# Cisco Flexible Radio Assignment


- Flexible radio assignments, on page 1
- FRA role selection by AP model and client capability, on page 2
- Configure FRA radio (GUI), on page 3
- Enable FRA (CLI), on page 5
- Configure Client FRA in RF Profile (CLI), on page 6
- Verify flexible radio assignment configurations, on page 7
- Verify FRA XOR 5-GHz and 6-GHz details, on page 8
- Flexible Radio Assignment (FRA) Action, on page 9


# Flexible radio assignments

A flexible radio assignment is a configuration management feature that

- adapts AP radio hardware for multiple roles
- manages various Cisco AP models such as Cisco Aironet 2800 series, Cisco Aironet 3800 series, and Catalyst series, and
- optimizes client experience by adapting radio roles based on client capabilities.

### Feature history

| Release | Feature | Feature Information |
|---|---|---|
| Cisco IOS XE 17.11.1 | Convert Redundant 2.4-GHz Radios to Monitor Mode | From this release, you can select the redundant dual-band radios in a network to operate in monitor only mode. |
| Cisco IOS XE 17.9.1 | Support for Cisco Catalyst 9166I Series Wi-Fi 6E Access Points | From this release onwards, the dual-band radio in Cisco Catalyst 9166I Series Wi-Fi 6E Access Points offers the ability to serve either in 5-GHz or 6-GHz band, as monitor or sniffer on the same AP. |
| Cisco IOS XE 16.10.1 | Flexible Radio Assignment | This feature was introduced. |

# FRA role selection by AP model and client capability

FRA performs multiple roles depending on the AP model and capabilities. FRA dynamically adjusts radio roles to optimize client performance and network coverage.

### FRA configuration modes

All FRA-capable models support these configuration options:

- Automatic: Allows FRA to manage role selection automatically.
- Client Serving: Manual role selection of 2.4-GHz, 5-GHz, or 6-GHz. FRA is not engaged.
- Monitor: Manual role selection. FRA is not engaged.
- Sniffer: Manual role selection. FRA is not engaged.

### 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.

### 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.

### Role selection based on client capabilities

**5-GHz Tri-Radio**: 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.

**5/6-GHz XOR Radios**: For the 5/6-GHz XOR radio, the band that the radios should operate on is based on the availability of 6-GHz client presence in the regulatory domain.

### FRA client steering and load balancing

FRA works with client steering to optimize how clients connect across available radios.

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).

### Macro-macro radio layouts

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.

### FRA on Cisco Catalyst 9130

In Cisco Catalyst 9130 APs , FRA also manages the operating mode of the band-locked 8x8 5-GHz tri-radio by monitoring client capabilities of connected clients. Mode selection depends on the client types.

**Wi-Fi 5 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.

**Wi-Fi 6 clients**: 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.

### FRA on CW9166 AP

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.

# AP models and types of hardware managed by FRA

To provide comprehensive details on the AP models and types of hardware managed by Flexible Radio Assignment (FRA) technology, enabling users to identify the appropriate access points for their specific wireless network needs and configurations.

| 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 |

# Configure FRA radio (GUI)

This task helps in setting up the Flexible Radio Assignment (FRA) to efficiently manage radio resources for optimal performance.

Use this task to configure the FRA settings for both the 5/6 GHz and 2.4/5 GHz radios via the GUI.

### Procedure

**Step 1** Choose **Configuration** > **Radio Configurations** > **RRM** > **FRA**.

**Step 2** In the **Flexible Radio Assignment** window, perform the following steps for both **5/6 GHz** and **2.4/5 GHz** sections:

- Click the **FRA Status** toggle button to change the FRA status to **Enabled**. By default, the FRA status is **Disabled**.
- Click the **FRA Freeze** toggle button to enable FRA freeze. Enable **FRA Freeze** to lock the current assigned role of the radio. Radios continue to operate in their role until you change their mode or disable FRA Freeze
- From the **FRA Interval** drop-down list, choose the FRA run interval. The interval value range is from 1 hour to 24 hours.

**Step 3** In the **2.4/5 GHz Flexible Radio Assignment** section, perform the additional configuration:

- From the **FRA Sensitivity** drop-down list, choose the percentage of Coverage Overlap Factor (COF) required to consider a radio as redundant.

| Option | COF Requirement |
|---|---|
| **Low** | 100 percent |
| **Medium** (default) | 95 percent |
| **High** | 90 percent |
| **Higher** | 85 percent |
| **Even Higher** | 80 percent |
| **Super High** | 50 percent |

- Check the **Client Aware** check box to permit redundancy decisions.

  When enabled, the **Client Aware** option allows the system to adjust radio roles based on client distribution to improve overall performance.

- In the **Client Reset** field, enter a reset value for the client. Valid values range from 0 to 100 percent channel utilization.

  Adjust the reset value to manage client distribution. Return the dual-band radio to monitor mode when channel utilization drops below the selected percentage.

**Step 4** Click **Apply** to save the configuration.

The configuration settings are applied, enabling the specified FRA settings, enhancing adaptive radio resource management for optimal network performance.

### What to do next

Review the configuration to ensure optimal FRA settings.

# Enable FRA (CLI)

The purpose of this task is to enable Flexible Radio Assignment (FRA) features using command-line interface (CLI) configurations. This allows for dynamic adjustments of radio bands to optimize wireless performance.

**Procedure**

**Step 1** In the global configuration mode, enable or disable FRA

**Example:**

```
Device# configure terminal
Device(config)# [no] ap fra
```

Enters global configuration mode and enables or disables FRA.

**Step 2** Enable FRA 5 GHz or 6 GHz on AP

**Example:**

```
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 **no** form of this command to disable this feature.

**Step 3** Enable FRA freeze

**Example:**

```
Device(config)# ap fra freeze
```

Enables FRA freeze. Use the **no** form of this command to disable this feature.

**Step 4** Enable FRA 5 GHz or 6 GHz freeze

**Example:**

```
Device(config)# ap fra 5-6ghz freeze
```

Enables FRA 5 GHz or 6 GHz freeze. Use the **no** form of this command to disable this feature.

**Step 5** Configure FRA interval

**Example:**

```
Device(config)# ap fra interval 3
```

Configures the FRA interval, in hours. The range is from 1 to 24 hours.

**Note**
The FRA interval must be more than the configured RRM interval.

**Step 6** Configure FRA 5 GHz or 6 GHz interval

**Example:**

```
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.

**Step 7** Configure FRA sensitivity

**Example:**

```
Device(config)# ap fra sensitivity high
```

Configures FRA sensitivity.

- **high**: Sets the FRA Coverage Overlap Sensitivity to **high**.
- **medium**: Sets the FRA Coverage Overlap Sensitivity to **medium**.
- **low**: Sets the FRA Coverage Overlap Sensitivity to **low**.

**Step 8** Return to privileged EXEC mode

**Example:**

```
Device(config)# end
```

Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

**Step 9** Reverts to XOR radios state

**Example:**

```
Device# ap fra revert all auto
```

Rolls back the XOR radio state.

- **all**: Reverts all XOR Radios
- **auto-only**: Reverts only XOR radios that are currently in automatic band selection.
- **auto**: Places the XOR radios in automatic band selection.
- **static**: Places the XOR radios in static 2.4-GHz, 5-GHz, and 6-GHz bands.

Upon successful completion, FRA will be enabled on the specified radios, optimizing the wireless network environment for better performance and coverage.

# Configure Client FRA in RF Profile (CLI)

This task enables the configuration of Client FRA in an RF profile using a series of CLI commands. It helps to manage the RF profile settings efficiently for optimized network performance.

**Procedure**

**Step 1** Configure terminal

**Example:**

```
Device# configure terminal
```

Enters global configuration mode.

**Step 2** Configure the RF profile

**Example:**

```
Device(config)# ap dot11 6ghz rf-profile rf-profile-name
```

Configures the RF profile and enters RF profile configuration mode.

**Step 3** Configure the client count threshold

**Example:**

```
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 1 to 10 clients.

**Step 4** Configure utilization threshold for radio

**Example:**

```
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 0 to 100 percent.

Upon completion of this task, the RF profile will be configured with client FRA settings, optimizing radio band utilization and client distribution.

# Verify flexible radio assignment configurations

The purpose of this task is to review the Flexible Radio Assignment (FRA) configurations and associated 802.11 parameters on your Cisco Access Points.

**Procedure**

**Step 1** (Optional) View configuration and statistics of 802.11 APs

**Example:**

```
Device# show ap dot11 6ghz summary
```

Shows the configuration and statistics of 802.11 Cisco APs.

**Step 2** (Optional) View the current FRA configuration

**Example:**

```
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.

**Step 3** (Optional) View FRA 5-GHz - 6-GHz configurations

Shows the FRA 5-GHz - 6-GHz configurations.

**Step 4** (Optional) View the current 802.11 parameters

**Example:**

```
Device# show ap name config dot11 6ghz
```

Shows the current 802.11 parameters in a given AP.

---

Upon completing this task, you will have successfully verified the Flexible Radio Assignment (FRA) configurations and 802.11 parameters on your AP.

# Verify FRA XOR 5-GHz and 6-GHz details

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

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

To view the client utilization threshold and client reset count, run this 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
.
.
.
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

## Flexible radio assignment actions

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

### Feature history for flexible radio assignment action

*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 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. |

### Release Information

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 set redundant dual-band radios in a network to operate in monitor-only mode.

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

## Configure FRA action in default RF profile (CLI)

Configure the FRA action in the default RF profile to optimize radio frequency management.

**Procedure**

**Step 1** Configure terminal

**Example:**

```
Device# configure terminal
```

Enters global configuration mode.

**Step 2** Configure the FRA action

**Example:**

```
Device(config)# ap dot11 24ghz fra action monitor
```

Configures the FRA action to monitor mode, moving all redundant dual-band APs solely to the monitor role.

**Step 3** Exit configuration mode

**Example:**

```
Device(config)# end
```

Exits configuration mode and returns to privileged EXEC mode.

Upon completion, the FRA action is set, redundancy in dual-band radios is handled efficiently, and the system returns to privileged EXEC mode.

# Configure FRA action in 2.4-GHz RF profile (CLI)

**Procedure**

**Step 1** Configure terminal

**Example:**

```
Device# configure terminal
```

Enters global configuration mode

**Step 2** Configure the RF profile name

**Example:**

```
Device(config)# ap dot11 24ghz rf-profile alpha-rfprofile-24ghz
```

Configures the RF profile name and enters RF profile configuration mode.

**Step 3** Configure the FRA action as monitor

**Example:**

```
Device(config-rf-profile)# fra action monitor
```

Configures the FRA action as monitor, and moves all redundant dual-band radios to monitor role only.

**Step 4** Exit configuration mode

**Example:**

```
Device(config-rf-profile)# end
```

Exits configuration mode and returns to privileged EXEC mode.

# Verify 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
```