



## **Cisco Catalyst IW9167E Heavy Duty Access Point Configuration Guide, Cisco IOS XE Dublin 17.11.x**

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# CHAPTER 1

## Introduction

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## Overview of the Access Point

The Cisco Catalyst IW9167E Heavy Duty Access Point provides reliable wireless connectivity for mission-critical applications in a state-of-the-art platform. It can operate as Cisco Catalyst Wi-Fi (CAPWAP) mode or Cisco Ultra-Reliable Wireless Backhaul (Cisco URWB) mode starting from IOS XE Cupertino 17.9.3 Software Release. The IW9167EH access point has the flexibility to change the operating mode from Wi-Fi to Cisco URWB, and vice versa.

Starting from Cisco IOS XE Dublin 17.11.1, Workgroup Bridge (WGB) and Universal WGB (uWGB) are supported on the Cisco Catalyst IW9167E Heavy Duty Access Points.

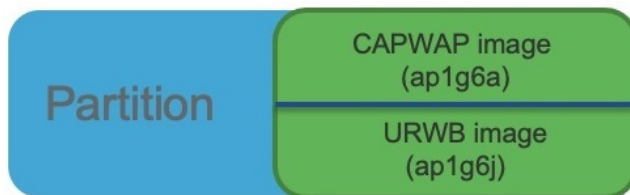
This document covers configuration of CAPWAP mode and WGB/uWGB mode specific to the IW9167EH access points.

For CAPWAP mode, the access points can operate in the following modes:

- Local
- Flexconnect
- Bridge
- Flexconnect + Bridge
- Sniffer
- Monitor
- Site survey

## Determine Image on IW9167EH

Software images are stored under different folders on the same partition on IW9167EH.



You need to choose the image to boot up with according to the mode your AP is running, CAPWAP, Cisco URWB, or WGB/uWGB. The following table provides the software images of each mode:

**Table 1: IW9167EH Software Images**

IW9167EH Mode	Software Image
CAPWAP	<b>ap1g6a-k9w8-xxx.tar</b>
Cisco URWB	Unified Industrial Wireless image <b>ap1g6j-k9c1-xxx.tar</b>
WGB/uWGB	

To determine the image that your IW9167EH is running, use the **show version** command.

- If the **show version** output displays **Cisco AP Software, (ap1g6a)** as shown in the following example, it means that AP is running the CAPWAP image **ap1g6a-k9w8-xxx.tar**, which supports the CAPWAP mode.

```
Cisco AP Software, (ap1g6a), C9167, RELEASE SOFTWARE
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2022 by Cisco Systems, Inc.
Compiled Fri Jul 29 01:56:00 PDT 2022

ROM: Bootstrap program is U-Boot boot loader
BOOTLDR: U-Boot boot loader Version 2022010100

APFC58.9A16.E648 uptime is 0 days, 1 hours, 03 minutes
Last reload time   : Mon Sep 19 02:23:13 UTC 2022
Last reload reason : Image Upgrade

cisco IW9167EH-B ARMv8 Processor rev 4 (v8l) with 1757076/1006864K bytes of memory.
```

- If the **show version** output displays **Cisco AP Software (ap1g6j)** as shown in the following example, it means that AP is running **ap1g6j-k9c1-xxx.tar** image, which supports the Cisco URWB mode or Cisco WGB/uWGB.

```
Cisco AP Software, (ap1g6j), C9167, RELEASE SOFTWARE
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2022 by Cisco Systems, Inc.
Compiled Thu Aug 18 01:01:29 PDT 2022

ROM: Bootstrap program is U-Boot boot loader
BOOTLDR: U-Boot boot loader Version 2022010100

APFC58.9A16.E464 uptime is 1 days, 3 hours, 58 minutes
```

```
Last reload time   : Wed Sep 7 11:17:00 UTC 2022
Last reload reason : reload command
```

```
cisco IW9167EH-B ARMv8 Processor rev 4 (v8l) with 1759128/1091316K bytes of memory.
```

## Configuring AP to Boot up with Different Image Options

To configure the access point to boot up with CAPWAP, URWB, or WGB/uWGB mode, follow these steps:



**Note** Switching between different modes performs full factory reset. Any configuration and data will be removed completely.

### Step 1 enable

Enables privileged EXEC mode. Enter your password if prompted.

### Step 2 configure boot mode {capwap | urwb | wgb}

Configures AP to CAPWAP, URWB, or WGB/uWGB mode. AP will reboot with specified mode.

## Upgrade IW9167EH with 17.9.x to Support WGB/uWGB

If your IW9167EH is shipped with Cisco IOS XE Cupertino 17.9.3 software and operating as CAPWAP mode, and you want to upgrade your AP to Cisco IOS XE Dublin 17.11.1 to support WGB/uWGB mode, you need to switch your AP to Cisco URWB mode first, and then you can upgrade to 17.11.1.

To determine whether your IW9167EH is running CAPWAP mode or Cisco URWB mode, use the **show version** command.

- If the **show version** output displays **Cisco AP Software (ap1g6a)**, your AP is running as CAPWAP mode.
- If the **show version** output displays **Cisco AP Software (ap1g6j)**, your AP is running as Cisco URWB mode.

Cisco WGB/uWGB mode shares the same image with Cisco URWB. You cannot upgrade the **ap1g6j** image to 17.11.1 in CAPWAP mode (**ap1g6a**). Because the **archive download** command checks image type, upgrade gets aborted if image types mismatch.

### Step 1 Convert CAPWAP mode to Cisco URWB mode.

#### Example:

```
#configure boot mode urwb
Before image swapping device need factory reset. Are you sure to proceed? (Y/N):y
Converting to Cisco URWB Mode...
<rebooting...>
```

**Step 2** Log in with default credential (Cisco/Cisco/Cisco).

**Step 3** Configure Cisco URWB, to make it work in **Offline** mode.

**Example:**

```
#configure iotod-iw offline
Switching to IOTOD IW Offline mode...
Will switch from Provisioning Mode to IOTOD IW offline Mode, device need to reboot: Y/N? Y
<rebooting...>
```

**Step 4** Configure networking in Cisco URWB (IP/netmask/gateway, passphrase)

**Example:**

```
Cisco-23.174.76#configure wireless passphrase unit1
Cisco-23.174.76#configure ap address ipv4 static 192.168.1.200 255.255.255.0 192.168.1.1
Cisco-23.174.76#write
Cisco-23.174.76#reload
<rebooting...>
```

**Note** Passphrase is optional, but it is recommended to assign different passphrases if you are upgrading multiple units at the same time and they are connected to the same Layer 2 network. Because Cisco URWB forms MPLS network automatically if all nodes have the same passphrase, without further MPLS configuration, your IP service might not work properly.

**Step 5** Upgrade to 17.11.1.

**Example:**

```
#archive download-sw /reload tftp://<TFTP_SERVER>/<ap1g6j-FILENAME>
<rebooting...>
```

**Step 6** Convert the AP from Cisco URWB mode to Cisco WGB/uWGB mode.

**Example:**

```
#configure boot mode wgb
<rebooting...>
```

## Related Documentation

To view all support information for the Cisco Catalyst IW9167E Heavy Duty Access Point, see <https://www.cisco.com/c/en/us/support/wireless/catalyst-iw9167-series/series.html>.

In addition to the documentation available on the support page, you will need to refer to the following guides:

- For information about IW9167EH hardware, see [Cisco Catalyst IW9167E Heavy Duty Access Point Hardware Installation Guide](#).
- A full listing of the AP's features and specifications is provided in [Cisco Catalyst IW9167E Heavy Duty Access Point Data Sheet](#).
- For more information about the configuration on Cisco Catalyst 9800 Series Wireless Controllers, see <https://www.cisco.com/c/en/us/support/wireless/catalyst-9800-series-wireless-controllers/products-installation-and-configuration-guides-list.html>.
- For information about Cisco URWB mode configuration, see the relevant documents at:



<https://www.cisco.com/c/en/us/support/wireless/catalyst-iw9167-series/series.html>.

- For more information about Cisco IOS XE, see the relevant documents at:

<http://www.cisco.com/c/en/us/products/ios-nx-os-software/ios-xe/index.html>





## CHAPTER 2

# AP Mode Configuration

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- [Configuring Indoor Deployment for -E Domain, on page 7](#)
- [802.11ax 1600ns and 3200ns Guard Interval Support, on page 10](#)
- [GNSS Support, on page 11](#)
- [RAP Ethernet Daisy Chain, on page 12](#)

## Configuring Indoor Deployment for -E Domain

IW9167EH supports indoor deployment for -E domain.

By default, indoor deployment is disabled, and the 5G radio supports channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140. After factory reset, indoor deployment configuration is reset to default, which is disabled.

You can check AP mode by using the **show ap name <ap-name> config general | section Indoor** command. In the command output, "Enabled" means AP is in indoor mode, and "Disabled" means AP is in outdoor mode, as shown in the following example.

```
#show ap name APFC58.9A15.C9A4 config general | inc Indoor
AP Indoor Mode                               : Disabled
```

Edit Radios 5 GHz Band
✕

**Configure**
Detail

General

AP Name: APFC58.9A15.C9A4

AP Mode: Local

Admin Status: ENABLED

Mesh Backhaul: Disabled

Mesh Designated Downlink: Disabled

Antenna Parameters

Antenna Type: External

Antenna Mode: Omni

Self-Identifying Antenna (SIA): Not Present

Radio Profile: [roaming-radio-profile](#)

Number of Antennas Selected: 1

Supported Antenna Modes: 1x1, 2x2, 4x4

Antenna Port Mapping: 4

Antenna Gain (in .5 dBi units):

Download [Core Dump](#) to bootflash

RF Channel Assignment

Current Channel: 100

Channel Width: 20 MHz

Assignment Method: Custom

Channel Number:

**100**

104

108

112

116

120

124

128

Tx Power Level Assignment:

Current Tx Power Level: 112

Assignment Method:

BSS Color

BSS Color Configuration: Global

BSS Color Global Admin Status: Disabled

BSS Color Radio Operational Status: Disabled

BSS Color Radio Admin Status: ENABLED

Current BSS Color:

To configure the AP to indoor mode, use the **ap name** *<ap-name>* **indoor** command from wireless LAN controller. This command triggers an AP rebooting. After AP registers to the wireless LAN controller after rebooting, you need to assign corresponding country code to the AP. When indoor deployment is enabled, 5G radio supports channels 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140.



**Note** To disable indoor deployment, use the **ap name** *<ap-name>* **no indoor** command.

The screenshot shows the Cisco Catalyst 9800-L Wireless Controller interface. On the left is a navigation menu with options like Dashboard, Monitoring, Configuration, Administration, Licensing, and Troubleshooting. The main area is divided into two panes. The left pane shows 'All Access Points' with a table listing APs and their details. The right pane is 'Edit AP' for APFC58.9A15.C9A4, with the 'Advanced' tab selected. A red box highlights the 'Country Code' dropdown menu, which is set to 'FR'. Other settings visible include 'Multiple Countries' (CN, FR, US), 'Statistics Timer' (180), 'CAPWAP MTU' (1485), 'AP Link Latency' (Disabled), 'AP PMK Propagation Capability' (Enabled), 'Global mDNS Gateway' (Disabled), 'mDNS' (checkbox), 'Services Learnt' (0), 'TCP Adjust MSS Option' (checkbox), 'AP TCP MSS Adjust' (Enabled), 'AP TCP MSS Size' (1250), 'AP IPv6 TCP MSS Adjust' (Enabled), 'AP IPv6 TCP MSS Size' (1250), and 'AP Retransmit Config Parameters'.

Edit Radios 5 GHz Band

Configure Detail

General		RF Channel Assignment	
AP Name	APFC58.9A15.C9A4	Current Channel	36
AP Mode	Local	Channel Width	20 MHz
Admin Status	ENABLED <input checked="" type="checkbox"/>	Assignment Method	Custom
Mesh Backhaul	Disabled	Channel Number	36
Mesh Designated Downlink	Disabled	Tx Power Level Assignmer	40
Antenna Parameters		Current Tx Power Level	44
Antenna Type	External	Assignment Method	48
Antenna Mode	Omni	BSS Color	52
			56
			60
			64



**Note** Channel list extends from U-NII-2c to U-NII-1, U-NII-2a, U-NII-2c (channel 144 is excluded).

## 802.11ax 1600ns and 3200ns Guard Interval Support

802.11ac has two Guard Interval (GI) options – long GI (800ns) and short GI (400ns). 802.11ax introduces new guard interval options. It has three types of GI – 800ns, 1600ns, and 3200ns. Longer guard intervals provide improved performance in environments with multi-path and delay spread. It improves link reliability for longer-range outdoor deployments and helps to prevent inter-symbol interference in outdoor environments and therefore improve coverage and performance.

The following table compares 802.11ax to the previous two standards.

*Table 2: 802.11ax Guard Interval Comparing With Previous Standards*

Capabilities	802.11n	802.11ac	802.11ax
Physical Layer (PHY)	High Throughput (HT)	Very High Throughput (VHT)	High-Efficiency (HE)
Guard Interval	800/400 ns	800/400 ns	800/1600/3200 ns

### Configuring 802.11ax Long Guard Interval

HE mode guard intervals should be configured in RF profiles.

**Step 1** Enters global configuration mode.

```
Device#configure terminal
```

**Example:**

```
Device#conf t
Enter configuration commands, one per line. End with CNTL/Z.
```

**Step 2** Configures RF profile and enters RF profile configuration mode

```
ap dot11 {24ghz|5ghz} rf-profile <profile-name>
```

**Example:**

```
Device(config)#ap dot11 24ghz rf-profile 24G-RF-profile
```

**Step 3** Configures guard interval for the RF profile.

```
guard-interval {GUARD_INTERVAL_1600NS | GUARD_INTERVAL_3200NS | GUARD_INTERVAL_400NS
| GUARD_INTERVAL_800NS}
```

**Example:**

```
Device(config-rf-profile)#guard-interval GUARD_INTERVAL_1600NS
```

- GUARD\_INTERVAL\_1600NS: Set 1600 ns guard interval (only in HE mode)
- GUARD\_INTERVAL\_3200NS: Set 3200 ns guard interval (only in HE mode)
- GUARD\_INTERVAL\_400NS: Set 400 ns guard interval (HT VHT mode)
- GUARD\_INTERVAL\_800NS: Set 800 ns guard interval

**Note** Valid guard interval values are 800, 1600, and 3200 ns for HE mode. By default, GI is 800 ns.

**Step 4** Exit global configuration mode.

**end**

**Example:**

Device (config) #**end**

---

Use the following command to verify the configuration on wireless controller:

```
#show ap rf-profile name Demo-24G-RF-profile detail | inc Guard
Guard Interval      : 1600ns
#show ap rf-profile name Demo-5G-RF-profile detail | inc Guard
Guard Interval      : 3200ns
```

### Example

#### 1. Define GI in RF profile

```
ap dot11 24ghz rf-profile Demo-24G-RF-profile
shutdown
guard-interval GUARD_INTERVAL_1600NS
no shutdown
ap dot11 5ghz rf-profile Demo-5G-RF-profile
shutdown
guard-interval GUARD_INTERVAL_3200NS
no shutdown
```

#### 2. Associate RF profile to RF tag

```
wireless tag rf Demo-Guard-Interval-RF-tag
24ghz-rf-policy Demo-24G-RF-profile
5ghz-rf-policy Demo-5G-RF-profile
```

#### 3. Associate RF tag to AP

```
ap fc58.9a15.c83c
rf-tag Demo-Guard-Interval-RF-tag
```

## GNSS Support

From Cisco IOS XE Dublin 17.11.1, GNSS is supported on IW9167EH. The AP tracks GPS information for devices deployed in the outdoor environment and sends the GNSS information to the wireless controller.

Use the following command to display the GNSS information on the AP:

ap# **show gnss info**.

Use the following commands to display the GPS location of the AP:

controller# **show ap geolocation summary**

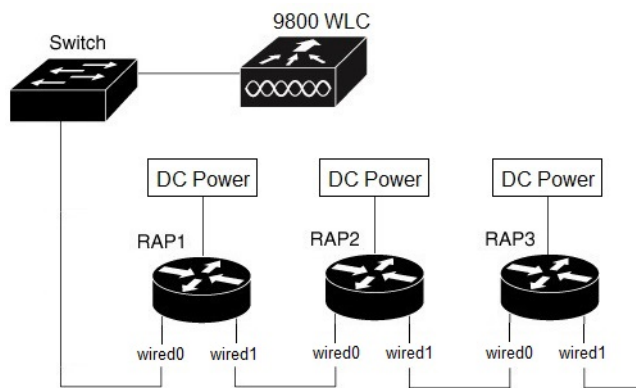
controller# **show ap name <Cisco AP> geolocation detail**

# RAP Ethernet Daisy Chain

The RAP Ethernet Daisy Chain feature enhances the existing Ethernet bridging functionality. It forces the bridge AP to stick to the Ethernet link, and block the selecting of wireless link for uplink backhaul. Even the Ethernet link failure happens, the access point will never select a parent over wireless backhaul.

The following figure shows an example of RAP Ethernet Daisy Chain topology. Standalone DC power source is provided to each RAP.

**Figure 1: RAP Ethernet Daisy Chain Topology**



**Table 3: Port Mapping**

Panel Label	SW Interface
mGig POE-IN port	wired 0
SFP	wired 1



**Note** The supported SFP module for this feature is the 1000BASE-T rugged SFP (Cisco PID: GLC-T-RGD).

Follow these guidelines when you configure this feature:

- All APs in daisy chain is operating in mesh bridge mode or Flex+Bridge mode with Root AP role. The PoE-IN (wired0) and SFP (wired1) port can be used as uplink port and the PoE-IN (wired0) port has the higher priority than SFP (wired1).
- VLAN transparency should be disabled on all daisy-chained RAPs.
- To enable VLAN support on each root AP:
  - For bridge mode APs, use the **ap name name-of-rap mesh vlan-trunking [native] vlan-id** command to configure a trunk VLAN on the corresponding RAP.
  - For Flex+Bridge APs, you must configure the native VLAN ID under the corresponding flex profile.





	Prior to Release 17.11.1	Release 17.11.1
Topology	<b>Fixed topology</b> RAP must use its mGig port as uplink in daisy chain topology	<b>Flexible topology</b> RAP can use either mGig port or SFP port as uplink in daisy chain topology by enabling WSTP on AP
Feature enablement	<b>Persistent-ssid</b> in AP profile <a href="#">1</a>	<b>rap-eth-daisychain</b> in Mesh profile
Ring Topology	Not supported <a href="#">2</a>	Not supported

<sup>1</sup> **Persistent-ssid** is still supported in 17.11, so that daisy chain function will not be impacted after upgrading from previous release to 17.11 with old configuration. But **Persistent-ssid** is not recommended in 17.11, and the new **rap-eth-daisychain** command is recommended.

<sup>2</sup> Supported only on IW6300 access point, by enabling **daisychain-stp-redundancy**. For more information, see the [RAP Ethernet Daisy Chain Redundancy for STP Ring Topology](#) section in [Cisco Catalyst IW6300 Heavy Duty Series and 6300 Series Embedded Services Access Point Software Configuration Guide](#).

## RAP Ethernet Daisy Chain Configuration

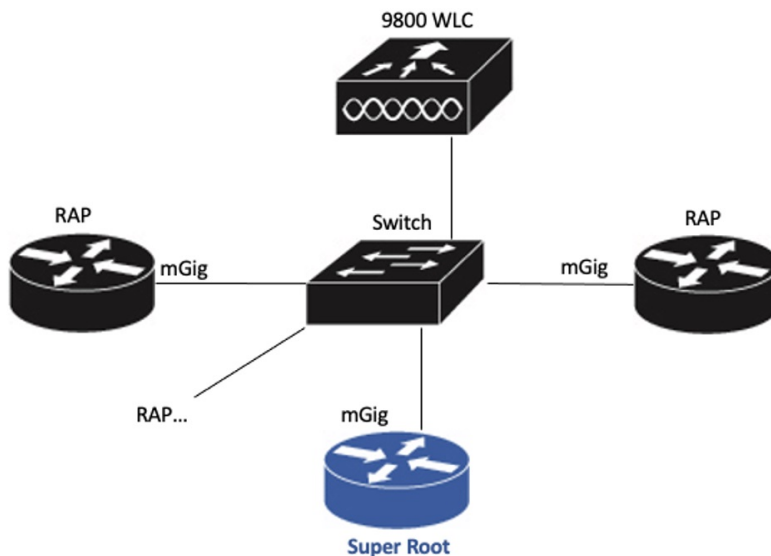
This section provides procedures for the RAP Ethernet daisy chain configuration.

### Preconfiguring RAP Ethernet Daisy Chain Before Field Deployment

This section provides the preconfiguration that you should complete in lab before you set up in field deployment.

**Step 1** Unpack, connect, and power on the AP.

**Step 2** Join each AP to controller with mGig port. See the following figure for details.



**Step 3** Configure AP to bridge mode and configure AP role to Root AP.

For detailed configuration procedures, see [https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-11/config-guide/b\\_wl\\_17\\_eleven\\_cg/m\\_mesh\\_ewlc.html#task\\_pnb\\_bwy\\_mlb](https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-11/config-guide/b_wl_17_eleven_cg/m_mesh_ewlc.html#task_pnb_bwy_mlb).

**Step 4** Configuring RAP Ethernet Daisy Chain.

- a) Create mesh profile and enable the Rap Ethernet Daisy chain feature.  
See [Enabling RAP Ethernet Daisy Chain, on page 15](#).
- b) Attach the profile to all the RAP.
- c) Configure one AP as Super Root which should be the first hop to the wireless controller.  
See [Configuring Super Root, on page 16](#).
- d) Configure primary Ethernet port on the Super Root AP if you use SFP port as uplink.  
See [Configuring Primary Ethernet Port, on page 17](#).

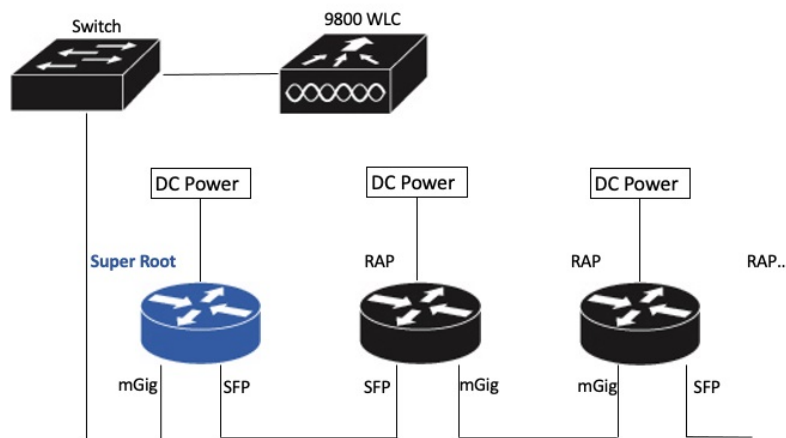
**Step 5** Enable Ethernet Bridging and Configure Ethernet port.

See [Configuring Ethernet Bridging and Ethernet Port, on page 17](#).

- a) Enable Ethernet Bridging.
- b) Ethernet port configuration on both Port 0 and Port 1, including port mode and vlan. It is recommended to configure port to trunk mode.

**Step 6** Verify the behavior in daisy chain topology.

- a) Connecting the RAP via wired port one by one.



**Note** The RAP which is the first hop from wireless controller should be configured as Super Root, as shown in the above figure.

- b) Make sure that RAP of each hop can join the controller.

**Note** In field deployment, just repeat Step 6 of this procedure. Make sure you configure the first hop as Super Root.

## Enabling RAP Ethernet Daisy Chain

To enable RAP Ethernet Daisy Chain feature, use the **rap-eth-daisychain** command, or configure from GUI.

The following example shows enabling the feature from CLI:

```
#configure terminal
(config)#wireless profile mesh default-mesh-profile
(config-wireless-mesh-profile)#ethernet-bridging
(config-wireless-mesh-profile)#rap-ethernet-daisychain
```

The following figure shows enabling the feature from GUI:

The screenshot shows the 'Edit Mesh Profile' configuration page with two tabs: 'General' and 'Advanced'. The 'General' tab is active. On the right side, there is a list of features with checkboxes. The 'RAP Ethernet Daisy Chain' checkbox is checked and circled in red. Other checked features include 'Backhaul amsdu', 'Backhaul Client Access', 'Battery State for an AP', 'Full sector DFS status', and 'Background Scanning'. Other unchecked features include 'IDS (Rogue/Signature Detection)', 'Convergence Method' (set to 'Very Fast'), 'Channel Change Notification', 'LSC', 'Daisychain STP Redundancy', and 'MAP Fast Ancestor Find'.

To verify the configuration, use the **show wireless profile mesh detailed** command or **show wireless mesh ethernet daisy-chain summary** command from wireless controller, as shown in the following examples:

```
#show wireless profile mesh detailed <profile name>
...
RAP ethernet daisychain      : ENABLED

#show wireless mesh ethernet daisy-chain summary
AP Name      BVI MAC      BGN      Backhaul      Ethernet      STP Red      Super
Root
-----
APxxxxxxx   xxxxxxxx   xxxxxx   Ethernet0     Up Up         NA
Enabled
```

Or use the **show mesh config** command on AP, as shown in the following example:

```
#show mesh config
...
RAP Ethernet Daisy Chain: Enabled
Daisy Chain Root: Disabled
```

## Configuring Super Root

The first RAP which connects to the upstream switch should be configured as super root, which means it's the source of all WSTP hello. Other RAPs only start hello after receiving a hello.

You can configure the super root from wireless controller or from AP.

- From wireless controller, use the **ap name <name> [no] mesh rap-eth-daisychain super-root** command to configure a super root.

To verify the configuration, use the following command:

```
#show ap name <name> config general
...
RAP ethernet daisychain           : Enabled
Super Root                        : Enabled
```

- On AP, use the **capwap ap mesh wstp super-root** command to configure a super root.

To verify the configuration, use the following command:

```
#show mesh config
...
RAP Ethernet Daisy Chain: Enabled
Daisy Chain Root: Enabled
```

## Configuring Primary Ethernet Port

Super root must use its primary Ethernet port to connect to upstream switch. For IW9167EH, the default primary Ethernet port is Ethernet port 0. To manually configure the primary Ethernet port, use the **ap name <name> mesh backhaul ethernet <0/1>** command from wireless controller.

To verify the configuration, use the following command from wireless controller:

```
#show ap name <name> config general
...
AP Primary Ethernet port           : 1
RAP ethernet daisychain           : Enabled
Super Root                         : Disabled
```

Or use the following commands on AP:

```
#show mesh config
...
RAP Ethernet Daisy Chain: Enabled
Daisy Chain Root: Enabled
AP Primary ethernet backhaul interface: 1

#show mesh adjacency parent
AdjInfo: Wired Backhaul: 1 [xx:xx:xx:xx:xx:xx]
```

## Configuring Ethernet Bridging and Ethernet Port

### Configuring Ethernet Bridging (CLI)

The Ethernet port on the MAPs are disabled by default. It can be enabled only by configuring Ethernet bridging on the Root AP and the other respective MAPs. Follow these steps to enable Ethernet bridging on the AP.

**Step 1** Enters global configuration mode.

```
Device#configure terminal
```

**Step 2** Creates a mesh profile.

```
wireless profile mesh profile-name
```

**Example:**

```
(config)#wireless profile mesh rap-eth-daisy
```

**Step 3 ethernet-bridging****Example:**

```
(config-wireless-mesh-profile)#ethernet-bridging
```

Connects remote wired networks to each other.

**Step 4** Disables VLAN transparency to ensure that the bridge is VLAN aware.

```
no ethernet-vlan-transparent
```

**Example:**

```
(config-wireless-mesh-profile)#no ethernet-vlan-transparent
```

**Step 5** Exit global configuration mode.

```
end
```

**Example:**

```
(config-wireless-mesh-profile)#end
```

**Example**

Use the following command to verify the configuration:

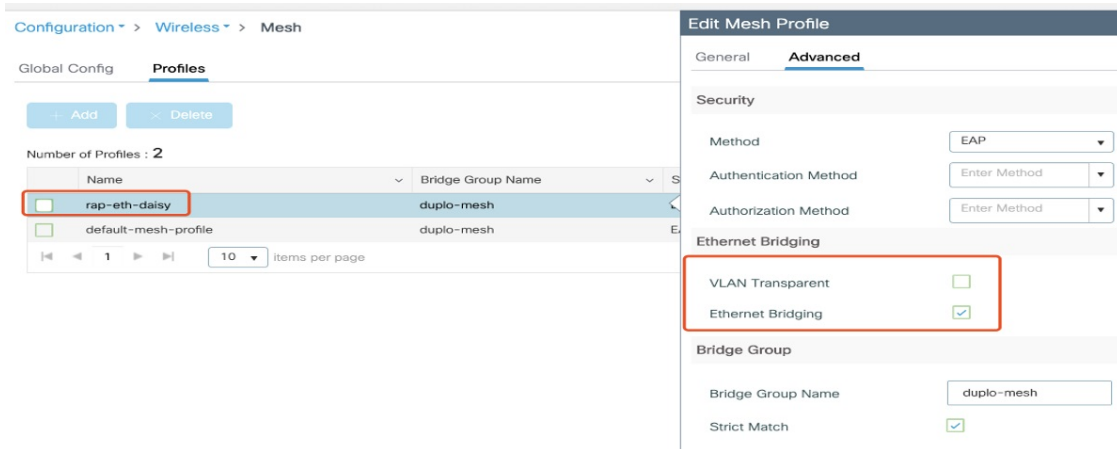
```
#show wireless profile mesh detailed rap-eth-daisy
```

```
Mesh Profile Name          : rap-eth-daisy
-----
Description                :
Bridge Group Name          : unconfigured
Strict match BGN           : DISABLED
Amsdu                      : ENABLED
Background Scan            : DISABLED
Channel Change Notification : DISABLED
Backhaul client access     : DISABLED
Ethernet Bridging          : ENABLED
Ethernet Vlan Transparent  : DISABLED
Daisy Chain SP Redundancy  : DISABLED
Full Sector DFS            : ENABLED
```

**Configuring Ethernet Bridging (GUI)**

Follow these steps to configure Ethernet Bridging from wireless controller GUI:

- 
- Step 1** Choose **Configuration > Wireless > Mesh > Profiles**
  - Step 2** Click **Add**.
  - Step 3** In **General** tab, enter the **Name** of the mesh profile.
  - Step 4** In **Advanced** tab, uncheck the **VLAN Transparent** check box to disable VLAN transparency.
  - Step 5** In **Advanced** tab, check the **Ethernet Bridging** check box.
  - Step 6** Click **Apply to Device**.



## Configuring Ethernet Port (CLI)

RAP Ethernet secondary port supports Access mode and Trunk mode. Follow these steps to configure Ethernet port mode.

- Use the following command to configure access mode.

```
#ap name ap-name mesh ethernet 1 mode access Vlan-ID
```

- Use the following commands to configure trunk mode. VLAN support must be enabled in advance, and VLAN transparent should be disabled in your mesh profile.

- Configure a trunk VLAN on the corresponding RAP.

```
#ap name ap-name mesh vlan-trunking native Vlan-ID
```

- Configure the native VLAN for the trunk port.

```
#ap name ap-name mesh ethernet 1 mode trunk vlan native Vlan-ID
```

- Configure the allowed VLANs for the trunk port. Permits VLAN filtering on an ethernet port of any Mesh or Root Access Point. Active only when VLAN transparency is disabled in the mesh profile.

```
#ap name ap-name mesh ethernet 1 mode trunk allowed Vlan-ID
```

## Configuring Ethernet Port (GUI)

Follow these steps to configure Ethernet port from wireless controller GUI:

**Step 1** Choose **Configuration > Wireless > Access Points**.

The **All Access Points** section, which lists all the configured APs in the network, is displayed with their corresponding details.

**Step 2** Click the configured mesh AP.

The **Edit AP** window is displayed.

- Step 3** Choose the **Mesh** tab.
- Step 4** In the **Ethernet Port Configuration** section, from the **Port** drop-down list, choose the port to configure.
- Step 5** From the **Mode** drop-down list, choose access mode or trunk mode.
- Step 6** In the **Native VLAN ID** field, enter the native VLAN for the trunk port.
- Step 7** Click **Update and Apply to Device**.

Edit AP

General
Interfaces
High Availability
Inventory
Mesh
Advanced
Support Bundle

General

Ethernet Port Configuration

Block Child

Daisy Chaining

Daisy Chaining strict-RAP

Preferred Parent MAC

Role

Remove PSK

Port

Mode

Native VLAN ID\*

Allowed VLAN IDs

**!** Ethernet Bridging on the associated Mesh Profile should be enabled to configure this section successfully

## Show and Debug Command

- Use the following command to debug WTP:

```
AP#debug mesh wstp
error    Mesh wstp error debugs
events   Mesh wstp events debugs
packets  Mesh wstp packet debugs
```

```
03:05:24.5918] chatter: wstp_ctl :: WstpControl: RX Hello(00) - BID:FC:58:9A:15:C8:04 SR:FC:58:9A:15:C8:04/0 Flags:02 Port:wired0
03:05:24.5918] chatter: wstp_ctl :: WstpControl - wired_hello_only, hello received, update parent record
03:05:24.5946] chatter: wstp_ctl :: WstpControl: TX Hello(00) - BID:FC:58:9A:17:58:EC SR:FC:58:9A:15:C8:04/0 Flags:02 Port:wired1
03:05:26.5918] chatter: wstp_ctl :: WstpControl: RX Hello(00) - BID:FC:58:9A:15:C8:04 SR:FC:58:9A:15:C8:04/0 Flags:02 Port:wired0
03:05:26.5918] chatter: wstp_ctl :: WstpControl - wired_hello_only, hello received, update parent record
03:05:26.5946] chatter: wstp_ctl :: WstpControl: TX Hello(00) - BID:FC:58:9A:17:58:EC SR:FC:58:9A:15:C8:04/0 Flags:02 Port:wired1
```

- Use the following command to display the WSTP statistics:

```
AP#show mesh stats
WSTP stats:
Attach-Cnt Hello-TX Hello-Rx TCN-TX TCN-RX SR-Chg-Cnt ST-Roam-Cnt
           0       58       58       0       0           0           0
```





## CHAPTER 3

# Workgroup Bridges

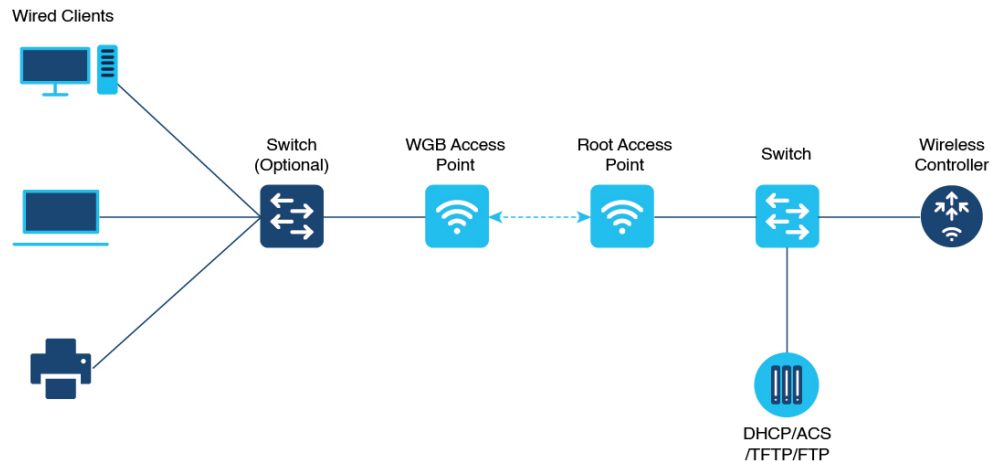
- [Overview, on page 21](#)
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- [Configuring Strong Password in Day0, on page 23](#)
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## Overview

A workgroup bridge (WGB) is an Access Point (AP) mode to provide wireless connectivity to wired clients that are connected to the Ethernet port of the WGB AP. A WGB connects a wired network over a single wireless segment by learning the MAC addresses of its wired clients on the Ethernet interface and reporting them to the WLC through infrastructure AP using Internet Access Point Protocol (IAPP) messaging. The WGB establishes a single wireless connection to the root AP, which in turn, treats the WGB as a wireless client.

Universal WGB (uWGB) is a complementary mode of WGB feature that acts as a wireless bridge between the wired client connected to uWGB and wireless infrastructure including Cisco and non-Cisco wireless network. One of the wireless interface is used to connect with the access point. The radio MAC is used to associate AP.

Figure 3: Example of a WGB



Starting from Cisco IOS XE Dublin 17.11.1, WGB is supported on the Cisco Catalyst IW9167E Heavy Duty Access Points.

## Limitations and Restrictions

This section provides limitations and restrictions for WGB and uWGB modes.

- The WGB can associate only with Cisco lightweight access points. The universal WGB can associate to a third party access point.
- Speed and duplex are automatically negotiated based on the capabilities of the locally connected endpoint and cannot be manually configured on the AP's wired 0 and wired 1 interfaces.
- Per-VLAN Spanning Tree (PVST) and packets are used to detect and prevent loops in the wired and wireless switching networks. WGB transparently bridge STP packets. WGB can bridge STP packets between two wired segments. Incorrect or inconsistent configuration of STP in the wired segments can cause WGB wireless link to be blocked by the connected switch(es) to Access Point or WGB. This could cause WGB to disconnect from AP or AP disconnection to Controller to drop, and wired clients not receiving IP addresses, as STP begins to block switch port in the wired network. If administrator needs to disable bridging of STP between the wired segments by the WGB, we recommend disabling the STP on the directly connected switches in the wireless network.
- The following features are not supported for use with a WGB:
  - Idle timeout
  - Web authentication
- With Layer 3 roaming, if you plug a wired client into the WGB network after the WGB has roamed to another controller (for example, to a foreign controller), the wired client's IP address displays only on the anchor controller, not on the foreign controller.
- When you deauthenticate a WGB record from a controller, all of the WGB wired clients' entries are also deleted.

- These features are not supported for wired clients connected to a WGB:
  - MAC filtering
  - Link tests
  - Idle timeout
- Associating a WGB to a WLAN that is configured for Adaptive 802.11r is not supported.
- WGB supports IPv6 only when IPv4 is enable. But there is no impact on WGB wired clients IPv6 traffic.
- WGB management IPv6 does not work after WGB uplink association is completed. WGB can get an IPv6 address when the association is successful. But IPv6 ping will not be passed from or to WGB. SSH from wireless or wired client to WGB management IPv6 is not working. The workaround to bypass the pingable issue is to re-enable IPv6, even though IPv6 has already been enabled and the IPv6 address has been assigned.
- uWGB mode does not support SSH connecting to itself.
- uWGB mode supports neither TFTP nor SFTP. For software upgrade, you should perform it from WGB mode. For more information, see [uWGB Image Upgrade, on page 25](#).
- uWGB does not support host IP service. Some functions, such as image upgrade via radio uplink and remote management via SSH session, are not supported.
- For IW9167EH WGB/uWGB mode, the **packet retries [N] drop** command does not work in IOS XE Release 17.11.1.
- DFS channels are supported on IW9167EH WGB/uWGB from Release 17.13.1.
- Only Dot11Radio 0 and Dot11Radio 1 interfaces can be used as wireless uplink on IW9167EH WGB/uWGB.

## Configuring Strong Password in Day0

It is required to set a strong password for WGB/uWGB after first login. The username and strong password should follow these rules:

1. Username length is between 1 and 32 characters.
2. Password length is between 8 to 120 characters.
3. Password must contain at least one uppercase character, one lowercase character, one digit, and one punctuation.
4. Password can contain alphanumeric characters and special characters (ASCII decimal code from 33 to 126), but the following special characters are not permitted: " (double quote), ' (single quote), ? (question mark).
5. Password cannot contain three sequential characters.
6. Password cannot contain three same characters consecutively.
7. Password cannot be the same as or reverse of the username.
8. New password must have at least four different characters compared to the current password.

For example, by default, the credential is

- username: Cisco
- password: Cisco
- enable password: Cisco

To reset the credential with the following strong password:

- username: demouser
- password: DemoP@ssw0rd
- enable password: DemoE^aP@ssw0rd

```
User Access Verification
Username: Cisco
Password: Cisco

% First Login: Please Reset Credentials

Current Password:Cisco
Current Enable Password:Cisco
New User Name:demouser
New Password:DemoP@ssw0rd
Confirm New Password:DemoP@ssw0rd
New Enable Password:DemoE^aP@ssw0rd
Confirm New Enable Password:DemoE^aP@ssw0rd

% Credentials changed, please re-login

[*04/18/2023 23:53:44.8926] chpasswd: password for user changed
[*04/18/2023 23:53:44.9074]
[*04/18/2023 23:53:44.9074] Management user configuration saved successfully
[*04/18/2023 23:53:44.9074]

User Access Verification
Username: demouser
Password: DemoP@ssw0rd
APFC58.9A15.C808>enable
Password:DemoE^aP@ssw0rd
APFC58.9A15.C808#
```




---

**Note** In above example, all passwords are displayed in plain text for demonstration purpose. In real case, they are hidden by asterisks (\*).

---

## Controller Configuration for WGB

For a WGB to join a wireless network, you need to configure specific settings on the WLAN and related policy profile on the controller.

Follow these steps to configure the Cisco Client Extensions option and set the support of Aironet IE in the WLAN:

1. Enter WLAN configuration submode. The *profile-name* is the profile name of the configured WLAN.

```
#wlan profile-name
```

2. Configure the Cisco Client Extensions option and set the support of Aironet IE on the WLAN.

```
#ccx aironet-iesupport
```




---

**Note** Without this configuration, WGB is not able to associate to AP.

---

Follow these steps to configure WLAN policy profile:

1. Enter wireless policy configuration mode.

```
#wireless profile policy profile-policy
```

2. Assign the profile policy to the VLAN.

```
#vlan vlan-id
```

3. Configure WGB VLAN client support.

```
#wgb vlan
```

## uWGB Image Upgrade

uWGB mode does not support TFTP or SFTP. To perform a software upgrade, follow these steps:

**Step 1** Connect a TFTP or SFTP server to wired 0 port of uWGB.

**Step 2** Turn radio interfaces into Administratively Down state.

```
configure Dot11Radio <0|1> disable
```

**Example:**

```
#configure Dot11Radio 0 disable
#configure Dot11Radio 1 disable
```

**Step 3** Convert uWGB to WGB mode.

```
configure Dot11Radio slot_id mode wgb ssid-profile ssid_profile_name
```

**Example:**

```
#configure Dot11Radio 1 mode wgb ssid-profile a_uwgb_demo_ssid
```

This command will reboot with downloaded configs.  
Are you sure you want continue? <confirm>

**Note** *ssid\_profile\_name* can be any existing SSID profile configured by users.

**Step 4** After rebooting, assign a static IP address to the WGB.

```
configure ap address ipv4 static IPv4_address netmask Gateway_IPv4_address
```

**Example:**

```
#configure ap address ipv4 static 192.168.1.101 255.255.255.0 192.168.1.1
```

**Step 5** Verify the ICMP ping works.

```
ping server_IP
```

**Example:**

```
#ping 192.168.1.20
Sending 5, 100-byte ICMP Echos to 192.168.1.20, timeout is 2 seconds

PING 192.168.1.20
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0.858/0.932/1.001 ms
```

**Step 6** Upgrade the software.

```
archive download /reload <tftp | sftp | http>://server_ip/file_path
```

**Step 7** Convert WGB back to uWGB.

```
configure Dot11Radio slot_id mode uwgb wired_client_mac_addr ssid-profile ssid_profile_name
```

**Example:**

```
#configure Dot11Radio 1 mode uwgb 00b4.9e00.a891 ssid-profile a_uwgb_demo_ssid
```

## WGB Configuration

The typical WGB configuration involves the following steps:

1. Create an SSID profile.
2. Configure radio as workgroup, and associate the SSID profile to the radio.
3. Turn on the radio.

WGB uplink supports various security methods, including:

- Open (unsecured)
- PSK
- Dot1x (LEAP, PEAP, FAST-EAP, TLS)

The following is an example of Dot1x FAST-EAP configuration:

```
configure dot1x credential demo-cred username demouser1 password Dem0Pass!@
configure eap-profile demo-eap-profile dot1x-credential demo-cred
configure eap-profile demo-eap-profile method fast
configure ssid-profile demo-FAST ssid demo-fast authentication eap profile demo-eap-profile
  key-management wpa2
configure dot11radio 0 mode wgb ssid-profile demo-FAST
configure dot11radio 0 enable
```

The following sections provide detailed information about WGB configuration.

## Configuring IP Address

### Configuring IPv4 Address

Configure the IPv4 address of the AP by entering the following commands:

- To configure IPv4 address by DHCP, use the following command:  
**#configure ap address ipv4 dhcp**
- To configure the static IPv4 address, use the following command. By doing so, you can manage the device via wired interface without uplink connection.  
**#configure ap address ipv4 static *ipv4\_addr netmask gateway***
- To display current IP address configuration, use the following command:  
**#show ip interface brief**

### Configuring IPv6 Address

Configure the IPv6 address of the AP by entering the following commands:

- To configure the static IPv6 address, use the following command. By doing so, you can manage the device via wired interface without uplink connection.  
**#configure ap address ipv6 static *ipv6\_addr prefixlen [gateway]***
- **#configure ap address ipv6 auto-config {enable|disable}**



---

**Note** The **configure ap address ipv6 auto-config enable** command is designed to enable IPv6 SLAAC. However, SLAAC is not applicable for cos WGB. This CLI will configure IPv6 address with DHCPv6 instead of SLAAC.

---

- To configure IPv6 address by DHCP, use the following command:  
**#configure ap address ipv6 dhcp**
- To display current IP address configuration, use the following command:  
**#show ipv6 interface brief**

## Configuring a Dot1X Credential

Configure a dot1x credential by entering this command:

```
# configure dot1x credential profile-name username name password pwd
```

View the WGB EAP dot1x profile summary by entering this command:

```
# show wgb eap dot1x credential profile
```

## Deauthenticating WGB Wired Client

Deauthenticate WGB wired client by entering this command:

```
# clear wgb client {all |single mac-addr}
```

## Configuring an EAP Profile

Follow these steps to configure the EAP profile:

1. Bind dot1x credential profile to EAP profile.
2. Bind EAP profile to SSID profile
3. Bind SSID profile to the radio.

---

**Step 1** Configure the EAP profile method type by entering this command:

```
# configure eap-profile profile-name method {fast | leap | peap | tls}
```

**Step 2** Attaching the CA Trustpoint for TLS by entering the following command. With the default profile, WGB uses the internal MIC certificate for authentication.

```
# configure eap-profile profile-name trustpoint {default | name trustpoint-name}
```

**Step 3** Bind dot1x-credential profile by entering this command:

```
# configure eap-profile profile-name dot1x-credential profile-name
```

**Step 4** [Optional] Delete an EAP profile by entering this command:

```
# configure eap-profile profile-name delete
```

**Step 5** View summary of EAP and dot1x profiles by entering this command:

```
# show wgb eap profile all
```

---

## Configuring Manual Enrollment of a Trustpoint for Terminal

**Step 1** Create a Trustpoint in WGB by entering this command:

```
# configure crypto pki trustpoint ca-server-name enrollment terminal
```

**Step 2** Authenticate a Trustpoint manually by entering this command:

```
# configure crypto pki trustpoint ca-server-name authenticate
```

Enter the base 64 encoded CA certificate and end the certificate by entering **quit** in a new line.

**Note** User has to import complete certificate chains in the trustpoint if intermediate certificate is used.

**Example:**



```
#configure crypto pki trustpoint demotp authenticate
```

Enter the base 64 encoded CA certificate.

...And end with the word "quit" on a line by itself...

```
-----BEGIN CERTIFICATE-----
[base64 encoded root CA certificate]
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
[base64 encoded intermediate CA certificate]
-----END CERTIFICATE-----
quit
```

**Step 3** Configure a private key size by entering this command:

```
# configure crypto pki trustpoint ca-server-name key-size key-length
```

**Step 4** Configure the subject-name by entering this command:

```
# configure crypto pki trustpoint ca-server-name subject-name name [Optional] 2ltr-country-code state-name
locality org-name org-unit email
```

**Step 5** Generate a private key and Certificate Signing Request (CSR) by entering this command:

```
# configure crypto pki trustpoint ca-server-name enroll
```

Create the digitally signed certificate using the CSR output in the CA server.

**Step 6** Import the signed certificate in WGB by entering this command:

```
# configure crypto pki trustpoint ca-server-name import certificate
```

Enter the base 64 encoded CA certificate and end the certificate by entering **quit** in a new line.

**Step 7** [Optional] Delete a Trustpoint by entering this command:

```
# configure crypto pki trustpoint trustpoint-name delete
```

**Step 8** View the Trustpoint summary by entering this command:

```
# show crypto pki trustpoint
```

**Step 9** View the content of the certificates that are created for a Trustpoint by entering this command:

```
# show crypto pki trustpoint trustpoint-name certificate
```

---

## Configuring Auto-Enrollment of a Trustpoint for Workgroup Bridge

---

**Step 1** Enroll a Trustpoint in WGB using the server URL by entering this command:

```
# configure crypto pki trustpoint ca-server-name enrollment url ca-server-url
```

**Step 2** Authenticate a Trustpoint by entering this command:

```
# configure crypto pki trustpoint ca-server-name authenticate
```

This command will fetch the CA certificate from CA server automatically.

- Step 3** Configure a private key size by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **key-size** *key-length*
- Step 4** Configure the subject-name by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **subject-name** *name* [Optional] *2ltr-country-code* *state-name* *locality* *org-name* *org-unit* *email*
- Step 5** Enroll the Trust point by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **enroll**  
 Request the digitally signed certificate from the CA server.
- Step 6** Enable auto-enroll by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **auto-enroll enable** *renew-percentage*  
 You can disable auto-enrolling by using the `disable` syntax in the command.
- Step 7** [Optional] Delete a Trustpoint by entering this command:  
**# configure crypto pki trustpoint** *trustpoint-name* **delete**
- Step 8** View the Trustpoint summary by entering this command:  
**# show crypto pki trustpoint**
- Step 9** View the content of the certificates that are created for a Trustpoint by entering this command:  
**# show crypto pki trustpoint** *trustpoint-name* **certificate**
- Step 10** View the PKI timer information by entering this command:  
**# show crypto pki timers**

---

## Configuring Manual Certificate Enrollment Using TFTP Server

---

- Step 1** Specify the enrollment method to retrieve the CA certificate and client certificate for a Trustpoint in WGB by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **enrollment tftp** *tftp-addr/file-name*
- Step 2** Authenticate a Trustpoint manually by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **authenticate**  
 Retrieves the CA certificate and authenticates it from the specified TFTP server. If the file specification is included, the wgb will append the extension “.ca” to the specified filename.
- Step 3** Configure a private key size by entering this command:  
**# configure crypto pki trustpoint** *ca-server-name* **key-size** *key-length*
- Step 4** Configure the subject-name by entering this command:

```
# configure crypto pki trustpoint ca-server-name subject-name name [Optional] 2ltr-country-code state-name
locality org-name org-unit email
```

**Step 5** Generate a private key and Certificate Signing Request (CSR) by entering this command:

```
# configure crypto pki trustpoint ca-server-name enroll
```

Generates certificate request and writes the request out to the TFTP server. The filename to be written is appended with the extension “.req”.

**Step 6** Import the signed certificate in WGB by entering this command:

```
# configure crypto pki trustpoint ca-server-name import certificate
```

Imports a certificate via TFTP at the console terminal, which retrieves the granted certificate. The WGB will attempt to retrieve the granted certificate via TFTP using the same filename and the file name append with “.cert” extension.

**Step 7** View the Trustpoint summary by entering this command:

```
# show crypto pki trustpoint
```

**Step 8** View the content of the certificates that are created for a Trustpoint by entering this command:

```
# show crypto pki trustpoint trustpoint-name certificate
```

## SSID configuration

SSID configuration consists of the following two parts:

1. [Creating an SSID Profile, on page 31](#)
2. [Configuring Radio Interface for Workgroup Bridges, on page 32](#)

### Creating an SSID Profile

Choose one of the following authentication protocols for the SSID profile:

#### Configuring an SSID profile with Open Authentication

Use the following command to configure an SSID profile with Open Authentication:

```
# configure ssid-profile ssid-profile-name ssid radio-serv-name authentication open
```

#### Configuring an SSID profile with PSK Authentication

Use the following command to configure an SSID profile with PSK WPA2 Authentication:

```
# configure ssid-profile ssid-profile-name ssid SSID_name authentication psk preshared-key
key-management wpa2
```

Use the following command to configure an SSID profile with PSK Dot11r Authentication:

```
# configure ssid-profile ssid-profile-name ssid SSID_name authentication psk preshared-key
key-management dot11r
```

Use the following command to configure an SSID profile with PSK Dot11w Authentication:

```
# configure ssid-profile ssid-profile-name ssid SSID_name authentication psk presared-key
key-management dot11w
```

### Configuring an SSID Profile with Dot1x Authentication

Use the following commands to configure an SSID profile with Dot1x authentication:

```
# configure ssid-profile ssid-profile-name ssid radio-serv-name authentication eap profile eap-profile-name
key-management { dot11r | wpa2 | dot11w { optional | required } }
```

The following example configures an SSID profile with Dot1x EAP-PEAP authentication:

```
configure dot1x credential c1 username wgbusr password cisco123456
configure eap-profile p1 dot1x-credential c1
configure eap-profile p1 method peap
configure ssid-profile iot-peap ssid iot-peap authentication eap profile p1 key-management
wpa2
```

### Configuring Radio Interface for Workgroup Bridges

- From the available two radio interfaces, before configuring WGB mode on one radio interface, configure the other radio interface to root-ap mode.

Map a radio interface as root-ap by entering this command:

```
# configure dot11radio radio-slot-id mode root-ap
```

#### Example

```
# configure dot11radio 0 mode root-ap
```




---

**Note** When an active SSID or EAP profile is modified, you need to reassociate the profile to the radio interface for the updated profile to be active.

---

- Map a radio interface to a WGB SSID profile by entering this command:

```
# configure dot11radio radio-slot-id mode wgb ssid-profile ssid-profile-name
```

#### Example

```
# configure dot11radio 1 mode wgb ssid-profile psk_ssid
```

- Configure a radio interface by entering this command:

```
# configure dot11radio radio-slot-id { enable | disable }
```

#### Example

```
# configure dot11radio 0 disable
```




---

**Note** Only one radio or slot is allowed to operate in WGB mode.

---

## Configuring WGB/uWGB Timer

The timer configuration CLIs are common for both WGB and uWGB. Use the following commands to configure timers:

- Configure the WGB association response timeout by entering this command:

```
# configure wgb association response timeout response-millisecs
```

The default value is 100 milliseconds. The valid range is between 100 and 5000 milliseconds.

- Configure the WGB authentication response timeout by entering this command:

```
# configure wgb authentication response timeout response-millisecs
```

The default value is 100 milliseconds. The valid range is between 100 and 5000 milliseconds.

- Configure the WGB EAP timeout by entering this command:

```
# configure wgb eap timeout timeout-secs
```

The default value is 3 seconds. The valid range is between 2 and 60 seconds.

- Configure the WGB bridge client response timeout by entering this command:

```
# configure wgb bridge client timeout timeout-secs
```

Default timeout value is 300 seconds. The valid range is between 10 and 1000000 seconds.

## uWGB Configuration

The universal WGB is able to interoperate with non-Cisco access points using uplink radio MAC address, thus the universal workgroup bridge role supports only one wired client.

Most WGB configurations apply to uWGB. The only difference is that you configure wired client's MAC address with the following command:

```
configure dot11 <0|1> mode uwgb <uwgb_wired_client_mac_address> ssid-profile <ssid-profile>
```

The following is an example of Dot1x FAST-EAP configuration:

```
configure dot1x credential demo-cred username demouser1 password Dem0Pass!@
configure eap-profile demo-eap-profile dot1x-credential demo-cred
configure eap-profile demo-eap-profile method fast
configure ssid-profile demo-FAST ssid demo-fast authentication eap profile demo-eap-profile
  key-management wpa2
configure dot11radio 0 mode uwgb fc58.220a.0704 ssid-profile demo-FAST
configure dot11radio 0 enable
```

The following sections provide detailed information about uWGB configuration.

## Configuring IP Address

### Configuring IPv4 Address

Configure the IPv4 address of the AP by entering the following commands:

- To configure IPv4 address by DHCP, use the following command:

**#configure ap address ipv4 dhcp**

- To configure the static IPv4 address, use the following command. By doing so, you can manage the device via wired interface without uplink connection.

```
#configure ap address ipv4 static ipv4_addr netmask gateway
```

- To display current IP address configuration, use the following command:

```
#show ip interface brief
```

## Configuring IPv6 Address

Configure the IPv6 address of the AP by entering the following commands:

- To configure the static IPv6 address, use the following command. By doing so, you can manage the device via wired interface without uplink connection.

```
#configure ap address ipv6 static ipv6_addr prefixlen [gateway]
```

- **#configure ap address ipv6 auto-config {enable|disable}**




---

**Note** The **configure ap address ipv6 auto-config enable** command is designed to enable IPv6 SLAAC. However, SLAAC is not applicable for cos WGB. This CLI will configure IPv6 address with DHCPv6 instead of SLAAC.

---

- To configure IPv6 address by DHCP, use the following command:

```
#configure ap address ipv6 dhcp
```

- To display current IP address configuration, use the following command:

```
#show ipv6 interface brief
```

## Configuring a Dot1X Credential

Configure a dot1x credential by entering this command:

```
# configure dot1x credential profile-name username name password pwd
```

View the WGB EAP dot1x profile summary by entering this command:

```
# show wgb eap dot1x credential profile
```

## Configuring an EAP Profile

Follow these steps to configure the EAP profile:

1. Bind dot1x credential profile to EAP profile.
2. Bind EAP profile to SSID profile
3. Bind SSID profile to the radio.

- 
- Step 1** Configure the EAP profile method type by entering this command:
- ```
# configure eap-profile profile-name method { fast | leap | peap | tls }
```
- Step 2** Attaching the CA Trustpoint for TLS by entering the following command. With the default profile, WGB uses the internal MIC certificate for authentication.
- ```
# configure eap-profile profile-name trustpoint { default | name trustpoint-name }
```
- Step 3** Bind dot1x-credential profile by entering this command:
- ```
# configure eap-profile profile-name dot1x-credential profile-name
```
- Step 4** [Optional] Delete an EAP profile by entering this command:
- ```
# configure eap-profile profile-name delete
```
- Step 5** View summary of EAP and dot1x profiles by entering this command:
- ```
# show wgb eap profile all
```
- 

## Configuring Manual Enrollment of a Trustpoint for Terminal

---

- Step 1** Create a Trustpoint in WGB by entering this command:
- ```
# configure crypto pki trustpoint ca-server-name enrollment terminal
```
- Step 2** Authenticate a Trustpoint manually by entering this command:
- ```
# configure crypto pki trustpoint ca-server-name authenticate
```
- Enter the base 64 encoded CA certificate and end the certificate by entering **quit** in a new line.
- Note** User has to import complete certificate chains in the trustpoint if intermediate certificate is used.

**Example:**

```
#configure crypto pki trustpoint demotp authenticate
```

```
Enter the base 64 encoded CA certificate.  
....And end with the word "quit" on a line by itself....
```

```
-----BEGIN CERTIFICATE-----  
[base64 encoded root CA certificate]  
-----END CERTIFICATE-----  
-----BEGIN CERTIFICATE-----  
[base64 encoded intermediate CA certificate]  
-----END CERTIFICATE-----  
quit
```

- Step 3** Configure a private key size by entering this command:
- ```
# configure crypto pki trustpoint ca-server-name key-size key-length
```
- Step 4** Configure the subject-name by entering this command:

```
# configure crypto pki trustpoint ca-server-name subject-name name [Optional] 2ltr-country-code state-name
locality org-name org-unit email
```

**Step 5** Generate a private key and Certificate Signing Request (CSR) by entering this command:

```
# configure crypto pki trustpoint ca-server-name enroll
```

Create the digitally signed certificate using the CSR output in the CA server.

**Step 6** Import the signed certificate in WGB by entering this command:

```
# configure crypto pki trustpoint ca-server-name import certificate
```

Enter the base 64 encoded CA certificate and end the certificate by entering **quit** in a new line.

**Step 7** [Optional] Delete a Trustpoint by entering this command:

```
# configure crypto pki trustpoint trustpoint-name delete
```

**Step 8** View the Trustpoint summary by entering this command:

```
# show crypto pki trustpoint
```

**Step 9** View the content of the certificates that are created for a Trustpoint by entering this command:

```
# show crypto pki trustpoint trustpoint-name certificate
```

## Configuring Auto-Enrollment of a Trustpoint for Workgroup Bridge

**Step 1** Enroll a Trustpoint in WGB using the server URL by entering this command:

```
# configure crypto pki trustpoint ca-server-name enrollment url ca-server-url
```

**Step 2** Authenticate a Trustpoint by entering this command:

```
# configure crypto pki trustpoint ca-server-name authenticate
```

This command will fetch the CA certificate from CA server automatically.

**Step 3** Configure a private key size by entering this command:

```
# configure crypto pki trustpoint ca-server-name key-size key-length
```

**Step 4** Configure the subject-name by entering this command:

```
# configure crypto pki trustpoint ca-server-name subject-name name [Optional] 2ltr-country-code state-name
locality org-name org-unit email
```

**Step 5** Enroll the Trust point by entering this command:

```
# configure crypto pki trustpoint ca-server-name enroll
```

Request the digitally signed certificate from the CA server.

**Step 6** Enable auto-enroll by entering this command:

```
# configure crypto pki trustpoint ca-server-name auto-enroll enable renew-percentage
```



You can disable auto-enrolling by using the `disable` syntax in the command.

- Step 7** [Optional] Delete a Trustpoint by entering this command:  
**# configure crypto pki trustpoint *trustpoint-name* delete**
- Step 8** View the Trustpoint summary by entering this command:  
**# show crypto pki trustpoint**
- Step 9** View the content of the certificates that are created for a Trustpoint by entering this command:  
**# show crypto pki trustpoint *trustpoint-name* certificate**
- Step 10** View the PKI timer information by entering this command:  
**# show crypto pki timers**
- 

## Configuring Manual Certificate Enrollment Using TFTP Server

---

- Step 1** Specify the enrollment method to retrieve the CA certificate and client certificate for a Trustpoint in WGB by entering this command:  
**# configure crypto pki trustpoint *ca-server-name* enrollment tftp *tftp-addr/file-name***
- Step 2** Authenticate a Trustpoint manually by entering this command:  
**# configure crypto pki trustpoint *ca-server-name* authenticate**  
Retrieves the CA certificate and authenticates it from the specified TFTP server. If the file specification is included, the wgb will append the extension “.ca” to the specified filename.
- Step 3** Configure a private key size by entering this command:  
**# configure crypto pki trustpoint *ca-server-name* key-size *key-length***
- Step 4** Configure the subject-name by entering this command:  
**# configure crypto pki trustpoint *ca-server-name* subject-name *name* [Optional] *2ltr-country-code state-name locality org-name org-unit email***
- Step 5** Generate a private key and Certificate Signing Request (CSR) by entering this command:  
**# configure crypto pki trustpoint *ca-server-name* enroll**  
Generates certificate request and writes the request out to the TFTP server. The filename to be written is appended with the extension “.req”.
- Step 6** Import the signed certificate in WGB by entering this command:  
**# configure crypto pki trustpoint *ca-server-name* import certificate**  
Imports a certificate via TFTP at the console terminal, which retrieves the granted certificate. The WGB will attempt to retrieve the granted certificate via TFTP using the same filename and the file name append with “.crt” extension.
- Step 7** View the Trustpoint summary by entering this command:

```
# show crypto pki trustpoint
```

**Step 8** View the content of the certificates that are created for a Trustpoint by entering this command:

```
# show crypto pki trustpoint trustpoint-name certificate
```

## SSID configuration

SSID configuration consists of the following two parts:

1. [Creating an SSID Profile, on page 31](#)
2. [Configuring Radio Interface for uWGB, on page 39](#)

### Creating an SSID Profile

Choose one of the following authentication protocols for the SSID profile:

#### Configuring an SSID profile with Open Authentication

Use the following command to configure an SSID profile with Open Authentication:

```
# configure ssid-profile ssid-profile-name ssid radio-serv-name authentication open
```

#### Configuring an SSID profile with PSK Authentication

Use the following command to configure an SSID profile with PSK WPA2 Authentication:

```
# configure ssid-profile ssid-profile-name ssid SSID_name authentication psk preshared-key
key-management wpa2
```

Use the following command to configure an SSID profile with PSK Dot11r Authentication:

```
# configure ssid-profile ssid-profile-name ssid SSID_name authentication psk preshared-key
key-management dot11r
```

Use the following command to configure an SSID profile with PSK Dot11w Authentication:

```
# configure ssid-profile ssid-profile-name ssid SSID_name authentication psk preshared-key
key-management dot11w
```

#### Configuring an SSID Profile with Dot1x Authentication

Use the following commands to configure an SSID profile with Dot1x authentication:

```
# configure ssid-profile ssid-profile-name ssid radio-serv-name authentication eap profile eap-profile-name
key-management { dot11r | wpa2 | dot11w { optional | required } }
```

The following example configures an SSID profile with Dot1x EAP-PEAP authentication:

```
configure dot1x credential c1 username wgbusr password cisco123456
configure eap-profile p1 dot1x-credential c1
configure eap-profile p1 method peap
configure ssid-profile iot-peap ssid iot-peap authentication eap profile p1 key-management
wpa2
```

## Configuring Radio Interface for uWGB

- From the available two radio interfaces, before configuring WGB mode on one radio interface, configure the other radio interface to root-ap mode.

Map a radio interface as root-ap by entering this command:

```
# configure dot11radio radio-slot-id mode root-ap
```

### Example

```
# configure dot11radio 0 mode root-ap
```




---

**Note** When an active SSID or EAP profile is modified, you need to reassociate the profile to the radio interface for the updated profile to be active.

---

- Map a radio interface to a WGB SSID profile by entering this command:

```
# configure dot11radio radio-slot-id mode uwgb uwgb-wired-client-mac-address ssid-profile ssid-profile-name
```

- Configure a radio interface by entering this command:

```
# configure dot11radio radio-slot-id { enable | disable }
```

### Example

```
# configure dot11radio 0 disable
```




---

**Note** After configuring the uplink to the SSID profile, we recommend you to disable and enable the radio for the changes to be active.

---




---

**Note** Only one radio or slot is allowed to operate in uWGB or WGB mode.

---

## Converting Between WGB and uWGB

To convert from WGB to uWGB, use the following command:

```
#configure dot11radio <0|1> mode uwgb <WIRED_CLIENT_MAC> ssid-profile <SSID_PROFILE_NAME>
```

To convert from uWGB to WGB, use the following command. This conversion involves a reboot of the AP.

```
#configure Dot11Radio 1 mode wgb ssid-profile <SSID_PROFILE_NAME>
```

This command will reboot with downloaded configs.  
Are you sure you want continue? [confirm]

## Fast Roaming With Assistant Second 5G Radio

IW9167EH is equipped with dual 5G radios. Only the first 5G (radio 1) can be used as uplink. With proper configuration, the second 5G can accelerate scanning in roaming.



**Note** This feature is supported only on WGB mode, and is not supported on uWGB mode.

To enable this feature, use the following command:

```
#configure dot11radio 2 mode scan
```

When the assistant scanning feature is enabled, the second radio keeps scanning configured SSID based on the channel list. By default, the channel list contains all supported 5G channels (based on reg domain).

You can also configure the channel list explicitly, using the following command:

```
#configure wgb mobile station interface dot11Radio 1 scan <channel> [add|delete]
```

By default, candidate AP entries in scanning table ages out in 1200 ms. You can adjust the timer by the following command:

```
#configure wgb scan radio 2 timeout
<1-5000> Scanning ap expire time
```



**Note** AP selection algorithm picks candidate with best RSSI from the scanning table. In some cases, the RSSI values are out-of-date. This can lead to a failed roaming.



**Note** It is recommended to make the second 5G radio (antenna port 5-8) have the same antenna installation as the first 5G radio (antenna port 1-4).

Check the scanning table by using the following command:

```
#show wgb scan
Best AP expire time: 5000 ms

*****[ AP List ]*****
BSSID          RSSI  CHANNEL  Time
FC:58:9A:15:E2:4F  84    136      1531
FC:58:9A:15:DE:4F  37    136      41

*****[ Best AP ]*****
BSSID          RSSI  CHANNEL  Time
FC:58:9A:15:DE:4F  37    136      41
```

## LED Pattern

Two new LED patterns are added to IW9167EH WGB mode:

- When WGB is in disassociated state, the System LED is blinking RED.

- When WGB makes association to parent AP, System LED turns to solid GREEN.

## Configuring WGB/uWGB Radio Parameters

### Configuring WGB Radio Antenna

Use the following command to configure WGB radio antenna gain. The default antenna gain is 4 dBi.

```
configure dot11 <0|1|2> antenna gain <1-30>
```

Use the following command to configure WGB radio antenna. Default is abcd-antenna.

```
configure dot11 <0|1|2> antenna <a-antenna|ab-antenna|abcd-antenna>
```

### 802.11ax 1600ns and 3200ns Guard Interval

802.11ax supports multiple Guard Interval (GI) value: 800ns, 1600ns, and 3200ns. By default, GI is set to 800ns. But you can set it to a different value.

Longer GI is commonly used in outdoor deployment.

```
#configure dot11radio <0|1|2> guard-interval
 1600 Configure 1600 ns guard interval (only in HE mode)
 3200 Configure 3200 ns guard interval (only in HE mode)
 800   Configure 800 ns guard interval
```

### Customized Transmit Power

By default, the transmit power of the radio is set to AUTO(0) level.

To manually set the transmit power of the radio use the following command:

```
# configure Dot11Radio <0|1|2> txpower-level <0-8>
```

## Assign Country Code to WGB/uWGB With -ROW PID

On day 0, you should assign proper country code to the WGB/uWGB with -ROW reg domain. WGB will load corresponding power table after rebooting.

To assign country code, use the following command:

```
#configure countrycode
Supported ROW country codes:
GB VN

WORD Select one of above ROW country codes.
```



**Note** After the ROW country code is configured, if you want to change the configuration to another country, you need to perform a factory reset first, and then configure the new country code.

# Indoor Deployment for -E Domain and United Kingdom

IW9167EH supports indoor deployment for -E domain and GB in -ROW domain .

For outdoor mode, the IW9167EH 5G radio supports channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140. When indoor deployment is enabled, 5G radio supports channels 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140.

To configure indoor mode, use the **configure wireless indoor-deployment enable** command.

To disable indoor mode, use the **configure wireless indoor-deployment disable** command.

```
#configure wireless indoor-deployment
  disable  Disable indoor deployment
  enable   Enable indoor deployment
```

You can check the indoor or outdoor mode by using the **show controllers Dot11Radio [1|2]** command. In the command output, "-Ei" means the indoor mode is enabled, and "-E" means indoor mode is disabled, as shown in the following examples. The CLI output also shows the supported channels.

```
#show controllers Dot11Radio [1|2]
...
Radio Info Summary:
=====
Radio: 5.0GHz
Carrier Set: (-Ei) ( GB )
Base radio MAC: FC:58:9A:15:B7:C0
Supported Channels:
36 40 44 48 52 56 60 64 100 104 108 112 116 120 124 128 132 136 140

#show controllers Dot11Radio [1|2]
...
Radio Info Summary:
=====
Radio: 5.0GHz
Carrier Set: (-E) ( GB )
Base radio MAC: FC:58:9A:15:B7:C0
Supported Channels:
100 104 108 112 116 120 124 128 132 136 140
```

## Configuring WGB Roaming Parameters

Use the following command to configure the threshold duration and signal strength to trigger reconnecting. Default value is: period 20s and threshold -70db.

```
# configure wgb mobile period <time> <rssi-threshold>
```

Use the following command to configure beacon miss count to trigger reconnecting. Default value is 10.

```
# config wgb beacon miss-count <count>
```

Use the following command to configure max packet retry to trigger reconnecting. Default value is 64.

```
# configure wgb packet retries <retry-count>
```

Use the following command to configure the static roaming channel:

```
# configure wgb mobile station interface dot11Radio <slot_id> scan <channel_id> add
```

Use the following command to delete the mobile channel:

```
# configure wgb mobile station interface dot11Radio <slot_id> scan <channel_id> delete
```

Use the following command to scan all channels:

```
# configure wgb mobile station interface Dot11Radio 1 scan all
```

## Importing and Exporting WGB Configuration

You can upload the working configuration of an existing WGB to a server, and then download it to the new deployed WGBs.

To upload the configuration to a server, use the following command:

```
#copy configuration upload <sftp:|tftp://> ip-address [directory] [file-name]
```

To download a sample configuration to all WGBs in the deployment, use the following command:

```
#copy configuration download <sftp:|tftp://> ip-address [directory] [file-name]
```

The access point will reboot after the **copy configuration download** command is executed. The imported configuration will take effect after the rebooting.

## Verifying the Configuration of WGB and uWGB

Use the **show run** command to check whether the AP is in WGB mode or uWGB mode.

- WGB:

```
#show run
AP Name           : APFC58.9A15.C808
AP Mode           : WorkGroupBridge
CDP State         : Enabled
Watchdog monitoring : Enabled
SSH State         : Disabled
AP Username       : admin
Session Timeout   : 300
```

```
Radio and WLAN-Profile mapping:-
```

```
=====
Radio ID   Radio Mode   SSID-Profile           SSID
          Authentication
-----
1          WGB         myssid                 demo
          OPEN
```

```
Radio configurations:-
```

```
=====
Radio Id      : NA
  Admin state : NA
  Mode        : NA
Radio Id      : 1
  Admin state : DISABLED
  Mode        : WGB
  Dot11 type  : 11ax
Radio Id      : NA
  Admin state : NA
```

```
Mode : NA
```

- uWGB:

```
#show run
AP Name : APFC58.9A15.C808
AP Mode : WorkGroupBridge
CDP State : Enabled
Watchdog monitoring : Enabled
SSH State : Disabled
AP Username : admin
Session Timeout : 300
```

Radio and WLAN-Profile mapping:-

```
=====
Radio ID   Radio Mode   SSID-Profile   SSID
          Authentication
-----
1          UWGB         myssid         demo
          OPEN
```

Radio configurations:-

```
=====
Radio Id : NA
  Admin state : NA
  Mode : NA
Radio Id : 1
  Admin state : DISABLED
  Mode : UWGB
  Uclient mac : 0009.0001.0001
  Current state : WGB
  UClient timeout : 0 Sec
  Dot11 type : 11ax
Radio Id : NA
  Admin state : NA
  Mode : NA
```

Use the **show wgb dot11 associations** command to verify the configuration of WGB and uWGB.

- WGB:

```
#show wgb dot11 associations
Uplink Radio ID : 1
Uplink Radio MAC : 00:99:9A:15:B4:91
SSID Name : roam-m44-open
Parent AP Name : APFC58.9A15.C964
Parent AP MAC : 00:99:9A:15:DE:4C
Uplink State : CONNECTED
Auth Type : OPEN
Dot11 type : 11ax
Channel : 100
Bandwidth : 20 MHz
Current Datarate (Tx/Rx) : 86/86 Mbps
Max Datarate : 143 Mbps
RSSI : 53
IP : 192.168.1.101/24
Default Gateway : 192.168.1.1
IPV6 : ::/128
Assoc timeout : 100 Msec
Auth timeout : 100 Msec
Dhcp timeout : 60 Sec
```



## • uWGB:

```
#show wgb dot11 associations
Uplink Radio ID : 1
Uplink Radio MAC : 00:09:00:01:00:01
SSID Name : roam-m44-open
Parent AP MAC : FC:58:9A:15:DE:4C
Uplink State : CONNECTED
Auth Type : OPEN
Uclient mac : 00:09:00:01:00:01
Current state : UWGB
Uclient timeout : 60 Sec
Dot11 type : llax
Channel : 36
Bandwidth : 20 MHz
Current Datarate (Tx/Rx) : 77/0 Mbps
Max Datarate : 143 Mbps
RSSI : 60
IP : 0.0.0.0
IPV6 : ::/128
Assoc timeout : 100 Msec
Auth timeout : 100 Msec
Dhcp timeout : 60 Sec
```



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