



## Configuring Radio Settings

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This chapter describes how to configure radio settings for the wireless device. This chapter includes these sections:

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## Enabling the Radio Interface

The wireless device radios are disabled by default.


**Note**

In Cisco IOS Release 12.3(7)JA there is no default SSID. You must create a Radio Service Set Identifier (SSID) before you can enable the radio interface.

Beginning in privileged EXEC mode, follow these steps to enable the access point radio:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>ssid</b>	Enter the SSID. The SSID can consist of up to 32 alphanumeric characters. SSIDs are case sensitive.
Step 4	<b>no shutdown</b>	Enable the radio port.
Step 5	<b>end</b>	Return to privileged EXEC mode.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **shutdown** command to disable the radio port.

## Configuring the Role in Radio Network

Table 6-1 shows the role in the radio network for each device.

**Table 6-1** Device Role in Radio Network Configuration

Role in Radio Network	WGB350	AP350	AP1200	AP1100	AP1130	AP1240
Workgroup bridge	X	–	X	X	X	X
Root access point	–	X	X	X	X	X
Repeater access point	–	X	X	X	X	X
Root bridge with clients	–	–	X	–	–	X
Non-root bridge with clients	–	–	X	–	–	X
Root bridge without clients	–	–	X	–	–	X
Non-root bridge without clients	–	–	X	–	–	X
Scanner	–	X	X	X	X	X

You can also configure a fallback role for root access points. The wireless device automatically assumes the fallback role when its Ethernet port is disabled or disconnected from the wired LAN. There are two possible fallback roles:

- Repeater—When the Ethernet port is disabled, the wireless device becomes a repeater and associates to a nearby root access point. You do not have to specify a root access point to which the fallback repeater associates; the repeater automatically associates to the root access point that provides the best radio connectivity.
- Shutdown—the wireless device shuts down its radio and disassociates all client devices.

Beginning in privileged EXEC mode, follow these steps to set the wireless device's radio network role and fallback role:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>station role</b>  <b>non-root {bridge   wireless-clients}</b>  <b>repeater</b>  <b>root {access-point   ap-only   [bridge   wireless-clients]   [fallback   repeater   shutdown]}</b>  <b>scanner</b>  <b>workgroup-bridge</b>	Set the wireless device role. <ul style="list-style-type: none"> <li>• Set the role to non-root bridge with or without wireless clients, repeater access point, root access point or bridge, scanner, or workgroup bridge.</li> <li>• Bridge modes are available only on the 1200 and 1240AG series access points. When in bridge mode, they are interoperable with the 1300 series outdoor access point/bridge only on supported bridge features. See the <a href="#">“Bridge Features Not Supported”</a> section on page 6-4.</li> <li>• The bridge mode radio supports point-to-point configuration only.</li> <li>• The Ethernet port is shut down when any one of the radios is configured as a repeater. Only one radio per access point may be configured as a workgroup bridge or repeater.</li> <li>• The <b>dot11radio 0 1 antenna-alignment</b> command is available when the access point is configured as a repeater.</li> <li>• Spanning Tree Protocol (STP) is configurable on 1200 and 1240AG series access points in bridge modes.</li> <li>• (Optional) Select the root access point's fallback role. If the wireless device's Ethernet port is disabled or disconnected from the wired LAN, the wireless device can either shut down its radio port or become a repeater access point associated to any nearby root access point.</li> </ul>
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

**Note**

When you enable the Bridge/WGB role in the radio network and enable the interface using the **no shut** command, the physical status and the software status of the interface is UP, only if the device on the other end is also UP. Otherwise, only the physical status of the device is UP. The software status of the device comes UP only when the device on the other side is configured and UP.

## Bridge Features Not Supported

The following features are not supported when a 1200 or 1240AG series access point is configured as a bridge:

- Clear Channel Assessment (CCA)
- Interoperability with 1400 series bridge
- Concatenation
- Install mode
- EtherChannel and PageP configuration on switch

## Configuring Radio Data Rates

You use the data rate settings to choose the data rates the wireless device uses for data transmission. The rates are expressed in megabits per second. The wireless device always attempts to transmit at the highest data rate set to **Basic**, also called **Require** on the browser-based interface. If there are obstacles or interference, the wireless device steps down to the highest rate that allows data transmission. You can set each data rate to one of three states:

- **Basic** (the GUI labels Basic rates as Required)—Allows transmission at this rate for all packets, both unicast and multicast. At least one of the wireless device's data rates must be set to Basic.
- **Enabled**—The wireless device transmits only unicast packets at this rate; multicast packets are sent at one of the data rates set to Basic.
- **Disabled**—The wireless device does not transmit data at this rate.

**Note**

At least one data rate must be set to **basic**.

You can use the Data Rate settings to set an access point to serve client devices operating at specific data rates. For example, to set the 2.4-GHz radio for 11 megabits per second (Mbps) service only, set the 11-Mbps rate to **Basic** and set the other data rates to **Disabled**. To set the wireless device to serve only client devices operating at 1 and 2 Mbps, set 1 and 2 to **Basic** and set the rest of the data rates to **Disabled**. To set the 2.4-GHz, 802.11g radio to serve only 802.11g client devices, set any Orthogonal Frequency Division Multiplexing (OFDM) data rate (6, 9, 12, 18, 24, 36, 48, 54) to **Basic**. To set the 5-GHz radio for 54 Mbps service only, set the 54-Mbps rate to **Basic** and set the other data rates to **Disabled**.

You can configure the wireless device to set the data rates automatically to optimize either the range or the throughput. When you enter **range** for the data rate setting, the wireless device sets the 1 Mbps rate to basic and the other rates to **enabled**. When you enter **throughput** for the data rate setting, the wireless device sets all four data rates to **basic**.

**Note**

When a wireless network has a mixed environment of 802.11b clients and 802.11g clients, make sure that data rates 1, 2, 5.5, and 11 Mbps are set to required (basic) and that all other data rates are set to enable. The 802.11b adapters do not recognize the 54 Mbps data rate and do not operate if data rates higher than 11Mbps are set to require on the connecting access point.

Beginning in privileged EXEC mode, follow these steps to configure the radio data rates:

	<b>Command</b>	<b>Purpose</b>
<b>Step 1</b>	<b>configure terminal</b>	Enter global configuration mode.
<b>Step 2</b>	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.

	Command	Purpose
<b>Step 3</b>	<p><b>speed</b></p> <p>These options are available for the 802.11b, 2.4-GHz radio:</p> <pre>{ [1.0] [11.0] [2.0] [5.5] [basic-1.0] [basic-11.0] [basic-2.0] [basic-5.5]   range   throughput }</pre> <p>These options are available for the 802.11g, 2.4-GHz radio:</p> <pre>{ [1.0] [2.0] [5.5] [6.0] [9.0] [11.0] [12.0] [18.0] [24.0] [36.0] [48.0] [54.0] [basic-1.0] [basic-2.0] [basic-5.5] [basic-6.0] [basic-9.0] [basic-11.0] [basic-12.0] [basic-18.0] [basic-24.0] [basic-36.0] [basic-48.0] [basic-54.0]   range   throughput [ofdm]   default }</pre> <p>These options are available for the 5-GHz radio:</p> <pre>{ [6.0] [9.0] [12.0] [18.0] [24.0] [36.0] [48.0] [54.0] [basic-6.0] [basic-9.0] [basic-12.0] [basic-18.0] [basic-24.0] [basic-36.0] [basic-48.0] [basic-54.0]   range   throughput   default }</pre>	<p>Set each data rate to <b>basic</b> or <b>enabled</b>, or enter <b>range</b> to optimize range or <b>throughput</b> to optimize throughput.</p> <ul style="list-style-type: none"> <li>(Optional) Enter <b>1.0</b>, <b>2.0</b>, <b>5.5</b>, and <b>11.0</b> to set these data rates to <b>enabled</b> on the 802.11b, 2.4-GHz radio.</li> <li>Enter <b>1.0</b>, <b>2.0</b>, <b>5.5</b>, <b>6.0</b>, <b>9.0</b>, <b>11.0</b>, <b>12.0</b>, <b>18.0</b>, <b>24.0</b>, <b>36.0</b>, <b>48.0</b>, and <b>54.0</b> to set these data rates to <b>enabled</b> on the 802.11g, 2.4-GHz radio.</li> <li>Enter <b>6.0</b>, <b>9.0</b>, <b>12.0</b>, <b>18.0</b>, <b>24.0</b>, <b>36.0</b>, <b>48.0</b>, and <b>54.0</b> to set these data rates to <b>enabled</b> on the 5-GHz radio.</li> <li>(Optional) Enter <b>basic-1.0</b>, <b>basic-2.0</b>, <b>basic-5.5</b>, and <b>basic-11.0</b> to set these data rates to <b>basic</b> on the 802.11b, 2.4-GHz radio.</li> <li>Enter <b>basic-1.0</b>, <b>basic-2.0</b>, <b>basic-5.5</b>, <b>basic-6.0</b>, <b>basic-9.0</b>, <b>basic-11.0</b>, <b>basic-12.0</b>, <b>basic-18.0</b>, <b>basic-24.0</b>, <b>basic-36.0</b>, <b>basic-48.0</b>, and <b>basic-54.0</b> to set these data rates to <b>basic</b> on the 802.11g, 2.4-GHz radio.</li> </ul> <p><b>Note</b> The client must support the basic rate that you select or it cannot associate to the wireless device. If you select 12 Mbps or higher for the basic data rate on the 802.11g radio, 802.11b client devices cannot associate to the wireless device's 802.11g radio.</p> <p>Enter <b>basic-6.0</b>, <b>basic-9.0</b>, <b>basic-12.0</b>, <b>basic-18.0</b>, <b>basic-24.0</b>, <b>basic-36.0</b>, <b>basic-48.0</b>, and <b>basic-54.0</b> to set these data rates to <b>basic</b> on the 5-GHz radio.</p> <ul style="list-style-type: none"> <li>(Optional) Enter <b>range</b> or <b>throughput</b> to automatically optimize radio range or throughput. When you enter <b>range</b>, the wireless device sets the lowest data rate to <b>basic</b> and the other rates to <b>enabled</b>. When you enter <b>throughput</b>, the wireless device sets all data rates to <b>basic</b>.</li> </ul> <p>(Optional) On the 802.11g radio, enter <b>speed throughput ofdm</b> to set all OFDM rates (6, 9, 12, 18, 24, 36, and 48) to <b>basic</b> (required) and set all the CCK rates (1, 2, 5.5, and 11) to <b>disabled</b>. This setting disables 802.11b protection mechanisms and provides maximum throughput for 802.11g clients. However, it prevents 802.11b clients from associating to the access point.</p> <ul style="list-style-type: none"> <li>(Optional) Enter <b>default</b> to set the data rates to factory default settings (not supported on 802.11b radios).</li> </ul> <p>On the 802.11g radio, the <b>default</b> option sets rates 1, 2, 5.5, and 11 to <b>basic</b>, and rates 6, 9, 12, 18, 24, 36, 48, and 54 to <b>enabled</b>. These rate settings allow both 802.11b and 802.11g client devices to associate to the wireless device's 802.11g radio.</p> <p>On the 5-GHz radio, the <b>default</b> option sets rates 6.0, 12.0, and 24.0 to <b>basic</b>, and rates 9.0, 18.0, 36.0, 48.0, and 54.0 to <b>enabled</b>.</p>

	Command	Purpose
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the **speed** command to remove one or more data rates from the configuration. This example shows how to remove data rates basic-2.0 and basic-5.5 from the configuration:

```
ap1200# configure terminal
ap1200(config)# interface dot11radio 0
ap1200(config-if)# no speed basic-2.0 basic-5.5
ap1200(config-if)# end
```

## Configuring Radio Transmit Power

Radio transmit power is based on the type of radio or radios installed in your access point and the regulatory domain in which it operates. To determine what transmit power is available for your access point and which regulatory domain it operates in, refer to the hardware installation guide for that device. hardware installation guides are available at [cisco.com](http://cisco.com). Follow these steps to view and download them:

- 
- Step 1** Browse to <http://www.cisco.com>.
  - Step 2** Click **Technical Support & Documentation**. A small window appears containing a list of technical support links.
  - Step 3** Click **Technical Support & Documentation**. The Technical Support and Documentation page appears.
  - Step 4** In the Documentation & Tools section, choose **Wireless**. The Wireless Support Resources page appears.
  - Step 5** In the Wireless LAN Access section, choose the device you are working with. An introduction page for the device appears.
  - Step 6** In the Install and Upgrade section, choose **Install and Upgrade Guides**. The Install and Upgrade Guides page for the device appears.
  - Step 7** Choose the hardware installation guide for the device. The home page for the guide appears.
  - Step 8** In the left frame, click **Channels and Antenna Settings**.
- 

Table 6-2 shows the relationship between mW and dBm.

**Table 6-2** Translation between mW and dBm

<b>dBm</b>	-1	2	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<b>mW</b>	1	2	3	4	5	6	8	10	12	15	20	25	30	40	50	60	80	100	125	150	200	250

Beginning in privileged EXEC mode, follow these steps to set the transmit power on access point radios:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<p><b>power local</b></p> <p>These options are available for the 802.11b, 2.4-GHz radio (in mW):</p> <p><b>{ 1   5   20   30   50   100   maximum }</b></p> <p>These options are available for the 5-GHz radio (in mW):</p> <p><b>{ 5   10   20   40   maximum }</b></p> <p>These options are available for the 802.11a, 5-GHz radio (in dBm):</p> <p><b>{ -1   2   5   8   11   14   15   17   maximum }</b></p> <p>If your access point contains an AIR-RM21A 5-GHz radio module, these power options are available (in dBm):</p> <p><b>{ -1   2   5   8   11   14   16   17   20   maximum }</b></p>	<p>Set the transmit power for the 802.11b, 2.4-GHz radio or the 5-GHz radio to one of the power levels allowed in your regulatory domain.</p> <p><b>Note</b> See the hardware installation guide for your access point to determine the power settings for your regulatory domain.</p>
Step 4	<p><b>power local</b></p> <p>These options are available for the 802.11g, 2.4-GHz radio:</p> <p><b>power local cck</b> settings:</p> <p><b>{ -1   2   5   8   11   14   17   20   maximum }</b></p> <p><b>power local ofdm</b> settings:</p> <p><b>{ -1   2   5   8   11   14   17   maximum }</b></p>	<p>Set the transmit power for the 802.11g, 2.4-GHz radio to one of the power levels allowed in your regulatory domain. All settings are in mW.</p> <p>On the 2.4-GHz, 802.11g radio, you can set Orthogonal Frequency Division Multiplexing (OFDM) power levels and Complementary Code Keying (CCK) power levels. CCK modulation is supported by 802.11b and 802.11g devices. OFDM modulation is supported by 802.11g and 802.11a devices.</p> <p><b>Note</b> See the hardware installation guide for your access point to determine the power settings for your regulatory domain.</p> <p><b>Note</b> The 802.11g radio transmits at up to 100 mW for the 1, 2, 5.5, and 11Mbps data rates. However, for the 6, 9, 12, 18, 24, 36, 48, and 54Mbps data rates, the maximum transmit power for the 802.11g radio is 30 mW.</p>
Step 5	<b>end</b>	Return to privileged EXEC mode.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the power command to return the power setting to **maximum**, the default setting.

## Limiting the Power Level for Associated Client Devices

You can also limit the power level on client devices that associate to the wireless device. When a client device associates to the wireless device, the wireless device sends the maximum power level setting to the client.



### Note

Cisco AVVID documentation uses the term Dynamic Power Control (DTPC) to refer to limiting the power level on associated client devices.

Beginning in privileged EXEC mode, follow these steps to specify a maximum allowed power setting on all client devices that associate to the wireless device:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>power client</b> These options are available for 802.11b, 2.4-GHz clients (in mW): <b>{ 1   5   20   30   50   100   maximum }</b> These options are available for 802.11g, 2.4-GHz clients (in mW): <b>{ 1   5   10   20   30   50   100   maximum }</b> These options are available for 5-GHz clients (in mW): <b>{ 5   10   20   40   maximum }</b> If your access point contains an AIR-RM21A 5-GHz radio module, these power options are available for 5-GHz clients (in dBm): <b>{ -1   2   5   8   11   14   16   17   20   maximum }</b>	Set the maximum power level allowed on client devices that associate to the wireless device. <b>Note</b> The settings allowed in your regulatory domain might differ from the settings listed here.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the client power command to disable the maximum power level for associated clients.



### Note

Aironet extensions must be enabled to limit the power level on associated client devices. Aironet extensions are enabled by default.

# Configuring Radio Channel Settings

The default channel setting for the wireless device radios is least congested; at startup, the wireless device scans for and selects the least-congested channel. For the most consistent performance after a site survey, however, we recommend that you assign a static channel setting for each access point. The channel settings on the wireless device correspond to the frequencies available in your regulatory domain. See the access point's hardware installation guide for the frequencies allowed in your domain.



## Note

Cisco Aironet CB20A client radios sometimes fail to associate to the AIR-RM21A radio module because the CB20A client does not support all the channels supported by the AIR-RM21A radio module. The default channel setting for the AIR-RM21A radio module, least congested, often results in the access point settling on one of these frequencies that the CB20A client radio does not support: channel 149 (5745 GHz), channel 153 (5765 GHz), channel 157 (5785 GHz), and channel 161 (5805 GHz). To avoid this problem, set the channel on the AIR-RM21A radio module to one of the channels supported by the CB20A client.

Each 2.4-GHz channel covers 22 MHz. The bandwidth for channels 1, 6, and 11 does not overlap, so you can set up multiple access points in the same vicinity without causing interference. Both 802.11b and 802.11g 2.4-GHz radios use the same channels and frequencies.

The 5-GHz radio operates on eight channels from 5180 to 5320 MHz. Each channel covers 20 MHz, and the bandwidth for the channels overlaps slightly. For best performance, use channels that are not adjacent (44 and 46, for example) for radios that are close to each other.



## Note

Too many access points in the same vicinity creates radio congestion that can reduce throughput. A careful site survey can determine the best placement of access points for maximum radio coverage and throughput.

Beginning in privileged EXEC mode, follow these steps to set the wireless device's radio channel:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio {0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>channel frequency   least-congested</b>	Set the default channel for the wireless device radio. <a href="#">Table 6-3</a> through <a href="#">Table 6-6</a> show the available channels and frequencies for all radios. To search for the least-congested channel on startup, enter <b>least-congested</b> .  <b>Note</b> The <b>channel</b> command is disabled for 5-GHz radios that comply with European Union regulations on dynamic frequency selection (DFS). See the “ <a href="#">DFS Automatically Enabled on Some 5-GHz Radio Channels</a> ” section on <a href="#">page 6-14</a> for more information.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Table 6-3 shows the available channels and frequencies for the IEEE 802.11b 2.4-GHz radio.

**Table 6-3 Channels and Frequencies for IEEE 802.11b 2.4 GHz Radio**

Channel Identifier	Center Frequency (MHz)	Regulatory Domains				
		Americas (-A)	China (-C)	EMEA (-E)	Israel (-I)	Japan (-J)
1	2412	X	X	X	-	X
2	2417	X	X	X	-	X
3	2422	X	X	X	-	X
4	2427	X	X	X	-	X
5	2432	X	X	X	X	X
6	2437	X	X	X	X	X
7	2442	X	X	X	X	X
8	2447	X	X	X	X	X
9	2452	X	X	X	-	X
10	2457	X	X	X	-	X
11	2462	X	X	X	-	X
12	2467	-	-	X	-	X
13	2472	-	-	X	-	X
14	2484	-	-	-	-	X

Table 6-4 shows the available frequencies for the 802.11g 2.4 GHz radio.

**Table 6-4 Channels and Available Frequencies for IEEE 802.11g 2.4 GHz Radio**

Channel Identifier	Center Frequency (MHz)	Regulatory Domains							
		Americas (-A)		EMEA (-E)		Israel (-I)		Japan (-J)	
		CCK	OFDM	CCK	OFDM	CCK	OFDM	CCK	OFDM
1	2412	X	X	X	X	-	-	X	X
2	2417	X	X	X	X	-	-	X	X
3	2422	X	X	X	X	-	-	X	X
4	2427	X	X	X	X	-	-	X	X
5	2432	X	X	X	X	X	X	X	X
6	2437	X	X	X	X	X	X	X	X
7	2442	X	X	X	X	X	X	X	X
8	2447	X	X	X	X	X	X	X	X
9	2452	X	X	X	X	X	-	X	X
10	2457	X	X	X	X	X	-	X	X
11	2462	X	X	X	X	X	-	X	X
12	2467	-	-	X	X	X	-	X	X

Channel Identifier	Center Frequency (MHz)	Regulatory Domains							
		Americas (-A)		EMEA (-E)		Israel (-I)		Japan (-J)	
		CCK	OFDM	CCK	OFDM	CCK	OFDM	CCK	OFDM
13	2472	-	-	X	X	X	-	X	X
14	2484	-	-	-	-	-	-	X	-

Table 6-5 shows the available channels and frequencies for the RM20A IEEE 802.11a radio

**Table 6-5 Channels and Available Frequencies for the RM20A IEEE 802.11a Radio**

Channel Identifier	Center Frequency (MHz)	Regulatory Domains							
		Americas (-A)		EMEA (-E)		Israel (-I)		Japan (-J)	
		CCK	OFDM	CCK	OFDM	CCK	OFDM	CCK	OFDM
1	2412	X	X	X	X	-	-	X	X
2	2417	X	X	X	X	-	-	X	X
3	2422	X	X	X	X	-	-	X	X
4	2427	X	X	X	X	-	-	X	X
5	2432	X	X	X	X	X	X	X	X
6	2437	X	X	X	X	X	X	X	X
7	2442	X	X	X	X	X	X	X	X
8	2447	X	X	X	X	X	X	X	X
9	2452	X	X	X	X	X	-	X	X
10	2457	X	X	X	X	X	-	X	X
11	2462	X	X	X	X	X	-	X	X
12	2467	-	-	X	X	X	-	X	X
13	2472	-	-	X	X	X	-	X	X
14	2484	-	-	-	-	-	-	X	-

Table 6-6 shows the available frequencies for the RM21A and RM22A IEEE 802.11a 5-GHz radios.

**Table 6-6 Channels and Available Frequencies for the RM21A and RM22A IEEE 802.11a 5-GHz Radios**

Channel ID	Center Freq (MHz)	Americas (-A)	China (-C)	EMEA (-E)	Japan (-J)	South Korea (-K)	North America (-N)	Japan (-P)	Singapore (-S)	Tiawan (-T)	-
34	5170	-	-	-	X	-	-	-	-	-	-
36	5180	X	-	X	-	X	X	X	X	-	-
38	5190	-	-	-	X	-	-	-	-	-	-
40	5200	X	-	X	-	X	X	X	X	-	-
42	5210	-	-	-	X	-	-	-	-	-	-
44	5220	X	-	X	-	X	X	X	X	-	-
46	5230	-	-	-	X	-	-	-	-	-	-
48	5240	X	-	X	-	X	X	X	X	-	-
52	5260	X	-	X	-	X	X	X	X	-	-
56	5280	X	-	X	-	X	X	X	X	X	-
60	5300	X	-	X	-	X	X	X	X	X	-
64	5320	X	-	X	-	X	X	X	X	X	-
100	5500	-	-	X	-	X	-	-	-	X	-
104	5520	-	-	X	-	X	-	-	-	X	-
108	5540	-	-	X	-	X	-	-	-	X	-
112	5560	-	-	X	-	X	-	-	-	X	-
116	5580	-	-	X	-	X	-	-	-	X	-
120	5600	-	-	X	-	X	-	-	-	X	-
124	5620	-	-	X	-	X	-	-	-	X	-
128	5640	-	-	X	-	-	-	-	-	X	-
132	5660	-	-	X	-	-	-	-	-	X	-
136	5680	-	-	X	-	-	-	-	-	X	-
140	5700	-	-	X	-	-	-	-	-	X	-
149	5745	X	X	-	-	X	X	-	X	X	-
153	5765	X	X	-	-	X	X	-	X	X	-
157	5785	X	X	-	-	X	X	-	X	X	-
161	5805	X	X	-	-	X	X	-	X	X	-
165	5825	-	-	-	-	-	-	-	-	-	-



**Note**

The frequencies allowed in your regulatory domain might differ from the frequencies listed here.

## DFS Automatically Enabled on Some 5-GHz Radio Channels

Access points with 5-GHz radios configured at the factory for use in Europe and Singapore now comply with regulations that require radio devices to use Dynamic Frequency Selection (DFS) to detect radar signals and avoid interfering with them. Radios configured for use in other regulatory domains do not use DFS.

When a DFS-enabled 5-GHz radio operates on one of the 15 channels listed in [Table 6-7](#), the access point automatically uses DFS to set the operating frequency.


**Note**

You cannot manually select a channel for DFS-enabled 5-GHz radios.

**Table 6-7** DFS Automatically Enabled on these 5-GHz Channels

5-GHz Channels on Which DFS is Automatically Enabled		
52 (5260 MHz)	104 (5520 MHz)	124 (5620 MHz)
56 (5280 MHz)	108 (5540 MHz)	128 (5640 MHz)
60 (5300 MHz)	112 (5560 MHz)	132 (5660 MHz)
64 (5320 MHz)	116 (5580 MHz)	136 (5680 MHz)
100 (5500 MHz)	120 (5600 MHz)	140 (5700 MHz)

When DFS is enabled, the access point monitors its operating frequency for radar signals. If it detects radar signals on the channel, the access point takes these steps:

- Blocks new transmissions on the channel.
- Flushes the power-save client queues.
- Broadcasts an 802.11h channel-switch announcement.
- Disassociates remaining client devices.
- If participating in WDS, sends a DFS notification to the active WDS device that it is leaving the frequency.
- Randomly selects a different 5-GHz channel.
- If the channel selected is one of the channels in [Table 6-7](#), scans the new channel for radar signals for 60 seconds.
- If there are no radar signals on the new channel, enables beacons and accepts client associations.
- If participating in WDS, sends a DFS notification of its new operating frequency to the active WDS device.


**Note**

The maximum legal transmit power is greater for some 5-GHz channels than for others. When it randomly selects a 5-GHz channel on which power is restricted, the access point automatically reduces transmit power to comply with power limits for that channel.

**Note**

Cisco recommends that you use the **world-mode dot11d country-code** configuration interface command to configure a country code on DFS-enabled radios. The IEEE 802.11h protocol requires access points to include the country information element (IE) in beacons and probe responses. By default, however, the country code in the IE is blank. You use the **world-mode** command to populate the country code IE.

## Confirming that DFS is Enabled

Use the **show controller dot11radio1** command to confirm that DFS is enabled. This example shows a line from the output for the show controller command for a channel on which DFS is enabled:

```
Current Frequency: 5300 MHz Channel 60 (DFS enabled)
```

## Blocking Channels from DFS Selection

If your regulatory domain limits the channels that you can use in specific locations--for example, indoors or outdoors--you can block groups of channels to prevent the access point from selecting them when DFS is enabled. Use this configuration interface command to block groups of channels from DFS selection:

```
[no] dfs band [1] [2] [3] [4] block
```

The 1, 2, 3, and 4 options designate blocks of channels:

- **1**—Specifies frequencies 5.150 to 5.250 GHz. This group of frequencies is also known as the UNII-1 band.
- **2**—Specifies frequencies 5.250 to 5.350 GHz. This group of frequencies is also known as the UNII-2 band.
- **3**—Specifies frequencies 5.470 to 5.725 GHz.
- **4**—Specifies frequencies 5.725 to 5.825 GHz. This group of frequencies is also known as the UNII-3 band.

This example shows how to prevent the access point from selecting frequencies 5.150 to 5.350 GHz during DFS:

```
ap(config-if)# dfs band 1 2 block
```

This example shows how to unblock frequencies 5.150 to 5.350 for DFS:

```
ap(config-if)# no dfs band 1 2 block
```

This example shows how to unblock all frequencies for DFS:

```
ap(config-if)# no dfs band block
```

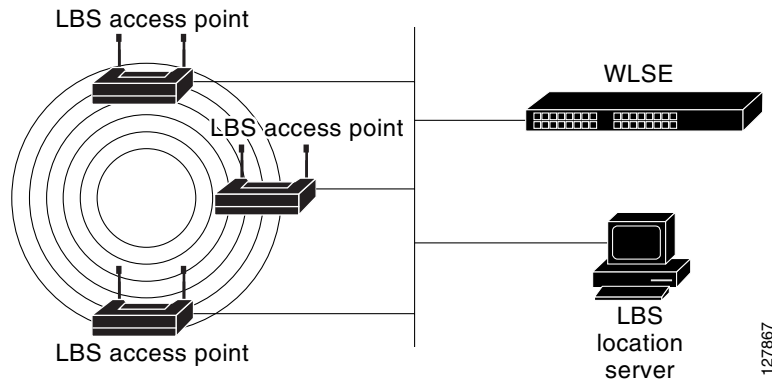
# Configuring Location-Based Services

This section describes how to configure location-based services using the access point CLI. As with other access point features, you can use a WLSE on your network to configure LBS on multiple access points. LBS settings do not appear on the access point GUI in this release.

## Understanding Location-Based Services

Cisco recommends that you configure a minimum of three access points for LBS. When you configure location-based services (LBS) on your access points, the access points monitor location packets sent by LBS positioning tags attached to assets that you want to track. When an access point receives a positioning packet, it measures the received signal strength indication (RSSI) and creates a UDP packet that contains the RSSI value and the time that the location packet was received. The access point forwards the UDP packets to a location server. The location server calculates the LBS tag's position based on the location information that it receives from the LBS-enabled access points. If your network has a WLSE, the location server can query the WLSE for the status of LBS-enabled access points. [Figure 6-1](#) shows the basic parts of an LBS-enabled network.

**Figure 6-1 Basic LBS Network Configuration**



The access points that you configure for LBS should be in the same vicinity. If only one or two access points report messages from a tag, the location server can report that the location of the tag is somewhere in the coverage area of the two reporting access points. Consult the documentation for your LBS tags and location server for additional configuration details.

## Configuring LBS on Access Points

Use the CLI to configure LBS on your access point. Beginning in privileged EXEC mode, follow these steps to configure LBS:

	Command	Purpose
Step 1	<code>configure terminal</code>	Enter global configuration mode.
Step 2	<code>dot11 lbs profile-name</code>	Create an LBS profile for the access point and enter LBS configuration mode.

	Command	Purpose
Step 3	<b>server-address</b> <i>ip-address</i> <b>port</b> <i>port</i>	Enter the IP address of the location server and the port on the server to which the access point sends UDP packets that contain location information.
Step 4	<b>method</b> { <i>rss</i> }	(Optional) Select the location method that the access point uses when reporting location information to the location server. In this release, <b>rss</b> (in which the access point measures the location packet's RSSI) is the only option and is also the default.
Step 5	<b>packet-type</b> { <i>short</i>   <i>extended</i> }	(Optional) Select the packet type that the access point accepts from the LBS tag. <ul style="list-style-type: none"> <li><b>short</b>—The access point accepts short location packets from the tag. In short packets, the LBS information is missing from the tag packet's frame body and the packet indicates the tag's transmit channel.</li> <li><b>extended</b>—This is the default setting. The access point accepts extended packets from the tag. An extended packet contains two bytes of LBS information in the frame body. If the packet does not contain those two bytes in the frame body, the access point drops the packet.</li> </ul>
Step 6	<b>channel-match</b>	(Optional) Specifies that the LBS packet sent by the tag must match the radio channel on which the access point receives the packet. If the channel used by the tag and the channel used by the access point do not match, the access point drops the packet. Channel match is enabled by default.
Step 7	<b>multicast-address</b> <i>mac-address</i>	(Optional) Specifies the multicast address that the tag uses when it sends LBS packets. The default multicast address is 01:40:96:00:00:10.
Step 8	<b>interface dot11</b> { <i>0</i>   <i>1</i> }	Specify the radio interface on which this LBS profile is enabled. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1. The profile remains inactive until you enter this command.
Step 9	<b>exit</b>	Return to global configuration mode.

In this example, the profile *southside* is enabled on the access point's 802.11g radio:

```
ap# configure terminal
ap(config)# dot11 lbs southside
ap(dot11-lbs)# server-address 10.91.105.90 port 1066
ap(dot11-lbs)# interface dot11 0
ap(dot11-lbs)# exit
```

## Enabling and Disabling World Mode

You can configure the wireless device to support 802.11d world mode or Cisco legacy world mode. When you enable world mode, the wireless device adds channel carrier set information to its beacon. Client devices with world mode enabled receive the carrier set information and adjust their settings automatically. For example, a client device used primarily in Japan could rely on world mode to adjust its channel and power settings automatically when it travels to Italy and joins a network there. Cisco

client devices running firmware version 5.30.17 or later detect whether the wireless device is using 802.11d or Cisco legacy world mode and automatically use world mode that matches the mode used by the wireless device. World mode is disabled by default.

Beginning in privileged EXEC mode, follow these steps to enable world mode:

	Command	Purpose
Step 1	<code>configure terminal</code>	Enter global configuration mode.
Step 2	<code>interface dot11radio { 0   1 }</code>	Enter interface configuration mode for the radio interface.
Step 3	<code>world-mode</code> <code>dot11d country_code code</code> <code>{ both   indoor   outdoor }</code> <code>  legacy</code>	<p>Enable world mode.</p> <ul style="list-style-type: none"> <li>Enter the <b>dot11d</b> option to enable 802.11d world mode. <ul style="list-style-type: none"> <li>When you enter the <b>dot11d</b> option, you must enter a two-character ISO country code (for example, the ISO country code for the United States is <b>US</b>). You can find a list of ISO country codes at the ISO website.</li> <li>After the country code, you must enter <b>indoor</b>, <b>outdoor</b>, or <b>both</b> to indicate the placement of the wireless device.</li> </ul> </li> <li>Enter the <b>legacy</b> option to enable Cisco legacy world mode.</li> </ul> <p><b>Note</b> Aironet extensions must be enabled for legacy world mode operation, but Aironet extensions are not required for 802.11d world mode. Aironet extensions are enabled by default.</p>
Step 4	<code>end</code>	Return to privileged EXEC mode.
Step 5	<code>copy running-config startup-config</code>	(Optional) Save your entries in the configuration file.

Use the **no** form of the command to disable world mode.

## Disabling and Enabling Short Radio Preambles

The radio preamble (sometimes called a *header*) is a section of data at the head of a packet that contains information that the wireless device and client devices need when sending and receiving packets. You can set the radio preamble to long or short:

- Short—A short preamble improves throughput performance. Cisco Aironet Wireless LAN Client Adapters support short preambles. Early models of Cisco Aironet's Wireless LAN Adapter (PC4800 and PC4800A) require long preambles.
- Long—A long preamble ensures compatibility between the wireless device and all early models of Cisco Aironet Wireless LAN Adapters (PC4800 and PC4800A). If these client devices do not associate to the wireless devices, you should use short preambles.

You cannot configure short or long radio preambles on the 5-GHz radio.

Beginning in privileged EXEC mode, follow these steps to disable short radio preambles:

	Command	Purpose
Step 1	<code>configure terminal</code>	Enter global configuration mode.
Step 2	<code>interface dot11radio { 0 }</code>	Enter interface configuration mode for the 2.4-GHz radio interface.
Step 3	<code>no preamble-short</code>	Disable short preambles and enable long preambles.
Step 4	<code>end</code>	Return to privileged EXEC mode.
Step 5	<code>copy running-config startup-config</code>	(Optional) Save your entries in the configuration file.

Short preambles are enabled by default. Use the `preamble-short` command to enable short preambles if they are disabled.

## Configuring Transmit and Receive Antennas

You can select the antenna the wireless device uses to receive and transmit data. There are three options for both the receive and the transmit antenna:

- **Diversity**—This default setting tells the wireless device to use the antenna that receives the best signal. If the wireless device has two fixed (non-removable) antennas, you should use this setting for both receive and transmit.
- **Right**—If the wireless device has removable antennas and you install a high-gain antenna on the wireless device's right connector, you should use this setting for both receive and transmit. When you look at the wireless device's back panel, the right antenna is on the right.
- **Left**—If the wireless device has removable antennas and you install a high-gain antenna on the wireless device's left connector, you should use this setting for both receive and transmit. When you look at the wireless device's back panel, the left antenna is on the left.

Beginning in privileged EXEC mode, follow these steps to select the antennas the wireless device uses to receive and transmit data:

	Command	Purpose
Step 1	<code>configure terminal</code>	Enter global configuration mode.
Step 2	<code>interface dot11radio { 0   1 }</code>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<code>antenna receive { diversity   left   right }</code>	Set the receive antenna to diversity, left, or right. <b>Note</b> For best performance, leave the receive antenna setting at the default setting, <b>diversity</b> .
Step 4	<code>antenna transmit { diversity   left   right }</code>	Set the transmit antenna to diversity, left, or right. <b>Note</b> For best performance, leave the transmit antenna setting at the default setting, <b>diversity</b> .
Step 5	<code>end</code>	Return to privileged EXEC mode.
Step 6	<code>copy running-config startup-config</code>	(Optional) Save your entries in the configuration file.

## Disabling and Enabling Aironet Extensions

By default, the wireless device uses Cisco Aironet 802.11 extensions to detect the capabilities of Cisco Aironet client devices and to support features that require specific interaction between the wireless device and associated client devices. Aironet extensions must be enabled to support these features:

- Load balancing—The wireless device uses Aironet extensions to direct client devices to an access point that provides the best connection to the network based on factors such as number of users, bit error rates, and signal strength.
- Message Integrity Check (MIC)—MIC is an additional WEP security feature that prevents attacks on encrypted packets called bit-flip attacks. The MIC, implemented on both the wireless device and all associated client devices, adds a few bytes to each packet to make the packets tamper-proof.
- Cisco Key Integrity Protocol (CKIP)—Cisco's WEP key permutation technique based on an early algorithm presented by the IEEE 802.11i security task group. The standards-based algorithm, TKIP, does not require Aironet extensions to be enabled.
- Repeater mode—Aironet extensions must be enabled on repeater access points and on the root access points to which they associate.
- World mode (legacy only)—Client devices with legacy world mode enabled receive carrier set information from the wireless device and adjust their settings automatically. Aironet extensions are not required for 802.11d world mode operation.
- Limiting the power level on associated client devices—When a client device associates to the wireless device, the wireless device sends the maximum allowed power level setting to the client.

Disabling Aironet extensions disables the features listed above, but it sometimes improves the ability of non-Cisco client devices to associate to the wireless device.

Aironet extensions are enabled by default. Beginning in privileged EXEC mode, follow these steps to disable Aironet extensions:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>no dot11 extension aironet</b>	Disable Aironet extensions.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **dot11 extension aironet** command to enable Aironet extensions if they are disabled.

## Configuring the Ethernet Encapsulation Transformation Method

When the wireless device receives data packets that are not 802.3 packets, the wireless device must format the packets to 802.3 using an encapsulation transformation method. These are the two transformation methods:

- 802.1H—This method provides optimum performance for Cisco Aironet wireless products. This is the default setting.
- RFC1042—Use this setting to ensure interoperability with non-Cisco Aironet wireless equipment. RFC1042 does not provide the interoperability advantages of 802.1H but is used by other manufacturers of wireless equipment.

Beginning in privileged EXEC mode, follow these steps to configure the encapsulation transformation method:

	Command	Purpose
Step 1	<code>configure terminal</code>	Enter global configuration mode.
Step 2	<code>interface dot11radio { 0   1 }</code>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<code>payload-encapsulation snap   dot1h</code>	Set the encapsulation transformation method to RFC1042 ( <code>snap</code> ) or 802.1h ( <code>dot1h</code> , the default setting).
Step 4	<code>end</code>	Return to privileged EXEC mode.
Step 5	<code>copy running-config startup-config</code>	(Optional) Save your entries in the configuration file.

## Enabling and Disabling Reliable Multicast to Workgroup Bridges

The *Reliable multicast messages from the access point to workgroup bridges* setting limits reliable delivery of multicast messages to approximately 20 Cisco Aironet Workgroup Bridges that are associated to the wireless device. The default setting, **disabled**, reduces the reliability of multicast delivery to allow more workgroup bridges to associate to the wireless device.

Access points and bridges normally treat workgroup bridges not as client devices but as infrastructure devices, like access points or bridges. Treating a workgroup bridge as an infrastructure device means that the wireless device reliably delivers multicast packets, including Address Resolution Protocol (ARP) packets, to the workgroup bridge.

The performance cost of reliable multicast delivery—duplication of each multicast packet sent to each workgroup bridge—limits the number of infrastructure devices, including workgroup bridges, that can associate to the wireless device. To increase beyond 20 the number of workgroup bridges that can maintain a radio link to the wireless device, the wireless device must reduce the delivery reliability of multicast packets to workgroup bridges. With reduced reliability, the wireless device cannot confirm whether multicast packets reach the intended workgroup bridge, so workgroup bridges at the edge of the wireless device's coverage area might lose IP connectivity. When you treat workgroup bridges as client devices, you increase performance but reduce reliability.

**Note**

This feature is best suited for use with stationary workgroup bridges. Mobile workgroup bridges might encounter spots in the wireless device's coverage area where they do not receive multicast packets and lose communication with the wireless device even though they are still associated to it.

A Cisco Aironet Workgroup Bridge provides a wireless LAN connection for up to eight Ethernet-enabled devices.

This feature is not supported on the 5-GHz radio.

Beginning in privileged EXEC mode, follow these steps to configure the encapsulation transformation method:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0 }</b>	Enter interface configuration mode for the 2.4-GHz radio interface.
Step 3	<b>infrastructure-client</b>	Enable reliable multicast messages to workgroup bridges.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the command to disable reliable multicast messages to workgroup bridges.

## Enabling and Disabling Public Secure Packet Forwarding

Public Secure Packet Forwarding (PSPF) prevents client devices associated to an access point from inadvertently sharing files or communicating with other client devices associated to the access point. It provides Internet access to client devices without providing other capabilities of a LAN. This feature is useful for public wireless networks like those installed in airports or on college campuses.

**Note**

To prevent communication between clients associated to different access points, you must set up protected ports on the switch to which the wireless devices are connected. See the “[Configuring Protected Ports](#)” section on page 6-23 for instructions on setting up protected ports.

To enable and disable PSPF using CLI commands on the wireless device, you use bridge groups. You can find a detailed explanation of bridge groups and instructions for implementing them in this document:

- *Cisco IOS Bridging and IBM Networking Configuration Guide, Release 12.2*. Click this link to browse to the Configuring Transparent Bridging chapter:  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fibm\\_c/bcfpart1/bcftb.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fibm_c/bcfpart1/bcftb.htm)

You can also enable and disable PSPF using the web-browser interface. The PSPF setting is on the Radio Settings pages.

PSPF is disabled by default. Beginning in privileged EXEC mode, follow these steps to enable PSPF:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>bridge-group <i>group</i> port-protected</b>	Enable PSPF.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the command to disable PSPF.

## Configuring Protected Ports

To prevent communication between client devices associated to different access points on your wireless LAN, you must set up protected ports on the switch to which the wireless devices are connected.

Beginning in privileged EXEC mode, follow these steps to define a port on your switch as a protected port:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface <i>interface-id</i></b>	Enter interface configuration mode, and enter the type and number of the switchport interface to configure, such as <b>gigabitethernet0/1</b> .
Step 3	<b>switchport protected</b>	Configure the interface to be a protected port.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>show interfaces <i>interface-id</i> switchport</b>	Verify your entries.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

To disable protected port, use the **no switchport protected** interface configuration command.

For detailed information on protected ports and port blocking, refer to the “Configuring Port-Based Traffic Control” chapter in the *Catalyst 3550 Multilayer Switch Software Configuration Guide, 12.1(12c)EAI*. Click this link to browse to that guide:

[http://www.cisco.com/en/US/products/hw/switches/ps646/products\\_configuration\\_guide\\_book09186a008011591c.html](http://www.cisco.com/en/US/products/hw/switches/ps646/products_configuration_guide_book09186a008011591c.html)

## Configuring the Beacon Period and the DTIM

The beacon period is the amount of time between access point beacons in Kilomicroseconds. One Kμsec equals 1,024 microseconds. The Data Beacon Rate, always a multiple of the beacon period, determines how often the beacon contains a delivery traffic indication message (DTIM). The DTIM tells power-save client devices that a packet is waiting for them.

For example, if the beacon period is set at 100, its default setting, and the data beacon rate is set at 2, its default setting, then the wireless device sends a beacon containing a DTIM every 200 Kμsecs. One Kμsec equals 1,024 microseconds.

The default beacon period is 100, and the default DTIM is 2. Beginning in privileged EXEC mode, follow these steps to configure the beacon period and the DTIM:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>beacon period <i>value</i></b>	Set the beacon period. Enter a value in Kilomicroseconds.
Step 4	<b>beacon dtim-period <i>value</i></b>	Set the DTIM. Enter a value in Kilomicroseconds.
Step 5	<b>end</b>	Return to privileged EXEC mode.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

## Configure RTS Threshold and Retries

The RTS threshold determines the packet size at which the wireless device issues a request to send (RTS) before sending the packet. A low RTS Threshold setting can be useful in areas where many client devices are associating with the wireless device, or in areas where the clients are far apart and can detect only the wireless device and not each other. You can enter a setting ranging from 0 to 2347 bytes.

Maximum RTS retries is the maximum number of times the wireless device issues an RTS before stopping the attempt to send the packet over the radio. Enter a value from 1 to 128.

The default RTS threshold is 2312, and the default maximum RTS retries setting is 32. Beginning in privileged EXEC mode, follow these steps to configure the RTS threshold and maximum RTS retries:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>rts threshold <i>value</i></b>	Set the RTS threshold. Enter an RTS threshold from 0 to 2347.
Step 4	<b>rts retries <i>value</i></b>	Set the maximum RTS retries. Enter a setting from 1 to 128.
Step 5	<b>end</b>	Return to privileged EXEC mode.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the command to reset the RTS settings to defaults.

## Configuring the Maximum Data Retries

The maximum data retries setting determines the number of attempts the wireless device makes to send a packet before giving up and dropping the packet.

The default setting is 32. Beginning in privileged EXEC mode, follow these steps to configure the maximum data retries:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>packet retries</b> <i>value</i>	Set the maximum data retries. Enter a setting from 1 to 128.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the command to reset the setting to defaults.

## Configuring the Fragmentation Threshold

The fragmentation threshold determines the size at which packets are fragmented (sent as several pieces instead of as one block). Use a low setting in areas where communication is poor or where there is a great deal of radio interference.

The default setting is 2338 bytes. Beginning in privileged EXEC mode, follow these steps to configure the fragmentation threshold:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>fragment-threshold</b> <i>value</i>	Set the fragmentation threshold. Enter a setting from 256 to 2346 bytes for the 2.4-GHz radio. Enter a setting from 256 to 2346 bytes for the 5-GHz radio.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

Use the **no** form of the command to reset the setting to defaults.

## Enabling Short Slot Time for 802.11g Radios

You can increase throughput on the 802.11g, 2.4-GHz radio by enabling short slot time. Reducing the slot time from the standard 20 microseconds to the 9-microsecond short slot time decreases the overall backoff, which increases throughput. Backoff, which is a multiple of the slot time, is the random length of time that a station waits before sending a packet on the LAN.

Many 802.11g radios support short slot time, but some do not. When you enable short slot time, the wireless device uses the short slot time only when all clients associated to the 802.11g, 2.4-GHz radio support short slot time.

Short slot time is supported only on the 802.11g, 2.4-GHz radio. Short slot time is disabled by default.

In radio interface mode, enter this command to enable short slot time:

```
ap(config-if)# slot-time-short
```

Enter **no slot-time-short** to disable short slot time.

## Performing a Carrier Busy Test

You can perform a carrier busy test to check the radio activity on wireless channels. During the carrier busy test, the wireless device drops all associations with wireless networking devices for 4 seconds while it conducts the carrier test and then displays the test results.

In privileged EXEC mode, enter this command to perform a carrier busy test:

```
dot11 interface-number carrier busy
```

For *interface-number*, enter **dot11radio 0** to run the test on the 2.4-GHz radio, or enter **dot11radio 1** to run the test on the 5-GHz radio.

Use the **show dot11 carrier busy** command to re-display the carrier busy test results.