CHAPTER 6

Wireless Mobile Interface Cards

The Cisco Wireless Mobile Interface Card (WMIC) is a Cisco 3200 Series router interface card in a standard PC/104-*Plus* form factor.

It is one component of the Cisco 3200 Series routers and provides a wireless interface with the following:

- 2.4 GHz (802.11b/g) – Cisco 3201
- 4.9 GHz (public safety) – Cisco 3202
- 5.0 GHz (802.11h) – Cisco 3205 (The C3205WMIC-K9 and C3205WMIC-TP-K9 WMICs are available only in the European Telecommunications Standards Institute [ETSI] domain.)

Caution The 4.9 GHz (public safety) radio requires an operators license and can be operated only by US Public Safety operators who meet the requirements specified under FCC Part 90.20.

This chapter provides basic information about the WMIC hardware for performing simple troubleshooting, such as reconnecting a loose cable. To solve more difficult problems, contact your vendor.

WMIC Component Systems

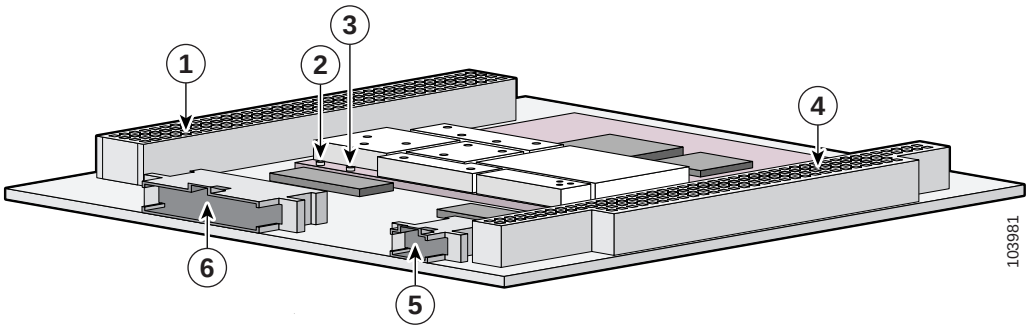
The ISA buses and PCI buses on the Cisco 3200 Series router cards provide power to the components on the cards. The WMIC does not receive or transmit communications signals on either bus, but it will pass signals through the bus to a card above or below the WMIC. Both buses comply with the PC/104-*Plus* standard.

The PCI bus signals allow the Cisco cards to communicate. Non-Cisco cards cannot communicate with the Cisco 3200 Series Router cards over the PCI bus.

Caution If you add non-Cisco cards that generates signals on the PCI bus, the router might shut down. Do not add non-Cisco cards that generate signals on the PCI bus.

Figure 6-1 shows the WMIC header and bus locations.

Figure 6-1 WMIC Header and Bus Locations



1	PCI bus	**2**	Left antenna connector (J2)
3	Right antenna connector (J1)	**4**	ISA bus
5	10-pin Fast Ethernet header	**6**	24-pin multifunction header

Note The PC/104-Plus standard requires that the PCI bus and the ISA bus use keying features in the standard stacking headers to guarantee proper module installation. On the PCI bus, pin D30 is removed and its opening is plugged. On the ISA bus, pin C19 and pin B10 are removed, and their openings are plugged.

Antenna Connector

On the radio card, two ultra-miniature coaxial connectors (U.FL connector) connect the coax cables between the WMIC and the external antenna connectors. Two connectors support antenna diversity.

The cable should be as short as possible to minimize the loss in strength of the RF signal. The cable carries the RF signal from the antenna to the low noise amplifier (LNA) on the receiver and carries the RF signal from the power amplifier (PA) to the antenna that radiates the RF signal.

There are many antenna connector families. The Cisco RP-TNC antenna connector can be used to support standard antennas.

WMIC Console and Fast Ethernet Ports

Cisco 3200 Series router cards do not support any ISA bus signals. The PCI bus connector supports communication between the Cisco 3200 Series router card and the PCI Serial Mobile Interface Card (SMIC) and between the SMIC and the Fast Ethernet Switch Mobile Interface Card (FESMIC).

In a Cisco Rugged Enclosure, the WMIC communicates with the router through the WMIC Fast Ethernet interface. The WMIC Fast Ethernet ports are connected internally to Fast Ethernet ports that provide a communications link with the router.

The WMIC interfaces are configured through a WMIC console port.

In contrast, the Serial Mobile Interface Card (SMIC) and FESMIC communicate with the router through the PC/104-*Plus* bus. The interfaces are configured through the router console port, and all of the router and FESMIC Fast Ethernet ports are identified by using the slot/port format.

The WMIC runs an independent Cisco IOS image and when it is configured, the link between the WMIC and the router forms an internal LAN. In standard configurations, a WMIC Fast Ethernet port is never brought out to the end cap.

The WMIC console port is brought out to the corresponding RJ-45 port on the I/O end cap, replacing a Fast Ethernet port. If the router includes one WMIC, the RS-232 WMIC console port replaces a Fast Ethernet port on the end cap. If the router includes two WMICs, two WMIC EIA/TIA-232 console ports replace two Fast Ethernet ports on the end cap.

Note At present, even if the router contains zero WMICs, in standard configurations a maximum of three Fast Ethernet ports are brought out to the end cap. Unused EIA/TIA-232 ports are sealed.

Fast Ethernet Signals on the WMIC

The Fast Ethernet signals are delivered through a 10-pin header. LED signals and EIA/TIA-232 console signals are provided through the 24-pin multifunction header.

There is one set of fixed Fast Ethernet signals on the WMIC. The Fast Ethernet port signals comply with IEEE 802.3. The signals are provided through the Ethernet headers, which support the following:

- Autonegotiation for 10/100BASE-TX connection
- Full-duplex and half-duplex modes
- Low-power sleep mode
- 10BASE-T and 100BASE-TX using a single Ethernet connection
- Robust baseline wander correction performance
- Standard carrier signal multiple access collision detect (CSMA/CD) or full-duplex operation
- Integrated LED drivers

Note If Auto-MDIX is disabled, when connecting to Ethernet switches or repeaters, use a straight-through cable. When connecting to compatible workstations, servers, and routers, use a crossover cable. If Auto-MDIX is enabled, you can use either a straight-through cable or a crossover cable to make the connection, as the router automatically changes the signals on the pins to compensate.

LED Behavior

During normal operations, the indicator signals (LEDs) on the wireless device have the following meanings:

- The status indicator signals operational status. Steady green indicates that the wireless device is associated with at least one wireless client. Blinking green indicates that the wireless device is operating normally but is not associated with any wireless devices.
- The radio indicator blinks green to indicate radio traffic activity. The light is normally off, but it blinks whenever a packet is received or transmitted over the radio.
- The Ethernet indicator signals traffic on the wired LAN. This indicator is normally green when an Ethernet cable is connected. The indicator blinks green when a packet is received or transmitted over the Ethernet infrastructure. The indicator is off when the Ethernet cable is not connected.

Table 6-1 lists the details of LED indicator signals.

Table 6-1 Indicator Signals

Message Type	Ethernet Indicator	Status Indicator	Radio Indicator	Meaning
Boot loader status	Green	—	Green	DRAM memory test.
	—	Amber	Red	Board initialization test.
	—	Blinking green	Blinking green	Flash memory test.
	Amber	Green	—	Ethernet initialization test.
	Green	Green	Green	Starting Cisco IOS software.
Association status	—	Green	—	At least one wireless client device is associated with the unit.
	—	Blinking green	—	No client devices are associated; check the wireless device service set identifier (SSID) and Wired Equivalent Privacy (WEP) settings.
Operating status	—	Green	Blinking green	Transmitting/receiving radio packets.
	Green	—	—	Ethernet link is operational.
	Blinking green	—	—	Transmitting/receiving Ethernet packets.
Boot Loader Errors	Red	—	Red	DRAM memory test failure.
	—	Red	Red	File system failure.
	Red	Red	—	Ethernet failure during image recovery.
	Amber	Green	Amber	Boot environment error.
	Red	Green	Red	No Cisco IOS image file.
	Amber	Amber	Amber	Boot failure.

Table 6-1 Indicator Signals (continued)

Message Type	Ethernet Indicator	Status Indicator	Radio Indicator	Meaning
Operation Errors	–	Green	Blinking amber	Maximum retries or buffer full occurred on the radio.
	Blinking amber	–	–	Transmit/receive Ethernet errors.
	–	Blinking amber	–	General warning.
Configuration Reset	–	Amber	–	Resetting the configuration options to factory defaults.
Failures	Red	Red	Red	Firmware failure; try disconnecting and reconnecting unit power.
	Blinking red	–	–	Hardware failure. The wireless device must be replaced.
Firmware Upgrade	–	Red	–	Loading new firmware image.

Key Features

Table 6-2 lists the key features of the Cisco wireless devices.

Table 6-2 Key Features

Feature	Description
Wireless Medium	Direct Sequence Spread Spectrum (DSSS). Orthogonal Frequency Division Multiplexing (OFDM).
Radio Media Access Protocol	Carrier sense multiple access with collision avoidance (CSMA/CA).
SNMP Compliance	MIB I and MIB II.
Encryption Key Length	128-bit.
Quality of Service (QoS) Support	Prioritization of traffic for different requirements, such as voice and video.

Table 6-2 Key Features (continued)

Feature	Description
Security	Cisco Wireless Security Suite: **Authentication:** • 802.1X support including Extensible Authentication Protocol (EAP)-Transport Layer Security (TLS), Lightweight EAP (LEAP), Protected EAP (PEAP), and EAP-Subscriber Identity Module (SIM) to yield mutual authentication and dynamic, per-user, per-session WEP keys. • MAC address and by standard 802.11 authentication mechanisms. **Encryption:** • Static and dynamic IEEE 802.11 WEP keys of 40 bits and 128 bits. • 802.11i/WPAv2 Advanced Encryption Standard-Counter Mode with Cipher Block Chaining Message Authentication Code Protocol (AES-CCMP); 128-bit key length. • Temporal Key Integrity Protocol (TKIP) WEP enhancements: key hashing (per-packet keying), message integrity check (MIC), and broadcast key rotation by using WPA TKIP. **All WMICs in Root Mode:** PEAP, EAP-TTLS, LEAP, EAP-TLS, EAP-FAST, and EAP-SIM. **Cisco 3201 WMICs in Client Mode:** LEAP, EAP-TLS, and EAP-FAST. **Cisco 3202 and Cisco 3205 WMICs in Client Mode:** LEAP.
Status Indicators	LEDs provide information about association status, operation, error/warning, firmware upgrade, and configuration, network/modem, and radio status.
Memory	8 MB Flash. 32 MB DRAM.
Automatic Configuration Support	BOOTP and DHCP.
Remote Configuration Support	Telnet, HTTP, FTP, TFTP, and SNMP.
Uplink	Autosensing 10/100BaseT Ethernet.
Local Configuration	Console port.

MAC Address Allocation

The WMIC stores one unique MAC address for the BVI interface.

WMIC Power Requirement

In a typical Cisco 3200 Series router configuration, the WMIC draws power from the PCI and the ISA connectors. Table 6-3 shows the estimated power consumption. Note that these are theoretical maximum wattages.

Table 6-3 WMIC Power Requirement

Voltage	Current Draw	Power	Source
+5.0 V	0.4 A	2.0 W	ISA and PCI connectors
+3.3 V	1.7 A	5.6 W	PCI connectors

Mean Time Between Failure

The calculated Mean Time Between Failure (MTBF) exceeds of 1,190,136 hours.

Differences Between WMICs

Table 6-4 highlights the differences between WMICs.

Table 6-4 Differences Between WMICs

Feature	2.4 GHz (802.11b/g)	4.9 GHz (public safety)	5.0 GHz (802.11h)	Comment
Cisco IOS image release	12.3(8) JK.	12.3.(2) JK.	12.3.(2) JL.	—
Cookie and banner	C3201.	C3202.	C3205.	—
Frequency	2.4 GHz.	4.9 GHz.	5.0 GHz.	—
Power	Maximum Orthogonal Frequency-Division Multiplexing (OFDM) power level is 15 dbm (30 mw), but the power level might vary by country.	Maximum OFDM power level is 17 dbm (50 mw).	The power levels can be defined as 4 dBm, 7 dBm, 10 dBm, 13 dBm, or 16 dBm.	—
power client Command	Supported.	Not supported. (Use the **power local** command.)	Not supported. (Use the **power local** command.)	—
Transmission Power Control (TPC)	Not supported.	Not supported.	Supported for ETSI.	TPC limits the transmitted power to the minimum power level needed to reach the farthest user.

Table 6-4 Differences Between WMICs (continued)

Feature	2.4 GHz (802.11b/g)	4.9 GHz (public safety)	5.0 GHz (802.11h)	Comment
Dynamic Frequency Selection (DFS)	—	—	Supported for ETSI.	DFS selects the radio channel most likely to minimize interference with military radar.
Channelization	Statically declared as defined by IEEE 802.11b/g.	Channel spacing selected by using the command-line interface (CLI).	Statically declared as defined by IEEE 802.11h. (Available only in Europe.)	—
Concatenation	Supported.	Not supported.	Not supported.	—
Fragmentation	Maximum threshold is 4000 bytes.	Maximum threshold is 2346 bytes.	Supported.	Fragment counter is in units of fragmented packets.
distance Command	Supported up to 99 kilometers.	Supported up to 3 kilometers (1.8 miles).	Supported up to 99 kilometers.	Minimizes delay propagation.
Autonomous Modes Supported	Work Group Bridge (WGB), Non Root Bridge (NRB), Root Bridge (RB), Repeater, and Access Point (AP).	Work Group Bridge (WGB), Non Root Bridge (NRB), Root Bridge (RB), Repeater, and Access Point (AP).	Work Group Bridge (WGB), Non Root Bridge (NRB), Root Bridge (RB), and Access Point (AP).	—
World Mode	Supported.	Supported only if the wireless device is in root access point or root bridge mode. Not supported in client modes.	Supported only if the wireless device is in root access point or root bridge mode. Not supported in client modes.	World mode on the client side updates a client with the channels of the specified domain. The Cisco 3200 Series router is limited to fixed channels, so world mode is not available on the client side.
Universal Workgroup Bridge Mode	Supported.	Not supported.	Not supported.	Enables operation with non-Cisco access points.
Multiple Client Profiles	Supported.	Not supported.	Not supported.	Support is enabled only when universal workgroup bridge mode is enabled.
Multiple Basic SSIDs	Supported.	Not supported.	Not supported.	—
VLANs	16 unencrypted VLANs, 16 static key VLANs, or 16 dynamic key VLANs.	16 unencrypted VLANs, 1 static key VLAN, or 4 dynamic key VLANs.	16 unencrypted VLANs, 1 static key VLAN, or 4 dynamic key VLANs.	—

Table 6-4 Differences Between WMICs (continued)

Feature	2.4 GHz (802.11b/g)	4.9 GHz (public safety)	5.0 GHz (802.11h)	Comment
Wireless encryption/cipher suites	WEP-40, WEP-128, TKIP, CKIP, CMIC and CKIP-CMIC.	WEP-40, WEP-128, TKIP, and AES-CCM.	WEP-40, WEP-128, TKIP, and AES-CCM.	—
Max Number of Stations with WEP	255.	116.	116.	—
Max Number of Stations with TKIP	256.	26.	26.	—
Max Number of Stations with AES-CCM	256.	116.	116.	—
WDS Server	Not supported.	Supported.	Supported.	—
WDS Client	Can automatically discover and work with a subnet WDS server.	Can automatically discover and work with a WDS server on the same subnet as the WMIC. If the IP address of a WDS server is anywhere on the network and the IP address is statically configured on a WMIC acting as root device, the WMIC can work with the WDS server.	Can automatically discover and work with a WDS server on the same subnet as the WMIC. If the IP address of a WDS server is anywhere on the network and the IP address is statically configured on a WMIC acting as root device, the WMIC can work with the WDS server.	—
EAP-TLS, EAP-TTLS	EAP-TLS is supported. EAP-TTLS is supported on root devices only.	EAP-TLS is supported in client mode. EAP-TTLS is not supported.	EAP-TLS is supported in client mode. EAP-TTLS is not supported.	—
EAP-FAST	Supported on root and non-root devices.	Not supported.	Supported on root and non-root devices.	—
WDS Server Related MIBS	—	Supported.	Supported.	—

Table 6-4 Differences Between WMICs (continued)

Feature	2.4 GHz (802.11b/g)	4.9 GHz (public safety)	5.0 GHz (802.11h)	Comment
Fast Roaming Scanning Enhancements	All scanning enhancements for faster roaming are available.	All scanning enhancements for faster roaming are available except “Use First Better Access Point.”	All scanning enhancements for faster roaming are available except “Use First Better Access Point.”	• Synthesizer tuning time. • Start on current channel. • Only probe current SSID. • Shorten wait time for probe response. • Automatically limiting which frequencies are scanned. • Time out the scan. • Use first better access point. • Save best probe response.
CCXv4 features	Supported.	Not supported.	Supported.	—
802.11e MMN QoS	Supported.	Not supported.	Supported.	—
Simple Network Management Protocol (SNMP) MIB IDs	Supported.	Supported for new values.	Supported.	The platform-dependent SNMP code was modified to return new values (entPhysicalVendorType, System OID, and Chassis ID).
Dot11 MIB parameters	Supported.	The dot11 parameters are returned through the dot11 MIB interface.	Supported.	—

2.4-GHz (802.11b/g) WMIC Features

The key features of the 2.4-GHz (802.11b/g) WMIC are listed in Table 6-5.

Table 6-5 Key 2.4-GHz (802.11b/g) WMIC Features

Feature	Description
Data Rates Supported	1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 Mbps
Network Standard	IEEE 802.11b and IEEE 802.11g
Frequency Band	2.400 GHz to 2.497 GHz

Table 6-5 Key 2.4-GHz (802.11b/g) WMIC Features

Feature	Description
Modulation	BPSK[1] 1 Mbps and 6 Mbps QPSK[2] 2 Mbps and 12 Mbps CCK[3] 5.5 Mbps BPSK[1] 9.6 Mbps CCK2[3] 11 Mbps QPSK[2] 18 Mbps 16 QAM[4] 24 Mbps and 36 Mbps 64 QAM[4] 48 Mbps and 54 Mbps
Operating Channels	North America: 11; ETSI: 13; Japan: 14
Receive Sensitivity	1 Mbps: -94 dBm 2 Mbps: -91 dBm 5.5 Mbps: -89 dBm 11 Mbps: -85 dBm
Transmit Power Settings	100 mW (20 dBm) 50 mW (17 dBm) 30 mW (15 dBm) 20 mW (13 dBm) 5 mW (7 dBm) 1 mW (0 dBm) Maximum power settings vary to comply with the regulatory domain.
Range (typical at 100-mW transmit power setting with 6-dBi diversity dipole antenna)	Outdoor: 0.5 mile (804 m) at 45 Mbps 1 mile (1609 m) at 11 Mbps 3 miles (4,827 m) at 1 Mbps
Compliance	2.4 GHz (802.11b/g) operates license free under FCC Part 15 and qualifies as a Class B device; complies with DOC regulations; complies with ETS 300.328, FTZ 2100, and MPT 1349 standards; rugged version complies with UL 2043

1. Binary Phase-shift keying (PSK)
2. Quadrature PSK
3. Complementary Code Keying
4. Quadrature Amplitude Modulation

Table 6-6 shows the channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11b/g 22-MHz-wide channel.

Table 6-6 Channels for IEEE 802.11b/g

Channel Identifier	Center Frequency (MHz)	Regulatory Domains					
		Americas (–A)		EMEA (–E)		Japan (–J)	
		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

Table 6-6 Channels for IEEE 802.11b/g (continued)

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

Universal Workgroup Bridge Limitations

The following limitations and restrictions apply to universal workgroup bridges:

- A universal workgroup bridge cannot associate with the Cisco WLAN AP when the bridge is configured with CKIP or CMIC encryption.
- If the universal workgroup bridge is associated with a Cisco AP or third-party AP and if the user issues the **show dot11 association all** command, the IP address and name information is not available.
- Users should configure the static IP address on the Bridge-Group Virtual Interface (BVI) when it is in the universal workgroup bridge mode, so that the WMIC is manageable from the MAR through the Mobile IP tunnel from the infrastructure side.
- If the dynamic Collocated Care-of Address (CCoA) is used on the Cisco 3200 Series Wireless and Mobile Router, you should configure the static IP address using the **ip secondary address** command.
- The universal workgroup bridge is not compatible with the Tropos version 3.1.1.2 AP.
- A universal workgroup bridge cannot associate with the Cisco 1500 router when it is configured with the Allow WPA2 TKIP Clients option.

4.9-GHz (Public Safety) WMIC Features

Table 6-7 lists the key features of the 4.9-GHz (public safety) WMIC.

Table 6-7 Key Features of the 4.9-GHz (Public Safety) WMIC

Feature	Description
Data Rates Supported	5-MHz channelization: 1.5, 2.25, 3, 4.5, 6, 9, 12, and 13.5 Mbps. 10-MHz channelization: 3, 4.5, 6, 9, 12, 18, 24, and 27 Mbps. 20-MHz channelization: 6, 9, 12, 18, 24, 36, 48, and 54 Mbps.
Network Standard	At present, there is no IEEE 4.9-GHz (public safety) standard; however, the public safety standard for the 4.9-GHz WMIC is similar to the IEEE 802.11a standard.
Frequency Band	4.940 GHz to 4.990 GHz.
Available Transmit Power Settings	50 mW (17 dBm). 40 mW (16 dBm). 30 mW (15 dBm). 20 mW (13 dBm). 10 mW (10 dBm). 5 mW (7 dBm).
Compliance	4.9 GHz (public safety): • Operation restricted to operators meeting requirements of CFR47 Part 90.20 of the technical rules for qualification as a Public Safety operator. • Requires an FCC license to operate under this part of the Part 90 Regulation.

4.9-GHz Channels

Table 6-8 lists the channel options for the 4.94-GHz to 4.99-GHz band for the United States regulatory domain as per the TIA TR-8 specification.

Table 6-8 FCC 4.9-GHz Operational Channels as per the TIA TR-8 Specification

Operating Channel Numbers	Channel Center 5-MHz Channel Spacing	Channel Center 10-MHz Channel Spacing	Channel Center 20-MHz Channel Spacing
1	—	—	—
3	—	—	—
5	4942.5	—	—
7	—	—	—
9	—	—	—
10	—	4945.0	—
15	4947.5	—	—
20	—	4950.0	4950.0
25	4952.5	—	—
30	—	4955.0	4955.0

Table 6-8 FCC 4.9-GHz Operational Channels as per the TIA TR-8 Specification (continued)

Operating Channel Numbers	Channel Center 5-MHz Channel Spacing	Channel Center 10-MHz Channel Spacing	Channel Center 20-MHz Channel Spacing
35	4957.5	—	—
40	—	4960.0	4960.0
45	4962.5	—	—
50	—	4965.0	4965.0
55	4967.5	—	—
60	—	4970.0	4970.0
65	4972.5	—	—
70	—	4975.0	4975.0
75	4977.5	—	—
80	—	4980.0	4980.0
85	4982.5	—	—
90	—	4985.0	—
91	—	—	—
93	—	—	—
95	4987.5	—	—
97	—	—	—
99	—	—	—

Note One-MHz channel spacing for Channel Center Frequencies is documented in the TIA TR-8 specification, but it is not supported by the 4.9-GHz (public safety) WMIC.

Throughput

The throughput is a minimum of:

- 4 Mbps half-duplex at one mile line-of-sight range for a 5 MHz-wide channel
- 8 Mbps half-duplex at one mile line-of-sight range for a 10 MHz-wide channel.
- 16 Mbps half-duplex at one mile line-of-sight range for a 20 MHz-wide channel.

Modulation

Table 6-9 lists the modulation supported modulations and data rates.

Table 6-9 Modulations and Data Rates

Modulation	5 Mbps	10 Mbps	20 Mbps
BPSK	1.5 Mbps and 2.25 Mbps	3 Mbps and 4.5 Mbps	6 Mbps and 9 Mbps
QPSK	3 Mbps and 4.5 Mbps	6 Mbps and 9 Mbps	12 Mbps and 18 Mbps

Table 6-9 Modulations and Data Rates (continued)

Modulation	5 Mbps	10 Mbps	20 Mbps
16 QAM	6 Mbps and 9 Mbps	12 Mbps and 18 Mbps	24 Mbps and 27 Mbps
64 QAM	12 Mbps and 13.5 Mbps	24 Mbps and 27 Mbps	48 Mbps and 54 Mbps

Receive Sensitivity

Table 6-10 shows the receive sensitivity for the 4.9-GHz WMIC.

Table 6-10 Receive Sensitivity for the 4.9-GHz WMIC

5 MHz		10 MHz		20 MHz	
1.5 Mbps	-89 dBm	3 Mbps	-87 dBm	6 Mbps	-85 dBm
2.25 Mbps	-89 dBm	4.5 Mbps	-87 dBm	9 Mbps	-85 dBm
3 Mbps	-89 dBm	6 Mbps	-87 dBm	12 Mbps	-85 dBm
4.5 Mbps	-85 dBm	9 Mbps	-87 dBm	18 Mbps	-82 dBm
6 Mbps	-82 dBm	12 Mbps	-85 dBm	24 Mbps	-79 dBm
9 Mbps	-79 dBm	18 Mbps	-79 dBm	36 Mbps	-76 dBm
12 Mbps	-74 dBm	24 Mbps	-74 dBm	48 Mbps	-71 dBm
13.5 Mbps	-72 dBm	27 Mbps	-72 dBm	54 Mbps	-69 dBm

5.0-GHz (802.11h) Radio Features

The 5-GHz radio supports only 20-MHz channelization. In addition, the 5-GHz radio supports Dynamic Frequency Selection (DFS) and Transmission Power Control (TPC) in the ETSI and FCC regulatory domains.

For more information about DFS and TPC, see *Radio Channels and Transmit Frequencies* at http://www.cisco.com/en/US/products/hw/routers/ps272/products_installation_and_configuration_guides_list.html.

Note 802.11h is supported only in the ETSI regulatory domain.

Note By default, the C3205 WMIC uses the right antenna to receive and transmit data.

5.0-GHz (802.11h) Channels

The 5.0-GHz (802.11h) radio in the Cisco 3200 Series router (currently available as the Cisco 3205 WMIC) supports the following channels and frequencies in the ETSI regulatory domain:

- 5.250 GHz to 5.350 GHz: 5260 MHz (52), 5280 MHz (56), 5300 MHz (60), 5320 MHz (64),
- 5.470 GHz to 5.725 GHz: 5500 MHz (100), 5520 MHz (104), 5540 MHz (108), 5560 MHz (112), 5580 MHz (116), 5600 MHz (120), 5620 MHz (124), 5640 MHz (128), 5660 MHz (132), 5680 MHz (136), 5700 MHz (140). (Channels 52 through 140 are ETSI outdoor channels.)

Note By default, the C3205 WMIC performs automatic channel selection on the radio interface. For more information about configuring a channel on the radio interface of the Cisco 3205 WMIC by using the command-line interface (CLI), see the "Configuring the Radio Channel or Frequency for the C3205 WMIC" section in the *Radio Channels and Transmit Frequencies* document. To see Dynamic Frequency Selection (DFS) statistics, use the **show interface d0 dfs** command.

Throughput

The throughput is a minimum of 16 Mbps half-duplex at one mile line-of-sight range for a 20-MHz-wide channel. The range performance is dependent on output power, antenna gain, path loss, and other factors.

The following are range performance estimations:

- 6 Mbps at 10 kilometers (6 miles) at 30 dBm equivalent isotropically radiated power (EIRP)
- 1 Mbps at 30 kilometers (18 miles) at 30 dBm EIRP

Modulation

Table 6-11 lists the supported 5.0-GHz (802.11h) modulations and data rates.

Table 6-11 5.0-GHz (802.11h) Modulations and Data Rates

Modulation	20 Mbps
BPSK	6 Mbps and 9 Mbps
QPSK	12 Mbps and 18 Mbps
16 QAM	24 Mbps and 27 Mbps
64 QAM	48 Mbps and 54 Mbps

Receive Sensitivity

Table 6-12 shows the receive sensitivity for 5.0-GHz (802.11h) radios.

Table 6-12 Receive Sensitivity for 5.0-GHz (802.11h) Radios

Data Rates	5.25 GHz to 5.35 GHz	5.47 GHz to 5.725 GHz	5.725 GHz to 5.825 GHz[1]
6 Mbps	-85 dBm	-85 dBm	-85 dBm
9 Mbps	-85 dBm	-85 dBm	-85 dBm
12 Mbps	-85 dBm	-85 dBm	-85 dBm
18 Mbps	-82 dBm	-82 dBm	-82 dBm
24 Mbps	-79 dBm	-79 dBm	-79 dBm
36 Mbps	-76 dBm	-76 dBm	-76 dBm
48 Mbps	-71 dBm	-71 dBm	-71 dBm
54 Mbps	-69 dBm	-69 dBm	-69 dBm

1. The 5.725-GHz to 5.825-GHz range is not supported on European models.

Transmit Sensitivity

Table 6-13 shows the transmit sensitivity for 5.0-GHz (802.11h) radios.

Table 6-13 Transmit Sensitivity for the C3205 WMIC

Data Rates	5.25 GHz to 5.35 GHz	5.47 GHz to 5.725 GHz	5.725 GHz to 5.825 GHz[1]
6 Mbps	16 dBm	16 dBm	16 dBm
9 Mbps	16 dBm	16 dBm	16 dBm
12 Mbps	16 dBm	16 dBm	16 dBm
18 Mbps	16 dBm	16 dBm	16 dBm
24 Mbps	16 dBm	16 dBm	16 dBm
36 Mbps	16 dBm	16 dBm	16 dBm
48 Mbps	14 dBm	14 dBm	14 dBm
54 Mbps	13 dBm	13 dBm	13 dBm

1. The 5.725-GHz to 5.825-GHz range is not supported on European models.

Additional cards and components provide power and link interfaces to the WMIC. The exact configuration of your router will vary, depending on how the vendor configured it.

Related Documentation

These documents provide detailed information regarding the configuration of the wireless card:

- *Cisco IOS Switching Services Configuration Guide.* Click this link to browse to this document: http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fswtch_c/index.htm
- *Cisco Internetwork Design Guide.* Click this link to browse to this document: http://www.cisco.com/univercd/cc/td/doc/cisintwk/idg4/index.htm
- *Cisco Internetworking Technology Handbook.* Click this link to browse to this document: http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/index.htm
- *Cisco Internetworking Troubleshooting Guide.* Click this link to browse to this document: http://www.cisco.com/univercd/cc/td/doc/cisintwk/itg_v1/index.htm