



## 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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## Disabling and Enabling the Radio Interface

The wireless device radios are enabled by default. Beginning in privileged EXEC mode, follow these steps to disable the wireless device radio:

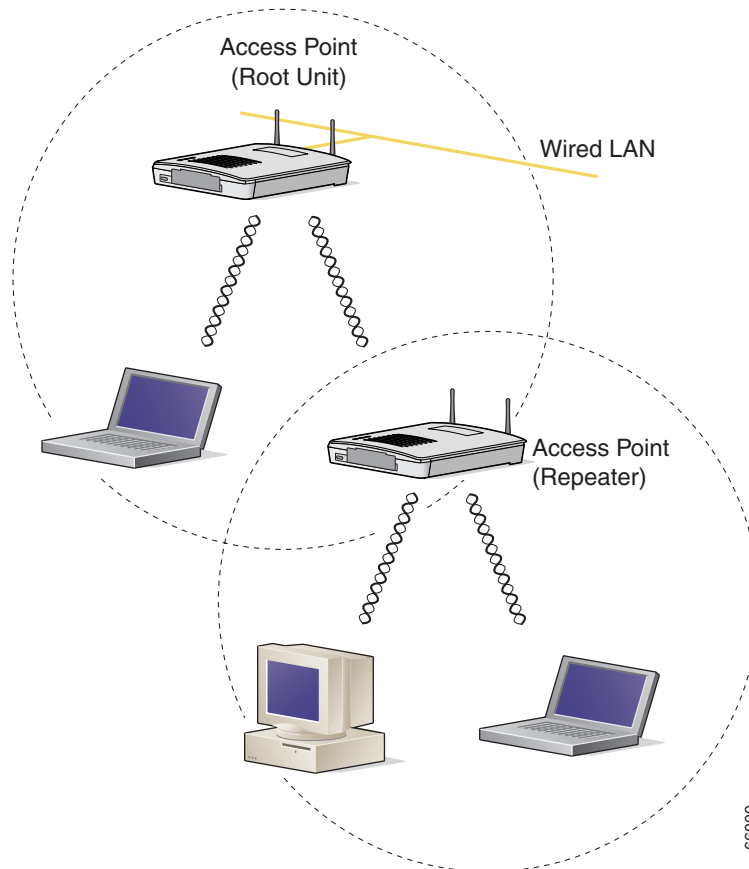
	<b>Command</b>	<b>Purpose</b>
<b>Step 1</b>	<b>configure terminal</b>	Enter global configuration mode.
<b>Step 2</b>	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
<b>Step 3</b>	<b>shutdown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

Use the **no** form of the shutdown command to enable the radio port.

## Configuring the Role in Radio Network

You can configure the wireless device as a root device that is connected to the wired LAN or as a repeater (non-root) device that is not connected to the wired LAN. You can also configure 1100 series access points as workgroup bridges. [Figure 6-1](#) shows root and repeater access points and an access point functioning as a workgroup bridge.

**Figure 6-1** Root Access Point, Repeater Access Point, and a Workgroup Bridge



See [Chapter 18, “Configuring Repeater and Standby Access Points and Workgroup Bridge Mode,”](#) for detailed instructions on setting up repeaters.

As a workgroup bridge, an 1100 series access point associates as a client device to an access point or bridge on your network. It provides a network connection to the devices attached to its Ethernet port, usually through a hub. See [Chapter 19, “Configuring Repeater and Standby Access Points and Workgroup Bridge,”](#) for detailed instructions on configuring access points as workgroup bridges.

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 repeater   root [ fallback { shutdown   repeater } ]   workgroup-bridge</b>	Set the wireless device role. <ul style="list-style-type: none"> <li>• Set the role to repeater, root, or workgroup bridge.</li> </ul> <p><b>Note</b> Workgroup bridge mode is available only on 1100 series access points.</p> <ul style="list-style-type: none"> <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.

## 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**.

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
Step 3	<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> </ul> <p>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.</p> <p>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.</p> <ul style="list-style-type: none"> <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> </ul> <p>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.</p> <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 basic 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 basic (required) and set all the CCK rates (1, 2, 5.5, and 11) to disabled. 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 basic, and rates 6, 9, 12, 18, 24, 36, 48, and 54 to enabled. 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 basic, and rates 9.0, 18.0, 36.0, 48.0, and 54.0 to enabled.</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 disable data rates. When you use the **no** form of the command, all data rates are disabled except the rates you name in the command. This example shows how to disable data rate 1.0:

```
ap1200# configure terminal
ap1200(config)# interface dot11radio 0
ap1200(config-if)# no speed basic-2.0 basic-5.5 basic-11.0
ap1200(config-if)# end
```

Data rate 1 is disabled, and the rest of the rates are set to basic.

This example shows how to set up the wireless device for 11-Mbps service only:

```
ap1200# configure terminal
ap1200(config)# interface dot11radio 0
ap1200(config-if)# no speed basic-11.0
ap1200(config-if)# end
```

Data rate 11 is set to basic, and the rest of the data rates are set to disabled.

## Configuring Radio Transmit Power

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>{ 1   5   20   30   50   100   maximum }</p> <p>These options are available for the 5-GHz radio (in mW):</p> <p>{ 5   10   20   40   maximum }</p> <p>If your access point contains an AIR-RM21A 5-GHz radio module, these power options are available (in dBm):</p> <p>{ -1   2   5   8   11   14   16   17   20   maximum }</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> The settings allowed in your regulatory domain might differ from the settings listed here.</p>

	Command	Purpose
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: { 1   5   10   20   30   50   100   <b>maximum</b> }</p> <p><b>power local ofdm</b> settings: { 1   5   10   20   30   <b>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> The settings allowed in your regulatory domain might differ from the settings listed here.</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.

## AIR-RM21A/AIR-RM22A Radio Modules Usually Set to Max Transmit Power

AIR-RM21A and AIR-RM22A radio modules measure transmit power in decibels per milliwatt (dBm), but earlier versions of 802.11a radios in Cisco Aironet access points measure power in milliwatts (mW). Because power settings in mW do not translate directly to settings in dBm, the access point usually uses the default power setting of maximum when you install a new AIR-RM21A or AIR-RM22A radio module.

Table 1 lists 802.11a transmit power settings in mW and the power settings that the access point assigns to a new radio module.

**Table 1** Transmit Power Settings Assigned to New Radio Modules

Power Settings in mW	Power Setting Assigned to New Radio Module
5	5 dBm (approximately 3 mW)
10	maximum (17 dBm)
20	maximum
40	maximum

## 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.

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 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 [Appendix A, “Channels and Antenna Settings,”](#) 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 6-2</a> and <a href="#">Table 6-3</a> show the channels and frequencies. To search for the least-congested channel on startup, enter <b>least-congested</b> .
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 6-2 shows the available frequencies for the 2.4-GHz radio.

**Table 6-2 2.4-GHz Radio Band**

Channel	Frequency (in MHz)	Geographic Location
channel 1	2412	Americas, EMEA, Japan, and China
channel 2	2417	Americas, EMEA, Japan, and China
channel 3	2422	Americas, EMEA, Japan, and China
channel 4	2427	Americas, EMEA, Japan, Israel, and China
channel 5	2432	Americas, EMEA, Japan, Israel, and China
channel 6	2437	Americas, EMEA, Japan, Israel, and China
channel 7	2442	Americas, EMEA, Japan, Israel, and China
channel 8	2447	Americas, EMEA, Japan, Israel, and China
channel 9	2452	Americas, EMEA, Japan, Israel, and China
channel 10	2457	Americas, EMEA, Japan, and China
channel 11	2462	Americas, EMEA, Japan, and China
channel 12	2467	EMEA and Japan only
channel 13	2472	EMEA and Japan only
channel 14	2484	Japan only

Table 6-3 shows the available frequencies for the 5-GHz radio.

**Table 6-3 5-GHz Radio Band**

Channel	Frequency (MHz)	North America (-A)	Taiwan (-T)	ETSI	Singapore (-S)	Japan (-J)
34	5170	—	—		—	X
36	5180	X	—	X	X	—
38	5190	—	—		—	X
40	5200	X	—	X	X	—
42	5210	—	—		—	X
44	5220	X	—	X	X	—
46	5230	—	—		—	X
48	5240	X	—	X	X	—
52	5260	X	X	X	—	—
56	5280	X	X	X	—	—
60	5300	X	X	X	—	—
64	5320	X	X	X	—	—
100	5500	—	—	X	—	—
104	5520	—	—	X	—	—

Table 6-3 5-GHz Radio Band (continued)

Channel	Frequency (MHz)	North America (-A)	Taiwan (-T)	ETSI	Singapore (-S)	Japan (-J)
108	5540	—	—	X	—	—
112	5560	—	—	X	—	—
116	5580	—	—	X	—	—
120	5600	—	—	X	—	—
124	5620	—	—	X	—	—
128	5640	—	—	X	—	—
132	5660	—	—	X	—	—
136	5680	—	—	X	—	—
140	5700	—	—	X	—	—
149	5745	—	—	—	—	—
153	5765	—	—	—	—	—
157	5785	—	—	—	—	—
161	5805	—	—	—	—	—

**Note**

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

## 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.

World mode is not supported on the 5-GHz radio.

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 }</code>	Enter interface configuration mode for the 2.4-GHz radio interface.

	Command	Purpose
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-removeable) 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	<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>antenna receive { diversity   left   right }</b>	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	<b>antenna transmit { diversity   left   right }</b>	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	<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.

## 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	<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.

	Command	Purpose
Step 3	<b>payload-encapsulation snap   dot1h</b>	Set the encapsulation transformation method to RFC1042 ( <b>snap</b> ) or 802.1h ( <b>dot1h</b> , the default setting).
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.

## 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 6-17 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/bcpart1/bcftb.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fibm_c/bcpart1/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> .

	Command	Purpose
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)EA1*. 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 <i>value</i></b>	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 <i>value</i></b>	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.

