



Cisco Connected Grid 2G/3G/4G Multimode LTE GRWIC Installation and Configuration Guide

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Note The 2G/3G/4G LTE GRWICS discussed in this guide are **NOT supported after Cisco IOS 15.5.x and beyond.**

Note: A newer version of a 4G LTE module GRWIC is supported on the Cisco 2000 Series Connected Routers in Cisco IOS 15.8(3)M1. For more details, please refer to the:

[Release Notes for Cisco 2000 Series Connected Grid Routers and GRWIC-4G-LTE-EA and GRWIC-4G-LTE-LA Modules](#)

This document provides an overview of hardware and configuration information for Cisco Connected Grid 2G/3G/4G Multimode LTE (Long-Term Evolution) GRWIC, a single-wide grid router WAN interface card supported on Cisco 2010 Connected Grid Router (CGR).

- [Feature History, page 1](#)
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Feature History

[Table 1](#) lists the release history for this feature.

[Table 1](#) lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 1 Feature Information for 4G GRWIC

Feature Name	Releases	Feature Information
New modules options supported	15.5(3)M	Cisco CGR 1120 with CGM-4G-LTE-GA Cisco CGR 1240 with CGM-4G-LTE-GA Cisco CGR 1240 with CGM-4G-LTE-MNA
Multimode Long Term Evolution (LTE) Support for CGR	15.2(2)T	4G GRWIC supports 4G-LTE cellular and 3G cellular networks. 4G-LTE mobile specification provides multi-megabit bandwidth, more efficient use of the radio network, latency reduction, and improved mobility. This feature was introduced for the Cisco 2010 Connected Grid Router.

Features

The 4G GRWIC offers the following key features:

- Supports the Cisco 2010 Connected Grid Router
- Primary cellular WAN connection for critical data applications in support of the Cisco 2010 Connected Grid Router
- WAN connectivity as a backup datalink for critical data applications
- Sierra Wireless MC7750, MC7700, or MC7710 modems

The 4G GRWIC supports the following:

- IPv4 bearer
- MIPv4, NEMOv4
- IPv4 subnet behind LTE UE interface
- Enhanced High Rate Packet Data (eHRPD) for seamless handoff between LTE and 3G services
- Remote access to Qualcomm Diagnostic Monitor (DM) port
- OTA-DM including wireless configuration FOTA
- RFC 3025—Mobile IP vendor/organization on specific extension
- Single UICC (USIM)

Hardware Overview

The 4G GRWIC is a cellular modem interface card for the Cisco 2010 Connected Grid Router that provides a primary wireless WAN data link interface over a cellular network. It is a High-Speed Packet Access (HSPA) multiband, multiservice, single-wide GRWIC allowing transmission and distribution communication between utilities and substations through 4G technologies. The module is backward-compatible with previous generation technologies and frequency bands.

This section cover the following topics:

- [RF Specifications, page 3](#)
- [Multimode Modem, page 4](#)

- 3G, 1xRTT/1xEVDO, dual-band 800/1900 MHz

Multimode Modem

The 4G GRWIC comes with a Sierra Wireless multi-mode modem that provides the RF interface for the modem. The modem complies with PCI Express Mini Card Electromechanical Specification, revision 1.2. The hardware includes the following:

- Multiple LED indicates modem status, service, and signal strength
- A single Subscriber Identity Module (SIM)

The modem supports one of the following standards:

- **3G Evolution-Data Optimized (EVDO or DOrA) Mode**—EVDO is a 3G telecommunications standard for the wireless transmission of data through radio signals, typically for broadband Internet access. EVDO uses multiplexing techniques including code division multiple access (CDMA) as well as time division multiple access (TDMA) to maximize both individual users' throughput and the overall system throughput.
 - Code Division Multiple Access (CDMA) is a method of dividing a radio spectrum to be shared by multiple users through the assignment of unique codes. CDMA implements spread spectrum transmission.
 - Time Division Multiplex Access (TDMA) is a type of multiplexing where two or more channels of information are transmitted over the same link by allocating a different time interval ("slot" or "slice") for the transmission of each channel; that is, the channels take turns to use the link. Some kind of periodic synchronizing signal or distinguishing identifier usually is required so that the receiver can tell which channel is which.
- **4G-LTE**— Designated as a fourth-generation (4G) mobile specification, LTE is designed to provide multi-megabit bandwidth, more efficient use of the radio network, latency reduction, and improved mobility. This combination aims to enhance the subscriber's interaction with the network and further drive the demand for mobile multimedia services.

Sierra Wireless AirPrime MC7700, MC7750, and MC7710 modules each deliver up to 100 Mbps download speeds and 50 Mbps upload speeds (within 20 MHz bandwidth), integrated GPS capabilities, and support for both Linux and Windows.

Environmental Specifications

Table 2 lists the environmental specifics of the 4G GRWIC.

Table 2 *Environmental Specifications*

Environmental—Operational	Requirement
Temperature—long term	-13 to 140 degrees F (-25 to 60 degrees C)
Altitude	Up to 1500 meters
Humidity	RH95% non condensed
Vibration	1.0 g from 1.0 to 150 Hz
Shock	30 G half sine 6 ms and 11 ms
Seismic	GR63-Core, Zone 4

Power Specifications

4G GRWIC draws +10.8V, +5V and +3.3V from the host platform. The +10.8 V is used exclusively for the modem +3.3 V power requirement. The +3.3V is for the board I/O. The power sourcing of +10.8 V rail (5000 mW) from the host precludes the need for any onboard modem power storage. The +5 V from the host is used to create a +3.3 V I/O voltage for the CPU, FPGA, FLASH, analog Muxes and LEDs, as well as the +1.0 V CPU Core voltage.

Subscriber-Identity-Module (SIM) power is provided directly by the modem.

Table 3 and Table 4 list the power specification of the 4G GRWIC.

Table 3 *Voltage and Current Power Specifications*

Voltage (V)	Peak Current (mA)	Maximum Current (mA)	Typical Current (mA)
+5V	500 (*1)	(*1)	(*1)
Modem +3.3 V	3000	1100	800
+ 3.3 V	208	189	73
+ 3.0 V	66	60	40
+ 2.5 V	84	76	71
+ 1.8 V	1091	992	392
+ 1.2 V	757	688	352
+ 1.1 V	2244	2040	810

Table 4 *Power Specifications*

Peak Power (mW)	Maximum Power (mW)	Typical Power (mW)
18129	10732	5118

Memory Specifications

Table 5 lists the memory specifications of the 4G GRWIC.

Table 5 *Memory Specifications*

Memory Type	Minimum	Maximum
SPI FLASH for GRWIC	512KB	NA (512KB is sufficient for the design of the Uboot)
DDR2 SDRAM for GRWIC	1Gb (128 Mbytes)	NA (1GB is sufficient for the Linux SDK design and modem firmware upgrade)

Kit Contents

Cisco Connected Grid 2G/3G/4G Multimode LTE GRWIC is a customer-replaceable unit and can be ordered by referencing the following information.

Table 6 describes the Cisco 4G WWAN GRWIC product SKUs.

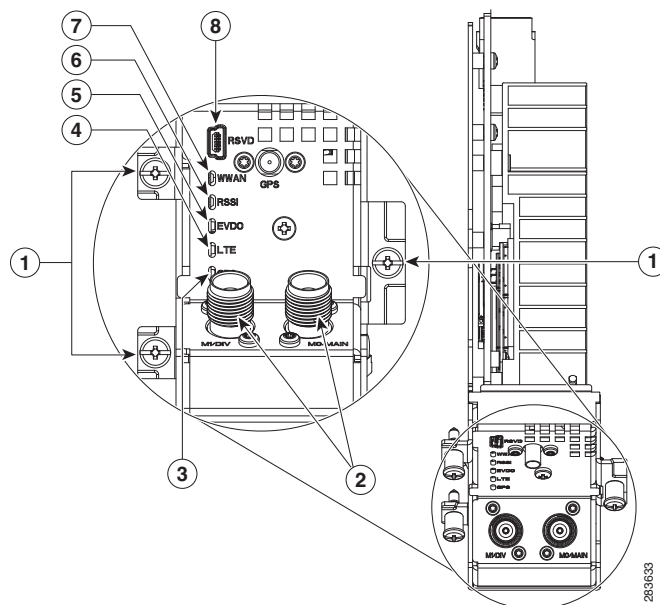
Table 6 Cisco 4G GRWIC by Mode, Operating Region, and Frequencies

Cisco 4G GRWIC	Modem	Standards
GRWIC-4G-LTE-V	MC7750	3GPP2: CDMAOne, 1xRTT, EVDO Rev0, EVDO RevA, LTE
GRWIC-4G-LTE-A	MC7700	GPRS, EDGE, W-CDMA, HSDPA, HSUPA, HSPA+, LTE
GRWIC-4G-LTE-G	MC7710	GPRS, EDGE, W-CDMA, HSDPA, HSUPA, HSPA+, LTE

Ports and LEDs

Figure 2 shows the GRWIC-4G-LTE front panel.

Figure 2 Front Panel of the Cisco GRWIC-4G-LTE



1	Mounting Screws	2	Antenna Connectors—M1/DIV, M0/MAIN
3	LED—GPS	4	LED—LTE
5	LED—EVDO	6	LED—RSSI
7	LED—WWAN	8	RSVD Port
9	Antenna Connector—GPS		

Table 7 lists the ports and the LED indicators and describes their behavior. The LEDs provide a visual indication of the available services.

Table 7 Cisco 4G GRWIC by Mode, Operating Region, and Frequencies

Port or LED	Description
RSVD	The RSVD (Reserved) port. Used as a diagnostic port not required for normal activation or operation. This port supports modem debug or provisioning. See Modem Troubleshooting, page 33 .
Antenna Connectors	<ul style="list-style-type: none"> ■ M1/DIV—Diversity antenna connector. ■ M0/MAIN—Main antenna connector. ■ GPS—GPS antenna connector. <p>For details, see Supported Cisco Antennas and Cables by Case, page 8.</p>
WWAN	<p>Indicates the GRWIC modem status.</p> <ul style="list-style-type: none"> ■ Off—Indicates the modem is in reset mode. <i>Wait for the process to complete.</i> ■ Solid green—Indicates the modem is receiving power and is associated and authenticated, but not receiving or transmitting data. ■ Fast green blinking—Indicates the activity is proportional to the transmitted and received data rate. ■ Slow green blinking—Indicates the modem is receiving power, is not associated or authenticated, and is searching for service. <i>Check the antenna, cable, SIM cards, or the user account with your service provider.</i> <p>For information on modem settings, see Modem Settings, page 33.</p>
RSSI	<p>Indicates the level of signal strength received by the GRWIC software.</p> <ul style="list-style-type: none"> ■ Off—Indicates the RSSI (Received Signal Strength Indication) is < -99 dBm. <i>Check the transmit channel, it is too weak.</i> ■ Solid green—Indicates high RSSI (> -69 dBm). ■ Medium green blinking—Indicates medium level RSSI (< -89 dBm to < -69 dBm). ■ Slow green blinking—Indicates low level RSSI (< -99 dBm to < -89 dBm). ■ Solid amber—Indicates no service is detected. <i>Relocate the equipment.</i>
EVDO	<p>Indicates whether HSDPA (High-Speed Downlink Packet Access) or EVDO (Evolution, Data Only) is in service.</p> <ul style="list-style-type: none"> ■ Off—Indicates neither HSDPA or EVDO services are in use. ■ Solid green—Indicates HSDPA is in service. ■ Blinking green—Indicates EVDO is in service.
LTE	Indicates whether LTE (Long-Term Evolution) is in service.
GPS	<p>Indicates whether GPS (Global Positioning System) is in service.</p> <ul style="list-style-type: none"> ■ Off—Indicates GPS is not active or not detected. ■ Solid green—GPS is active.

Supported Cisco Antennas and Cables by Case

Table 8 lists the Cisco antennas that are supported for use on the 4G GRWIC.

For more information about antennas, including installation procedures, refer to *Cisco Connected Grid Routers 2010 Hardware Installation Guide* at:

http://www.cisco.com/en/US/docs/routers/access/2000/CGR2010/hardware/installation/guide/CGR2010_HIG.html

Or the *Cisco CGR 1000 and 2000 Series Connected Grid Antennas Guide* at:

http://www.cisco.com/en/US/docs/routers/connectedgrid/antennas/installing/cg_antenna_install_guide.html

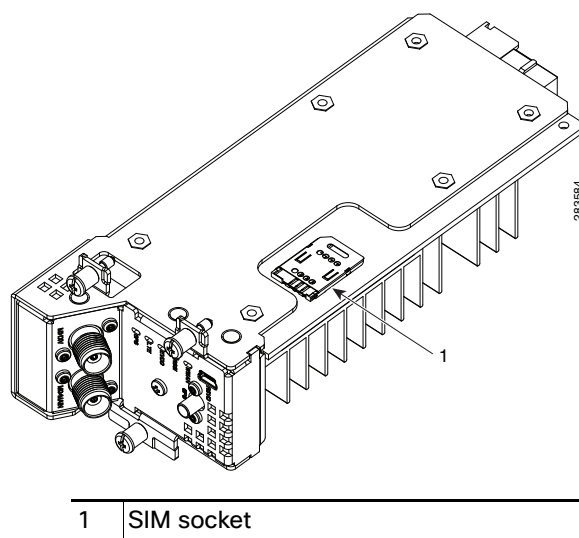
Table 8 4G GRWIC Supported Antennas

Case and Description	Indoor Cable	Lightning Arrestor	Outdoor Cable	Antenna
Conduit to antenna <ul style="list-style-type: none"> 4G radio module, TNC(f), quantity 2 20' cable through enclosure through conduit or boot Omnidirectional stick or flat-panel antenna 	RA-TNC(m) to N(m), LMR-400-FR, 20', quantity 2 <ul style="list-style-type: none"> CAB-L400-20-TNC-N 	None	Single cable passes through conduit from inside to outside building.	4G omnidirectional stick, standard performance, N(f), quantity 2 <ul style="list-style-type: none"> ANT-4G-OMNI-OUT-N 4G flat-panel antenna, N(f), quantity 1 <ul style="list-style-type: none"> ANT-4G-PNL-OUT-N
Conduit to Antenna <ul style="list-style-type: none"> 4G radio module, TNC(f), quantity 2 50' cable through enclosure through conduit or boot Omnidirectional stick or flat-panel antenna 	RA-TNC(m) to N(m), LMR-400-FR, 50', quantity 2 <ul style="list-style-type: none"> CAB-L400-50-TNC-N 	None	Single cable passes through conduit from inside to outside building.	4G omnidirectional stick, standard performance, N(f), quantity 2 <ul style="list-style-type: none"> ANT-4G-OMNI-OUT-N 4G flat-panel antenna, N(f), quantity 1 <ul style="list-style-type: none"> ANT-4G-PNL-OUT-N
Indoor swivel-mount dipole with 15' extension cable <ul style="list-style-type: none"> 4G radio module, TNC(f), quantity 2 15' coaxial cable with base Swivel-mount dipole 	Single-port antenna stand with 15' cable included, TNC(m) to TNC(m), quantity 2 <ul style="list-style-type: none"> CAB-L195-15-TNC 	None	None	4G indoor swivel-mount dipole, 0 dBi <ul style="list-style-type: none"> ANT-4G-DP-IN-TNC

Installing the SIM Card

The SIM card socket is located on the bottom side of the GRWIC as shown in Figure 3.

Figure 3 *Location of the SIM Socket*



Preventing Electrostatic Discharge Damage

Electrostatic Discharge (ESD) damage can occur when electronic cards or components are handled improperly, and can result in complete or intermittent failures.

To prevent ESD damage, follow these guidelines:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- Place a removed compact SIM card on an antistatic surface or in a static shielding bag. If the card will be returned to the factory, immediately place it in a static shielding bag.
- Avoid contact between the card and clothing. The wrist strap protects the card from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- Do not remove the wrist strap until the installation is complete.

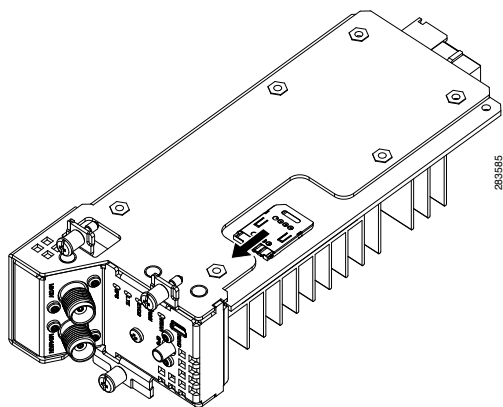
Warning **Only trained and qualified personnel should install, replace, or service this equipment.** Statement 1030

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).

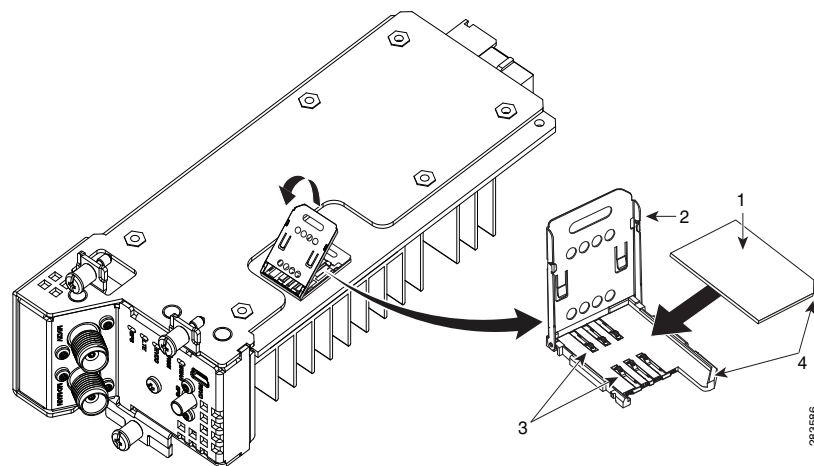
DETAILED STEPS

To install the SIM card:

- Step 1** Unlock the SIM socket cover, by sliding the cover towards the front of the module and in the direction of the unlock arrow.

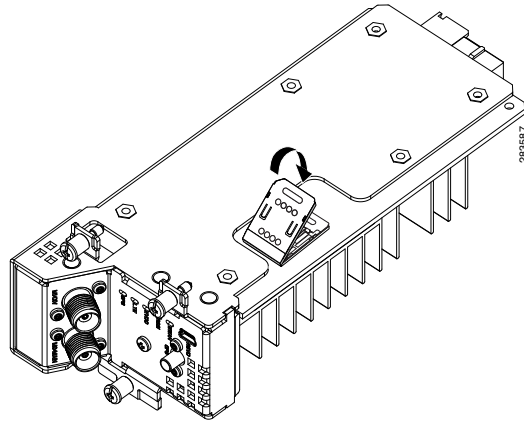


- Step 2** Open the cover and slide the SIM card into the slot in the cover.

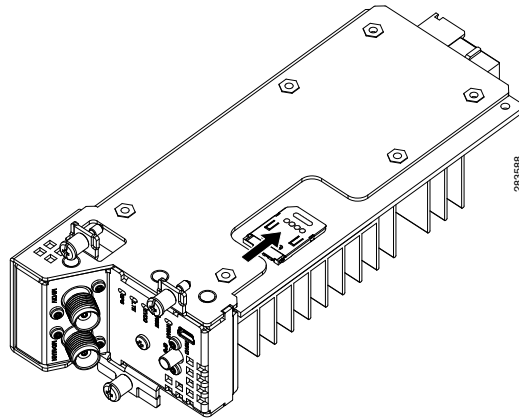


1	SIM card	2	Card slot
3	Metal contacts	4	Key

- Step 3** To close, gently push down on the socket cover. The SIM card will come in contact with the metal contacts in the socket.



- Step 4** Slide the cover away from the faceplate in the direction of the lock arrows to lock the cover.



Installing and Removing the Module

Some 4G GRWICs are installed into the host router at the factory.

Before You Begin Installation

Before installing the module, verify that the following guidelines have been met:

- Clearance to the I/O-side view is such that the LEDs can be easily read.
- Cabling is away from sources of electrical noise, such as radios, power lines, and fluorescent lighting fixtures. Make sure that the cabling is away from other devices that might damage the cables.
- Airflow around the switch module and through the vents is unrestricted.
- Temperature around the unit does not exceed 140°F (60°C). If the switch module is installed in a closed or multirack assembly, the temperature around it might be higher than normal room temperature.
- Relative humidity around the switch module does not exceed 95 percent (noncondensing).
- Altitude at the installation site is not higher than 10,000 feet.

- For 10/100 and 10/100/1000 fixed ports, cable lengths from the switch module to connected devices are not longer than 328 feet (100 meters).

Installation Warning Statements

This section includes the basic installation warning statements. Translations of these warning statements appear in the *Regulatory Compliance and Safety Information for Cisco Connected Grid Router 1000 Series Routers* documents.

- Warning** **This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security.**
Statement 1017
- Warning** **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030
- Warning** **To prevent the system from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of:**
140°F (60°C) Statement 1047
- Warning** **This equipment is supplied as “open type” equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool.**

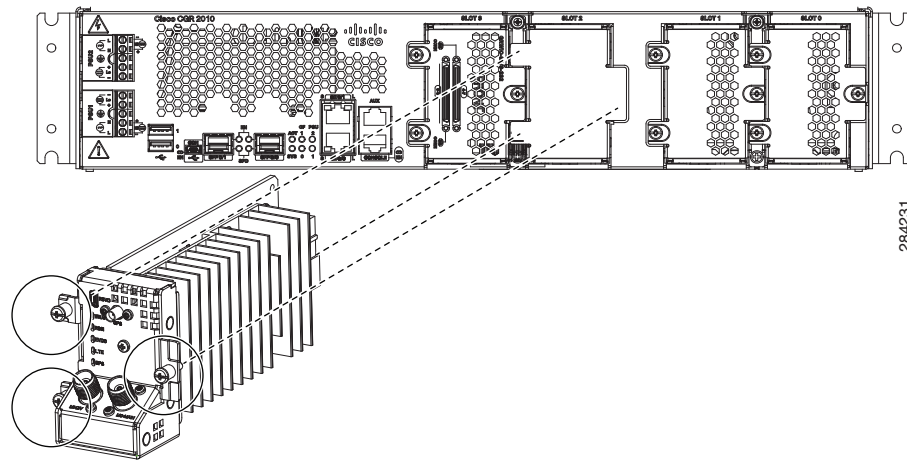
The enclosure must meet IP 54 or NEMA type 4 minimum enclosure rating standards. Statement 1063
- Warning** **This equipment is intended to be grounded to comply with emission and immunity requirements. Ensure that the switch functional ground lug is connected to earth ground during normal use.**
Statement 1064
- Warning** **To prevent airflow restriction, allow clearance around the ventilation openings to be at least: 1.75 in. (4.4 cm)** Statement 1076

Installing the Module

To install the module into an available slot in the router:

- Caution** The module can NOT be hot swapped—to install the module, you must first power down the module.
- Step 1** Before you install (or remove) the Cisco Connected Grid 3G module from the host CGR 1240 router, you must power down the router as described in the *Hardware Installation Guide* of your router.
- Step 2** Insert the module into the slot.

- Step 3** Using a screwdriver, secure the two captive screws into place. Tighten to 5 to 8 pound-force inches (lbf-in.).



Removing the Module

To remove the module from the router:

- Caution** The module can NOT be hot swapped—to install the module, you must first power down the module.
- Step 1** Using a screwdriver, loosen the two captive screws on the Cisco Connected Grid 3G module.
- Step 2** Gently pull the module out of the slot.

Installing the Antenna Cable

The swivel dipole antenna requires two LMR-400-DB TNC(m) to N(m) coaxial cables to connect to the female TNC connectors on the faceplate of the 4G GRWIC.

To install the cables, you will need a pair of needle-nose pliers.

- Step 1** Carefully position the male end of the cable connector over the female connector on the faceplate of the module so it aligns properly, i.e. directly on top of and in line with the female connector.
- Step 2** Hand tighten the connectors. It is important to begin tightening the connector by hand to properly align the connectors.
- Do not use a screwdriver on the body of the TNC connector, the screw head that is visible is not intended to be removed.
- Step 3** Use a pair of needle-nose pliers to tighten the connectors until they are nearly fully secured. Before the connectors are fully tightened, position the coaxial cables in their final desired positions, then proceed to fully tighten the connectors.
- Step 4** Tie-wrap the cables onto the cabinet and route toward the cable-entry point.

Be sure to adhere to the required bend radius of the cable.

Regulatory and Compliance Information

For regulatory compliance and safety information for the module, refer to the *Connected Grid Router 2000 Series Regulatory Compliance and Safety Information* document.

<http://www.cisco.com/en/US/docs/routers/access/2000/CGR2010/hardware/rcsi/rcsiCGR2000series.html>

Software Overview

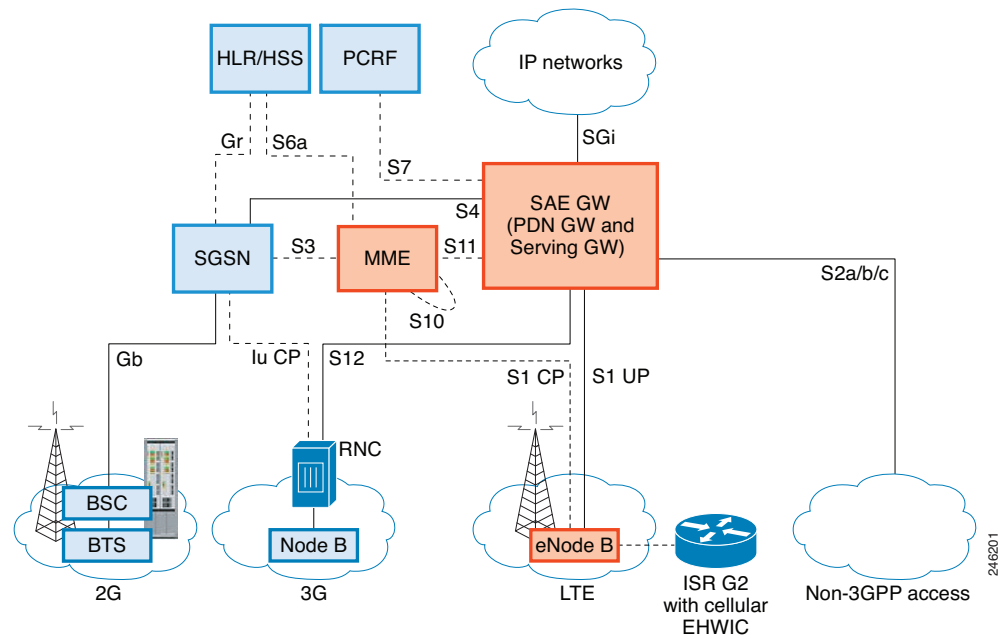
Cisco 4G Wireless WAN GRWICs operate over Fourth Generation (4G) Long-Term Evolution (LTE) cellular networks and Third Generation (3G) cellular networks.

Overview of 4G-LTE Networks

4G-LTE mobile specification provides multi-megabit bandwidth, more efficient use of the radio network, latency reduction, and improved mobility. LTE solutions target new cellular networks. These networks are designed to support up to 300 Mbps peak rates in the downlink and up to 75 Mbps peak rates in the uplink. The throughput of these networks is higher than the existing 3G networks.

[Figure 4](#) shows a 4G-LTE packet core network and the network elements it contains.

Figure 4 4G-LTE Packet Core Network Architecture



Legend	Description
Gateways	<p>Serving Gateway (SGW) routes and forwards user data packets while acting as the mobility anchor for the user plane, and as the anchor for mobility between LTE and other 3GPP (third-generation mobile) technologies</p> <p>The Packet Data Network (PDN) Gateway (PGW) provides connectivity from the User Equipment (UE) to external packet data networks by being the point of exit and entry of traffic for the UE.</p> <p>A UE may have simultaneous connectivity with more than one PGW for accessing multiple PDNs. The PGW performs policy enforcement, packet filtering for each user, charging support, lawful Interception and packet screening. Another key role of the PGW is to act as the anchor for mobility between 3GPP and non-3GPP technologies such as WiMAX and 3GPP2 (CDMA 1X and EvDO).</p>
RNC	<p>The Radio Network Controller (RNC) is responsible for controlling the Radio Access Network (RAN) that are connected to it. The RNC carries out radio resource management, some of the mobility management functions and is the point where encryption is done before user data is sent to and from the mobile. The RNC connects to the Circuit Switched Core Network through the Media Gateway (MGW).</p>
BTS	Base Transceiver Station
BSC	Base Station Controller
SGSN	Service GPRS Support Nnode

Configuring the Module

This section covers the following topics:

- [Prerequisites, page 16](#)
- [Configuration Restrictions, page 16](#)

- [Data Account Provisioning, page 16](#)
- [Verifying Signal Strength and Service Availability, page 16](#)
- [Data Call Setup, page 18](#)

Prerequisites

To configure the 4G GRWIC, you must meet the following requirements:

- Have 4G-LTE network coverage where your router will be physically located. For a complete list of supported carriers, see the product data sheet.
- Subscribe to a service plan with a wireless service provider and obtain a SIM card.
- Install the SIM card before configuring the 4G-LTE Wireless WAN GRWIC. For instructions on how to install the SIM card, see [Installing the SIM Card, page 8](#).

Configuration Restrictions

Be aware of the following restrictions that exist with a cellular network:

- Currently, cellular networks support only outgoing calls.
- Throughput—due to the shared nature of wireless communications, the experienced throughput varies depending on the number of active users or congestion in a given network.
- Cellular networks have higher latency compared to wired networks. Latency rates depend on the technology and carrier. Latency may be higher because of network congestion.
- Any restrictions that are a part of the terms of service from your carrier.

Data Account Provisioning

For 4G-LTE GRWICs, the numbering for Slot 0, wic 0 and port 0 is 0/0/0 for all commands.

To provision your modem, you must have an active wireless account with a service provider and a SIM card installed.

To provision your data account, see the following topics:

- [Verifying Signal Strength and Service Availability, page 16](#)
- [Configuring a Modem Data Profile, page 17](#)

Verifying Signal Strength and Service Availability

To verify the signal strength and service availability on your modem, use the following commands in privileged EXEC mode.

- **show cellular *slot/wic/port* network**
- **show cellular *slot/wic/port* radio**
- **show cellular *slot/wic/port* profile**
- **show cellular *slot/wic/port* security**
- **show cellular *slot/wic/port* all**

DETAILED STEPS

	Command	Purpose
Step 1	show cellular slot/wic/port network Example: router# show cellular 0/0/0 network	Displays information about the carrier network, cell site, and available service.
Step 2	show cellular slot/wic/port radio Example: router# show cellular 0/0/0 radio	Shows the radio signal strength. Note The RSSI should be better than -90 dBm for steady and reliable connection.
Step 3	show cellular slot/wic/port profile Example: router# show cellular 0/0/0 profile	Shows information about the modem data profiles created.
Step 4	show cellular slot/wic/port security Example: router# show cellular 0/0/0 security	Shows the security information for the modem, such as SIM and modem lock status.
Step 5	show cellular slot/wic/port all Example: router# show cellular 0/0/0 all	Shows consolidated information about the modem, profiles created, radio signal strength, network security, and so on.

Configuring a Modem Data Profile

To configure or create a new modem data profile, issue the command, **cellular slot/wic/port lte profile create profile-number apn authentication username password ipv4** in privileged EXEC mode. [Table 9](#) describes the command parameters.

Example:

```
router#cellular 0/0/0 profile create 2 apn.com chap username1 password1 ipv4
```

Table 9 *Modem Data Profile Parameters*

Environmental—Operational	Requirement
<i>profile-number</i>	Number for the profile you are creating. You can create upto 16 profiles.
<i>apn</i>	The Access Point Name provided by your service provider.
<i>protocol</i>	Network protocol: IPv4.
<i>authentication</i>	The type of authentication. For example, CHAP, PAP.
<i>username</i>	The username provided by your service provider.
<i>password</i>	The password provided by your service provider.

Data Call Setup

A data call is a call setup through a signaling protocol (for example, ISDN D Channel signaling) on the Public Switching Telephony Network (PSTN) to a Network Access Server (NAS) to transfer data, either as a byte stream (for example, terminal emulation) or in a packet format (for example, PPP packets) from a data terminal (such as a PC) to a data network (such as the Internet).

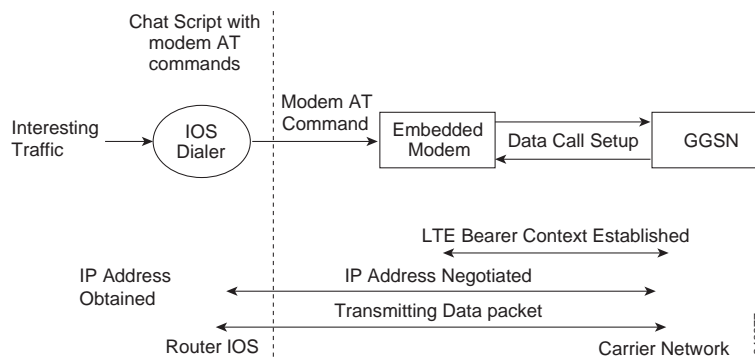
To verify data call setup, see, [Verifying Data Call Setup, page 30](#).

To set up a data call, use the following topics:

- [Configuring the Cellular Interface, page 18](#)
- [Configuring DDR \(Dial-on Demand Routing\), page 19](#)
- [Configuring DDR Backup, page 22](#)

Figure 5 shows a typical data call setup.

Figure 5 *Data Call Setup with the 4G GRWIC*



Configuring the Cellular Interface

To configure the cellular interface, enter the following commands starting in EXEC mode.

- **configure terminal**
- **interface cellular slot/wic/port**
- **encapsulation slip**
- **async mode interactive**
- **ip address negotiated** OR **ip address ip-address mask**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: router# configure terminal	Enters global configuration mode.
Step 2	interface cellular slot/wic/port Example: router(config)# interface cellular 0/0/0	Specifies the cellular interface.
Step 3	encapsulation slip Example: router(config-if)# encapsulation slip	Specifies Serial Line Internet Protocol (SLIP) encapsulation for an interface configured for dedicated asynchronous mode or dial-on-demand routing (DDR). This is the default for asynchronous interfaces.
Step 4	async mode interactive Example: router(config-if)# async mode interactive	Returns a line that has been placed into dedicated asynchronous network mode to interactive mode, thereby enabling the SLIP and PPP commands in privileged EXEC mode.
Step 5	ip address negotiated OR ip address ip-address mask Example: router(config-if)# ip address negotiated OR router(config-if)# ip address 10.4.0.254 255.255.0.0	Specifies that the IP address for a particular interface is dynamically obtained.

When a static IP address is required for the cellular interface, the address may be configured as **ip address negotiated**. The network ensures that the correct static IP address is allocated to the device. If a tunnel interface is configured with **ip unnumbered cellular 0/0/0**, it is necessary to configure the actual static IP address under the cellular interface, in place of **ip address negotiated**. For a sample cellular interface configuration, see the [“Basic Cellular Interface Configuration”](#) section on page 25.

Configuring DDR (Dial-on Demand Routing)

This section contains the commands to configure Dial-On-Demand Routing (DDR) for the cellular interface:

- **configure terminal**
- **interface cellular** *slot/wic/port*
- **dialer in-band**
- **dialer idle-timeout** *seconds*
- **dialer string** *string*
- **dialer-group** *group-number*
- **exit**
- **dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**}
- **access-list** *access-list-number* **permit** *ip-source-address*
- **line** *slot/wic/port*
- **script dialer** *regular-expression*
- **exit**
- **chat-script** *script-name* """ **AT!CALL***profile-number***#** **TIMEOUT** *timeout-value* **OK**"""
- **interface cellular** *slot/wic/port*
- **dialer string** *string*

Chat scripts are strings of text used to send commands for modem dialing, logging in to remote systems, and initializing asynchronous devices connected to an asynchronous line. On a router, chat scripts can be configured only on the auxiliary port.

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: <pre>router# configure terminal</pre>	Enters global configuration mode from the terminal.
Step 2	interface cellular <i>slot/wic/port</i> Example: <pre>router(config)# interface cellular 0/0/0</pre>	Specifies the cellular interface.
Step 3	dialer in-band Example: <pre>router(config-if)# dialer in-band</pre>	Enables DDR and configures the specified serial interface to use in-band dialing.
Step 4	dialer idle-timeout <i>seconds</i> Example: <pre>router(config-if)# dialer idle-timeout 30</pre>	Specifies the duration of idle time, in seconds, after which a line is disconnected.

	Command	Purpose
Step 5	dialer string <i>string</i> Example: <code>router(config-if)# dialer string lte</code>	Specifies the number or string to dial. Use the name of the chat script here.
Step 6	dialer-group <i>number</i> Example: <code>router(config-if)# dialer-group 1</code>	Specifies the number of the dialer access group to which the specific interface belongs.
Step 7	exit Example: <code>router(config-if)# exit</code>	Enters the global configuration mode.
Step 8	dialer-list <i>dialer-group protocol protocol-name {permit deny list access-list-number access-group}</i> Example: <code>router(config)# dialer-list 1 protocol ip list 1</code>	Creates a dialer list for traffic of interest and permits access to an entire protocol.
Step 9	access-list <i>access-list-number permit ip-source-address</i> Example: <code>router(config)# access-list 1 permit any</code>	Defines traffic of interest.
Step 10	line <i>slot/wic/port</i> Example: <code>router(config)# line 0/0/0</code>	Specifies the line configuration mode.
Step 11	script dialer <i>regular-expression</i> Example: <code>router(config-line)# script dialer lte</code>	Specifies a default modem chat script.
Step 12	exit Example: <code>router(config-line)# exit</code>	Exits line configuration mode.
Step 13	chat-script <i>script-name "" "AT!CALLprofile-number#" TIMEOUT timeout-value "OK"</i> Example: <code>router(config)# chat-script lte"" "AT!CALL2#" TIMEOUT 60 "OK"</code>	Defines the ATDT commands when the dialer is initiated.

	Command	Purpose
Step 14	interface cellular <i>slot/wic/port</i> Example: router(config)# interface cellular 0/0/0	Specifies the cellular interface.
Step 15	dialer string <i>string</i> Example: router(config-if)# dialer string lte	

Configuring DDR Backup

To monitor the primary connection and initiate the backup connection when needed, the router can use one of the following methods:

- **Backup Interface**—The backup interface stays in standby mode and is brought up when the primary interface line protocol is detected as down.
- **Dialer Watch**—Dialer watch is a backup feature that integrates dial backup with routing capabilities.
- **Floating Static Route**—The route through the backup interface is not in the routing table until the primary interface goes down because it has a greater administrative distance than that of the primary connection route.

Configuring Interfaces to Use a Backup Interface

You cannot configure a backup interface for the cellular interface and any other asynchronous serial interface.

To configure one or more interfaces to use a backup interface, use the following commands, beginning in global configuration mode.

SUMMARY STEPS

1. **interface** *type number*
2. **backup interface cellular** *number*
3. **backup delay** *enable-delay-period disable-delay-period*

DETAILED STEPS

	Command or Action	Purpose
Step 1	interface <i>type number</i> Example: router(config)# interface atm 0/0/0	Specifies the interface to be backed up and begins interface configuration mode.

	Command or Action	Purpose
Step 2	backup interface cellular <i>number</i> Example: <pre>router(config-if)# backup interface cellular 0/0/0</pre>	Specifies the cellular interface as backup.
Step 3	backup delay <i>enable-delay-period</i> <i>disable-delay-period</i> Example: <pre>router(config-if)# backup delay 0 10</pre>	Specifies delay between the physical interface going down and the backup interface being enabled, and between the physical interface coming back up and the backup being disabled.

Configuring DDR Backup Using Dialer Watch

To initiate dialer watch, you must configure the interface to perform DDR and backup. Use traditional DDR configuration commands, such as dialer maps, for DDR capabilities. To enable dialer watch on the backup interface and create a dialer list, use the following commands in interface configuration mode.

SUMMARY STEPS

1. **configure terminal**
2. **interface *type number***
3. **dialer watch group *group-number***
4. **exit**
5. **dialer watch-list *group-number* ip *ip-address* *address-mask***
6. **dialer-list *dialer-group* protocol *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**}**
7. **ip access-list *access-list-number* permit *ip-source-address***
8. **interface cellular *slot/wic/port***
9. **dialer string *string***

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>router# configure terminal</pre>	Enters global configuration mode from the terminal.
Step 2	interface <i>type number</i> Example: <pre>router(config)# interface cellular 0/0/0</pre>	Specifies the interface.

	Command or Action	Purpose
Step 3	dialer watch-group <i>group-number</i> Example: <code>router(config-if)# dialer watch-group 2</code>	Enables dialer watch on the backup interface.
Step 4	exit Example: <code>router(config-if)#exit</code>	
Step 5	dialer watch-list <i>group-number</i> ip <i>ip-address address-mask</i> Example: <code>router(config)# dialer watch-list 2 ip 10.4.0.254 255.255.0.0</code>	Defines a list of all IP addresses to be watched.
Step 6	dialer-list <i>dialer-group</i> protocol <i>protocol-name</i> { permit deny list <i>access-list-number</i> access-group } Example: <code>router(config)# dialer-list 2 protocol ip permit</code>	Creates dialer list for traffic of interest and permits access to an entire protocol.
Step 7	ip access-list <i>access list number</i> permit <i>ip source address</i> Example: <code>router(config)# access list 2 permit 10.4.0.0</code>	Defines traffic of interest. Note Do not use the access list permit all command to avoid sending traffic to the IP network. This may result in call termination.
Step 8	interface cellular <i>slot/wic/port</i> Example: <code>router(config)# interface cellular 0/0/0</code>	Specifies the cellular interface.
Step 9	dialer string <i>string</i> Example: <code>router(config-if)# dialer string lte</code>	Specifies the dialer script (defined using the chat script command).

Configuring DDR Backup Using Floating Static Route

To configure a floating static default route on the secondary interface beginning in the global configuration mode, perform the following tasks.

Make sure you have **ip classless** enabled on your router.

SUMMARY STEPS

1. configure terminal

2. ip route *network-number network-mask* {*ip-address* | *interface*} [*administrative distance*] [*name name*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode from the terminal.
Step 2	ip route network-number network-mask {ip-address interface} [administrative distance] [name name] Example: Router(config)# ip route 209.165.200.225 255.255.255.224 Dialer 2 253 name name1	Establishes a floating static route with the configured administrative distance through the specified interface. Note A higher administrative distance should be configured for the route through the backup interface, so that it is used only when the primary interface is down.

Configuration Examples

This section provides the following configuration examples:

- [Basic Cellular Interface Configuration, page 25](#)
- [Tunnel over Cellular Interface Configuration, page 26](#)
- [4G-LTE Wireless Modem as Backup with NAT and IPSec, page 26](#)

Basic Cellular Interface Configuration

The following example shows how to configure the cellular interface to be used as a primary and is configured as the default route:

```

router# show running-configuration
chat-script lte "" "AT!CALL1" TIMEOUT 20 "OK"

interface Cellular0/0/0
ip address negotiated
encapsulation slip
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer string lte
dialer-group 1
no peer default ip address
async mode interactive
routing dynamic

ip route 172.22.1.10 255.255.255.255 Cellular0/0/0

dialer-list 1 protocol ip permit

line 0/0/0
script dialer lte

```

```
modem InOut
no exec
transport input all
transport output all
```

Tunnel over Cellular Interface Configuration

The following example shows how to configure the static IP address when a tunnel interface is configured with **ip address unnumbered** *cellular interface*:

```
interface Tunnel2
 ip unnumbered Cellular0/3/0
 tunnel source Cellular0/3/0
 tunnel destination 128.107.x.y

interface Cellular0/3/0
 ip address negotiated
 ip virtual-reassembly
 encapsulation slip
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout 0
 dialer string dial<carrier>
 dialer-group 1
 async mode interactive

! traffic of interest through the tunnel/cellular interface
ip route 10.10.0.0 255.255.0.0 Tunnel2
```

4G-LTE Wireless Modem as Backup with NAT and IPSec

The following example shows how to configure the 4G-LTE wireless modem on the router as backup with NAT and IPSec:

The receive and transmit speeds cannot be configured. The actual throughput depends on the cellular network service.

```
ip dhcp excluded-address 10.4.0.254
!
ip dhcp pool gsmppool
 network 10.4.0.0 255.255.0.0
 dns-server 209.165.201.1 203.0.113.0
 default-router 10.4.0.254
!
!
chat-script lte "" "AT!CALL1" TIMEOUT 20 "OK"

crypto isakmp policy 1
 encr 3des
 authentication pre-share
crypto isakmp key address 192.0.2.0
!
!
crypto ipsec transform-set ah-sha-hmac esp-3des
!
crypto map gsm1 10 ipsec-isakmp
 set peer 192.0.2.0
 set transform-set
 match address 103
!
!
interface ATM0/0/0
 no ip address
```

```
ip virtual-reassembly
load-interval 30
no atm ilmi-keepalive
dsl operating-mode auto
!
interface ATM0/0/0.1 point-to-point
backup interface Cellular0/3/0
ip nat outside
ip virtual-reassembly
no snmp trap link-status
pvc 0/35
pppoe-client dial-pool-number 2
!
!
interface Cellular0/3/0
ip address negotiated
ip nat outside
ip virtual-reassembly
encapsulation slip
no ip mroute-cache
dialer in-band
dialer idle-timeout 0
dialer string
dialer-group 1
async mode interactive
crypto map gsm1
!

interface Vlan104
description used as default gateway address for DHCP clients
ip address 10.4.0.254 255.255.0.0
ip nat inside
ip virtual-reassembly
!
interface Dialer2
ip address negotiated
ip mtu 1492
ip nat outside
ip virtual-reassembly
encapsulation ppp
load-interval 30
dialer pool 2
dialer-group 2
ppp authentication chap callin
ppp chap hostname cisco@dsl.com
ppp chap password 0 cisco
ppp ipcp dns request
crypto map gsm1
!
ip local policy route-map track-primary-if
ip route 209.165.200.225 255.255.255.224 Dialer2 track 234
ip route 209.165.200.225 255.255.255.224 Cellular0/3/0 254
!
!
ip nat inside source route-map nat2cell interface Cellular0/3/0 overload
ip nat inside source route-map nat2dsl interface Dialer2 overload
!
ip sla 1
icmp-echo 209.131.36.158 source-interface Dialer2
timeout 1000
frequency 2
ip sla schedule 1 life forever start-time now
access-list 1 permit any
```

```
access-list 2 permit 10.4.0.0 0.0.255.255
access-list 3 permit any
access-list 101 permit ip 10.4.0.0 0.0.255.255 any
access-list 102 permit icmp any host 209.131.36.158
access-list 103 permit ip host 198.51.100 209.165.200.224 0.0.255.255
access-list 103 permit ip host 203.0.113.254 209.165.200.124 0.0.255.255
dialer-list 1 protocol ip list 1
dialer-list 2 protocol ip permit
!
!
route-map track-primary-if permit 10
  match ip address 102
  set interface Dialer2
!
route-map nat2dsl permit 10
  match ip address 101
  match interface Dialer2
!
route-map nat2cell permit 10
  match ip address 101
  match interface Cellular0/3/0
!

line 0/3/0
  exec-timeout 0 0
  script dialer dial
  login
  modem InOut
```

SNMP MIBs

The following MIBs are supported on the Cisco Connected Grid 2G/3G/4G Multimode LTE GRWIC:

- IF-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB
- CISCO-WAN-3G-MIB

You can download the MIBs from the Cisco MIB Locator at <http://www.cisco.com/go/mibs>.

This section provides a brief description of SNMP MIBs and contains the following topics:

- [SNMP Requirements, page 28](#)
- [SNMP MIB Overview, page 29](#)
- [MIB Links, page 29](#)

SNMP Requirements

The following are SNMP-related requirements for the 4G GRWIC:

- If your router runs the SNMP agent, you must configure appropriate access control (e.g. SNMP-server community) using the Cisco IOS CLI for the NMS (Network Management System) and agent to work properly.
- Cisco strongly recommends that you configure SNMP V3 with authentication/privacy when implementing SNMP SET operation.

SNMP MIB Overview

Simple Management Network Protocol (SNMP) development and its use is centered around the Management Information Base (MIB). An SNMP MIB is an abstract database, a conceptual specification for information that a management application may read and modify in a certain form. This does not imply that the information is kept in the managed system in that same form. The SNMP agent translates between the internal data structures and formats of the managed system and the external data structures and formats defined for the MIB.

The SNMP MIB is a tree structure with conceptual tables. (Cisco 4G MIB is discussed in detail in the next section.) Relative to this tree structure, the term MIB is used in two senses. In one sense, it is actually a MIB branch, usually containing information for a single aspect of technology, such as a transmission medium or a routing protocol. A MIB used in this sense is more accurately called a MIB module, and is usually defined in a single document. In the other sense, a MIB is a collection of such branches. Such a collection might comprise, for example, all the MIB modules implemented by a given agent, or the entire collection of MIB modules defined for SNMP.

A MIB is a tree where the leaves are individual items of data called objects. An object may be, for example, a counter or a protocol status. MIB objects are also sometimes called variables.

MIBs can be classified into three categories:

- **IF MIBs**—Describes interface statistics
- **Cisco-Entity-Vendortype-OID-MIB**—ENTITY-MIBs are used to provide general hardware type for both the HWIC and the modem. CISCO-ENTITY-VENDORTYPE-OID-MIB assigns OIDs for Cisco components (including the HWICs & the modems). The OIDs are then used as the values of entPhysicalVendorType in the ENTITY-MIB.
- **3G/Wireless MIBs**—Cellular or wireless-specific MIBs

MIB Links

To locate and download the following MIBs for selected platforms, Cisco software releases, and feature sets, search the MIB name in Cisco MIB Locator found at: <http://www.cisco.com/go/mibs>

- IF-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB
- CISCO-WAN-3G-MIB

Troubleshooting and Diagnostics

This section provides the necessary background information and resources available for troubleshooting the Cisco Cisco Connected Grid 2G/3G/4G Multimode LTE GRWIC.

For LED descriptions, see [Ports and LEDs, page 6](#).

- [Verifying Data Call Setup, page 30](#)
- [Checking Signal Strength, page 30](#)
- [Verifying Service Availability, page 30](#)
- [Successful Call Setup, page 32](#)
- [Modem Troubleshooting, page 33](#)
- [Modem Settings, page 33](#)
- [Retrieving the Electronic Serial Number \(ESN\), page 35](#)

- [Converting Hexadecimal ESN to Decimal Notation, page 36](#)

Verifying Data Call Setup

To verify the data call setup, follow these steps:

- Step 1** After you create a modem data profile **cellular profile create** command and configuring DDR on the cellular interface, send a ping from the router to a host across the wireless network.
- Step 2** If the ping fails, debug the failure by using the following **debug** and **show** commands:
- **debug chat**
 - **debug dialer**
 - **debug ppp negotiation**
 - **show cellular all**
 - **show interface cellular**
 - **show running-config**
 - **show ip route**
- Step 3** Save the output from these commands and contact your system administrator.

Checking Signal Strength

If the Received Signal Strength Indication (RSSI) level is very low (for example, if it is less than -110 dBm) follow these steps:

- Step 1** Check the antenna connection. Make sure the TNC connector is correctly threaded and tightened.
- Step 2** If you are using a remote antenna, move the antenna cradle and check if the RSSI has improved.
- Step 3** Contact your wireless service provider to verify that there is service availability in your area.

Verifying Service Availability

The following is sample **show cellular all** command output for a scenario where the antenna is disconnected and a modem data profile has not been created. The errors in this case have been indicated with the symbols “<---”:

```
router# show cellular 0/0/0 all
Load for five secs: 0%/0%; one minute: 0%; five minutes: 1%
Time source is hardware calendar, 19:40:43.239 UTC Wed Nov 8 2006

Hardware Information
=====
Modem Firmware Version = H1_0_0_7MCPAP G:/WS/
Modem Firmware built = 10/26/06
Hardware Version = 1.0
International Mobile Subscriber Identity (IMSI) = <specific sim number>
International Mobile Equipment Identity (IMEI) = <specific modem number>
Factory Serial Number (FSN) = X2819460388100D
Modem Status = Online
Current Modem Temperature = 38 deg C, State = Normal

Profile Information
=====
* - Default profile <-- No profile here.
```

Data Connection Information

=====

Profile 1, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 2, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 3, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 4, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 5, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 6, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 7, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 8, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 9, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 10, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 11, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 12, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 13, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 14, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 15, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state
Profile 16, Packet Session Status = INACTIVE
Inactivity Reason = Normal inactivate state

Network Information

=====

Current Service Status = No service, Service Error = None <-- No service means there is no connection to the network.
Current Service = Combined
Packet Service = None
Packet Session Status = Inactive
Current Roaming Status = Home
Network Selection Mode = Automatic
Country = USA, Network = Cinglr
Mobile Country Code (MCC) = 310
Mobile Network Code (MNC) = 380
Location Area Code (LAC) = 6042
Routing Area Code (RAC) = 255
Cell ID = 0
Primary Scrambling Code = 0
PLMN Selection = Automatic

Radio Information

=====

Current Band = None, Channel Number = 0
Current RSSI = -110 dBm <-- Either no antenna is present, non-functional, or out of network.

Modem Security Information

=====

Card Holder Verification (CHV1) = Disabled
SIM Status = OK

```
SIM User Operation Required = None
Number of Retries remaining = 3
```

Successful Call Setup

The following sample output was taken when a call was set up using a chat script. It shows a received IP address from the network. Call setup is successful, and data path is open.

```
debug modem
debug chat
debug ppp negotiation
debug ppp event
debug ppp error

router#
Nov  8 20:04:42.295: CHAT0/3/0: Attempting async line dialer script
Nov  8 20:04:42.295: CHAT0/3/0: Dialing using Modem script: <carrier> & System script: none
Nov  8 20:04:42.299: CHAT0/3/0: process started
Nov  8 20:04:42.299: CHAT0/3/0: Asserting DTR
Nov  8 20:04:42.299: CHAT0/3/0: Chat script <carrier> started <--- chat script invoked
Nov  8 20:04:42.299: CHAT0/3/0: Sending string: atdt*98*1#
Nov  8 20:04:42.299: CHAT0/3/0: Expecting string: CONNECT
Nov  8 20:04:42.343: CHAT0/3/0: Completed match for expect: CONNECT
Nov  8 20:04:42.343: CHAT0/3/0: Chat script <carrier> finished, status = Success <--- successful
communication with modem
Nov  8 20:04:42.395: TTY0/3/0: no timer type 1 to destroy
Nov  8 20:04:42.395: TTY0/3/0: no timer type 0 to destroy
Nov  8 20:04:42.395: TTY0/3/0: no timer type 2 to destroy
Nov  8 20:04:44.395: %LINK-3-UPDOWN: Interface Cellular0/3/0, changed state to up
Nov  8 20:04:44.395: Ce0/3/0 PPP: Using dialer call direction
Nov  8 20:04:44.395: Ce0/3/0 PPP: Treating connection as a callout
Nov  8 20:04:44.395: Ce0/3/0 PPP: Session handle[7E000089] Session id[46]
Nov  8 20:04:44.395: Ce0/3/0 PPP: Phase is ESTABLISHING, Active Open
Nov  8 20:04:44.395: Ce0/3/0 PPP: No remote authentication for call-out
Nov  8 20:04:44.395: Ce0/3/0 LCP: O CONFREQ [Closed] id 75 len 16
Nov  8 20:04:44.395: Ce0/3/0 LCP:   ACCM 0x000A0000 (0x0206000A0000)
Nov  8 20:04:44.395: Ce0/3/0 LCP:   MagicNumber 0x179E8E46 (0x0506179E8E46)
Nov  8 20:04:44.395: Ce0/3/0 LCP: I CONFREQ [REQsent] id 83 len 25
Nov  8 20:04:44.395: Ce0/3/0 LCP:   ACCM 0x00000000 (0x020600000000)
Nov  8 20:04:44.395: Ce0/3/0 LCP:   AuthProto CHAP (0x0305C22305)
Nov  8 20:04:44.395: Ce0/3/0 LCP:   MagicNumber 0x374C7C61 (0x0506374C7C61)
Nov  8 20:04:44.395: Ce0/3/0 LCP:   PFC (0x0702)
Nov  8 20:04:44.395: Ce0/3/0 LCP:   ACFC (0x0802)
Nov  8 20:04:44.395: Ce0/3/0 LCP: O CONFREQ [REQsent] id 83 len 8
Nov  8 20:04:44.395: Ce0/3/0 LCP:   PFC (0x0702)
Nov  8 20:04:44.395: Ce0/3/0 LCP:   ACFC (0x0802)
Nov  8 20:04:44.399: Ce0/3/0 LCP: I CONFACK [REQsent] id 75 len 16
Nov  8 20:04:44.399: Ce0/3/0 LCP:   ACCM 0x000A0000 (0x0206000A0000)
Nov  8 20:04:44.399: Ce0/3/0 LCP:   MagicNumber 0x179E8E46 (0x0506179E8E46)
Nov  8 20:04:44.399: Ce0/3/0 LCP: I CONFREQ [ACKrcvd] id 84 len 21
Nov  8 20:04:44.399: Ce0/3/0 LCP:   ACCM 0x00000000 (0x020600000000)
Nov  8 20:04:44.399: Ce0/3/0 LCP:   AuthProto CHAP (0x0305C22305)
Nov  8 20:04:44.399: Ce0/3/0 LCP:   MagicNumber 0x374C7C61 (0x0506374C7C61)
Nov  8 20:04:44.399: Ce0/3/0 LCP: O CONFACK [ACKrcvd] id 84 len 21
Nov  8 20:04:44.399: Ce0/3/0 LCP:   ACCM 0x00000000 (0x020600000000)
Nov  8 20:04:44.399: Ce0/3/0 LCP:   AuthProto CHAP (0x0305C22305)
Nov  8 20:04:44.399: Ce0/3/0 LCP:   MagicNumber 0x374C7C61 (0x0506374C7C61)
Nov  8 20:04:44.399: Ce0/3/0 LCP: State is Open
Nov  8 20:04:44.399: Ce0/3/0 PPP: Phase is AUTHENTICATING, by the peer
Nov  8 20:04:44.403: Ce0/3/0 CHAP: I CHALLENGE id 1 len 35 from "UMTS_CHAP_SRVR"
Nov  8 20:04:44.403: Ce0/3/0 CHAP: Using hostname from interface CHAP
```



```

Nov  8 20:04:44.403: Ce0/3/0 CHAP: Using password from interface CHAP
Nov  8 20:04:44.403: Ce0/3/0 CHAP: O RESPONSE id 1 len 40 from "<username configured on the cellular
interface>"
Nov  8 20:04:44.407: Ce0/3/0 CHAP: I SUCCESS id 1 len 4
Nov  8 20:04:44.407: Ce0/3/0 PPP: Phase is FORWARDING, Attempting Forward
Nov  8 20:04:44.407: Ce0/3/0 PPP: Phase is ESTABLISHING, Finish LCP
Nov  8 20:04:44.407: Ce0/3/0 PPP: Phase is UP

<-- Password Authentication Protocol (PAP), and the Challenge Handshake Authentication Protocol (CHAP)
succeeded.

Nov  8 20:04:44.407: Ce0/3/0 IPCP: O CONFREQ [Closed] id 1 len 22
Nov  8 20:04:44.407: Ce0/3/0 IPCP:   Address 0.0.0.0 (0x030600000000)
Nov  8 20:04:44.407: Ce0/3/0 IPCP:   PrimaryDNS 0.0.0.0 (0x810600000000)
Nov  8 20:04:44.407: Ce0/3/0 IPCP:   SecondaryDNS 0.0.0.0 (0x830600000000)
Nov  8 20:04:44.407: Ce0/3/0 PPP: Process pending ncp packets
Nov  8 20:04:45.411: Ce0/3/0 IPCP: I CONFNAK [REQsent] id 1 len 16
Nov  8 20:04:45.411: Ce0/3/0 IPCP:   PrimaryDNS 10.11.12.13 (0x81060A0B0C0D)
Nov  8 20:04:45.411: Ce0/3/0 IPCP:   SecondaryDNS 10.11.12.14 (0x83060A0B0C0E)
Nov  8 20:04:45.411: Ce0/3/0 IPCP: O CONFREQ [REQsent] id 2 len 22
Nov  8 20:04:45.411: Ce0/3/0 IPCP:   Address 0.0.0.0 (0x030600000000)
Nov  8 20:04:45.411: Ce0/3/0 IPCP:   PrimaryDNS 10.11.12.13 (0x81060A0B0C0D)
Nov  8 20:04:45.411: Ce0/3/0 IPCP:   SecondaryDNS 10.11.12.14 (0x83060A0B0C0E)
Nov  8 20:04:45.459: Ce0/3/0 IPCP: I CONFREQ [REQsent] id 25 len 4
Nov  8 20:04:45.459: Ce0/3/0 IPCP: O CONFACK [REQsent] id 25 len 4
Nov  8 20:04:45.459: Ce0/3/0 IPCP: I CONFNAK [ACKsent] id 2 len 22
Nov  8 20:04:45.459: Ce0/3/0 IPCP:   Address 166.138.186.119 (0x0306A68ABA77)
Nov  8 20:04:45.459: Ce0/3/0 IPCP:   PrimaryDNS 66.102.163.231 (0x81064266A3E7)
Nov  8 20:04:45.459: Ce0/3/0 IPCP:   SecondaryDNS 66.102.163.232 (0x83064266A3E8)
Nov  8 20:04:45.459: Ce0/3/0 IPCP: O CONFREQ [ACKsent] id 3 len 22
Nov  8 20:04:45.459: Ce0/3/0 IPCP:   Address 166.138.186.119 (0x0306A68ABA77)
Nov  8 20:04:45.459: Ce0/3/0 IPCP:   PrimaryDNS 66.102.163.231 (0x81064266A3E7)
Nov  8 20:04:45.459: Ce0/3/0 IPCP:   SecondaryDNS 66.102.163.232 (0x83064266A3E8)
Nov  8 20:04:45.463: Ce0/3/0 IPCP: I CONFACK [ACKsent] id 3 len 22
Nov  8 20:04:45.463: Ce0/3/0 IPCP:   Address 166.138.186.119 (0x0306A68ABA77)
Nov  8 20:04:45.463: Ce0/3/0 IPCP:   PrimaryDNS 66.102.163.231 (0x81064266A3E7)
Nov  8 20:04:45.463: Ce0/3/0 IPCP:   SecondaryDNS 66.102.163.232 (0x83064266A3E8)
Nov  8 20:04:45.463: Ce0/3/0 IPCP: State is Open
Nov  8 20:04:45.463: Ce0/3/0 IPCP: Install negotiated IP interface address 166.138.186.119

```

Modem Troubleshooting

The RSVD port on the faceplate of the 4G GRWIC provides access to the debug port on the modem. Use an industry-standard diagnostic tool like Qualcomm QXDM to perform remote radio-level diagnostics and traffic monitoring on the modem.

Use the following test command to turn diagnostics on:

```
router# test cell-hwic slot/port/wic dm-port on
```

To enable test commands, you must enter the **service internal** command in the global configuration mode.

Modem Settings

For HWIC-3G- deployments in North America and for carriers operating in the 850MHz and 1900 MHz bands, you can prevent long network attach times by making the following changes to the modem settings.

The output of **show cellular x/x/x all** command shows the following:

- No network attach

- RSSI value is -110 dB
- Band selection is set to AUTO

For information on troubleshooting the modem, see [Modem Troubleshooting, page 33](#).

Changing Modem Settings

To change the modem settings to force the modem to scan NA (North American) bands only, follow these steps:

Step 1 Change the PRL region to '2' (the default is 1). To do this, follow the procedure in [“Changing the PRL Region on the Modem”](#) section.

Step 2 Set the band to WCDMA/ NA using the following Cisco IOS command:

```
router# cellular 0/0/0 band wcdma--na
```

Prerequisites

Before you change the PRL (Preferred Roaming List) region, you must ensure that:

- The interface is in a shutdown mode before the chat-script is executed.
- Interface is un-shut for normal operation after the chat-script is executed.
- You must run the chat-script only once.

Changing the PRL Region on the Modem

To change the PRL region on the modem, follow these steps:

Step 1 Go to the configuration mode of the router and configure the PRL change chat-script. The following is an example using “prl” as the name of the chat script and “02” specifying the PRL region:

```
router# configure terminal
Router(config)# chat-script prl "" "at" TIMEOUT 5 "OK" AT!ENTERCND="A710" TIMEOUT 5 "OK"
AT!CUSTOM="PRLREGION",02 TIMEOUT 5 "OK" "AT!RESET"
```

The entire chat script command must be entered in one line. Copy and paste it from this document to avoid typing errors.

Step 2 Shut down the cellular interface by entering the **shut** command in the configuration mode:

In the following example, 0/0/0 is a sample interface number. Replace it with the correct interface number based on the slot in which the 3G HWIC is plugged in.

```
Router(config)# interface cellular 0/0/0
Router(config-if)# shutdown
```

Step 3 Exit the configuration mode.

```
Router(config-if)# exit
```

Step 4 To execute the chat-script, enter the **start-chat prl** command. In the following example, “prl” is the name of the chat script and 0/0/0 is the corresponding slot/port number that the cellular HWIC is plugged into.

```
Router# start-chat prl 0/0/0
```

Enabling "debug chat" and monitoring the console logs will indicate whether the chat-script executed successfully. For example,

```
Router# configure terminal
Router(config)# logging enable
Router(config)# exit
Router# debug chat
```

Step 5 Un-shut the cellular interface once the chat-script is over by entering the **no shut** command in the configuration mode:

```
Router# configure terminal
Router(config)# interface cellular 0/0/0
Router(config-if)# no shutdown
```

Below is a sample output after the debugs are enabled for a successful PRL change after invoking the chat-script:

```
Router# start-chat prl 0/3/0
Router#
*May 8 11:01:04.598: CHAT0/3/0: Matched chat script prl to string prl
*May 8 11:01:04.598: CHAT0/3/0: Asserting DTR
*May 8 11:01:04.598: CHAT0/3/0: Chat script prl started
*May 8 11:01:04.598: CHAT0/3/0: Sending string: at
*May 8 11:01:04.598: CHAT0/3/0: Expecting string: OK
*May 8 11:01:04.638: CHAT0/3/0: Completed match for expect: OK
*May 8 11:01:04.638: CHAT0/3/0: Sending string: AT!ENTERCND="A710"
*May 8 11:01:04.638: CHAT0/3/0: Expecting string: OK
*May 8 11:01:04.650: CHAT0/3/0: Completed match for expect: OK
*May 8 11:01:04.650: CHAT0/3/0: Sending string: AT!CUSTOM="PRLREGION",02
*May 8 11:01:04.650: CHAT0/3/0: Expecting string: OK
*May 8 11:01:04.682: CHAT0/3/0: Completed match for expect: OK
*May 8 11:01:04.682: CHAT0/3/0: Sending string: AT!RESET
*May 8 11:01:04.682: CHAT0/3/0: Expecting string: OK
*May 8 11:01:04.690: CHAT0/3/0: Completed match for expect: OK
*May 8 11:01:04.690: CHAT0/3/0: Chat script prl finished, status = Success
*May 8 11:01:05.374: %CELLWAN-2-MODEM_DOWN: Cellular0/3/0 modem is DOWN
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface cellular 0/0/0
Router(config-if)#no shut
*May 9 01:48:58.398: %LINK-5-CHANGED: Interface Cellular0/0/0, changed state to up
Router(config-if)#exit
Router(config)#exit
Router#
```

Retrieving the Electronic Serial Number (ESN)

If your network provider requests the 11-digit decimal equivalent of your ESN, you must retrieve your ESN, then convert it to decimal notation. See also, [Converting Hexadecimal ESN to Decimal Notation](#), page 36.

The ESN number is located directly on the modem label in hexadecimal notation. It can also be retrieved using the Cisco IOS CLI using the **show cellular all** command.

The sample output below shows the ESN number:

```
Profile Information
=====
Electronic Serial Number (ESN) = 0x603C9854
```

Converting Hexadecimal ESN to Decimal Notation

If your network provider requests the 11-digit decimal equivalent of your ESN, you must retrieve your ESN, then convert it to decimal notation. See also, [Retrieving the Electronic Serial Number \(ESN\)](#), page 35.

To convert the ESN number from hexadecimal notation to decimal notation, follow this procedure:

Step 1 Start with the 8-digit HEX ESN # obtained from the label or using CLI, for example 0x603C9854. This number consists of two parts:

- 0x60—Serial number
- 3C9854—Manufacturer's code

Step 2 Convert manufacturer's code to decimal as shown:

Hexadecimal 0x60 equals decimal 96.

If the decimal value is two digits only, prepend it with a zero to expand it to three digits.

Manufacturer's code is thus 096.

Step 3 Convert the serial number to decimal, as shown in the example below:

Hexadecimal 0x3C9854 equals decimal 3971156.

If decimal value is less than 8 digits, add enough zeros to make it into an 8 digit number.

Serial number is thus 03971156.

Step 4 To obtain complete 11-digit decimal ESN notation, combine manufacturer code and serial number:

Manufacturer code: 096

Serial #: 03971156

Decimal ESN: 09603971156

Additional References

This section provides a brief description of SNMP MIBs and contains the following topics:

- [Related Documents](#), page 36
- [RFCs](#), page 37
- [Technical Assistance](#), page 37

Related Documents

Consult the following resources for related information about the 4G GRWIC or for technical assistance.

Hardware Overview and Installation

- *For Cisco Connected Grid Modules datasheets and other literature, see:*

http://www.cisco.com/en/US/products/ps10984/prod_module_series_home.html

Supported Cisco Antennas and Accessories

- *Connected Grid Modules, Antennas, and Accessories Hardware Documentation Roadmap*
www.cisco.com/go/cg-modules
- *Cisco 4G/3G Omnidirectional Dipole Antenna (4G-LTE-ANTM-D)*
http://preview.cisco.com/en/US/docs/routers/access/wireless/hardware/notes/4G3G_ant.html
- *Cisco 3G Omnidirectional Outdoor Antenna (3G-ANTM-OUT-OM)*
<http://www.cisco.com/en/US/docs/routers/access/wireless/hardware/notes/ant3gom.html>
- *Cisco Multiband Omnidirectional Panel-Mount Antenna (3G-ANTM-OUT-LP)*
<http://www.cisco.com/en/US/docs/routers/access/wireless/hardware/notes/antcmLP.html>

Cisco IOS commands

- *Cisco IOS Master Commands List, All Releases*
http://www.cisco.com/en/US/docs/ios/mcl/allreleasemcl/all_book.html
- *Configuring Cisco EHWIC-3G-EDVO-x*
http://www.cisco.com/en/US/docs/routers/access/1800/1861/software/feature/guide/mrwls_evdo.html
- *Configuring 3G Wireless WAN on Modular and Fixed ISRs (HWIC-3G-CDMA, HWIC-3G-CDMA-x, and PCEX-3G-CDMA-x)*
<http://www.cisco.com/en/US/docs/routers/access/1800/1861/software/feature/guide/mrwlcdma.html>

Regulatory, Compliance, and Safety Information

- *Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information*
<http://www.cisco.com/en/US/docs/routers/access/interfaces/rcsi/IOHrcsi.html>

RFCs

The following RFC is supported by Cisco Connected Grid 2G/3G/4G Multimode LTE GRWIC:

RFC	Title
RFC 3025	Mobile IP Vendor/Organization-Specific Extensions

Technical Assistance

The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.

<http://www.cisco.com/cisco/web/support/index.html>

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