OFDMA Support for 11ax Access Points

Information About OFDMA Support for 11ax Access Points

The Cisco Catalyst 9100 series access points are the next generation WiFi 802.11ax access point, which is ideal for high-density high-definition applications.

The IEEE 802.11ax protocol aims to improve user experience and network performance in high density deployments for both 2.4 GHz and 5 GHz. The 802.11ax APs supports transmission or reception to more than one client simultaneously using Orthogonal Frequency Division Multiplexing (OFDMA).

The IEEE 802.11ax supports uplink MU-MIMO and also adds OFDMA for multiple users in the uplink and downlink. All the users in IEEE 802.11ax OFDMA have the same time allocations and it ends at the same time. In MU-MIMO and OFDMA, multiple stations (STAs) either simultaneously transmit to a single STA or simultaneously receive from a single STA independent data streams over the same radio frequencies.

Supported Modes on 11ax Access Points

The following AP modes are supported:

- Local mode
- Flex-connect mode
- Bridge mode
- Flex+Mesh mode

Configuring 11AX (GUI)

You can configure 11ax for the frequencies, 5 GHz and 2.4 GHz.

Procedure

Step 1 Choose **Configuration** > **Radio Configurations** > **High Throughput**.

Step 2 Click the **5 GHz Band** tab.

a) Expand the **11ax** section.
b) Select the **Enable 11ax** and **Multiple Bssid** check boxes, if required.
c) Check either the **Select All** check box to configure all the data rates or select the desired options from the available data rates list.

Step 3 Click the **2.4 GHz Band** tab.

a) Expand the **11ax** section.
b) Select the **Enable 11ax** and **Multiple Bssid** check boxes, if required.
c) Check either the **Select All** check box to configure all the data rates or select the desired options from the available data rates list.

Configuring Channel Width

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.
Step 2	**ap dot11** { **24ghz** | **5ghz** } **rrm channel dca chan-width 160** **Example:** `Device(config)# ap dot11 5ghz rrm channel dca chan-width 160`	Configures channel width for 802.11 radios as 160. Use the **no** form of the command to disable the configuration. **Note** Cisco Catalyst 9115 and C9120 series APs do not support 80+80 channel width. Cisco Catalyst 9117 series APs do not support OFDMA in 160 channel width.
Step 3	**ap dot11** { **24ghz** | **5ghz** } **rf-profile** *profile-name* **Example:**	Configures an RF profile and enters RF profile configuration mode.

	Command or Action	Purpose
	`Device(config)# ap dot11 5ghz rf-profile ax-profile`	
Step 4	**channel chan-width 160** **Example:** `Device(config-rf-profile)# channel chan-width 160`	Configures the RF profile DCA channel width.

Configuring 802.11ax Radio Parameters (GUI)

Procedure

Step 1 Choose **Configuration** > **Radio Configurations** > **High Throughput** > **5 GHz Band** > **11ax**.

Step 2 Check or uncheck the **Enable 11 n** check box.

Step 3 Check the check boxes for the desired MCS/(data rate) or to select all of them, check the **Select All** check box.

Step 4 Click **Apply**.

Step 5 Choose **Configuration** > **Radio Configurations** > **High Throughput** > **2.4 GHz Band** > **11ax**.

Step 6 Check or uncheck the **Enable 11 n** check box.

Step 7 Check the check boxes for the desired MCS/(data rate) or to select all of them, check the **Select All** check box.

Step 8 Click **Apply**.

Step 9 Choose **Configuration** > **Wireless** > **Access Points**.

Step 10 Click the Access Point.

Step 11 In the **Edit AP** dialog box, enable the **LED State** toggle button and choose the LED brightness level from the **LED Brightness Level** drop-down list.

Step 12 Click **Update and Apply to Device**.

Configuring 802.11ax Radio Parameters (CLI)

Follow the procedure given below to configure radio parameters:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	**ap dot11** {**24ghz** | **5ghz** | **6ghz** } **dot11ax** **Example:** `Device(config)# ap dot11 6ghz dot11ax`	Configures 802.11 6GHz dot11ax parameters. Use the **no** form of the command to disable the configuration.
Step 3	**ap dot11** {**24ghz** | **5ghz** | **6ghz**} **dot11ax mcs tx index** *index* **spatial-stream** *spatial-stream-value* **Example:** `Device(config)# ap dot11 5ghz dot11ax mcs tx index 11 spatial-stream 8`	Enables the 11ax 2.4-Ghz, 5-Ghz, or 6-Ghz band modulation and coding scheme (MCS) transmission rates.
Step 4	**ap led-brightness** *brightness-level* **Example:** `Device(config)# ap led-brightness 6`	(Optional) Configures the led brightness level.

Setting up the 802.11ax Radio Parameters

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device# enable`	Enters privileged EXEC mode.
Step 2	**ap name** *ap-name* **led-brightness-level** *brightness-level* **Example:** `Device# ap name ax-ap led-brightness-level 6`	Configures the led brightness level.
Step 3	**ap name** *ap-name***dot11** {**24ghz** | **5ghz**} **dot11n antenna** *antenna-port* **Example:** `Device# ap name ap1 dot11 5ghz dot11n antenna A`	Configures the 802.11n - 5 GHz antenna selection. Use the **no** form of the command to disable the configuration.
Step 4	**ap name** *ap-name* **dot11** {**24ghz** | **5ghz**} **channel width** *channel-width* **Example:** `Device# ap name ap1 dot11 5ghz channel width 160`	Configures 802.11 channel width.

	Command or Action	Purpose
Step 5	**ap name** *ap-name* **dot11** { **24ghz** | **5ghz** } **secondary-80** *channel-num* **Example:** `Device# ap name ap1 dot11 5ghz secondary-80 12`	Configures the advanced 802.11 secondary 80Mhz channel assignment parameters.

Configuring OFDMA on a WLAN

Note For Cisco Catalyst 9115 and 9120 series APs, the configuration given below are per radio, and not per WLAN. This feature remains enabled on the controller, if it is enabled on any of the WLANs.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.
Step 2	**wlan** *wlan1* **Example:** `Device(config)# wlan wlan1`	Enters the WLAN configuration mode.
Step 3	**dot11ax** *downlink-ofdma* **Example:** `Device(config-wlan)# dot11ax downlink-ofdma`	Enables the downlink connection that uses the OFDMA technology. Use the **no** form of the command to disable the configuration.
Step 4	**dot11ax** *uplink-ofdma* **Example:** `Device(config-wlan)# dot11ax uplink-ofdma`	Enables the uplink connection that uses the OFDMA technology .
Step 5	**dot11ax** *downlink-mumimo* **Example:** `Device(config-wlan)# dot11ax downlink-mumimo`	Enables the downlink connection that uses the MUMIMO technology.
Step 6	**dot11ax** *uplink-mumimo* **Example:** `Device(config-wlan)# dot11ax uplink-mumimo`	Enables the uplink connection that uses the MUMIMO technology.

	Command or Action	Purpose
Step 7	**dot11ax** *twt-broadcast-support* **Example:** `Device (config-wlan)# dot11ax twt-broadcast-support`	Enables the TWT broadcast support operation.

Verifying Channel Width

To verify the channel width and other channel information, use the following **show** commands:

```
Device# show ap dot11 5ghz summary

AP Name             Mac Address       Slot    Admin State  Oper State  Channel    Width
 Txpwr
-----------------------------------------------------------------------------------------------
AP80e0.1d75.6954    80e0.1d7a.7620     1       Enabled      Up          (52)*      160
  1(*)

Device# show ap dot11 dual-band summary

AP Name        Subband    Radio Mac        Status     Channel    Power Level  Slot ID
   Mode
-----------------------------------------------------------------------------------------------
kartl28021mi    All       002a.1058.38a0    Enabled   (52)*      (1)*            1
   REAP

Device# show ap name <ap-name> channel

802.11b/g Current Channel                        : 11
Slot ID                                          : 0
Allowed Channel List                             : 1,2,3,4,5,6,7,8,9,10,11
802.11a Current Channel ....................... 52  (160 MHz)
Slot ID                                          : 1
Allowed Channel List                             :
36,40,44,48,52,56,60,64,100,104,108,112,116,132,136,140,149,153,157,161,165

Device# show ap name <ap-name> config slot <slot-num>
.
.
.
Phy OFDM Parameters
              Configuration                              : Automatic
              Current Channel                            : 52
              Extension Channel                          : No Extension
              Channel Width                              : 160 MHz
             Allowed Channel List                        :
36,40,44,48,52,56,60,64,100,104,108,112,116,132,136,140,149,153,157,161,165
             TI Threshold                                : 0

Device# show ap dot11 5ghz channel
.
.
.
  DCA Sensitivity Level                       : MEDIUM : 15 dB
  DCA 802.11n/ac Channel Width                : 160 MHz
  DCA Minimum Energy Limit                    : -95 dBm
.
.
.
```

```
Device# show ap rf-profile name <name> detail
.
.
.
Unused Channel List               : 165
DCA Bandwidth                     :  160 MHz
DCA Foreign AP Contribution       : Enabled
.
.
.
```

Verifying Client Details

To verify the client information, use the following **show** commands:

```
Device# show wireless client mac-address <mac-address> detail



Client MAC Address : a886.ddb2.05e9
Client IPv4 Address : 169.254.175.214
Client IPv6 Addresses : fe80::b510:a381:8099:4747
                        2009:300:300:57:4007:6abb:2c9a:61e2
Client Username: N/A
Voice Client Type   : Unknown
AP MAC Address : c025.5c55.e400
AP Name: APe4c7.22b2.948e
Device Type: N/A
Device Version: N/A
AP slot : 0
Client State : Associated
Policy Profile : default-policy-profile
Flex Profile : default-flex-profile
Wireless LAN Id : 1
Wireless LAN Name: SSS_OPEN
BSSID : c025.5c55.e406
Connected For : 23 seconds
Protocol : 802.11ax - 5 GHz
Channel : 8
Client IIF-ID : 0xa0000001
Association Id : 1
Authentication Algorithm : Open System
Client CCX version : No CCX support
Session Timeout : 86400 sec (Remaining time: 86378 sec)

.
.
.
Device# show wireless client summary

Number of Local Clients: 1

MAC Address    AP Name                          WLAN  State             Protocol Method
  Role
-------------------------------------------------------------------------------------------
a886.ddb2.05e9 APe4c7.22b2.948e                 1     Run               11ax(5) None
 Local


Device# show wireless stats client detail
```

```
Total Number of Clients : 1

Protocol Statistics

---------------------------------------------------------------------------
Protocol            Client Count
 802.11b              : 0
 802.11g              : 0
 802.11a              : 0
 802.11n-2.4GHz       : 0
 802.11n-5 GHz        : 0
 802.11ac             : 0
 802.11ax-5 GHz       : 0
 802.11ax-2.4 GHz     : 0
 802.11ax-6 GHz       : 1
```

Verifying Radio Configuration

To verify the radio configuration information, use the following **show** commands:

```
Device# show ap dot11 5ghz network

802.11a Network                          : Enabled
.
.
.
802.11ax                                 : Enabled
  DynamicFrag                            : Enabled
  MultiBssid                             : Disabled
802.11ax MCS Settings:
  MCS  7, Spatial Streams = 1            : Disabled
  MCS  9, Spatial Streams = 1            : Disabled
  MCS 11, Spatial Streams = 1            : Disabled
  MCS  7, Spatial Streams = 2            : Supported
  MCS  9, Spatial Streams = 2            : Supported
  MCS 11, Spatial Streams = 2            : Supported
  MCS  7, Spatial Streams = 3            : Supported
  MCS  9, Spatial Streams = 3            : Disabled
  MCS 11, Spatial Streams = 3            : Disabled
  MCS  7, Spatial Streams = 4            : Supported
  MCS  9, Spatial Streams = 4            : Supported
  MCS 11, Spatial Streams = 4            : Supported
  MCS  7, Spatial Streams = 5            : Supported
  MCS  9, Spatial Streams = 5            : Supported
  MCS 11, Spatial Streams = 5            : Supported
  MCS  7, Spatial Streams = 6            : Supported
  MCS  9, Spatial Streams = 6            : Supported
  MCS 11, Spatial Streams = 6            : Supported
  MCS  7, Spatial Streams = 7            : Supported
  MCS  9, Spatial Streams = 7            : Supported
  MCS 11, Spatial Streams = 7            : Supported
  MCS  7, Spatial Streams = 8            : Supported
  MCS  9, Spatial Streams = 8            : Supported
  MCS 11, Spatial Streams = 8            : Supported
Beacon Interval                          : 100
.
.
.
Maximum Number of Clients per AP Radio    : 200
```

```
Device# show ap dot11 24ghz network

802.11b Network                          : Enabled
.
.
.
802.11axSupport..................................... Enabled
      dynamicFrag............................... Disabled
      multiBssid................................ Disabled
802.11ax                                 : Enabled
  DynamicFrag                            : Enabled
  MultiBssid                             : Enabled
802.11ax MCS Settings:
  MCS  7, Spatial Streams = 1            : Supported
  MCS  9, Spatial Streams = 1            : Supported
  MCS 11, Spatial Streams = 1            : Supported
  MCS  7, Spatial Streams = 2            : Supported
  MCS  9, Spatial Streams = 2            : Supported
  MCS 11, Spatial Streams = 2            : Supported
  MCS  7, Spatial Streams = 3            : Supported
  MCS  9, Spatial Streams = 3            : Supported
  MCS 11, Spatial Streams = 3            : Supported
  MCS  7, Spatial Streams = 4            : Disabled
  MCS  9, Spatial Streams = 4            : Disabled
  MCS 11, Spatial Streams = 4            : Disabled
Beacon Interval                          : 100
.
.
.
Maximum Number of Clients per AP Radio    : 200

Device# show ap dot11 6ghz network
802.11 6Ghz Network                      : Enabled
802.11ax                                 : Enabled
.
.
.
802.11ax MCS Settings:
  MCS  7, Spatial Streams = 1            : Supported
  MCS  9, Spatial Streams = 1            : Supported
  MCS 11, Spatial Streams = 1            : Supported
  MCS  7, Spatial Streams = 2            : Supported
  MCS  9, Spatial Streams = 2            : Supported
  MCS 11, Spatial Streams = 2            : Supported
  MCS  7, Spatial Streams = 3            : Supported
  MCS  9, Spatial Streams = 3            : Supported
  MCS 11, Spatial Streams = 3            : Supported
  MCS  7, Spatial Streams = 4            : Supported
  MCS  9, Spatial Streams = 4            : Supported
  MCS 11, Spatial Streams = 4            : Supported
Beacon Interval                          : 95
.
.
.
Maximum Number of Clients per AP Radio    : 200
WiFi to Cellular RSSI Threshold           : -85 dbm
Client Network Preference                 : default

#show wlan id 1
WLAN Profile Name     : wlanon66
================================================
Identifier                                     : 1
Description                                    :
Network Name (SSID)                            : wlanon66
Status                                         : Enabled
```

```
Broadcast SSID                                  : Enabled
Advertise-Apname                                : Enabled
Universal AP Admin                              : Disabled
Max Associated Clients per WLAN                 : 0
Max Associated Clients per AP per WLAN          : 0
Max Associated Clients per AP Radio per WLAN    : 200
OKC                                             : Enabled
Number of Active Clients                        : 0
CHD per WLAN                                    : Enabled
WMM                                             : Allowed
WiFi Direct Policy                              : Disabled
.
.
.
Operational State of Radio Bands
    2.4ghz                                      : UP
    5ghz                                        : UP
    6ghz                                        : DOWN (Required config: Disable WPA2 and
Enable WPA3 & dot11ax)
DTIM period for 802.11a radio                   :
DTIM period for 802.11b radio                   :
Local EAP Authentication                        : Disabled
Mac Filter Authorization list name              : Disabled
Mac Filter Override Authorization list name     : Disabled
Accounting list name                            :
802.1x authentication list name                 : Disabled
802.1x authorization list name                  : Disabled
Security
    802.11 Authentication                       : Open System
.
.
.
802.11ac MU-MIMO                                : Enabled
802.11ax parameters
    802.11ax Operation Status                   : Enabled
    OFDMA Downlink                              : Enabled
    OFDMA Uplink                                : Enabled
    MU-MIMO Downlink                            : Enabled
    MU-MIMO Uplink                              : Enabled
    BSS Target Wake Up Time                     : Enabled
    BSS Target Wake Up Time Broadcast Support   : Enabled
.
.
.
```

Note For 6-GHz radio, the 802.11ax parameters are taken from the multi BSSID profile tagged to the corresponding 6-GHz RF profile of the AP. So, the WLAN dot11ax parameters are overridden by multi BSSID profile parameters in the case of 6-GHz. There are no changes for 2.4 and 5-GHz band WLANs. They continue to use the WLAN parameters for 802.11ax.

```
Device# show ap led-brightness-level summary

AP Name                          LED Brightness level
-------------------------------------------------------
AP00FC.BA01.CC00                 Not Supported
AP70DF.2FA2.72EE                 8
AP7069.5A74.6678                 2
APb838.6159.e184                 Not Supported
```