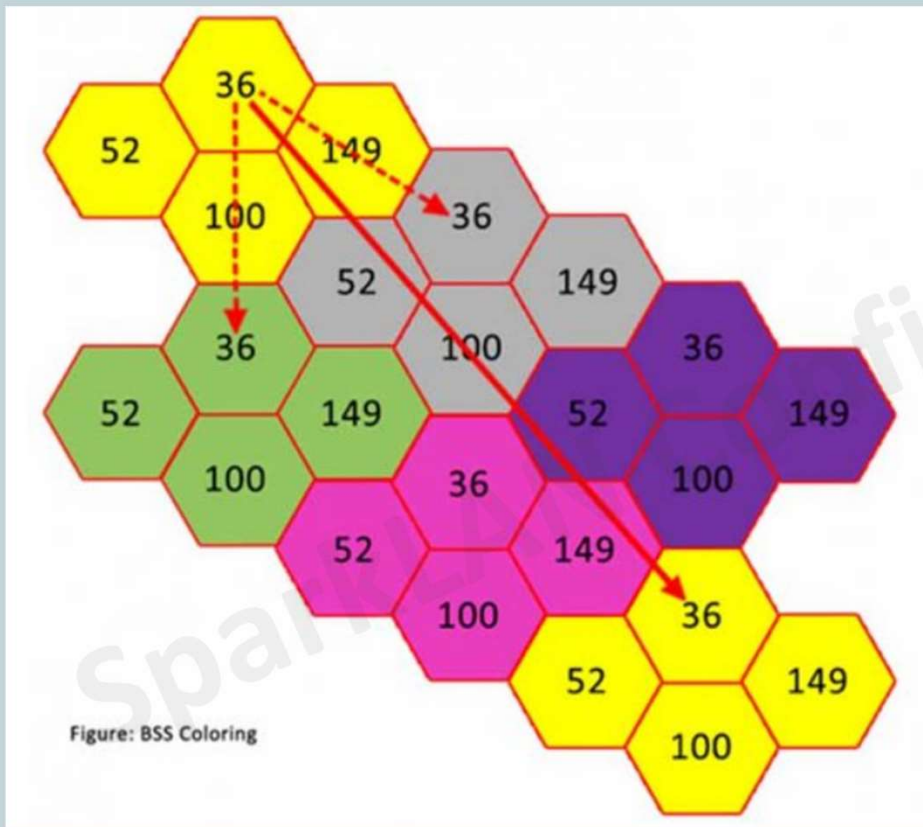
If multiple access points are operating on the same channel(s), they can transmit data with a unique "color" identifier that allows them to communicate over the wireless medium at the same time.
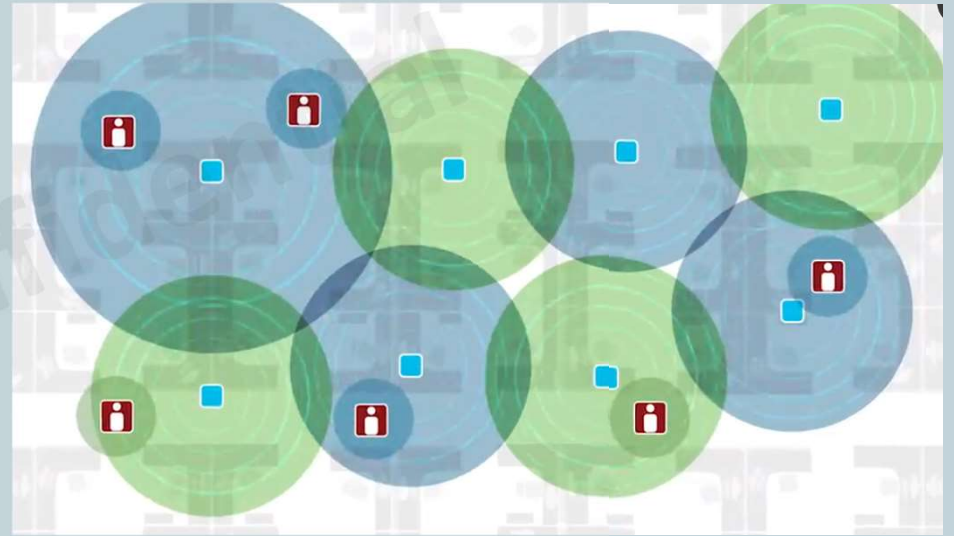
Improve the user waiting time.

BBS Coloring

What about the time when just waiting for chance to transmit?

Source: Cisco

- Access rule is "Listen before talking"
- In high density area, there's too much noise, channel will become very busy to offer available access.
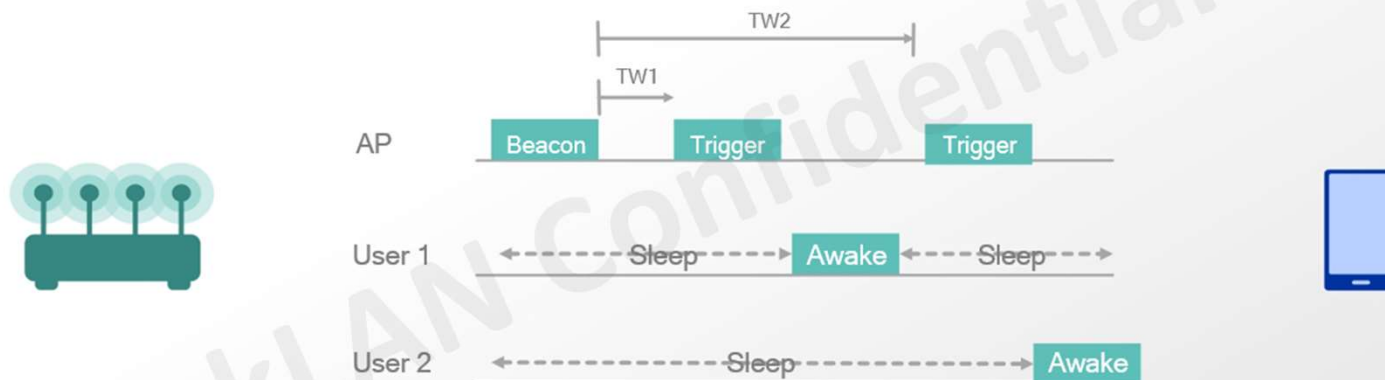- Client devices might need to wait for access even if they could be transmitting

- BSS coloring allows AP to offer an insigne for their team members → grouping
- Within same team, the AP could provide prevaginal channel access for each client device

TWT Target wake up time

Resource scheduling significantly improves device battery life

TWT : Target Wake Time

- AP and devices negotiate and define a specific times to access the medium
- Reduced contention and overlap between users
- Significantly increases the device sleep time to reduce power consumption

Chipset vendor readiness

- Chipset:
  - Intel → module ready, support Windows and Linux
  - Broadcom → chipset MP, SPK provide SiP, Module and AP on board solutions
  - Marvell → chipset MP
  - Qualcomm → in progress
  - Realtek → in progress
  - Mediatek → not yet ready

SparkLan Wi-fi 6 in Industrial Application

Wi-fi 6 Technology

o Dual-stream spatial multiplexing data rate of up to 1200 Mbps (2T2R)

o 20/40/80 MHz channels with 1024-QAM modulation

o Client and AP MU-MIMO

o Bluetooth 5.0 including Low-Energy Long Range (LELR)

o Dual-Band support 802.11ax/ac/a/b/g/n

o O/S support Linux

o Multiple design concept to fit most of applications

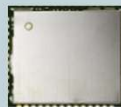o Technical support on driver porting
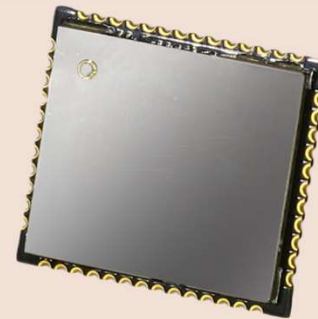
WiFi 6 product roadmap

2020 Q1

SiP module ready

AP6275S

AP6275P

2020 Q2

Connectorized module ready

WNFB-265AXI(BT)

WPEB-265AXI(BT) series

2020 Q3/4

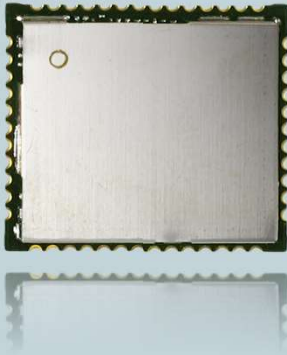Connectorized module ready

WNFB-266AXI(BT)

AP board sample ready

AP21750_P

SiP collections

- o WiFi spec: 802.11ax Dual-Band 2x2 +BT5.0
- o Driver support: Linux
- o Operating temp.: -30°C to 85°C
- o Dimension: 13x15mm
- o Voltage input: 1.8V
- o Application: Client mode, soft AP
- o Module status: MP
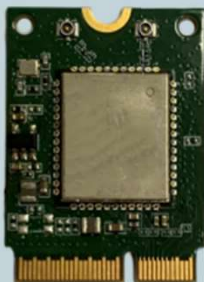- o Certification: system based

AP6275S

Wi-Fi: SDIO V3.0/2.0
BT:UART

AP6275P

SPECIALS

Wi-Fi: PCIe
BT:UART

SparkLAN
Connections Made Easy

M.2 collections

- WiFi spec: 802.11ax Dual-Band 2x2 +BT5.0
- Driver support: Linux
- Operating temp.: -30°C to 85°C
- Formfactor: M.2 2230 Key E
- Antenna connector: MHF4
- Voltage input: 3.3V
- Application: Client mode, soft AP
- Module status: EVT
- Certification: FCC/IC/CE/MIC in planning stage

WNFB-265AXI(BT)

Wi-Fi: PCIe
BT:UART
**Draft datasheet ready

WNFB-266AXI(BT)

SPECIALS

Wi-Fi: SDIO V3.0/2.0
BT:UART
**Draft datasheet ready

SparkLAN Confidential

SparkLAN
Connections Made Easy

Half sized mini card collections

- WiFi spec: 802.11ax Dual-Band 2x2 +BT5.0
- Driver support: Linux
- Operating temp.: -30°C to 85°C
- Formfactor: Half sized mini card
- Antenna connector: MHF1
- Voltage input: 1.8V / 3.3V
- Application: Client mode, soft AP
- Module status: EVT
- Certification: FCC/IC/CE/MIC in planning stage

WPEB-265AXI(BT)(B33)

Wi-Fi: PCIe
BT:USB
Voltage input: 3.3V
**Draft datasheet ready

WPEB-265AXI(BT)(R33)

Wi-Fi: PCIe
BT:UART
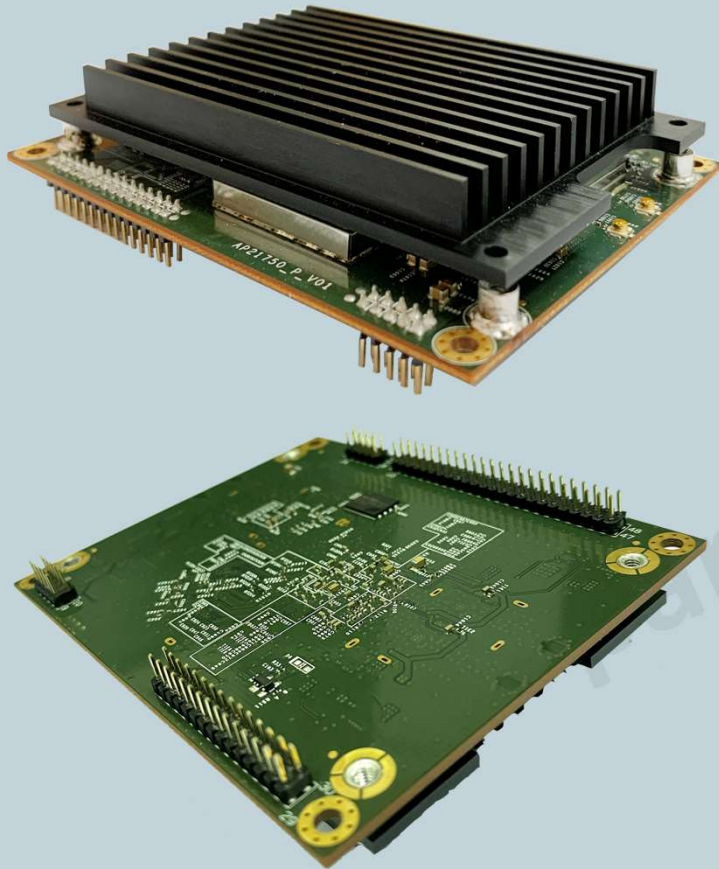Voltage input: 3.3V

WPEB-265AXI(BT)(B18)

Wi-Fi: PCIe
BT:USB
Voltage input: 1.8V

WPEB-265AXI(BT)(R18)

Wi-Fi: PCIe
BT:UART
Voltage input: 1.8V

AP on module solution

AP21750_P

- WiFi spec: 2T2R 802.11ax/ac/n + 2T2R b/g/n
- Dual-Band Con-current, Support 256 clients
- Operation System: Embedded Linux, AP features supported
- Operating temp.: 0°C to 70°C
- Dimension: 75 x 90mm
- Antenna connector: MHF1
- Voltage input: 5V / 2A
- Application: AP on module
- Status: planning
- Certification: planning stage

WiFi6 is a trend

- **Possible end applications**
  - Education
  - Medical
  - Manufacture
  - AR/VR applications
  - Indoor

802.11ax Growing Exponentially with End-Devices

Source: iThome

Thank you