



# Cisco Flexible Radio Assignment

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## Information About Flexible Radio Assignment

Flexible Radio Assignment (FRA) takes advantage of the dual-band radios included in APs. The FRA is a new feature added to the RRM to analyze the Neighbor Discovery Protocol (NDP) measurements, which manages the hardware used to determine the role of the new flexible radio (2.4 GHz, 5 GHz, or monitor) in your network.

Traditional legacy dual-band APs always had 2 radio slots, (1 slot per band) and were organized by the band they were serving, that is slot 0= 802.11b,g,n and slot 1=802.11a,n,ac.

### XOR Support in 2.4-GHz or 5-GHz Bands

The flexible radio (XOR) offers the ability to serve the 2.4-GHz or the 5-GHz bands, or passively monitor both bands on the same AP. The AP models that are offered are designed to support dual 5-GHz band operations, with the Cisco APs *i* model supporting a dedicated Macro/Micro architecture, and the *e* and *p* models supporting Macro/Macro architecture.

When using FRA with the internal antenna (*i* series models), two 5-GHz radios can be used in a Micro/Macro cell mode. When using FRA with external antenna (*e* and *p* models) the antennas may be placed to enable the creation of two completely separate macro (wide-area cells) or two micro cells (small cells) for HDX or any combination.

FRA calculates and maintains a measurement of redundancy for 2.4-GHz radios and represents this as a new measurement metric called COF (Coverage Overlap Factor).

This feature is integrated into existing RRM and runs in mixed environments with legacy APs. The **AP MODE** selection sets the entire AP (slot 0 and slot1) into one of several operating modes, including:

- Local Mode
- Monitor Mode
- FlexConnect Mode
- Sniffer Mode

- Spectrum Connect Mode

Before XOR was introduced, changing the mode of an AP propagated the change to the entire AP, that is both radio slot 0 and slot 1. The addition of the XOR radio in the slot 0 position provides the ability to operate a single radio interface in many of the previous modes, eliminating the need to place the whole AP into a mode. When this concept is applied to a single radio level, it is called *role*. Three such roles can be assigned now:

- Client Serving
- Either 2.4 GHz(1) or 5 GHz(2)
- Monitor-Monitor mode (3)

**Note**

- MODE: Assigned to a whole AP (slot 0 and slot 1)
- ROLE: Assigned to a single radio interface (slot 0)

## Benefits of the FRA

- Solves the problem of 2.4-GHz over coverage.
- Creating two diverse 5-GHz cells doubles the airtime that is available.
- Permits one AP with one Ethernet drop to function like two 5-GHz APs.
- Introduces the concept of Macro/Micro cells for airtime efficiency.
- Allows more bandwidth to be applied to an area within a larger coverage cell.
- Can be used to address nonlinear traffic.
- Enhances the High-Density Experience (HDX) with one AP.
- XOR radio can be selected by the corresponding user in either band-servicing client mode or monitor mode.

## Configuring an FRA Radio (CLI)

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device# <b>enable</b>	Enters privileged EXEC mode.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b>	Enters global configuration mode.

	Command or Action	Purpose
	Device# <code>configure terminal</code>	
<b>Step 3</b>	<p><code>[no] ap fra</code></p> <p><b>Example:</b></p> <pre>Device(config)# [no] ap fra</pre>	Enables or disables FRA on the AP.
<b>Step 4</b>	<p><code>ap fra interval</code></p> <p><b>Example:</b></p> <pre>Device(config)# ap fra interval 3</pre>	<p>Configures the FRA interval in hours. The range is 1 to 24 hours.</p> <p><b>Note</b> The FRA interval has to be more than the configured RRM interval.</p>
<b>Step 5</b>	<p><code>ap fra sensitivity {high   medium   low}</code></p> <p><b>Example:</b></p> <pre>Device(config)# ap fra sensitivity high</pre>	<p>Configures the FRA sensitivity.</p> <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>
<b>Step 6</b>	<p><code>end</code></p> <p><b>Example:</b></p> <pre>Device(config)# end</pre>	<p>Returns to privileged EXEC mode. Alternatively, you can also press <b>Ctrl-Z</b> to exit global configuration mode.</p>
<b>Step 7</b>	<p><code>ap fra revert {all   auto-only} {auto   static}</code></p> <p><b>Example:</b></p> <pre>Device# ap fra revert all auto</pre>	<p>Rolls back the XOR Radio state.</p> <ul style="list-style-type: none"> <li>• <b>all</b>: Reverts all XOR Radios</li> <li>• <b>auto-only</b>: Revert only XOR radios currently in automatic band selection.</li> <li>• <b>auto</b>: Sets the XOR radios in automatic band selection.</li> <li>• <b>static</b>: Sets the XOR radio in static 2.4-GHz band.</li> </ul>
<b>Step 8</b>	<p><code>show ap dot11 {24ghz   5ghz} summary</code></p> <p><b>Example:</b></p> <pre>Device# show ap dot11 5ghz summary</pre>	Shows the configuration and statistics of 802.11 Cisco APs
<b>Step 9</b>	<p>Device# <code>show ap fra</code></p> <p><b>Example:</b></p> <pre>Device# show ap fra</pre> <pre>FRA State       : Disabled</pre>	Shows the current FRA configuration.

	Command or Action	Purpose
	<pre>FRA Sensitivity       : medium (95%) FRA Interval       : 1 Hour(s)  AP Name          MAC Address Slot ID  Current-Band    COF % Suggested Mode</pre> <pre>AP00A6.CA36.295A    006b.f09c.8290 0                  2.4GHz          None 2.4GHz</pre> <pre>COF : Coverage Overlap Factor  test_machine#</pre>	
<b>Step 10</b>	<p><b>show ap name <i>ap-name</i> config dot11 dual-band</b></p> <p><b>Example:</b></p> <pre>Device# show ap name config dot11 dual-band</pre>	Shows the current 802.11 dual-band parameters in a given AP.

## Configuring an FRA Radio (GUI)

### Procedure

- Step 1** Choose **Configuration > Radio Configurations > RRM > FRA**.
- Step 2** In the **Flexible Radio Assignment** window, enable FRA status and determine the overlapping 2.4 GHz or 5 GHz coverage for each AP, choose **Enabled** in the **FRA Status** field. By default, the FRA status is disabled.
- Step 3** Under the From the **FRA Interval** drop-down list, choose the FRA run interval. The interval values range from 1 hour to 24 hours. You can choose the FRA run interval value only after you enable the FRA status.
- Step 4** 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

The **Last Run** and **Last Run Time** fields will show the time FRA was run last and the time it was run.

- Step 5** Check the **Client Aware** check box to take decisions on redundancy.

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

- Step 6** In the **Client Select** field, enter a value for client selection. The valid values range between 0 and 100 percent. The default value is 50 percent.
- This means that if the dedicated 5-GHz interface reaches 50% channel utilization, this will trigger the monitor role dual-band interface to transition to a 5-GHz client-serving role.
- Step 7** In the **Client Reset** field, enter a reset value for the client. The valid values range between 0 and 100 percent. The default value is 5 percent.
- Once 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 8** Click **Apply** to save the configuration.

## 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 1: 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 Dublin 17.11.1	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> Device(config)# ap dot11 24ghz rf-profile alpha-rfprofile-24ghz	Configures the RF profile name and enters RF profile configuration mode.
<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
```

