



# Cisco Flexible Radio Assignment

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## Information About Flexible Radio Assignment

Flexible Radio Assignment (FRA) takes advantage of Cisco FRA-capable APs whose radio hardware can operate in multiple roles. The following are the AP models and types of hardware managed by FRA:

**Table 1: AP Models and Types of Hardware Managed by FRA**

AP Model	FRA Radios	Functions
Cisco Aironet 2800 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Aironet 3800 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Aironet 4800 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Catalyst 9120 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Catalyst 9130AX Series Access Points	5-GHz Tri-Radio	2.4-GHz 4x4 and single 5-GHz 8x8, or 2.4-GHz 4x4 and dual 5-GHz 4x4
Cisco Catalyst Wireless 9166 Access Points	5/6-GHz XOR	2.4-GHz 4x4 and dual 5-GHz 4x4, or 5-GHz 4x4 and 6-GHz 4x4

FRA performs a number of functions. On the 2.4-GHz and 5-GHz XOR models, FRA establishes the required 2.4-GHz coverage, identifies redundant radios, and converts them to either 5-GHz or a monitor role. For

tri-radio and 5/6-GHz XOR models, FRA determines the 2.4-GHz coverage, and the redundant radios are converted to a monitor role. Additionally, FRA determines the best operating role for the 5-GHz tri-radio (as either a single 8x8 or a dual 4x4), based on connected client capabilities. For the 5/6-GHz XOR radio, the band that the radios should operate on is based on the availability 6-GHz client presence in the regulatory domain.

FRA also manages the resulting configurations of the radios to optimize client experience across flexible roles. Client Steering is responsible for load balancing client connections. For instance, from Cisco Aironet 2800 APs through Cisco Catalyst 9120 Series APs, all the internal antenna AP models perform dual 5-GHz roles as a Macro-Micro cell (a cell within a cell). The antennas on these models are built to support the directionality needed for the micro cell. FRA client steering helps to steer clients to the appropriate radio based on their position within the cell (closer clients are put on the micro cell).

The FRA APs that support external antennas operate as Macro-Macro, which allows full control over power and channels. The CW9166I AP also supports a Macro-Macro model when using the internal antennas.

In Cisco Catalyst 9130 APs and Cisco Catalyst 9136 APs, FRA also manages the operating mode of the band-locked 8x8 5-GHz tri-radio by monitoring client capabilities of connected clients. For instance, if the attached clients are largely Wi-Fi 5-capable clients, then, beam forming should be multi-user MIMO (MU-MIMO), ensuring better capacity with dual 4x4 5-GHz cells. However, if the same cell has a higher number of Wi-Fi 6-capable clients, then 8x8 spatial streams support more MU-MIMO capacity and increase the overall performance of the cell and client experience.

The CW9166 AP is the first AP with a dual-band XOR radio covering the 5-GHz and 6-GHz bands. Criteria for role selection is regulatory domain (that is, if the country's regulatory rules support 6-GHz operations). If yes, 6-GHz is chosen. If not, 5-GHz operations are chosen.

Configuration choices for all FRA radio models include:

- Automatic (Allows FRA to manage role selection automatically)
- Client Serving (Manual role selection of 2.4-GHz, 5-GHz, or 6-GHz, or FRAs are not engaged)
- Monitor (Manual: no FRA)
- Sniffer (Manual: no FRA)

## Configuring an FRA Radio (GUI)

### Procedure

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- Step 1** Choose **Configuration > Radio Configurations > RRM > FRA**.
- Step 2** In the **Flexible Radio Assignment** window, in the **5/6 GHz Flexible Radio Assignment** section, perform the following steps:
- a) Click the **FRA Status** toggle button to change the FRA status to **Enabled**. By default, the FRA status is **Disabled**.
  - b) Click the **FRA Freeze** toggle button to enable FRA freeze. Enable **FRA Freeze** to lock the radio's current assigned role. When enabled, the radios continue to operate in their role (monitor, sniffer or client serving) until you manually change it or disable FRA Freeze.
  - c) From the **FRA Interval** drop-down list, choose the FRA run interval. The interval value range is from 1 hour to 24 hours. You can choose the FRA run interval value only after you enable the FRA status.

**Step 3**

In the **2.4/5 GHz Flexible Radio Assignment** section, perform the following steps:

- a) Click the **FRA Status** toggle button to change the FRA status to **Enabled**. By default, the FRA status is **Disabled**.
- b) Click the **FRA Freeze** toggle button to enable FRA freeze. Enable **FRA Freeze** to lock the radio's current assigned role. When enabled, the radios continue to operate in their role (monitor, sniffer or client serving) until you manually change it or disable FRA Freeze.
- c) From the **FRA Interval** drop-down list, choose the FRA run interval. The interval value range is from 1 hour to 24 hours. You can choose the FRA run interval value only after you enable the FRA status.
- d) From the **FRA Sensitivity** drop-down list, choose the percentage of Coverage Overlap Factor (COF) required to consider a radio as redundant. You can select the supported value only after you enable the FRA status.

The supported values are as follows:

- **Low**: 100 percent
- **Medium** (default): 95 percent
- **High**: 90 percent
- **Higher**: 85 percent
- **Even Higher**: 80 percent
- **Super High**: 50 percent

- e) From the **FRA Action** drop-down list, select the **2.4GHz Monitor** option to globally configure the redundant dual-band (XOR 2.4/5-GHz) radios to operate in monitor role.

By default, dual-band radios operate in the 2.4-GHz/5-GHz/Monitor role. This configuration is helpful especially when there is enough coverage on the 5-GHz band and you want to restrict radios from moving to the 5-GHz band to prevent further interference. Instead, the radios directly move to the monitor mode in the 2.4-GHz band.

- f) Check the **Client Aware** check box to take decisions on redundancy.

When enabled, the **Client Aware** feature monitors the dedicated 5-GHz radio. When the client load passes a preset threshold, the Flexible Radio assignment is automatically changed from a monitor role to a 5-GHz role, effectively doubling the capacity of the cell on demand. After the capacity crisis is over and Wi-Fi load returns to normal, the radios resume their previous roles.

- g) In the **Client Select** field, enter a value for client selection. The valid value range is between 0 and 100 percent. The default value is 50 percent.

This means that if the dedicated 5-GHz interface reaches 50 percent channel utilization, it triggers the monitor role dual-band interface to transition to a 5-GHz client-serving role.

- h) In the **Client Reset** field, enter a reset value for the client. The valid value range is between 0 and 100 percent. The default value is 5 percent.

When the AP is operating as a dual 5-GHz AP, this setting indicates the reduction in the combined radios' overall channel utilization required to reset the dual-band radio to monitor role.

**Step 4**

Click **Apply** to save the configuration.

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# Enabling FRA (CLI)

## Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>[no] ap fra</b> <b>Example:</b> Device(config)# [no] ap fra	Enables or disables FRA on the AP.
<b>Step 3</b>	<b>[no] ap fra 5-6ghz</b> <b>Example:</b> Device(config)# ap fra 5-6ghz	Enables FRA 5-GHz or 6-GHz on APs that support XOR (5-GHz or 6-GHz). Use the <b>no</b> form of this command to disable this feature.
<b>Step 4</b>	<b>[no] ap fra freeze</b> <b>Example:</b> Device(config)# ap fra freeze	Enables FRA freeze. Use the <b>no</b> form of this command to disable this feature.
<b>Step 5</b>	<b>[no] ap fra 5-6ghz freeze</b> <b>Example:</b> Device(config)# ap fra 5-6ghz freeze	Enables FRA 5-GHz or 6-GHz freeze. Use the <b>no</b> form of this command to disable this feature.
<b>Step 6</b>	<b>ap fra interval</b> <b>Example:</b> Device(config)# ap fra interval 3	Configures the FRA interval, in hours. The range is from 1 to 24 hours.  <b>Note</b> The FRA interval must be more than the configured RRM interval.
<b>Step 7</b>	<b>ap fra 5-6ghz interval number-of-hours</b> <b>Example:</b> Device(config)# ap fra 5-6ghz interval 4	Configures the FRA 5-GHz or 6-GHz interval, in hours. The valid range is from 1 to 24 hours.
<b>Step 8</b>	<b>ap fra sensitivity {high   medium   low}</b> <b>Example:</b> Device(config)# ap fra sensitivity high	Configures FRA sensitivity. <ul style="list-style-type: none"> <li>• <b>high</b>: Sets the FRA Coverage Overlap Sensitivity to <b>high</b>.</li> <li>• <b>medium</b>: Sets the FRA Coverage Overlap Sensitivity to <b>medium</b>.</li> <li>• <b>low</b>: Sets the FRA Coverage Overlap Sensitivity to <b>low</b>.</li> </ul>

	Command or Action	Purpose
<b>Step 9</b>	<b>end</b> <b>Example:</b> Device(config)# end	Returns to privileged EXEC mode. Alternatively, you can also press <b>Ctrl-Z</b> to exit global configuration mode.
<b>Step 10</b>	<b>ap fra revert {all   auto-only} {auto   static}</b> <b>Example:</b> Device# ap fra revert all auto	Rolls back the XOR radio state. <ul style="list-style-type: none"> <li>• <b>all</b>: Reverts all XOR Radios</li> <li>• <b>auto-only</b>: Reverts only XOR radios that are currently in automatic band selection.</li> <li>• <b>auto</b>: Places the XOR radios in automatic band selection.</li> <li>• <b>static</b>: Places the XOR radios in static 2.4-GHz, 5-GHz, and 6-GHz bands.</li> </ul>
<b>Step 11</b>	(Optional) <b>show ap dot11 {24ghz   5ghz   6ghz   dual-band} summary</b> <b>Example:</b> Device# show ap dot11 6ghz summary	Shows the configuration and statistics of 802.11 Cisco APs.
<b>Step 12</b>	(Optional) <b>show ap fra</b> <b>Example:</b> Device# show ap fra  FRA State : Disabled FRA Sensitivity : medium (95%) FRA Interval : 1 Hour(s)  AP Name                          MAC Address Slot ID  Current-Band          COF % Suggested Mode  AP00A6.CA36.295A          006b.f09c.8290 0          2.4GHz                  None 2.4GHz  COF : Coverage Overlap Factor  test_machine#	Shows the current FRA configuration.
<b>Step 13</b>	(Optional) <b>show ap fra 5-6ghz</b>	Shows the FRA 5-GHz - 6-GHz configurations.
<b>Step 14</b>	(Optional) <b>show ap name ap-name config dot11 {24ghz   5ghz   6ghz   dual}</b> <b>Example:</b> Device# show ap name config dot11 6ghz	Shows the current 802.11 parameters in a given AP.

## Configuring Client FRA in RF Profile (CLI)

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>ap dot11 6ghz rf-profile rf-profile-name</b>  <b>Example:</b> Device(config)# ap dot11 6ghz rf-profile rf-profile-name	Configures the RF profile and enters RF profile configuration mode.
<b>Step 3</b>	<b>client-aware-fra client-count-reset client-count</b>  <b>Example:</b> Device(config-rf-profile)# client-aware-fra client-count-reset 1	Configures the client count threshold for the radio to switch from 6-GHz to 5-GHz band. The valid range is from 1 to 10 clients.
<b>Step 4</b>	<b>client-aware-fra client-reset-util util-percentage</b>  <b>Example:</b> Device(config-rf-profile)# client-aware-fra client-reset-util 5	Configures the utilization threshold for the radio to switch from 6-GHz to 5-GHz band. The valid range is from 0 to 100 percent.

## Verifying FRA XOR 5-GHz and 6-GHz Details

To view the FRA 5-GHz and 6-GHz configuration details, run the following command:

```
Device# show ap fra 5-6ghz
```

To view the client utilization threshold and client reset count, run the following command:

```
Device# show ap rf-profile name default-rf-profile-6ghz detail
Description                : default rfprofile for 6GHz radio
RF Profile Name            : default-rf-profile-6ghz
Band                       : 6 GHz
Transmit Power Threshold v1 : -70 dBm
Min Transmit Power        : -10 dBm
Max Transmit Power        : 30 dBm
Operational Rates
 802.11 6GHZ 6M Rate       : Mandatory
 802.11 6GHZ 9M Rate       : Supported
 802.11 6GHZ 12M Rate      : Mandatory
 802.11 6GHZ 18M Rate      : Supported
 802.11 6GHZ 24M Rate      : Mandatory
 802.11 6GHZ 36M Rate      : Supported
 802.11 6GHZ 48M Rate      : Supported
 802.11 6GHZ 54M Rate      : Supported
```

```

Max Clients                : 200
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.
.
PSC Channel List          : 5,21,37,53,69,85,101,117,133,149,165,181,197,213,229
DCA Bandwidth              : best
DCA Foreign AP Contribution : Enabled
State                      : Up
  Client utilization threshold : 5%
  Client Reset count         : 1
Client Network Preference  : default
802.11ax
  OBSS PD                  : Disabled
  Non-SRG OBSS PD Maximum  : -62 dBm
  SRG OBSS PD              : Disabled
  SRG OBSS PD Minimum      : -82 dBm
  SRG OBSS PD Maximum      : -62 dBm
  Broadcast Probe Response : Disabled
  FILS Discovery           : Disabled
  Multi-BSSID Profile Name  : default-multi-bssid-profile
NDP mode                   : Auto
Guard Interval            : none
PSC Enforcement            : Disabled

```



**Note** The **client utilization threshold** is the utilization threshold for radios to switch from 6-GHz to 5-GHz band. The **client reset count** is the client count threshold for radios to switch from 6-GHz to 5-GHz band.

## Flexible Radio Assignment (FRA) Action

### Feature History for Flexible Radio Assignment Action

This table provides release and related information about the feature explained in this section.

This feature is also available in all the releases subsequent to the one in which they are introduced in, unless noted otherwise.

**Table 2: Feature History for FRA Action**

Release	Feature	Feature Information
Cisco IOS XE Dublin 17.10.1	Flexible Radio Assignment (FRA) Action	In Cisco IOS-XE 17.10.1 and earlier releases, the FRA moves the redundant dual-band radios to either 5-GHz client-serving role or monitor role.
Cisco IOS XE Dublin17.11.1	Flexible Radio Assignment (FRA) Action	From Cisco IOS-XE 17.11.1 onwards, you can select the redundant dual-band radios in a network to operate in monitor only mode.

## Information About Flexible Radio Assignment Action

Flexible Radio Assignment (FRA) evaluates only 2.4-GHz radio coverage and determines whether there is overlapping coverage that is causing radio interference. If there is an overlapping coverage, the dual-band radio moves to either 5-GHz client serving or monitor role.

In Cisco IOS-XE 17.10.1 and earlier releases, the FRA moves the redundant dual-band radios to either 5-GHz client-serving role or monitor role.

From Cisco IOS-XE 17.11.1 onwards, you can select the redundant dual-band radios in a network to operate in monitor only mode.



**Note** The FRA action feature is disabled by default.

## Configuring FRA Action in Default RF Profile (CLI)

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode
<b>Step 2</b>	<b>ap dot11 24ghz fra action monitor</b>  <b>Example:</b> Device(config)# ap dot11 24ghz fra action monitor	Configures the FRA action as monitor, and moves all redundant dual-band radios to monitor role only.
<b>Step 3</b>	<b>end</b>  <b>Example:</b> Device(config)# end	Exits configuration mode and returns to privileged EXEC mode.

## Configuring FRA Action in 2.4-GHz RF Profile (CLI)

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode
<b>Step 2</b>	<b>ap dot11 24ghz rf-profile <i>rf-profile-tag</i></b>  <b>Example:</b>	Configures the RF profile name and enters RF profile configuration mode.



	Command or Action	Purpose
	Device(config)# ap dot11 24ghz rf-profile alpha-rfprofile-24ghz	
<b>Step 3</b>	<b>fra action monitor</b>  <b>Example:</b> Device(config-rf-profile)# fra action monitor	Configures the FRA action as monitor, and moves all redundant dual-band radios to monitor role only.
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Device(config-rf-profile)# end	Exits configuration mode and returns to privileged EXEC mode.

## Verifying FRA Action Configuration

To view the selected FRA action, use the following command:

```
Device# show ap fra
FRA State           : Enabled
FRA Freeze          : Disabled
FRA Operation State : Up
FRA Sensitivity     : higher (85%)
FRA Interval        : 1 Hour(s)
Service Priority    : Coverage
Client Aware FRA   : Enabled
  Client Select     : 25%
  Client Reset      : 5%
FRA Action          : 2.4GHz/Monitor
  Last Run         : 3069 seconds ago
```

To view the FRA action details in an AP RF profile, use the following command:

```
Device# show ap rf-profile name madhu-rf-profile-24 detail | sec FRA
Client Aware FRA      : Disabled
FRA Action            : 2.4GHz/Monitor
```

To view the radio mode and role in an AP, use the following command:

```
Device# show ap name AP7872.5DED.CB74 config slot 0 | sec Attribute
Attributes for Slot 0
Radio Type           : 802.11n - 2.4/5 GHz
Radio Mode           : Monitor
Radio Role           : Monitor
  Assignment Method  : Auto
  Monitor Mode Reason : Automatically Switched by FRA
```

