Cambium Networks XE5-8 Access Point Application Note

Introduction

The XE5-8 is a five-radio Wi-Fi 6/6E 8x8/4x4 access point (AP) designed to deliver high-density, future-proof performance for building next-generation wireless networks. With five user-servicing radios, the XE5-8 delivers the highest density Wi-Fi 6 solution in the industry. Wi-Fi 6E support extends the capacity of Wi-Fi into the 6 GHz band, more than tripling the total wireless spectrum available. With high-speed software-defined radios, the XE5-8 enables seamless transition to Wi-Fi 6E with the ability to easily change from dual-band to tri-band (2.4GHz, 5GHz, 6GHz) support when sufficient 6 GHz clients are available. The XE5-8 is fully backward compatible with existing Wi-Fi technology, enabling simultaneous support of new high-speed clients, legacy clients, low-bitrate IoT devices, and more in a single wireless infrastructure.

The XE5-8 has more Wi-Fi capacity than any other access point in the industry, with an aggregate data rate of the five radios delivering 15.6Gbps. To utilize the maximum capacity of the XE5-8, you must configure its radios correctly. There are many operational modes available that leverage the AP's software-defined radios. Two radios are software definable between 5GHz and 6GHz operation. In addition, two of 5GHz radios can operate as separate 4x4 radios or be combined into one 8x8 radio.

This Application Note will address the requirements to consider when deploying this solution to optimize its performance in the network, including PoE power, radio assignments, channel assignments per radios, and radio TX power levels.

Use Cases

The XE5-8 access point is designed to address high client density Wi-Fi environments such as auditoriums, libraries, meeting rooms, ball rooms, large lobbies, and other areas where a high number of clients – generally in the hundreds – are being provided Wi-Fi service. The type of use cases can be found in education, convention centers, transportation hubs, and other types of public venues.

With 5 radios, the XE5-8 supports much higher capacity than traditional 2 and 3 radio access points. This enables support for high client density with a smaller number of access points. This reduction in equipment realizes savings in cabling, switch infrastructure, installation time, maintenance, power consumption and more, dramatically lowering the total cost of ownership of the solution over the lifetime of the product compared to more traditional Wi-Fi solutions.

LEDs

The LED on top of the unit will change colors based on the status of the device.

- Amber – Booting up
- Green – Operational
- Blue – Managed by cnMaestro or XMS-Cloud

PoE Requirements

The maximum PoE requirement for this access point is 59W (PoE++, 802.3bt) which can be supplied from either a mid-span power injector (N000000L142A PoE injector, 60W, 5 GbE, Indoor, Energy Level 6 Supply) or a PoE++ switch. Providing PoE 802.3af or PoE+ 802.3at power will result in instability issues and can cause the AP to reboot.

Radio band configuration options

The XE5-8 access point has software definable radios that allow for numerous different configurations, allowing you to customize the radio configurations to best suit your environment.

Radio 1 is a 2.4GHz radio. It is static and cannot be changed.

Radio 2 is software definable between 5GHz and 6GHz.

Radio 3 is software definable between 5GHz and 6GHz.

Radio 4 is software definable. It can operate as a single 5GHz radio with an 8x8 antenna design, or split into two 5GHz radios, each with a 4x4 antenna design.

Radio 5 (available when radio 4 is configured in split mode) is a 5GHz radio with a 4x4 antenna design.

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Radio 1 – 2.4GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz
Radio 2 - 5GHz or 6GHz	6GHz	6GHz	6GHz	6GHz	5GHz	5GHz	5GHz	5GHz
Radio 3 - 5GHz or 6GHz	6GHz	6GHz	5GHz	5GHz	6GHz	6GHz	5GHz	5GHz
Radio 4 - 5GHz, 8x8 or 4x4	5GHz (8x8)	5GHz (4x4)	5GHz (8x8)	5GHz (4x4)	5GHz (8x8)	5GHz (4x4)	5GHz (8x8)	5GHz (4x4)
Radio 5 - 5GHz 4x4	NA	5GHz (4x4)	NA	5GHz (4x4)	NA	5GHz (4x4)	NA	5GHz (4x4)

Table 1. XE5-8 radio configuration options

Channels

DFS Channels

DFS channels are open for use in the United States, Canada, and the EU. The XE5-8 access point must be running software version 6.5.3 or later for full channel support.

Radio channel assignment options

With the XE5-8, a defined set of channels are available for use on each 5GHz and 6GHz radio. The 2.4GHz radio supports channels 1-11 in the US and will also support channels 1-13 in countries that allow use of channels 12 & 13. The channel group assignments per radio are noted below for each configuration option:

01162024

Option 1: Dual 6GHz, 5GHz Combined	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	93
Radio 3 - 6GHz	129	233
Radio 4 - 5GHz	36	165

*Table 2. XE5-8 radio channel group options with **two 6GHz radios** and **one 5GHz radio** Combined*

Option 2: Dual 6GHz, 5GHz Split	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	93
Radio 3 - 6GHz	129	233
Radio 4 - 5GHz	100	165
Radio 5 - 5GHz	36	64

*Table 3. XE5-8 radio channel group options with **two 6GHz radios** and **two 5GHz radios** (Split mode)*

Options 3 & 5: Single 6GHz, 5GHz Combined	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	233
Radio 3 - 5GHz	100	165
Radio 4 - 5GHz	36	64

*Table 4. XE5-8 radio channel group options with **one 6GHz radio** and **two 5GHz radios** Combined*

Options 4 & 6: Single 6GHz, 5GHz Split	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	233
Radio 3 - 5GHz	100	128
Radio 4 - 5GHz	149	165
Radio 5 - 5GHz	36	64

*Table 5. XE5-8 radio channel group options with **one 6GHz radio** and **three 5GHz radios***

01162024

Option 7: Tri 5GHz, 5GHz Combined	Channel Group Start	Channel Group End
Radio 2 – 5GHz	100	128
Radio 3 - 5GHz	149	165
Radio 4 - 5GHz	36	64

*Table 6. XE5-8 radio channel group options with **three 5GHz radios** (Combined mode, 8x8)*

Option 8: Quad 5GHz radios, 5GHz Split	Channel Group Start	Channel Group End
Radio 2 – 5GHz	60	64
Radio 3 - 5GHz	100	128
Radio 4 - 5GHz	149	165
Radio 5 - 5GHz	36	40

*Table 7. XE5-8 radio channel group options with **four 5GHz radios***

Flexible Channel Distribution

An advanced mode of operation is available that loosens the above restrictions of channels per radio. This mode provides more flexibility for channel assignment on the 5GHz radios across channels 36 – 165.

*Important: Software version 6.5.1 or newer is required to use the Flexible Channels Distribution mode.

To enable this mode in cnMaestro, open the AP Group and on the **Basic** page and disable **Recommended Channel Distribution**.

To enable the command in XMS-Cloud, go to the **Access Points** page and open the **Details** fly-out window for the access point. Go to the **Radios** page and click the **Show Advanced** link. Then move the **Channel Distribution** slider bar to **Flexible**.

This mode can also be configured via the command line interface (CLI) of the access point using the "no channels-distribution" command.

*Important: If using cnMaestro, configure the radio channels on the device Configuration tab, or you can import the radio settings in bulk.

*Important: When using XMS-Cloud, configure the radio channels on the Access Point page, or you can configure the radio channel and power settings in bulk by importing a csv file with the radio power and channel settings into XMS-Cloud.

Below are examples using the Flexible Channels Distribution mode for channel assignment on the 5GHz and 6GHz radios.

Option 1: Dual 6GHz, 5GHz Combined	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	93
Radio 3 - 6GHz	129	233
Radio 4 - 5GHz	36	165

Table 8. XE5-8 radio channel group options with *two 6GHz radios* and *one 5GHz radio* Combined

Option 2: Dual 6GHz, 5GHz Split	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	233
Radio 3 - 6GHz	129	233
Radio 4 - 5GHz	100	165
Radio 5 - 5GHz	36	64

Table 9. XE5-8 radio channel group options with *two 6GHz radios* and *two 5GHz radios* (Split mode)

Options 3 & 5: Single 6GHz, 5GHz Combined	Channel Group Start	Channel Group End
Radio 2 – 6GHz	1	233
Radio 3 - 5GHz	36	165
Radio 4 - 5GHz	36	165

Table 10. XE5-8 radio channel group options with *one 6GHz radio* and *two 5GHz radios*

Below are examples of the CLI Commands to unlock the channels using the no channel-distribution command, and configure channel assignments, radio TX power and channel width. Actual settings are will vary depending on the environment.

XE5-8(config)# no channels-distribution

XE5-8(config)# save

1 -2.4GHz radio, 2 – 6GHz radios, 2 – 5GHz radios

XE5-8(config)# wireless radio 1

01162024

XE5-8(config-radio-1)# frequency-band 2.4GHz

XE5-8(config-radio-1)# channel 6

XE5-8(config-radio-1)# power 12

XE5-8(config-radio-1)# channel-width 20

XE5-8(config-radio-1)# save

XE5-8(config-radio-1)# exit

XE5-8(config)# wireless radio 2

XE5-8(config-radio-2)# frequency-band 6GHz

XE5-8(config-radio-2)# channel 45

XE5-8(config-radio-2)# power 15

XE5-8(config-radio-2)# channel-width 20

XE5-8(config-radio-2)# save

XE5-8(config-radio-2)# exit

XE5-8(config)# wireless radio 3

XE5-8(config-radio-3)# frequency-band 6GHz

XE5-8(config-radio-3)# channel 181

XE5-8(config-radio-3)# power 15

XE5-8(config-radio-3)# channel-width 20

XE5-8(config-radio-3)# save

XE5-8(config-radio-3)# exit

XE5-8(config)# wireless radio 4

XE5-8(config-radio-4)# frequency-band 5GHz

XE5-8(config-radio-4)# Channel 157

XE5-8(config-radio-4)# power 15

XE5-8(config-radio-4)# channel-width 20

XE5-8(config-radio-4)# save

XE5-8(config-radio-4)# exit

01162024

XE5-8(config)# wireless radio 5

XE5-8(config-radio-5)# frequency-band 5GHz

XE5-8(config-radio-5)# Channel 36

XE5-8(config-radio-5)# power 15

XE5-8(config-radio-5)# channel-width 20

XE5-8(config-radio-5)# save

XE5-8(config-radio-5)# exit

Below are channel number ranges for the different combinations of radio band settings with "no channels-distribution" command deployed.

0 – 6GHz radios, 3 – 5GHz radios (1 combined 5GHz radio, 8x8)

Radio 2 (5GHz) – Channels 36 - 165

Radio 3 (5GHz) – Channels 36 - 165

Radio 4 (5GHz) – Channels 36 - 165

1 – 6GHz radios, 2 – 5GHz radios (1 combined 8x8)

Radio 2 (5GHz) – Channels 36 - 165

Radio 3 (6GHx) – Channels 1 - 233

Radio 4 (5GHz) – Channels 36 – 165

2 – 6GHz radios, 1 – 5GHz radios (1 combined 8x8)

Radio 2 (6GHz) – Channels 1 - 93

Radio 3 (6GHz) – Channels 129 - 233

Radio 4 (5GHz) – Channels 36 – 165

0 – 6GHz radios, 4 – 5GHz radios (2 split 4x4)

Radio 2 (5GHz) – Channels 36 - 165

Radio 3 (5GHz) – Channels 36 - 165

Radio 4 (5GHz) – Channels 100 – 165

Radio 5 (5GHz) - Channels 36 - 64

01162024

1 – 6GHz radios, 3 – 5GHz radios (2 split 4x4)

Radio 2 (6GHz) – Channels 1 - 233

Radio 3 (5GHz) – Channels 36 - 165

Radio 4 (5GHz) – Channels 100 – 165

Radio 5 (5GHz) - Channels 36 - 64

2 – 6GHz radios, 2 – 5GHz radios (2 split 4x4)

Radio 2 (6GHz) – Channels 1 - 93

Radio 3 (6GHz) – Channels 129 - 233

Radio 4 (5GHz) – Channels 100 – 165

Radio 5 (5GHZ) - Channels 36-64

Global 6GHz Certifications

Different countries have certified operation for different portions of the 6GHz band. The following table summarizes these differences. This will impact channel design recommendations for a given deployment depending on the country.

Country	Frequency Start	Frequency Stop	Channel Start	Channel Stop	# of Channels
AT, AU, BA, BE, BG, CH, CY, DZ, DE, DK, EE, ES, FI, FR, GB, GR, HK, HR, HU, IE, IS, IT, JO, KR, LI, LT, LU, LV, MT, NL, NZ, PL, PT, QA, RO, SE, SI, SK, TR, ZA	5955	6425	1	97	25
BR, CA, US	5955	7125	1	233	59

Recommended Channel Assignments

To optimize overall system performance in the multi-radio XE5-8, it is important to provide as much channel separation as possible between radios operating in the same band. There are numerous XE5-8 radio configurations with numerous channel configuration options, so it is important to appropriately assign and verify channel settings before they are applied.

Below are suggested channel settings for the XE5-8 based on Groups. Each Group is comprised of a set of channels that provide as much separation as possible between the Group member channels on a given XE5-8. If deploying a single XE5-8, any of these Groups may be selected for that AP with consideration in the channel design for other APs deployed in the area. If multiple XE5-8's are being deployed in proximity of each other, they should each be configured with a separate Group number. If more than the total number of Groups of XE5-8's are being deployed, Group assignments can be repeated but physical separation between APs using the same Group should be maximized.

These examples are applicable for US, BR, and CA only.

01162024

Example 1: Option 8: Quad 5GHz radios

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Radio 2 Channel (5GHz)	140	144	149	153	157	161
Radio 3 Channel (5GHz)	60	64	124	128	132	136
Radio 4 Channel (5GHz)	100	104	108	112	116	120
Radio 5 Channel (5GHz)	36	40	44	48	52	56

Example 2: Option 7: Tri 5GHZ radios, 5GHz Combined

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Radio 3 Channel (5GHz)	36	40	44	48	52	56	60	64
Radio 4 Channel (5GHz)	100	104	108	112	116	120	124	128
Radio 5 Channel (5GHz)	132	136	140	144	149	153	157	161

Example 3: Option 2: Dual 6GHz radios, Dual 5GHz radios Split

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Radio 2 Channel (6GHz)	1	5	9	13	17	21
Radio 3 Channel (6GHz)	97	101	105	109	113	117
Radio 4 Channel (5GHz)	120	124	128	132	136	140
Radio 5 Channel (5GHz)	144	149	153	157	161	165

Example 4: Option 1: Dual 6GHz radios, Single 5GHZ radio Combined

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12	Group 13	Group 14	Group 15	Group 16
Radio 2 Channel (6GHz)	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61
Radio 3 Channel (6GHz)	97	101	105	109	113	117	121	125	129	133	137	141	145	149	153	157
Radio 4 Channel (5GHz)	36	40	44	48	52	56	60	64	100	104	108	112	116	120	124	128

When deploying the XE5-8 for the first time, you may encounter the situation where 6GHz radios are disabled even though the configuration has them enabled. Here are several thing to check:

- If the AP's model number ends in "0-RW" (use "show mfgrom" CLI command to check), it needs to be converted to a "6-RW" model number. Contact Cambium Support to have a conversion key and instructions sent to you.

- You must have at least one WLAN configured for WPA3 or OWE security with the 6GHz band.

01162024

- Verify the AP reports having sufficient PoE Power (you can use CLI command "show power").

- Verify there are 6GHz channels available for the radio based on the country code (use CLI command "show wireless radios channels <country-code>")

In cnMaestro, XE5-8 channel assignments must be configured on the Device Configuration page in the Radio and Location section. They are not configured in an AP Group. When setting only radio 2 to 6GHz, you are able to select channels 1 –233. When setting radios 2 and 3 to 6GHz, you are able to configure radio 2 to channels 1 – 93 and radio 3 to channels 129 – 233.

About Cambium Networks

Cambium Networks enables service providers, enterprises, industrial organizations, and governments to deliver exceptional digital experiences, and device connectivity, with compelling economics. Our ONE Network platform simplifies management of Cambium Networks' wired and wireless broadband and network edge technologies. Our customers can focus more resources on managing their business rather than the network. We deliver connectivity that just works.

01162024