

Connected Grid Module (CGM) WPAN-OFDM-FCC Module - Cisco IOS

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Organization

This guide includes the following sections:

Conventions, page 2	Details on style conventions used in the guide.
Introduction, page 2	Review of document content.
Hardware Overview, page 3	Provides details on hardware module kit, operating temperature, LEDs, and antennas.
Installation Guidelines, page 6	Provides a summary of warnings for the module and steps for installing the module within a CGR 1000 Series router.
Software Configuration, page 7	Software commands required to configure the CGM-WPAN-OFDM-FCC module and Cisco CGR 1000 Series routers.
Related Documentation, page 8	Provides links to supporting documentation.

Conventions

This document uses the following conventions.

Conventions	Indication
bold font	Commands and keywords and user-entered text appear in **bold** font.
italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
[ ]	Elements in square brackets are optional.
{x | y | z}	Required alternative keywords are grouped in braces and separated by vertical bars.
[x | y | z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
`courier font`	Terminal sessions and information the system displays appear in courier font.
< >	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Note: Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Caution: **Means *reader be careful.* In this situation, you might perform an action that could result in equipment damage or loss of data.**

Warning: **IMPORTANT SAFETY INSTRUCTIONS**

Means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

Caution: Cable distribution system should be grounded (earthed) in accordance with ANSI/NFPA 70, the National Electrical Code (NEC), article 800, Grounding of Outer Conductive Shield of a Coaxial Cable.

WARNING : Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

SAVE THESE INSTRUCTIONS

Regulatory: Provided for additional information and to comply with regulatory and customer requirements.

Introduction

This document provides an overview of the hardware and software configuration information for the Cisco Connected Grid Module Wireless Personal Area Network Orthogonal Frequency-division Multiplexing (CGM-WPAN-OFDM-FCC) plug-in module for CGR 1000 Series routers (CGR 1000) operating with Cisco IOS software within a Resilient Mesh (formerly known as CG-Mesh) network.

Note: Before you install the module, please review the following document on how to configure a Cisco Resilient Mesh Network that supports a Cisco 1000 running Cisco IOS software and installed with a CGM-WPAN-OFDM-FCC module:

Cisco Connected Grid WPAN Module for CGR 1000 Series Installation and Cisco Resilient Mesh Configuration Guide (Cisco IOS)

The CGM-WPAN-OFDM-FCC module is designed to operate within a RF900 wireless network to support applications over Resilient Mesh Endpoints (RMEs) with serial (RS232/RS485), USB (LS/FS), or Fast Ethernet (10/100) ports for intelligent control primarily in the electrical grid. Applications include distribution automation (DA), Advanced metering infrastructure (AMI), and Connected Cities.

CGR 1000s installed with a CGM-WPAN-OFDM-FCC module provide a low cost, low power, small scale DA solution.

Note: Refer to Software Configuration, page 7 for the minimum Cisco IOS version required to support the module.

Note: See Checking and Upgrading the WPAN Firmware Version in Cisco Connected Grid WPAN Module for CGR 1000 Series Installation and Cisco Resilient Mesh Configuration Guide (Cisco IOS) for information about how to check the WPAN hardware and firmware versions and perform firmware upgrades.

Hardware Overview

The CGM-WPAN-OFDM-FCC module occupies a single slot within a CGR 1000 Series router. The module allows the CGR 1000 to connect to RMEs (such as Digital Automation (DA) Gateways and Smart Meters) using a RF900 WPAN wireless interface.

Note: The tables below highlight key software and hardware specifications items relevant during hardware installation.

For a complete list of all hardware and software specifications for this product, please refer to the data sheet noted below:

Cisco Connected Grid WPAN Module for the Cisco 1000 Series Connected Grid Router Data Sheet

Table 1 CGM-WPAN-OFDM-FCC Module Kit

Cisco Part Number	Description
CGM WPAN-OFDM-FCC	Single Connected Grid Module - IEEE 802.15.4e/g WPAN 900 MHz

Table 2 Hardware Specifications

Item	Description
Dimensions	■ 1.50” x 4.24” x 5.25” ■ 3.81 cm x 10.77 cm x 13.34 cm
Weight	0.5 pounds
Antenna interface	1 antenna port - QMA connector
RF900 WPAN Wireless port	■ Provides access to 900 MHz mesh networks ■ Supports OFDM (up to 2400 Kb/s) and 2FSK (150 Kbp/s) modulations
Operating Temperature	Operating ambient temperature range (enclosed inside the CGR) is -40º F to 158º F (-40C to +70C).
Relative Humidity	5 to 95 percent non condensing
Altitude	10,000 ft (3,048 m) maximum operating temperature is derated with increasing altitude per IEEE1613a-2008

Table 3 Software Specifications

Item	Description
Software compatibility	IOS 15.7(3)M1 and above
PHY/MAC	■ IEEE 802.15.4g/e/v ■ IEEE 6LOWPAN (RFC 6282)
Management Information Bases (MIBs)	■ WPAN MIB ■ ENTITY MIB ■ IF MIB
Data rate	2400 kbps, 1200 kbps, 800 kbps, 400kbps, 200kbps, 150 kbps, 50 kbps

Kit Contents

Your CGM-WPAN OFDM-FCC module kit contains the module shown below. Captive screws on either side of the module secure the module to the CGR 1000 system.

Note: The CGM WPAN-OFDM-FCC module for the CGR 1000 Series routers is a field-replaceable unit (FRU).

Figure 1 Front Panel of the CGM-WPAN-OFDM-FCC Module



LEDs

Table 4 LEDs for CGM WPAN-OFDM-FCC

LED Name	Definition	State
RSSI	Measure of power present in the received radio signal.	Yellow (Off) / Green (Off): RSSI less than -105 dBm
		Yellow (On) / Green (Off): RSSI is -105 to -95 dBm
		Yellow (Off) / Green (Slow Blink): RSSI is -95 to -75 dBm
		Yellow (Off) / Green (Fast Blink): RSSI is -75 to -60 dBm
		Yellow (Off) / Green (Solid On): RSSI greater than -60 dBm
WPAN	WPAN traffic activity detect.	Yellow (Off) / Green (Off): WPAN port is disabled.
		Yellow (On) / Green (Off): Searching for network.
		Yellow (Off) / Green (Slow Blink): WPAN port is up.
		Yellow (Off) / Green (Fast Blink): Route is available and DHCPv6 configuration is starting.
		Yellow (Off) / Green (On): Global IPv6 address is available.
SYS	Indicates module status.	Green (Blinking): Broadcast slot time complete
		Yellow (Blinking): Bootload in process
		Yellow (Solid): Software update mode in process

Antenna

Supported antennas listed in the table below.

Cisco Part Number	Description
ANT-MP-INT-OUT-M	Multi-purpose integrated antenna, outdoor
ANT-LPWA-DB-O-N-5	Outdoor 5dBi Omni Antenna for 863-928 MHz WPAN, LoRaWAN, and ISM
ANT-WPAN-INT-OM-OUT-M	Omni antenna for 900 MHz WPAN, outdoor

For more details on the supported antennas, please refer to the document below:

Connected Grid Antennas Installation Guide

Installation Guidelines

Before you install the CGM-WPAN OFDM-FCC module in the CGR 1000 be sure to review the following guidelines:

CAUTION : Do not place anything on top of the router that weighs more than 10 pounds (4.5 kilograms), and do not stack routers on a desktop. Excessive weight on top of the router could damage the chassis.

CAUTION : Do not install the router or power supplies next to a heat source of any kind, including heating vents.

WARNING : Read the installation instructions before connecting the system to the power source. Statement 1004

WARNING : Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING : No user-serviceable parts inside. Do not open. Statement 1073

WARNING : Ultimate disposal of this product should be handled according to all national laws and regulations. Statement 1040

WARNING : Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

WARNING : This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Note: The WPAN module can be installed in any slot of the CGR 1120. You should only install the WPAN module in slot 4 of the CGR1240 due to the physical constraints of the short antenna cable for the integrated WPAN antenna and for adequate antenna isolation between WPAN and 3G cellular radios.

Before installing the CGM-WPAN-OFDM-FCC module, verify that the following guidelines have been met:

- For a CGR 1240: Install the WPAN module only in slot 4. (This is due to the physical constraints of the short antenna cable for the integrated WPAN antenna and to provide adequate antenna isolation between WPAN and 3G cellular radios.)
- For CGR 1120, you can install the CGM-WPAN-OFDM-FCC module in any slot.
- Clearance on the I/O side allows a clear view of the LED.
- Airflow around the module and through the vents is unrestricted.
- Temperature around the unit does not exceed 140 degrees F (60 degrees C). **Note**: If you install the WPAN module in a closed or multi-rack assembly, the temperature around it might be higher than normal room temperature.

- Relative humidity around the WPAN module does not exceed 95% (non-condensing).
- Altitude at the installation site is not higher than 10,000 feet.
- After replacing or installing a module in the router, you must update the label (on the router exterior) that lists the module types contained in the router. The label must list the FCC ID number and the IC Certification number for each module installed in the router. See Figure 1Front Panel of the CGM-WPAN-OFDM-FCC Module, page 5

Installing the Module

Note: Before you install or remove the CGM-WPAN-OFDM-FCC module within the host router, you must power down the router as described in either the Cisco 1120 Connected Grid Router Hardware Installation Guide or the Cisco 1240 Connected Grid Router Hardware Installation Guide.

CAUTION: The module CANNOT be hot swapped. To install the module, you must first power down the module.

Follow these steps to install the module in a supported and available slot in the CGR 1120 or CGR 1240:

1. Insert the WPAN module into a supported and available slot.
2. Using a screwdriver, screw both captive screws into place.

Removing the Module

Note: Before you install the WPAN module (or remove the module) within the host router, you must power down the router as described in either the Cisco 1120 Connected Grid Router Hardware Installation Guide or the Cisco 1240 Connected Grid Router Hardware Installation Guide.

Follow these steps to remove the WPAN module from a slot in the CGR 1120 or the CGR 1240:

1. Using a screwdriver, loosen the two captive screws on the WPAN module.
2. Gently pull the WPAN module out of the slot.

Software Configuration

Your CGR 1000 must be running Cisco IOS Release 15.7(3)M1 (cgr1000-universalk9-bundle.SPA.157-3.M1.bin) or greater to support the CGM WPAN-OFDM-FCC Module.

Note: Before you install the CGM-WPAN-OFDM-FCC module in your Resilient Mesh Network, please review the CGR 1000 and CGM-WPAN installation documents noted in the Introduction, page 2.

At the CGR 1000, configure the CGM-WPAN-OFDM-FCC Module interface using the Sample Configuration below as a guideline. The commands shown in **bold** type are new commands introduced to support the module. For syntax details, refer to Table 5 New CLI Interface commands for the CGM-WPAN-OFDM-FCC Module, page 8.

Sample Configuration

```
configure terminal
interface wpan 4/1 <---Where 4 is the slot and 1 is the port
no ip address
ip broadcast-address 0.0.0.0
no ip route-cache
ieee154 beacon-async min-interval 10 max-interval 20 suppression-coefficient 1
ieee154 dwell window 12400 max-dwell 400
ieee154 panid 106
```

```
ieee154 phy-mode 149
ieee154 ssid edgecompute-secure
ieee154 txpower 25
rpl storing-mode
rpl dag-lifetime
rpl dio-dbl 5
rpl dio-min 16
rpl version-incr-time 120
authentication host-mode multi-auth
authentication port-control auto
ipv6 address 2046:FACE::/64
ipv6 dhcp relay destination  2001:FACE::200
no ipv6 pim
```

Table 5 New CLI Interface commands for the CGM-WPAN-OFDM-FCC Module

Command	Definition
ieee154 phy-mode <64|96|66|98|144|146|147|149|150|192>	Defines the IEEE154 phy-mode. Possible options noted below, default value is 149.
	64: Rate=50 kb/s; Modulation=2FSK; Modulation Index=1.0; FEC=OFF; Channel Spacing=200 kHz
	96: Rate=50 kb/s; Modulation=2FSK; Modulation Index=1.0; FEC=ON; Channel Spacing=200 kHz
	66: Rate=150 kb/s; Modulation=2FSK; Modulation Index=0.5; FEC=OFF; Channel Spacing=400 kHz
	98: Rate=150 kb/s; Modulation=2FSK; Modulation Index=0.5; FEC=ON; Channel Spacing=400 kHz
	144: Rate=50 kb/s; Modulation=OFDM; Option=2; MCS=0; Channel Spacing=800 kHz
	146: Rate=200 kb/s; Modulation=OFDM; Option=2; MCS=2; Channel Spacing=800 kHz
	147: Rate=400 kb/s; Modulation=OFDM; Option=2; MCS=3; Channel Spacing=800 kHz
	149: Rate=800 kb/s; Modulation=OFDM; Option=2; MCS=5; Channel Spacing=800 kHz
	150: Rate=1200 kb/s; Modulation=OFDM; Option=2; MCS=6; Channel Spacing=800 kHz
	192: Rate=6.25 kb/s; Modulation=OQPSK; Chip Rate=100 kp/s; Rate Mode=0; Channel Spacing=200 kHz
ieee154 txpower <6 - 30 >	Enter a value between 6 and 30. The default is the maximum transmission power for the phymode.
[no] rpl dag-lifetime <15 - 255>	Enter a value between 15 and 255 minutes, where 120 is the default.
[no] rpl storing-mode	Enter command to enable RPL storing mode on the interface. Enter **no rpl storing-mode** to disable the command.

Related Documentation

Release Notes for Cisco Resilient Mesh Release 5.7.27

Related Documentation

Release Notes for Cisco Resilient Mesh Release 5.6.21

Cisco Connected Grid WPAN Module for CGR 1000 Series Installation and Cisco Resilient Mesh Configuration Guide (Cisco IOS)

Related Documentation