OFDMA Support for 11ax Access Points

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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

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>configure terminal</td>
</tr>
<tr>
<td></td>
<td>Example: Device# configure terminal</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>ap dot11 {24ghz</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# ap dot11 5ghz rrm channel dca chan-width 160</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>ap dot11 {24ghz</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
</tbody>
</table>

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.
Configuring 802.11ax Radio Parameters (CLI)

Follow the procedure given below to configure radio parameters:

**Procedure**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>configure terminal</td>
<td>Enters the global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ap dot11 {24ghz</td>
<td>5ghz} dot11ax</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>Use the <strong>no</strong> form of the command to disable the configuration.</td>
</tr>
<tr>
<td></td>
<td>Device(config)# ap dot11 5ghz dot11ax</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ap dot11 {24ghz</td>
<td>5ghz} dot11ax mcs tx index index spatial-stream spatial-stream-value</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# ap dot11 5ghz dot11ax mcs tx index 11 spatial-stream 8</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>ap led-brightness brightness-level</td>
<td>(Optional) Configures the led brightness level.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# ap led-brightness 6</td>
<td></td>
</tr>
</tbody>
</table>

Setting up the 802.11ax Radio Parameters

**Procedure**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# enable</td>
<td></td>
</tr>
</tbody>
</table>
### Purpose

**Command or Action**

**Purpose**

**Step 2**

```
ap name ap-name led-brightness-level
brightness-level
```

Configures the led brightness level.

**Example:**

Device# ap name ax-ap
led-brightness-level 6

**Step 3**

```
ap name ap-name dot11 {24ghz | 5ghz} dot11n
antenna antenna-port
```

Configures the 802.11n - 5 GHz antenna selection.

**Example:**

Device# ap name ap1 dot11 5ghz dot11n
antenna A

Use the `no` form of the command to disable the configuration.

**Step 4**

```
ap name ap-name dot11 {24ghz | 5ghz} channel width
channel-width
```

Configures 802.11 channel width.

**Example:**

Device# ap name ap1 dot11 5ghz channel
width 160

**Step 5**

```
ap name ap-name dot11 {24ghz | 5ghz} secondary-80
channel-num
```

Configures the advanced 802.11 secondary 80Mhz channel assignment parameters.

**Example:**

Device# ap name ap1 dot11 5ghz
secondary-80 12

---

# Configuring OFDMA on a WLAN

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
```

Enters the global configuration mode.

**Example:**

Device# configure terminal

**Step 2**

```
wlan wlan1
```

Enters the WLAN configuration mode.

**Example:**

Device(config)# wlan wlan1
<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td><code>dot11ax downlink-ofdma</code></td>
<td>Enables the downlink connection that uses the OFDMA technology. Use the <code>no</code> form of the command to disable the configuration.</td>
</tr>
<tr>
<td>4</td>
<td><code>dot11ax uplink-ofdma</code></td>
<td>Enables the uplink connection that uses the OFDMA technology.</td>
</tr>
<tr>
<td>5</td>
<td><code>dot11ax downlink-mumimo</code></td>
<td>Enables the downlink connection that uses the MUMIMO technology.</td>
</tr>
<tr>
<td>6</td>
<td><code>dot11ax uplink-mumimo</code></td>
<td>Enables the uplink connection that uses the MUMIMO technology.</td>
</tr>
<tr>
<td>7</td>
<td><code>dot11ax twt-broadcast-support</code></td>
<td>Enables the TWT broadcast support operation.</td>
</tr>
</tbody>
</table>

**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
---------  ------------  -----  ------------  -----------  -------  ------
AP80e0.1d75.6954  80e0.1d7a.7620  1  Enabled  Up  (52)*  160
```

```
Device# show ap dot11 dual-band summary
```

```
AP Name  Subband  Radio Mac  Status  Channel  Power Level  Slot ID
---------  --------  --------  ------  -------  ------------  -----  
kart128021mi  All  002a.1058.38a0  Enabled  (52)*  (1)*  1
```

```
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
```
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
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

<table>
<thead>
<tr>
<th>MAC Address</th>
<th>AP Name</th>
<th>WLAN</th>
<th>State</th>
<th>Protocol Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 Run</td>
<td>Run</td>
<td>11ax(5) None</td>
</tr>
</tbody>
</table>

Device# **show wireless stats client detail**

Total Number of Clients : 1

Protocol Statistics

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Client Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>802.11b</td>
<td>0</td>
</tr>
<tr>
<td>802.11g</td>
<td>0</td>
</tr>
<tr>
<td>802.11a</td>
<td>0</td>
</tr>
<tr>
<td>802.11n-2.4 GHz</td>
<td>0</td>
</tr>
<tr>
<td>802.11n-5 GHz</td>
<td>0</td>
</tr>
<tr>
<td>802.11ac</td>
<td>0</td>
</tr>
</tbody>
</table>

**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

802.11b Network : Enabled
802.11ax Support.................................................. Enabled
Dynamic Frag.................................................. Disabled
Multi Bssid.................................................. Disabled
802.11 ax : Enabled
Dynamic Frag : Enabled
Multi Bssid : Enabled

802.11 ax 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

WLAN Profile Name : ax-wlc
Identifier : 1
Network Name (SSID) : ax-wlc
Status : Enabled
Broadcast SSID : 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
Number of Active Clients : 0
CHD per WLAN : Enabled
Multicast Interface : Unconfigured

802.11ac MU-MIMO : Disabled

802.11ax parameters
- OFDMA Downlink : Enabled
- OFDMA Uplink : Enabled
- MU-MIMO Downlink : Enabled
- MU-MIMO Uplink : Enabled
- BSS Color : Enabled
- Partial BSS Color : Enabled
- BSS Color Code : 0
- BSS Target Wake Up Time : Enabled

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

<table>
<thead>
<tr>
<th>AP Name</th>
<th>LED Brightness level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP00FC.BA01.CC00</td>
<td>Not Supported</td>
</tr>
<tr>
<td>AP70DF.2FA2.72EE</td>
<td>8</td>
</tr>
<tr>
<td>AP7069.5A74.6678</td>
<td>2</td>
</tr>
<tr>
<td>APb838.6159.e184</td>
<td>Not Supported</td>
</tr>
</tbody>
</table>