



## RF Management

---

All best practices, except those that need manual configuration, are enabled by default in a Cisco Mobility Express network. These exceptions include [NTP](#), [WLAN with WPA2 or 802.1x](#), and [High SSID Counts](#).

- [Auto Coverage Hole Detection](#), on page 1
- [Auto Dynamic Channel Assignment](#), on page 2
- [Auto Transmit Power Control](#), on page 2
- [Best Channel Width](#), on page 3
- [CleanAir Detection](#), on page 3
- [Client Band Select](#), on page 4
- [Event Driven RRM](#), on page 5
- [High SSID Counts](#), on page 5
- [FRA Enabled](#), on page 6
- [5GHz Low Data Rates](#), on page 6
- [2.4GHz Low Data Rates](#), on page 7

## Auto Coverage Hole Detection

- **Description**—Auto CHD should be enabled.

The controller uses the quality of client signal levels reported by the APs to determine if the power level of that AP needs to be increased. Coverage Hole Detection (CHD) is controller independent, so the RF group leader is not involved in those calculations. The controller knows how many clients are associated with a particular AP and what are the signal-to-noise ratio (SNR) values for each client.

If a client SNR drops below the configured threshold value on the controller, the AP increases its power level to try to compensate for the client. The SNR threshold is based on the transmit power of the AP and the coverage profile settings on the controller.

For instructions on how to configure auto CHD, see the *Cisco Mobility Express User Guide*.

- **Status:**

- Selected—CHD enabled
- Unselected—None or one enabled

- **CLI Option**—Enable auto CHD by entering this command:

```
(Cisco Controller) >config advanced 802.11{a|b} coverage enable
```

## Auto Dynamic Channel Assignment

- Description—Auto DCA should be enabled to allow RRM to select best channels for each radio.

When a wireless network is first initialized, all radios participating require a channel assignment to operate without interference - optimizing the channel assignments to allow for interference free operation is DCA's job. Wireless network does this using the air metrics reported by each radio on every possible channel, and providing a solution that maximizes channel bandwidth and minimizes RF interference from all sources - Self (signal), other networks (foreign interference), Noise (everything else).

DCA is enabled by default and provides a global solution to channel planning for your network.

- Status:
  - Selected—DCA is enabled for 802.11a/b
  - Unselected—None or one is enabled
- CLI Option—Enable auto DCA by entering this command:

```
(Cisco Controller) >config 802.11a channel global auto
```

```
(Cisco Controller) >config 802.11b channel global auto
```

## Auto Transmit Power Control

- Description—The controller dynamically controls the access point transmit power based on real-time wireless LAN conditions. You can choose between two versions of transmit power control: TPCv1 and TPCv2. With TPCv1, power can be kept low to gain extra capacity and reduce interference. With TPCv2, transmit power is dynamically adjusted with the goal of minimum interference. TPCv2 is suitable for dense networks. In this mode, there could be higher roaming delays and coverage hole incidents.

Auto TPC is enabled by default to allow RRM to select best transmit power for each radio.

The Transmit Power Control (TPC) algorithm increases and decreases the power of an access point (AP) in response to changes in the RF environment. In most instances, TPC seeks to lower the power of the AP to reduce interference. But, in the case of a sudden change in the RF coverage—for example, if the AP fails or becomes disabled-TPC can also increase power of the surrounding APs. This feature is different from coverage hole detection, which is primarily concerned with clients. TPC provides enough RF power to achieve desired coverage levels while avoiding channel interference between APs.




---

**Note** For optimal performance, use the Automatic setting to allow best transmit power for each radio.

---

- Status:
  - Selected—TPC enabled for 802.11a/b
  - Unselected—None or one enabled
- CLI Option—Enable Auto TPC by entering this command:

```
(Cisco Controller) >config 802.11a txPower global auto
```

```
(Cisco Controller) >config 802.11b txPower global auto
```

## Best Channel Width

- Description—Dynamic bandwidth selection selects the widest channel width with the highest client data rates and lowest channel utilization per radio. This minimizes data retries and CRC errors on the 5 GHz band while avoiding rogue APs and CleanAir Interferers.
- Status:
  - Selected—Channel width is selected as Best on both bands.
  - Unselected—Channel width is not selected as Best on both bands.
- CLI Option—Enable best channel width by entering this command:

```
(Cisco Controller) >config advanced 802.11a channel dca chan-width best
```

## CleanAir Detection

- Description—CleanAir should be enabled.

To effectively detect and mitigate RF interference, enable CleanAir whenever possible. There are recommendations to various sources of interference to trigger security alerts, such as generic DECT phones, jammer, and so on.



---

**Note** All Cisco access points do not support CleanAir. However, it is recommended to enable CleanAir Detection as Cisco Mobility Express is used to manage multiple types of Cisco access points.

---

- Status:
  - Selected—Enabled
  - Unselected—Disabled
- CLI Option:
  - Verify CleanAir configuration on a network by entering this command:

```
(Cisco Controller) >show 802.11{a|b} cleanair config
```
  - Enable CleanAir functionality on a network by entering this command:

```
(Cisco Controller) >config 802.11{a|b} cleanair enable network
```
  - Configure to enable interference detection for specifically jammer by entering this command:

```
(Cisco Controller) >config 802.11{a|b} cleanair device enable jammer
```

## Client Band Select

- Description—Band selection should be enabled. However, if there is interactive traffic such as voice or video on the WLAN, do not use band selection. Clicking **Enable** turns band selection on.

Band selection enables client radios that are capable of dual-band (2.4 and 5 GHz) operation to move to a less congested 5 GHz AP. The 2.4 GHz band is often congested. Clients on this band typically experience interference from Bluetooth devices, microwave ovens, and cordless phones as well as co-channel interference from other APs because of the 802.11b/g limit of three non-overlapping channels. To prevent these sources of interference and improve overall network performance, you can configure band selection on controller:

- Band selection is enabled globally by default.
- Band selection works by regulating probe responses to clients. It makes 5 GHz channels more attractive to clients by delaying probe responses to clients on 2.4 GHz channels.
- Evaluate band selection for voice, particularly focusing on roaming performance. See below for further explanation.
- Most newer model clients prefer 5 GHz by default if the 5 GHz signal of the AP is equal to or stronger than the 2.4-GHz signal.
- Band select should be enabled for high-density designs

Also, in high-density designs, the study of available UNII-2 channels should be made. Those channels that are unaffected by Radar and also usable by the client base should be added to the RRM DCA list as usable channels.

Dual-band roaming can be slow depending on the client. If a majority of the base of voice clients exhibits a slow roaming behavior, it is more likely that the client sticks to 2.4 GHz. In this case, it has scanning issues on 5 GHz. Generally when a client decides to roam, it scans its current channel and band first. The clients generally scan for an AP that has a significantly better signal level, maybe as much as 20 dB and/or a significantly better SNR. Failing such available connection, the client may remain with its current AP. In this case, if the CU on 2.4 GHz is low and the call quality is not poor, then disabling the selected band is acceptable. However, the preferred design is to enable band selection on 5 GHz with all data rates enabled and 6 Mbps as mandatory. Then, set the 5 GHz RRM minimum Tx power level 6 dBm higher than the average 2.4 GHz power level set by RRM.

The goal of this configuration recommendation is to enable the client to obtain a band and channel with better SNR and Tx power initially. As already stated, generally when a client decides to roam, it scans its current channel and band first. So, if the client initially joins the 5 GHz band, then it is more likely to stay on the band if there are good power levels on 5 GHz. SNR levels on 5 GHz are generally better than 2.4 GHz because 2.4 GHz has only three Wi-Fi channels and is more susceptible to interference such as Bluetooth, iBeacons, and microwave signals.

802.11k is recommended to be enabled with dual-band reporting. This enables all 11k enabled clients to have the benefit of assisted roaming. With dual-band reporting enabled, the client receives a list of the best 2.4-GHz and 5-GHz APs upon a directed request from the client. Here, the client most likely looks at the top of the list for an AP on the same channel, and then on the same band as the client is currently on. This logic reduces scan times and saves battery power. Having 802.11k enabled on the WLC does not have a downside effect for non-802.11k clients.

- Status:

- Selected—Enabled on all WLANs
- Unselected—Disabled
- CLI Option:
  - Verify Band Select by entering this command:  

```
(Cisco Controller) >show band-select
```
  - Enable Band Select on a WLAN by entering this command:  

```
(Cisco Controller) >config wlan band-select allow enable wlan-id
```

## Event Driven RRM

- Description—Spontaneous interference is interference that appears suddenly on a network, perhaps jamming a channel or a range of channels completely. The Cisco CleanAir spectrum event-driven radio resource management (RRM) feature allows you to set a threshold for air quality (AQ) that, if exceeded, triggers an immediate channel change for the affected access point. Most RF management systems can avoid interference, but this information takes time to propagate through the system. Cisco CleanAir relies on AQ measurements to continuously evaluate the spectrum and can trigger a move within 30 seconds. For example, if an access point detects interference from a video camera, it can recover by changing channels within 30 seconds of the camera becoming active. Cisco CleanAir also identifies and locates the source of interference so that more permanent mitigation of the device can be performed at a later time.



---

**Note** Spectrum EDRRM can be triggered, to detect a significant level of interference, only by Cisco CleanAir-enabled access points in local mode.

---

Event driven RRM is enabled by default.

- Status:
  - Selected—Enabled
  - Unselected—Disabled
- CLI Option—Enable Cisco CleanAir spectrum event-driven RRM by entering this command:  

```
(Cisco Controller) >config advanced 802.11{a|b} channel cleanair-event enable
```

## High SSID Counts

- Description—Number of WLANs should be less than 4.

We recommend limiting the number of service set identifiers (SSIDs) configured at the controller. You can configure 16 simultaneous SSIDs (per radio on each AP), but as each WLAN/SSID needs separate probe responses and beaconing, the RF pollution increases as more SSIDs are added. Furthermore, some

smaller wireless stations like PDA, WiFi Phones, and barcode scanners cannot cope with a high number of basic SSID (BSSID) information. This results in lockups, reloads, or association failures. Also the more SSIDs, the more beaconing needed, so less RF time is available for real data transmits. Cisco recommends one to three SSIDs for corporate, and one SSID for high-density designs. AAA override can be leveraged for per user VLAN/ settings on a single SSID scenario.

The AP must beacon at the lowest mandatory speed set for each WLAN, in order to be able to reach the farthest stations irrespective of their location. If they can hear the AP's beacon, it considerably reduces the general traffic.

- Status—Click **Manual Configuration** to manually configure the number of service set identifiers (SSIDs) configured at the controller.
  - Selected—Active SSID count is 4 or less.
  - Unselected—Active SSID count is more than 4.
- CLI Option:
  - Verify the number of WLANs by entering this command:  

```
(Cisco Controller) >show wlan summary
```
  - Disable unwanted WLANs by entering this command:  

```
(Cisco Controller) >config wlan disable wlan-id
```

## FRA Enabled

- Description—Flexible radio assignment (FRA) enables automatic assignment of the XOR 2.4GHz radios to other roles such as 5 GHz and Monitor.

We recommend that you enable FRA when you have APs such as the Cisco Aironet 2800 and 3800 Series that support XOR operation.

- Status:
  - Selected—FRA is enabled.
  - Unselected—FRA is disabled.
- CLI Option: Enable FRA by entering this command:  

```
(Cisco Controller) >config advanced fra enable
```

## 5GHz Low Data Rates

- Description—We recommend that low data rates of 6 and 9 Mbps are disabled on 5GHz for better performance.



---

**Note** Low data rates should not be disabled for low density deployments where these data rates are expected to be present.

---

- Status:
  - Selected—Low data rates of 6 and 9 Mbps are disabled on 5GHz.
  - Unselected—Low data rates of 6 and 9 Mbps are enabled on 5GHz.
- CLI Option:
  - Disable 6Mbps on 5GHz by entering this command:  

```
(Cisco Controller) >config 802.11a rate disabled 6
```
  - Disable 9Mbps on 5GHz by entering this command:  

```
(Cisco Controller) >config 802.11a rate disabled 9
```

## 2.4GHz Low Data Rates

- Description—Low data rates of 1, 2, and 5.5 Mbps should be disabled on 2.4GHz and 11 Mbps set to *not mandatory* on 2.4GHz for better performance.



---

**Note** Low data rates should not be disabled for low density deployments where these data rates are expected to be present.

---

- Status:
  - Selected—Low data rates of 1, 2 or 5.5 Mbps are disabled on 2.4GHz or 11 Mbps is set to *not mandatory*.
  - Unselected—Low data rates of 1, 2 or 5.5 Mbps are enabled on 2.4GHz or 11 Mbps is set to *mandatory*.
- CLI Option:
  - Disable 1Mbps on 2.4GHz by entering this command:  

```
(Cisco Controller) >config 802.11b rate disabled 1
```
  - Disable 2Mbps on 2.4GHz by entering this command:  

```
(Cisco Controller) >config 802.11b rate disabled 2
```
  - Disable 5.5Mbps on 2.4GHz by entering this command:  

```
(Cisco Controller) >config 802.11b rate disabled 5.5
```
  - Configure or disable 11Mbps on 2.4GHz by entering this command:

```
(Cisco Controller) >config 802.11b rate {disabled | supported} 11
```