



Configuring Flexible Radio Assignment for Cisco 2800/3800 Series Access Points

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Information About Flexible Radio Assignment (FRA)

Flexible Radio Assignment (FRA) is a new core algorithm added to RRM to analyze the NDP measurements and manage the hardware used to determine the role of a new dual-band radio (2.4-GHz, 5-GHz, or Monitor) in your network.

FRA performs the following:

- Calculates and maintains a measurement of redundancy for 2.4-GHz radios and represents this as a new measurement metric called Coverage Overlap Factor (COF).
- Manages the radio role assignment or re-assignment of XOR radios that are marked as redundant.

The FRA is tightly integrated into the existing RRM to run on mixed environments with legacy APs. You will need to know few new naming conventions and behaviors to understand the new operations. The existing AP MODE concept requires some modification. The Mode selection sets the entire AP (slot0 and slot1) into one of many operating modes including:

- Local Mode

- Monitor Mode
- Sniffer Mode

With the addition of dual-band (XOR) radio in slot0, you now have the ability to operate a single radio interface in many of the previous modes. There is no longer a need to place the entire AP into a MODE. When we apply this concept at the single radio level, this is called as a ROLE. The following are the two roles that can be assigned at the product release:

- Client Serving—Either 2.4-GHz or 5-GHz.
- Monitor—Monitor role.

**Note**

Here, Client Serving is the same as the Local MODE, wherein, the radio supports clients in the selected band. Points to remember:

A MODE—Is assigned to the whole AP (slot0/1).

A ROLE—Is assigned to a single radio interface (slot0).

Coverage Overlap Factor (COF)

Let us discuss in detail about how the FRA calculates the Coverage Overlap Factor (COF) and what it does.

The FRA evaluates a coverage of 2.4-GHz only and determines if there is an overlapping coverage that creates interference. By default, the Cisco Aironet 3800/2800 Series APs initialize the 1*2.4-GHz interface and 1*5-GHz interface, which is the same as the Legacy AP. After the FRA completes the analysis, any 2.4-GHz XOR radio that is found to be redundant is assigned to a different and more beneficial role to support network goals.

The FRA uses the well-established Neighbor Discovery Protocol (NDP) output from RRM to locate each radio in RF distance and evaluates the overlapping coverage by cell. Using the NDP measurements from APs, the FRA plots the x and y co-ordinates relative to every other AP contained in the solution set (AP Group, physical neighbors). The circumference of each cell is calculated based on the present transmit power level of each AP. This produces a logical matrix of the coverage intersections for the AP.

A radio is marked as redundant when the calculated coverage meets or exceeds the FRA sensitivity threshold:

- **Low**—100% COF
- **Medium**—95% COF
- **High**—90% COF

For more information about COF, see the Radio Resource Management whitepaper.

Radio Role Assignment

Once a radio is marked as redundant, the radio configuration determines the next step. The dual-band radio can be assigned to two operational states, namely:

- **Auto**—Is the default state. Once a dual-band radio is marked as redundant, the DCA helps in deciding the role that needs to be assigned to a radio.
- **Manual**—During the manual state, the FRA still produces a COF for the radio. However, you have complete control over assigning radios manually.

For more information about Radio Role Assignment, see the Radio Resource Management whitepaper.

Client Network Preference

Client network preference allows you to characterize how you want to prioritize the behaviors of RRM. FRA has an entry here.

Let us see what happens when clients connected to 2.4-GHz interface is changed to 5-GHz interface. There are three options, out of which the FRA uses the Connectivity setting by default.

The three options are as follows:

- **Connectivity**—Preference on Connectivity.
- **Default**—No Client Network Preference Applied.
- **Throughput**—Preference on Throughput.

A radio returns to 2.4-GHz unless reverted (through CLI) or manually configured from the GUI or CLI.

For more information about Client Network Preference, see the Radio Resource Management whitepaper.

Steady State Operations

FRA is designed to evaluate and remediate the over population in 2.4-GHz spectrum. If you are designing a network to optimize 5-GHz, you will have redundant 2.4-GHz interfaces. FRA manages the selection, transition, and assignment of redundant radios.

If the network design and number of APs are not changed, FRA does not have much to do other than monitoring. You cannot see the COF for APs not available in 2.4-GHz role. However, the role selection and DCA remains active. This means that, if you add APs or change the bandwidth you are serving, the FRA may choose a different role for your dual-band radio, if 5-GHz is assigned. It becomes challenging to keep that many interfaces in the air peacefully. You may view a 5-GHz interface switch to Monitor mode. You can lock down the radios by changing them to Manual and prevent the FRA from taking any more action.

But if you do this, you could also create issues when making changes as it might alter the balance of the spectrum, such as, bandwidth changes; which must always be treated as a major upgrade.

Thus, the COF becomes unavailable after some time for any flexible interface excluding the 2.4-GHz role.

FRA and Dual 5-GHz Operations

The two modes of operation for a dual 5-GHz access points are as follows:

- **Micro or Macro**—A large cell with a smaller cell internal creating double the capacity within boundaries of a single cell.

- **Macro or Macro**—Dual independent 5-GHz cells doubling the coverage of a single traditional Dual-Band access point.

Micro or Macro modes of operation is applicable to the Cisco Aironet 2800/3800 Series I Model APs only. The antennas on this AP are designed to support a Cell within a Cell deployment.

The FRA and DCA enforces a minimum of 100MHz channel separation (frequency diversity) when operating as a dual 5-GHz Micro or Macro.

FRA also monitors two cells. You can move or transition clients between Micro and Macro cells using the following three methods:

- 802.11v BSS Transition
- 802.11k
- Probe Suppression

For more information on the 802.11v BSS Transition, 802.11k, and Probe Suppression, see the Radio Resource Management whitepaper.

Configuring Flexible Radio Assignment (CLI)

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 2	ap fra {interval sensitivity {high low medium}} Example: Device(config)# ap fra interval 2	Configures FRA on all Cisco access points. <ul style="list-style-type: none"> • interval—Configures the FRA interval in hours. The range is from 1 to 24 hours. The default value is 1 Hour. • sensitivity—Configures the FRA sensitivity level. <ul style="list-style-type: none"> • high—Specifies the most sensitivity. • low—Specifies the least sensitivity. • medium—Specifies the medium sensitivity.
Step 3	end Example: Device(config)# end	Returns to privileged EXEC mode. Alternatively, you can also press Ctrl-Z to exit global configuration mode.

Monitoring Flexible Radio Assignment (CLI)

Table 1: Command for monitoring Flexible Radio Assignment (FRA)

Command	Description
show ap fra	Displays the FRA configurations and overlap factor.

Configuring Client Network Preference (CLI)

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 2	ap dot11 {24ghz 5ghz } client-network-preference {connectivity throughput} Example: Device(config)# ap dot11 24 client-network-preference connectivity	Configures the client network preference. <ul style="list-style-type: none"> • connectivity—Sets the preference on connectivity. • throughput—Sets the preference on throughput.
Step 3	end Example: Device(config)# end	Returns to privileged EXEC mode. Alternatively, you can also press Ctrl-Z to exit global configuration mode.

Resetting Flexible Radio Assignment (CLI)

- Revert radios by entering this command:

ap fra revert {all {auto | static}| auto-only {auto | static}}

ap fra revert all auto

- **all**—Reverts all the XOR radios.
- **auto-only**—Reverts only the XOR radios currently in the automatic band selection.



Note If you have selected **all** or **auto-only** as the revert mode, you will need to select from either of these options as well, namely:

- **auto**—Places the XOR radios in the automatic band selection.
- **static**—Places the XOR radios in the static 2.4-GHz band.

Configuring Micro or Macro Mode (CLI)

When the XOR radio in Cisco Aironet 2800/3800 I Series access point models is changed to operate in 5GHz band, the controller puts the slot0 to the lowest power level. Thus, forming the Micro or Macro cells.

Perform the following steps to configure Micro or Macro mode:

Procedure

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- Step 1** Disable the dual-band radio on the Cisco access point by entering this command:
ap name *ap-name* dot11 dual-band shutdown
- Step 2** If the radio is in **auto** or **manual** role, you must change it to **client-serving** role by entering this command:
ap name *ap-name* dot11 dual-band role manual client-serving
- Step 3** Configure the operating band (5-GHz) by entering this command:
ap name *ap-name* dot11 dual-band band 5ghz
- Step 4** Enable the dual-band radio on the Cisco access point by entering this command:
ap name *ap-name* no dot11 dual-band shutdown
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Monitoring Macro or Micro Transition Thresholds (CLI)

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 2	wireless macro-micro steering transition-threshold {balancing-window	Configures Micro-Macro transition thresholds.

	Command or Action	Purpose
	<code>no_of_clients client count no_of_clients macro-to-micro RSSI_in_dBm micro-to-macro RSSI_in_dBm}</code> Example: <pre>Device(config)#wireless macro-micro steering transition-threshold balancing-window 1000</pre>	<ul style="list-style-type: none"> • balancing-window—Configures the Micro-Macro client load balancing window. The <i>no_of_clients</i> value ranges from 0 to 65535. • client—Configures the Micro-Macro client parameters. The <i>no_of_clients</i> value ranges from 0 to 65535. • macro-to-micro—Configures the Macro to Micro transition RSSI. The <i>RSSI_in_dBm</i> value ranges from -128 to 0. • micro-to-macro—Configures the Micro to Macro transition RSSI. The <i>RSSI_in_dBm</i> value ranges from -128 to 0.
Step 3	end Example: <pre>Device(config)# end</pre>	Returns to privileged EXEC mode. Alternatively, you can also press Ctrl-Z to exit global configuration mode.

Configuring Probe Suppression (CLI)

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 2	wireless macro-micro steering probe-suppression {aggressiveness no_of_cycles hysteresis RSSI_in_dBm probe-auth probe-only } Example: <pre>Device(config)#wireless macro-micro steering probe-suppression probe-only</pre>	Configures Micro-Macro probe suppression. <ul style="list-style-type: none"> • aggressiveness—Configures the probe cycles to be suppressed. The <i>no_of_cycles</i> value ranges from 0 to 255. • hysteresis—Configures the hysteresis. The <i>RSSI_in_dBm</i> value ranges from -6 to -3. • probe-auth—Suppresses both probes and single auth. • probe-only—Suppresses only probes.

	Command or Action	Purpose
Step 3	end Example: <code>Device(config)# end</code>	Returns to privileged EXEC mode. Alternatively, you can also press Ctrl-Z to exit global configuration mode.

Debugging Flexible Radio Assignment (CLI)

- Debug FRA by entering this command:

set platform software trace wireless switch active R0 rrm-fra {noise | verbose}

set platform software trace wireless switch active R0 rrm-fra noise

- **noise**—Maximum possible message.
- **verbose**—Verbose debug messages.