802.11 Parameters for Cisco Access Points

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2.4-GHz radio support

Configure 2.4-GHz radio support for the specified slot number (CLI)

Enable and configure 2.4-GHz radio features for a specified AP slot using commands.

Note The term **802.11b radio** or **2.4-GHz radio** are used interchangeably.

Procedure

Step 1 Enter the privileged EXEC mode.

Example:

```
Device# enable
```

Step 2 Enable Spectrum Intelligence (SI) for the dedicated 2.4-GHz radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 SI
```

For more information, see the *Spectrum Intelligence* section in this guide. In this context, ***0*** refers to the Slot ID.

Step 3 Configure 802.11b antenna hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 antenna {ext-ant-gain antenna_gain_value |
selection [ internal | external ]}
```

- **ext-ant-gain** : configures the 802.11b external antenna gain. *antenna_gain_value* : the external antenna gain value, specified in multiples of 0.5 dBi units. The valid range is from zero to 40, with a maximum gain of 20 dBi.
- **selection** : configures the 802.11b antenna to use either the internal or external option.

Note

- For APs that support self-identifying antennas (SIA), the gain depends on the antenna and not the AP model. The AP automatically learns the gain, so no controller configuration is necessary.
- For APs that do not support SIA, the AP sends the antenna gain in the configuration payload. The default antenna gain depends on the AP model.
- Cisco Catalyst 9120E and 9130E APs support self-identifying antennas (SIA). Cisco Catalyst 9115E APs do not support SIA antennas. Although Cisco Catalyst 9115E APs work with SIA antennas, they do not automatically detect SIA antennas or apply the correct external gain.

Step 4 Configure beamforming for the 2.4-GHz radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 beamforming
```

Step 5 Configure advanced 802.11 channel assignment parameters for the 2.4-GHz radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 channel {channel_number | auto}
```

Step 6 Enable CleanAir for 802.11b radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 cleanair
```

Step 7 Configure 802.11n antenna for 2.4-GHz radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 dot11n antenna {A | B | C | D}
```

Here, are the descriptions of various options:

A : A is the antenna port A.

B : B is the antenna port B.

C : C is the antenna port C.

D : D is the antenna port D.

Step 8 Disable 802.11b radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 shutdown
```

Step 9 Configure transmit power level for 802.11b radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 24ghz slot 0 txpower {tx_power_level | auto}
```

- *tx_power_level* : is the transmit power level in dBm. The valid range is from one to eight.
- **auto** : enables auto-RF.

5-GHz radio support

Configure 5-GHz radio support for the specified slot number (CLI)

Enable and configure 5-GHz radio features on a selected AP slot.

Note The term **802.11a radio** or **5-GHz radio** are used interchangeably in this document.

Procedure

Step 1 Enable Spectrum Intelligence (SI) for the dedicated 5-GHz radio hosted on slot 1 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 SI
```

Here, ***1*** refers to the Slot ID.

Step 2 Configure external antenna gain for 802.11a radios for a specific AP hosted on slot 1.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 antenna ext-ant-gain antenna_gain_value
```

antenna_gain_value : refers to the external antenna gain value in multiples of .5 dBi units. The valid range is from zero to 40, with the maximum gain of 20 dBi.

Note

- For APs supporting self-identifying antennas (SIA), the gain depends on the antenna, not on the AP model. The AP learns the gain, so controller configuration is not required.
- For APs that do not support SIA, the AP sends the antenna gain in the configuration payload. The default antenna gain depends on the AP model.
- Cisco Catalyst 9120E and 9130E APs support self-identifying antennas (SIA). Cisco Catalyst 9115E APs do not support SIA antennas. Although Cisco Catalyst 9115E APs work with SIA antennas, these APs do not automatically detect SIA antennas or add the correct external gain.

Step 3 Configure the antenna mode for 802.11a radios for a specific AP hosted on slot 1.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 antenna mode {omni | sectorA | sectorB}
```

Step 4 Configure the antenna selection for 802.11a radios for a specific AP hosted on slot 1.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 antenna selection {internal | external}
```

Step 5 Configure beamforming for the 5-GHz radio hosted on slot 1 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 beamforming
```

Step 6 Configure advanced 802.11 channel assignment parameters for the 5-GHz radio hosted on slot 1 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 channel {channel_number | auto | width [20 |
 40 | 80 | 160]}
```

Here,

channel_number : refers to the channel number. The valid range is from one to 173.

Step 7 Enable CleanAir for 802.11a radio hosted on slot 1 for a given or specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 cleanair
```

Step 8 Configure 802.11n for 5-GHz radio hosted on slot 1 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 dot11n antenna {A | B | C | D}
```

Here, are the descriptions of various options:

A : A is the antenna port A.

B : B is the antenna port B.

C : C is the antenna port C.

D : D is the antenna port D.

Change the channel hosted on slot 1 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 rrm channel 2
```

Here, *channel*: refers to the new channel created using 802.11h channel announcement. The valid range is from one to 173, provided 173 is a valid channel in the country where the AP is deployed.

Step 9 Disable 802.11a radio hosted on slot 1 for a specific AP and configure 802.11a radio hosted on slot 1 for a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 shutdown
Device# ap name AP-SIDD-A06 dot11 5ghz slot 1 txpower {tx_power_level | auto}
```

- *tx_power_level* : is the transmit power level in dBm. The valid range is from one to eight.
- **auto** : enables auto-RF.

Dual-band radios in Cisco AP models

A dual-band radio is a device category that

- offers connectivity on more than one frequency band (such as 2.4 GHz and 5 GHz)
- provides flexibility in network configuration, and
- is used in multiple Cisco AP models like the 2800, 3800, 4800, and 9120 series.

Feature history table

Table 1: Feature history table for dual-band radios in Cisco AP models

Feature name	Release information	Feature description
Dual-band (XOR) radio support	Cisco IOS XE 16.10.1	The Dual-band (XOR) radio support offers the ability to serve 2.4 GHz or 5 GHz bands or passively monitor both the bands on the same AP. These APs can be configured to serve clients in 2.4 GHz and 5 GHz bands, or serially scan both 2.4 GHz and 5 GHz bands on the flexible radio while the main 5 GHz radio serves clients.

Key features of dual-band radios in Cisco APs

The XOR radio support can be steered manually or automatically.

- Manual steering of a band on a radio: The band on the XOR radio can only be changed manually.
- Automatic client and band steering on radios: This is managed by the Flexible Radio Assignment (FRA) feature that monitors and changes the band configurations as per site requirements.

Client steering

When a radio moves between bands (from 2.4 GHz to 5 GHz and vice versa), clients need to be steered to get an optimal distribution across radios. When an AP has two radios in the 5 GHz band, client steering algorithms contained in the FRA algorithms are used to steer a client between the same band co-resident radios

Cisco APs and dual-band radios

Cisco 2800, 3800, 4800, and 9120 series AP models are equipped with dual-band (XOR) radios. These models have

- radios that operate on either 2.4 GHz or 5 GHz bands, or
- the ability to passively monitor both the bands on the same AP.

These APs can be configured to serve clients in 2.4 GHz and 5 GHz bands, or serially scan both 2.4 GHz and 5 GHz bands on the flexible radio while the main 5 GHz radio serves clients.

Cisco AP models up to the Cisco 9120 APs are designed to support dual 5 GHz band operations with the *i* model supporting a dedicated Macro or Micro architecture and the *e* and *p* models supporting Macro or Macro. The Cisco 9130AXI APs support dual 5 GHz operations as Macro or Micro cell.

Limitations

These are the limitations for XOR radio support:

- RF measurement is disabled when a static channel is configured on slot 1. As a result, the dual-band radio slot 0 operates only with 5 GHz radios and not in the monitor mode. When slot 1 radio is disabled, RF measurement will not run, and the dual band radio slot 0 will be only on 2.4 GHz radio.
- Only one of the 5 GHz radios can operate in the UNII band (100 to 144), due to an AP limitation to maintain the power budget within the regulatory limit.

Configure default XOR radio support (CLI)

Complete this task to configure the basic settings for XOR radio support.

Before you begin

Note The default radio points to the XOR radio hosted on slot 0.

Procedure

Step 1 Enable the priviledged EXEC mode.

Example:

```
Device> enable
```

Step 2 Configure the 802.11 dual-band external antenna gain on the AP.

Example:

```
Device# ap name ap-name  dot11 dual-band antenna ext-ant-gain antenna_gain_value
```

Enter external antenna gain value in multiple of .5 dBi units (that is, an integer value 4 means 4 x 0.5 = 2 dBi of gain).

Step 3 Shut down the default dual-band radio.

Example:

```
Device# ap name ap-name  dot11 dual-band shutdown
```

Use the **no** form of the command to enable the radio.

Step 4 Switch to the client-serving mode of the AP.

Example:

```
Device# ap name ap-name  dot11 dual-band role manual client-serving
```

Step 5 Switch to the 2.4 GHz radio band.

Example:

```
Device# ap name ap-name  dot11 dual-band band 24ghz
```

The basic configuration of the XOR radio is completed.

Example

```
Device> enable
Device# ap name ap-name  dot11 dual-band antenna ext-ant-gain 2
Device# ap name ap-name  dot11 dual-band shutdown
Device# Device# ap name ap-name  dot11 dual-band role manual client-serving
Device# Device# ap name ap-name  dot11 dual-band band 24ghz
```

What to do next

Continue with the configuration steps listed in the "Configure advanced settings" to complete the configuration.

Configure advanced settings (CLI)

Complete this task to configure the advanced settings for XOR radio support, such as, transmit power, channel, channel width, CleanAir settings and so on.

Procedure

Step 1 Configure the transmit power for the radio on the AP.

Example:

```
Device# ap name ap-name  dot11 dual-band txpower {transmit_power_level | auto}
```

Note
When an FRA-capable radio (slot 0 on 9120 AP[for instance]) is set to Auto, you cannot configure static channel and Txpower on this radio.

If you want to configure static channel and Txpower on this radio, you will need to change the radio role to Manual Client-Serving mode.

Step 2 Configure the channel number for the dual band.

Example:

```
Device# ap name ap-name  dot11 dual-band channel 40
```

The range of the *channel-number* is from 1 to 173.

Step 3 (Optional) Enable the auto channel assignment for the dual-band.

Example:

```
Device# ap name ap-name  dot11 dual-band channel auto
```

Step 4 Configure the channel width for the dual band.

Example:

```
Device# ap name ap-name  dot11 dual-band channel width {20 MHz | 40 MHz | 80 MHz | 160 MHz}
```

Step 5 Enable the Cisco CleanAir management on the dual-band radio.

Example:

```
Device# ap name ap-name  dot11 dual-band cleanair
```

Step 6 Configure a band for the Cisco CleanAir feature.

Example:

```
Device# ap name ap-name [no] dot11 dual-band cleanair band 5 GHz
```

Selects a band for the Cisco CleanAir feature.

Use the **no** form of this command to disable the Cisco CleanAir feature.

Step 7 Configure the 802.11n dual-band antenna and antenna ports selection for a specific AP.

Example:

```
Device# ap name ap-name  dot11 dual-band dot11n antenna {A | B | C | D}
```

Here, A, B, C, and D are the antenna ports.

The configuration of the additional features for dual-band (XOR) radios are completed.

Example

```
Device# ap name ap-name  dot11 dual-band txpower auto
Device# ap name ap-name  dot11 dual-band channel 40
Device# ap name ap-name  dot11 dual-band channel width 40 MHz
Device# ap name ap-name  dot11 dual-band cleanair
Device# ap name ap-name [no] dot11 dual-band cleanair band 5 GHz
Device# ap name ap-name  dot11 dual-band dot11n antenna A
```

Configure XOR radio support for the specified slot number (GUI)

Complete this task to configure XOR radio for the specified slot number.

Procedure

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

Step 2 In the **Dual-Band Radios** section, select the AP for which you want to configure dual-band radios.

The AP name, MAC address, CleanAir capability and slot information for the AP are displayed. If the Hyperlocation method is HALO, it displays the antenna PID and antenna design specifics.

Step 3 Click **Configure**.

Step 4 In the **General** tab, set the **Admin Status** as required.

Step 5 Set the **CleanAir Admin Status** field to Enable or Disable.

Step 6 Click **Update & Apply to Device**.

The XOR radio support for the specified slot number has been configured.

Configure XOR radio support for the specified slot number (CLI)

Complete this task to configure XOR radio for a specified slot number.

Procedure

Step 1 Enable the priviledged EXEC mode.

Example:

```
Device> enable
```

Step 2 Configure dual-band antenna for the XOR radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 antenna ext-ant-gain
external_antenna_gain_value
```

Here, *external_antenna_gain_value* is the external antenna gain value in multiples of .5 dBi unit. The range is from 0 to 40.

Note

- For APs supporting self-identifying antennas (SIA), the gain depends on the antenna, and not on the AP model. The gain is learned by the AP and there is no need for controller configuration.
- For APs that do not support SIA, the APs send the antenna gain in the configuration payload, where the default antenna gain depends on the AP model.

Step 3 Configure the current band for XOR radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 band {24ghz | 5ghz}
```

Step 4 Configures dual-band channel for the XOR radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 channel {channel-number | auto | width [160
 | 20 | 40 | 80]}
```

The range of the *channel_number* is from 1 to 165.

Step 5 Enable the Cisco CleanAir feature for dual-band radios hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 cleanair band {24Ghz | 5ghz}
```

Step 6 Configure 802.11n dual-band parameters hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 dot11n antenna {A | B | C | D}
```

Here are the antenna configurations.

A : Enables antenna port A.

B : Enables antenna port B.

C : Enables antenna port C.

D : Enables antenna port D.

Step 7 Configure dual-band role for the XOR radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 role {auto | manual [client-serving | monitor]}
```

Here are the dual-band roles.

- **auto** : refers to the automatic radio role selection.
- **manual** : refers to the manual radio role selection.

Step 8 Disable dual-band radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name [no] dot11 dual-band slot 0 shutdown
```

Use the **no** form of this command to enable the dual-band radio.

Step 9 Configure dual-band transmit power for XOR radio hosted on slot 0 for a specific AP.

Example:

```
Device# ap name ap-name dot11 dual-band slot 0 txpower {tx-power-level | auto}
```

Here,

- *tx_power_level* : is the transmit power level in dBm. The range is from 1 to 8.
- **auto** : enables auto-RF.

The XOR radio for the specified slot number is configured.

Example

```
Device> enable
Device# ap name AP-SIDD-A06 dot11 dual-band slot 0 antenna ext-ant-gain 2
Device# ap name AP-SIDD-A06 dot11 dual-band slot 0 band 24ghz
Device# ap name AP-SIDD-A06 dot11 dual-band slot 0 channel 3
Device# ap name AP-SIDD-A06 dot11 dual-band slot 0 cleanair band 24Ghz
Device# ap name AP-SIDD-A06 dot11 dual-band slot 0 dot11n antenna A
Device# ap name AP-SIDD-A06 [no] dot11 dual-band slot 0 shutdown
Device# ap name AP-SIDD-A06 dot11 dual-band slot 0 txpower 2
```

Verify XOR radio support

To verify the XOR radio support parameters, use these **show** commands:

Verify auto-RF information

To display the auto-RF information for a Cisco AP, use the **show ap name** *ap-name* **auto-rf dot11 dual-band** command.

```
Device# show ap name cisco-ap-name auto-rf dot11 dual-band
```

Verify the list of BSSIDs

To display the list of BSSIDs for a Cisco AP, use the **show ap name** *ap-name* **wlan dot11 dual-band** command.

Receiver only Dual-Band radio support

Receiver only dual-band radio support

A receiver only dual-band radio is a WLAN radio type that

- configures the dual-band Rx-only radio features for an AP with dual-band radios
- serves dedicated functions such as analytics, hyperlocation, wireless security monitoring, and BLE Angle of Arrival (AoA), and
- continually remains in monitor mode, preventing any *tx-rx* configuration for client or data traffic.

Configure receiver only Dual-Band parameters for APs

Enable CleanAir with receiver Only dual-band radio on a Cisco AP (GUI)

Enable CleanAir functionality on a Cisco AP that is configured with a receiver only dual-band radio through the GUI.

Procedure

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

Step 2 In the **Dual-Band Radios** settings, click the AP for which you want to configure the dual-band radios.

Step 3 In the **General** tab, enable the **CleanAir** toggle button.

Step 4 Click **Update & Apply to Device**.

Enabling CleanAir with receiver only dual-band radio on a Cisco AP (CLI)

Enable CleanAir spectrum analysis for a dual-band receiver-only radio on a specified Cisco AP.

Procedure

Step 1 Enter the privileged EXEC mode.

Example:

```
Device# enable
```

Step 2 Enable CleanAir with receiver only (Rx-only) dual-band radio on a specific AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 rx-dual-band slot 2 cleanair band 24Ghz
Device# ap name AP-SIDD-A06 [no] dot11 rx-dual-band slot 2 cleanair band 24Ghz
```

Here, 2 refers to the slot ID. Use the ***no*** form of this command to disable CleanAir.

Disable receiver only dual-band radio on a Cisco AP (GUI)

Prevent the AP from operating a receiver-only dual-band radio by using the GUI.

Procedure

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

Step 2 In the **Dual-Band Radios** settings, click the AP for which you want to configure the dual-band radios.

Step 3 In the **General** tab, disable the **CleanAir Status** toggle button.

Step 4 Click **Update & Apply to Device**.

Disable receiver only dual-band radio on a Cisco AP (CLI)

Disable the receiver only dual-band radio function on a specific Cisco AP using commands.

Procedure

Step 1 Enter the privileged EXEC mode.

Example:

```
Device# enable
```

Step 2 Disable receiver only dual-band radio on a specific Cisco AP.

Example:

```
Device# ap name AP-SIDD-A06 dot11 rx-dual-band slot 2 shutdown
Device# ap name AP-SIDD-A06 [no] dot11 rx-dual-band slot 2 shutdown
```

Here, 2 refers to the slot ID. Use the ***no*** form of this command to enable receiver only dual-band radio.

Configure client steering (CLI)

Enable and customize client steering on a wireless device to optimize client distribution between macro (5 GHz) and micro (2.4 GHz) radios, improving wireless network performance and load balancing.

Before you begin

Enable Cisco CleanAir on the corresponding dual-band radio.

Procedure

Step 1 Configure the macro-micro client load–balancing window for a set number of clients.

Example:

```
Device(config)# wireless macro-micro steering transition-threshold balancing-window
number-of-clients(0-65535) 10
```

Step 2 Configure the macro-micro client parameters for a minimum client count for transition.

Example:

```
Device(config)# wireless macro-micro steering transition-threshold client count
number-of-clients(0-65535) 10
```

Step 3 Configure the macro-to-micro transition RSSI.

Example:

```
Device(config)# wireless macro-micro steering transition-threshold macro-to-micro RSSI-in-dBm(
 -128—0) -100
```

Step 4 Configure the micro–to–macro transition RSSI.

Example:

```
Device(config)# wireless macro-micro steering transition-threshold micro-to-macro
RSSI-in-dBm(-128—0) -110
```

Step 5 Configure the number of probe cycles to be suppressed.

Example:

```
Device(config)# wireless macro-micro steering probe-suppression aggressiveness
number-of-cycles(-128—0) -110
```

Step 6 Configure the macro-to-micro probe in RSSI.

Example:

```
Device(config)# wireless macro-micro steering probe-suppression hysteresis RSSI-in-dBm -5
```

The range is between –6 to –3.

Step 7 Enable probe suppression mode.

Example:

```
Device(config)# wireless macro-micro steering probe-suppression probe-only
```

Step 8 Enable probe and single authentication suppression mode.

Example:

```
Device(config)# wireless macro-micro steering probe-suppression probe-auth
```

Step 9 Display the wireless client steering information.

Example:

```
Device# show wireless client steering
```

Verify Cisco APs with dual-band radios

To verify the APs with dual-band radios, use the command:

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


AP Name Subband Radio      Mac   Status Channel Power Level Slot ID Mode
-------------------------------------------------------------------------------
4800   All 3890.a5e6.f360 Enabled (40)* *1/8     (22 dBm)      0   Sensor
4800   All 3890.a5e6.f360 Enabled N/A    N/A       2              Monitor
```