



Cisco Remote-PHY Device Hardware Installation Guide

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CHAPTER

1

Cisco Remote-PHY Solution Overview

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Introduction

Driven by market evolution towards triple-play services, cable operators in emerging markets are seeking standardized and digital fiber-based solutions for economical and future proof access technologies. Much of the demand is driven by the need to provide higher bandwidth packet transport for Internet connectivity, video and voice services.

Data Over Cable Systems Interface Standard (DOCSIS[®]) is a standardized technology for services over cable and thus has strong interoperability between system providers. It also provides robust Quality of Service (QoS) methods, ensuring packet delivery during periods of network congestion. Traditionally, DOCSIS runs on linear fiber (or HFC) to provide service and is not naturally applicable for digital fiber. Cisco has bridged the gap by introducing a new access technology called the Remote-PHY.

Existing Architecture

In the emerging markets, most triple-play consumers live in multi-tenant buildings (referred to as Multi Dwelling Units or MDU) with the number of residents usually being less than 500 residents per building or cluster. These buildings are typically served by fiber with one of several “final 100 meter” technologies installed in the buildings. These technologies include fiber, twisted pair, Ethernet, and coaxial. Cable operators have access to the cable in the building and use this cable for their services. Several technologies exist for enabling two-way services over cable. These include a number of proprietary and vendor-specific methods. However, a standards-based approach to using cable is typically preferred by operators, since this ensures vendor interoperability.

Need for the Cisco Remote-PHY Solution

DOCSIS and EuroDOCSIS are standards that define two-way operation over a cable network. DOCSIS provides the necessary Quality of Service (QoS) tools for ensuring voice call connectivity during periods of network congestion that are anticipated in triple-play networks. DOCSIS is a robust and mature technology for voice, video, and IP video services.

The Cisco Remote-PHY solution leverages existing IP technologies and deploys DOCSIS in remote field over digital fiber to enable two-way services over cable.

Benefits

The Cisco Remote-PHY solution provides a cost-effective digital fiber-based DOCSIS solution that uses Metro Ethernet (MetroE) as the transmission network between the Cisco CMTS and the cable modem.

- Reduced investment cost including capital and operational expenditure.
- Low-cost yet highly stable Cisco GS7000 node (includes only the PHY layer).
- Reduced CMTS hardware complexity.
- No restriction on Converged Interconnect Network (CIN) network.
- Futureproof architecture. Easy to migrate as the hardware and control functions are on separate layers.
- End-to-end QoS assurance provided by DOCSIS.
- Support for all DOCSIS services.
- Support for existing DOCSIS network provisioning system.
- High access bandwidth.
- With deep fiber, the optical noise contribution to SNR is eliminated. As a result, the remote QAM modulator runs at higher orders of modulation as compared to a centralized QAM modulator.

Architecture Overview

Modular Headend Architecture version 2 (MHA v2) is a set of specifications for the Cisco Remote-PHY solution. It uses digital fiber compatible baseband networking technology to drive the fiber portion of the HFC plant. The coaxial portion of the plant remains the same. The upstream and downstream PHY are located on the remote side and acts as the remote PHY system. The Cisco GS7000 node with the Cisco DOCSIS R-PHY node acts as the remote PHY system. It connects the digital fiber and the coaxial portions of the plant together. The remote PHY system resides near or in buildings and has both RFI and Gigabit Ethernet interfaces. It provides layer 1 PHY (downstream and upstream PHY) functionality, layer 2 MAC functionality, and layer 3 tunneling and forwarding support. The CMTS remains unchanged with the exception of the upstream and downstream PHY being moved to the remote PHY system. The Cisco RF line card installed in the Cisco CMTS does not have the RFI interfaces for downstream and upstream, instead, it has Gigabit Ethernet interfaces for both downstream and upstream.

Protocols that form this architecture include:

- Downstream External PHY Interface Decapsulation—Downstream External PHY Interface (DEPI) is a L2TPv3-based protocol defined for downstream DOCSIS MAC management and data packets decapsulation. It is unidirectional, that is, from CMTS to remote PHY system.

DEPI supports:

- IP/User Datagram Protocol (UDP)
- DOCSIS MPT Mode (D-MPT)/Packet Streaming Protocol (PSP)
- Upstream External PHY Interface Encapsulation—Upstream External PHY Interface (UEPI) is a L2TPv3-based protocol defined for upstream DOCSIS MAC management and data packets encapsulation. It is unidirectional, that is, from remote PHY system to CMTS.

UEPI:

- Does not support UDP
- Supports PSP mode only
- Supports multiple pseudowires for RNG/BW-REQ/SPECTRUM-MGMT/MAP
- GCP—Generic Control Protocol, sets up a control plane tunnel over a generic transport protocol such as TCP or UDP. GCP is used to program the remote PHY system upstream and downstream parameters from the CMTS. It is also used to control the remote PHY system.

GCP supports:

- TCP/UDP
- DS/US PHY configuration and CMC provisioning/configuration
- Register mode and type, length, value (TLV) mode
- Notification

Cisco Cable Modem Termination System

The Cisco cBR converged broadband router acts as the Cable Modem Termination System (CMTS) core for the Cisco Remote-PHY architecture.

Following are its functions:

- Assigns downstream and upstream channels of the Cisco RF line card to the Cisco DOCSIS R-PHY GS7000 node.
- Performs MAC classification, forwarding, and management functions.
- Handles the Cisco DOCSIS R-PHY GS7000 node configuration and management.

For more information on the Cisco CMTS, go to [Cisco cBR Series Converged Broadband Routers](#) page.

Cisco 1.2 GHz Super High Output (SHO) GS7000 Node

The Cisco 1.2 GHz Super High Output (SHO) GS7000 Node (Cisco GS7000 node) acts as the edge QAM in the Cisco Remote-PHY architecture. It is located between the Cisco CMTS and the cable modem, and controlled by the Cisco CMTS. The Cisco GS7000 node has network interfaces on one side connecting to the fiber (digital and linear) portion of the Hybrid Fiber Coaxial (HFC) plant, and RF interfaces on the other side

connecting to the coaxial portion of the HFC plant. The Cisco GS7000 node can be mounted either on a wall or strand (aerial installation). The RF output of the Cisco GS7000 node can be combined with other services, such as, analog or digital video services. The Cisco GS7000 node uses the linux operating system. Most of the Cisco GS7000 node configurations are performed on the Cisco CMTS.

The Cisco GS7000 node originates the DOCSIS protocol using the DOCSIS MAC and PHY layer technology used in the Cisco CMTS. The Cisco GS7000 node has built-in downstream PHY and upstream PHY, and a small FPGA for DEPI decapsulation and UEPI encapsulation.

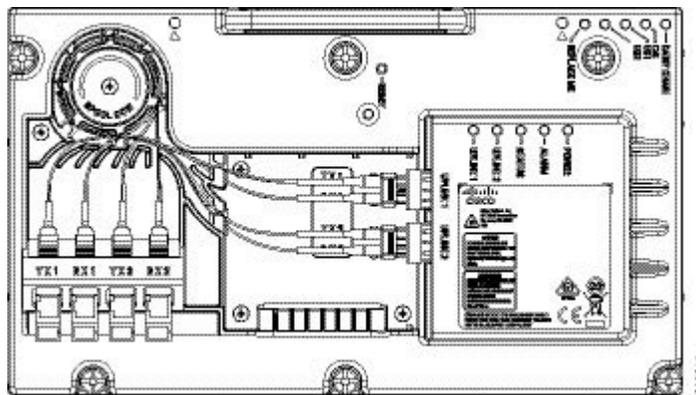
For more information, see the [Cisco GS7000 1218-MHz 4-Port Fiber Deep Node Data Sheet](#) and [Cisco 1.2 GHz Super High Output \(SHO\) GS7000 Node Installation and Operation Guide](#).

Cisco Remote-PHY Device

The Cisco Remote-PHY Device (RPD) resides inside the Cisco GS7000 node. Below are some of its features:

- Full spectrum DOCSIS 3.0 support
- Full spectrum DOCSIS 3.1 support
- Converged broadcast, narrowcast, and VOD video support
- Out of Band (OOB) signaling support
- Dual 10GBE SFP+ backhaul connectivity
- Support of Daisy Chain architecture topology
- CCAP support
- Support of optical overlay architectures

Figure 1: Cisco RPD



Cisco CCAP RF Line Card for R-PHY

The Cisco CCAP RF line card for remote PHY architecture is available in two flavours:

- CBR-LC-8D31-16U30—This RF line card with the downstream and upstream PHY modules can be connected with the Cisco GS7000 node by configuring it using the **card cBR-CCAP-LC-40G r-phy** command.
- CBR-CCAP-LC-40G-R—This RF line card with no downstream and upstream PHY modules can be connected with the Cisco GS7000 node.

Cisco Digital Physical Interface Card

The Cisco Digital Physical Interface Card (DPIC) transmits and receives RF signals between the subscriber and headend over the hybrid fiber-coaxial (HFC) system and is DOCSIS-compliant. This interface card is designed specifically for the Cisco cBR router and conforms to the Integrated CMTS (I-CMTS) architecture. The PID is cBR-DPIC-8X10G.

The DPIC is installed in the CMTS and connected to the Cisco GS7000 node via the Metro Ethernet. It supports both downstream and upstream traffic. Both the downstream and upstream traffic share the same ports.

Table 1: Physical Specifications of the DPIC

Unit	Dimensions
Width	10.96 in (27.8cm)
Height	1.43 in (3.6cm)
Depth	7.32 in (18.6cm) with handle
Weight	2.943lb (1.335kg)

The DPIC supports:

- Eight ten gigabit ethernet SFP+ interfaces
- 80 gigabit non-blocking switching architecture with 40+40 protection scheme
- 40 gigabit DOCSIS traffic bandwidth when connected with the Cisco CBR-CCAP-LC-40G-R line card
- Cisco SFP-10G-SR-S/Cisco SFP-10G-LR-S/Cisco SFP-10G-ZR-S/Cisco SFP-10G-ER-S optic modules
- MACSec and 1588 TC

The faceplate of the Cisco DPIC has the following:

- Optic Cable Clip—Helps route and manage the optic cables.
- 8 x SFP+ ports—Used as 8 x 10GE lanes for DOCSIS traffic to the Cisco RPDs.
- 10GE Link Status LED—Indicates the status of the 10GE link.
- Status LED—Indicates the status of the Cisco DPIC.
- Replace LED—Indicates the Cisco DPIC must be replaced.

Onboard Failure Logging

The Onboard Failure Logging (OBFL) feature enables the storage and collection of critical failure information in the nonvolatile memory of a Field Replaceable Unit (FRU), like a route processor (RP) or line card. The data stored through OBFL assists in understanding and debugging the field failures upon Return Material Authorization (RMA) of a RP or line card at repair and failure analysis sites. OBFL records operating temperatures, voltages, hardware uptime, and any other important events that assist board diagnosis in case of hardware failures.

For more information about the feature, see [Onboard Failure Logging](#).



Note

The sample output provided in the [Onboard Failure Logging](#) guide may vary slightly for the Cisco CMTS routers.



Cisco Remote-PHY Solution Deployment

- [Design Considerations, page 7](#)
- [Network Architecture, page 8](#)
- [Network Topologies, page 8](#)
- [Network Cables, page 9](#)

Design Considerations

This section helps you prepare for deploying the Cisco Remote-PHY solution.

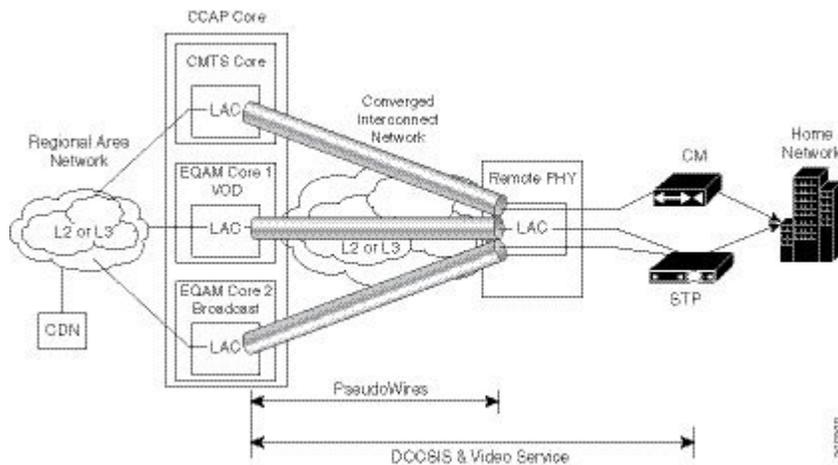
Prerequisites

- Ensure that a digital optical network is deployed between the Cisco GS7000 node and Cisco CMTS. The supported digital optical network is Metro Ethernet.
- Ensure that the data path is guaranteed between the Cisco CMTS and the Cisco GS7000 node.
- Reserve sufficient bandwidth for the DOCSIS traffic.
- Network must support IPv4 multicast forwarding.
- Ensure that the maximum latency is as low as possible.
- Based on the input type in the network, deploy or use the appropriate type of R-PHY device. For optical input, deploy the Cisco GS7000 node with the FRx.

Network Architecture

The Cisco Remote-PHY solution supports the *Single Controller Sharing* architecture. In this architecture, multiple Cisco GS7000 equipments share the downstream and upstream channels of a Cisco RF line card in a cisco cBR chassis.

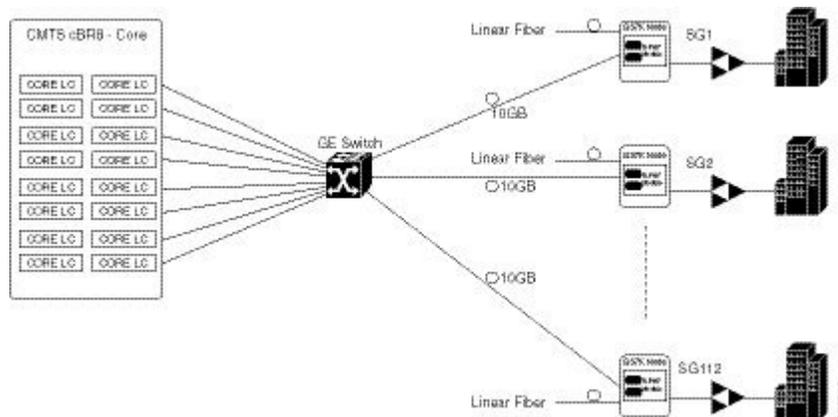
Figure 2: Single Controller Sharing Architecture



Network Topologies

The Cisco Remote-PHY solution supports Ethernet Based Networking topology.

Figure 3: Standard Deployment



Network Cables

Table 2: Cable Types Supported for the Cisco Remote-PHY Solution

Originating Device	Target Device	Cable Type	Connector Type
CMTS (Ten Gigabit Ethernet SFP+ module on the Cisco CCAP line card)	Switch	Ethernet cables	RJ-45 connector
		Copper cables	RJ-45 connector
		Optical fiber	LC Fiber-Optic connector
Switch	Cisco GS7000	Optical fiber	LC Fiber-Optic connector



Preparing for the Installation

Before you install the Cisco Remote-PHY solution, consider the following:

- Power and cabling requirements that must be in place at your installation sites
- Equipment required to install the Cisco Remote-PHY solution
- Environmental conditions your installation site must meet to maintain normal operation



Note

Do not unpack the equipment until you are ready to install it. Keep the equipment in the shipping container to prevent accidental damage until you determine an installation site.

This section provides information on:

- [General Safety Guidelines](#), page 11
- [Electrical Equipment Guidelines](#), page 12
- [Preventing Electrostatic Discharge Damage](#), page 12
- [Site Requirements](#), page 13
- [Power Guidelines](#), page 14
- [Laser Safety Guidelines for the Cisco GS7000 Node](#), page 15
- [Mounting Considerations for the Cisco GS7000 Node](#), page 15
- [Tools for Installation](#), page 16
- [Torque Specifications for the Cisco GS7000 Node](#), page 17
- [Unpacking the Equipment](#), page 18

General Safety Guidelines

When you install a component, observe all caution and warning statements mentioned in this section.

The following guidelines will help ensure your safety and protect the equipment. However, these guidelines may not cover all potentially hazardous situations you may encounter during system installation, *so be alert*.

- Install your product in compliance with the national and local electrical codes. In the United States, this means the National Fire Protection Association (NFPA) 70, United States National Electrical Code. In Canada, Canadian Electrical Code, part I, CC22.1. In other countries, International Electrotechnical Commission (IEC) 364, part 1 through part 7.
- Review the safety warnings listed in the regulatory compliance and safety documentation before installing, configuring, or performing maintenance on the product.
- Disconnect power at the source before you install or remove a chassis.
- Do not attempt to lift an object you might find too heavy to lift safely.
- Keep the equipment area clear and as dust free as possible during and after installation.
- Keep tools and equipment components away from walk areas.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught in the equipment.
- Use the product in accordance with its marked electrical ratings and product usage instructions.

**Warning**

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

Electrical Equipment Guidelines

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone in potentially hazardous conditions.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage occurs when electronic cards or components are improperly handled, and can result in complete or intermittent failures. All line cards consist of a printed circuit card that is fixed in a metal carrier. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the cards from ESD, use an antistatic strap each time you handle the modules. Handle the carriers by the edges only; never touch the cards or connector pins.

**Caution**

Always tighten the captive installation screws on all system components when you are installing them. These screws prevent accidental removal of the module, provide proper grounding for the system, and help to ensure that the line card connectors are properly seated in the backplane. Captive screws should be torqued to 6-8 in-lbs to ensure proper grounding and mechanical support. Never use cordless or corded drills to tighten screws; power screwdrivers and hand tools are acceptable.

Static electricity can harm delicate components inside your system. To prevent static damage, discharge static electricity from your body before you touch any of your system components. As you continue to work on your system, periodically touch an unpainted metal surface on the computer chassis.

The following guidelines can prevent ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Before removing a card from the chassis, connect the equipment end of the strap to the ESD plug at the bottom of the chassis below the power entry modules. Ensure that the chassis or rack or both have a grounding cable installed.
- Handle line cards by the faceplate and carrier edges only; avoid touching the card components or any connector pins.
- When removing a card, place the removed module component-side-up on an antistatic surface or in a static-shielding bag. If the module will be returned to the factory, immediately place it in a static-shielding bag.
- Avoid contact between the modules and clothing. The wrist-strap protects the card from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components in a static-safe area. If possible, use antistatic floor pads and workbench pads.

**Caution**

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

Site Requirements

This section provides information about environmental, power, cabling, and mounting requirements. Ensure that you have met all of these requirements before you install your product.

Environmental Requirements for the Cisco GS7000 Node

The table below lists the operating and non-operating environmental site requirements. The ranges listed are those within which the equipment continues to operate; however, a measurement that is approaching the minimum or maximum of a range indicates a potential problem. You can maintain normal operation by anticipating and correcting environmental anomalies before they approach a maximum operating range.

Table 3: Specifications for Operating and Non-operating Environments for the Cisco GS7000 Node

Specification	Value
Operating Temperature range	-40 to 140°F (-40 to 60°C)
Relative humidity range	5 to 95%

Environmental Requirements for the Cisco CCAP RF Line Card

The table below lists the operating and non-operating environmental site requirements. The ranges listed are those within which the equipment continues to operate; however, a measurement that is approaching the minimum or maximum of a range indicates a potential problem. You can maintain normal operation by anticipating and correcting environmental anomalies before they approach a maximum operating range.

Table 4: Specifications for Operating and Non-operating Environments for the Cisco CCAP RF Line Card

Specification	Minimum
Power Consumption	211W
Thermal Heat Dissipation	211W
Mean Time Between Failure (MTBF)	360,870 hours
Temperature Range	Operating: 41 to 104°F (5 to 40°C)
	Non-operating: -4 to 149°F (-20 to 65°C)
Relative Humidity	Operating: 10 to 90% non-condensing
	Non-operating: 10 to 90%
Operating Altitude	-196 to 13,123 ft. (-60 to 4000 m)

Power Guidelines



Important

If this equipment is a Class I equipment, it must be grounded.

- If this equipment plugs into an outlet, the outlet must be near this equipment, and must be easily accessible.
- Connect this equipment only to the power sources that are identified on the equipment-rating label, which is normally located close to the power inlet connector.

- This equipment may have two power sources. Be sure to disconnect all power sources before working on this equipment.
- If this equipment does not have a main power switch, the power cord connector serves as the disconnect device.
- Always disconnect the plug or the connector to disconnect a cable. Do not pull the cable itself.

Laser Safety Guidelines for the Cisco GS7000 Node

- Do not stare into an unmated fiber or at any mirror-like surface that could reflect light emitted from an unterminated fiber.
- Do not view an activated fiber with optical instruments such as eye loupes, magnifiers, or microscopes.
- Use safety-approved optical fibers to maintain compliance with applicable laser safety requirements.



Warning

This equipment is a Class 1 laser product. Statement 1008



Warning

Invisible laser radiation present. Avoid direct exposure to the laser light source. Statement 1016



Warning

Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051

Mounting Considerations for the Cisco GS7000 Node



Warning

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024.



Warning

Avoid personal injury and damage to this equipment. An unstable mounting surface may cause this equipment to fall.

The Cisco GS7000 node supports two types of mounting. Consider the following guidelines for mounting the Cisco GS7000 node:

Wall-Mounting Guidelines for the Cisco GS7000 Node

The Cisco GS7000 node can be mounted on a concrete, brick, wood, or metal wall, or in a cabinet. Before you wall-mount the Cisco GS7000 node, consider the following guidelines:

- Be aware of the size and weight of the equipment. A fully loaded Cisco GS7000 node weighs over 26 lbs (11.8 kg). Ensure that the mounting location has a stable, flat surface, and can safely support the maximum weight of the equipment.
- Ensure that the installation site meets the ventilation requirements given in the data sheet to avoid the possibility of equipment overheating.
- Ensure that the installation site and operating environment is compatible with the International Protection (IP) rating specified in the data sheet.
- Ensure that proper handling and lifting techniques are employed when working in confined spaces with heavy equipment.

Strand-Mounting Guidelines for the Cisco GS7000 Node

Before you strand-mount the Cisco GS7000 node, consider the following guidelines:

- Be aware of the size and weight of the equipment while strand-mounting. A fully loaded Cisco GS7000 node weighs over 26 lbs (11.8 kg). Ensure that the strand can safely support the maximum weight of the equipment.
- Ensure that proper handling and lifting techniques are employed when working in confined spaces with heavy equipment.
- Ensure the ground area below the installation site is clear of personnel before hoisting the equipment. If possible, block the walkway below the hoisting area to prevent pedestrian traffic during hoisting.

Tools for Installation

Tools for the Cisco GS7000 Node Installation

You need the following tools to install and cable the Cisco GS7000 node:

- Torque wrench capable of 5 to 12 ft-lbs (6.8 to 16.3 Nm)
- 4-inch to 6-inch extension for torque wrench
- 1/8-inch slot screwdriver for the F-connectors
- 1/2-inch socket for the strand clamp bolts
- #2 Phillips-head screwdriver for the grounding screw
- Heavy-duty wire cutters or snips for cutting the cable
- Deburring tool for filing the rough edges

Tools for the Cisco CCAP RF Line Card Installation

You need the following tools to install and cable the Cisco CCAP RF line card:

- T-10 Torx driver tool
- 1/4-inch flathead screwdriver
- Blank Cisco cBR-8 slot cover (if required)
- ESD-preventive wrist strap
- Antistatic surface, such as a mat or antistatic bag

Torque Specifications for the Cisco GS7000 Node

The table below provides the torque specifications for the fasteners used with the Cisco GS7000 Node.

Fastener	Torque Specification	Illustration
Strand clamp mounting bracket bolts	5 ft-lb to 8 ft-lb (6.8 Nm to 10.8 Nm)	
Housing closure bolts	5 ft-lb to 12 ft-lb (6.8 Nm to 16.3 Nm)	
5/8" port plugs	6.7 ft-lb (9 Nm)	
PG11-to-5/8" adapter	4.63 ft-lb (6.25 Nm)	
RJ-45 port PG16 plug	5.55 ft-lb (7.5 Nm)	
Power port PG11 gland	Plastic: 3 ft-lb (4 Nm) Metal: 4.63 ft-lb (6.25 Nm)	
RJ-45 port PG16 gland	Plastic: 4.44 ft-lb (6 Nm) Metal: 5.5 ft-lb (7.5 Nm)	

Fastener	Torque Specification	Illustration
PG11 F-connector	4.63 ft-lb (6.25 Nm)	
5/8" F-connector	6.7 ft-lb (9 Nm)	

Unpacking the Equipment

Before You Begin

Read the safety guidelines and review the electrical safety and ESD-preventive guidelines.



Caution

Ensure that you are properly grounded with an ESD-preventive wrist strap.

Procedure

-
- Step 1** Open the shipping box.
 - Step 2** Remove the equipment from the box.
 - Step 3** Place the equipment on an antistatic surface.
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Installing the Cisco Remote PHY Solution

- [Installing the Cisco GS7000 Node, page 19](#)
- [Opening the Cisco GS7000 Node, page 19](#)
- [Installing Cisco Remote PHY Device in the Cisco GS7000 Node, page 19](#)
- [Setting Up Cisco Remote PHY Device on the Cisco GS7000 Node, page 23](#)
- [Powering Up the Cisco GS7000 Node, page 25](#)
- [Closing the Cisco GS7000 Node, page 25](#)

Installing the Cisco GS7000 Node

For more information, see the [Cisco 1.2 GHz Super High Output \(SHO\) GS7000 Node Installation and Operation Guide](#).

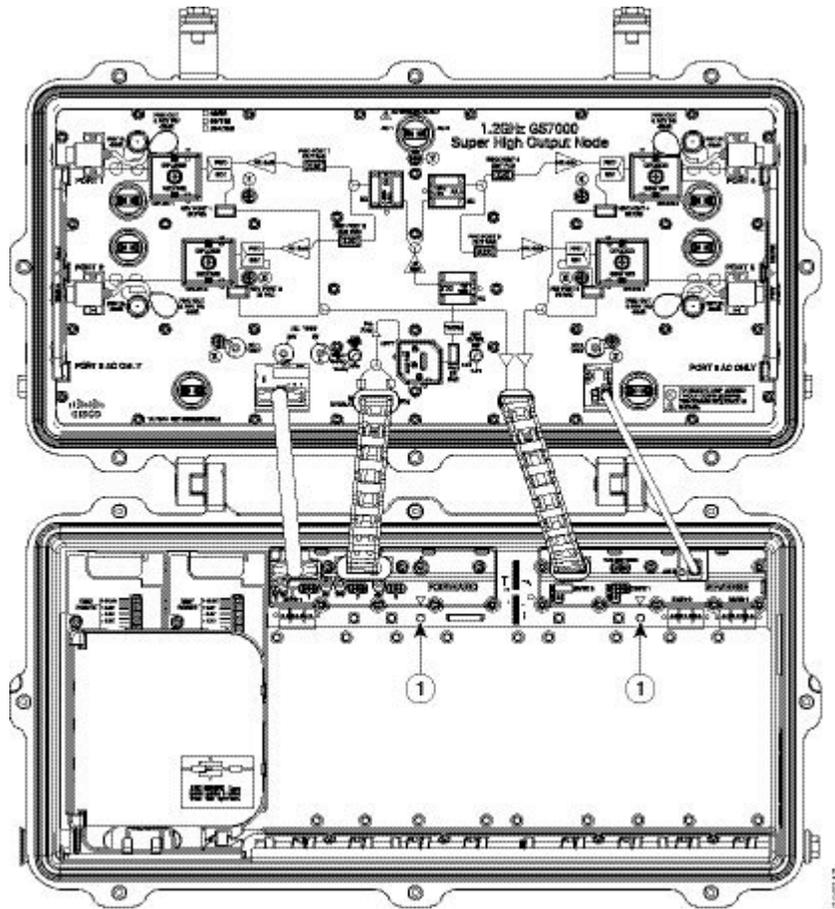
Opening the Cisco GS7000 Node

For more information, see the [Cisco 1.2 GHz Super High Output \(SHO\) GS7000 Node Installation and Operation Guide](#).

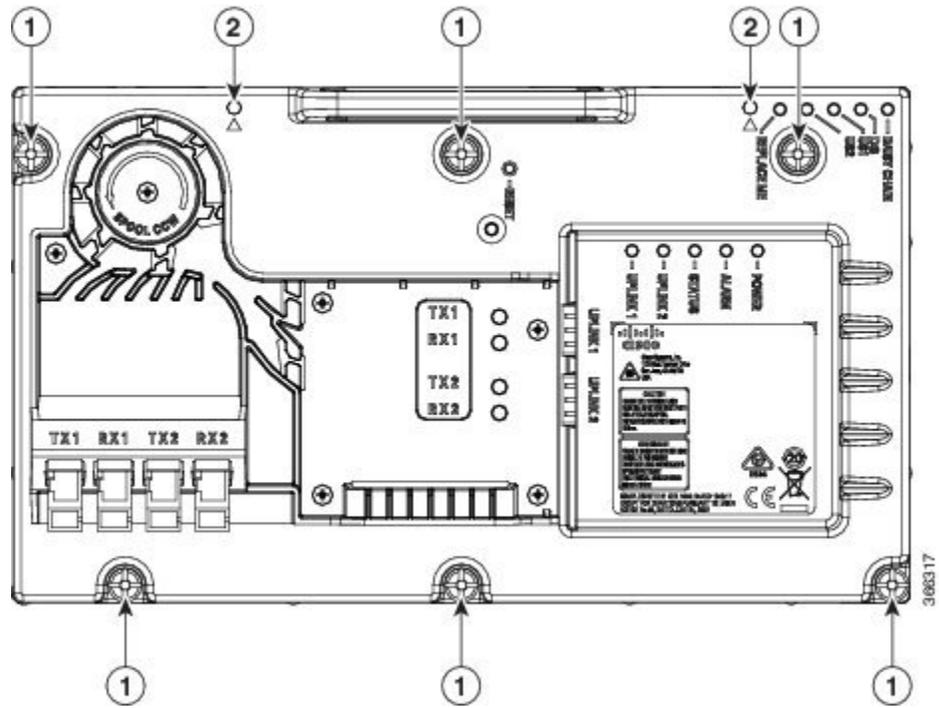
Installing Cisco Remote PHY Device in the Cisco GS7000 Node

Procedure

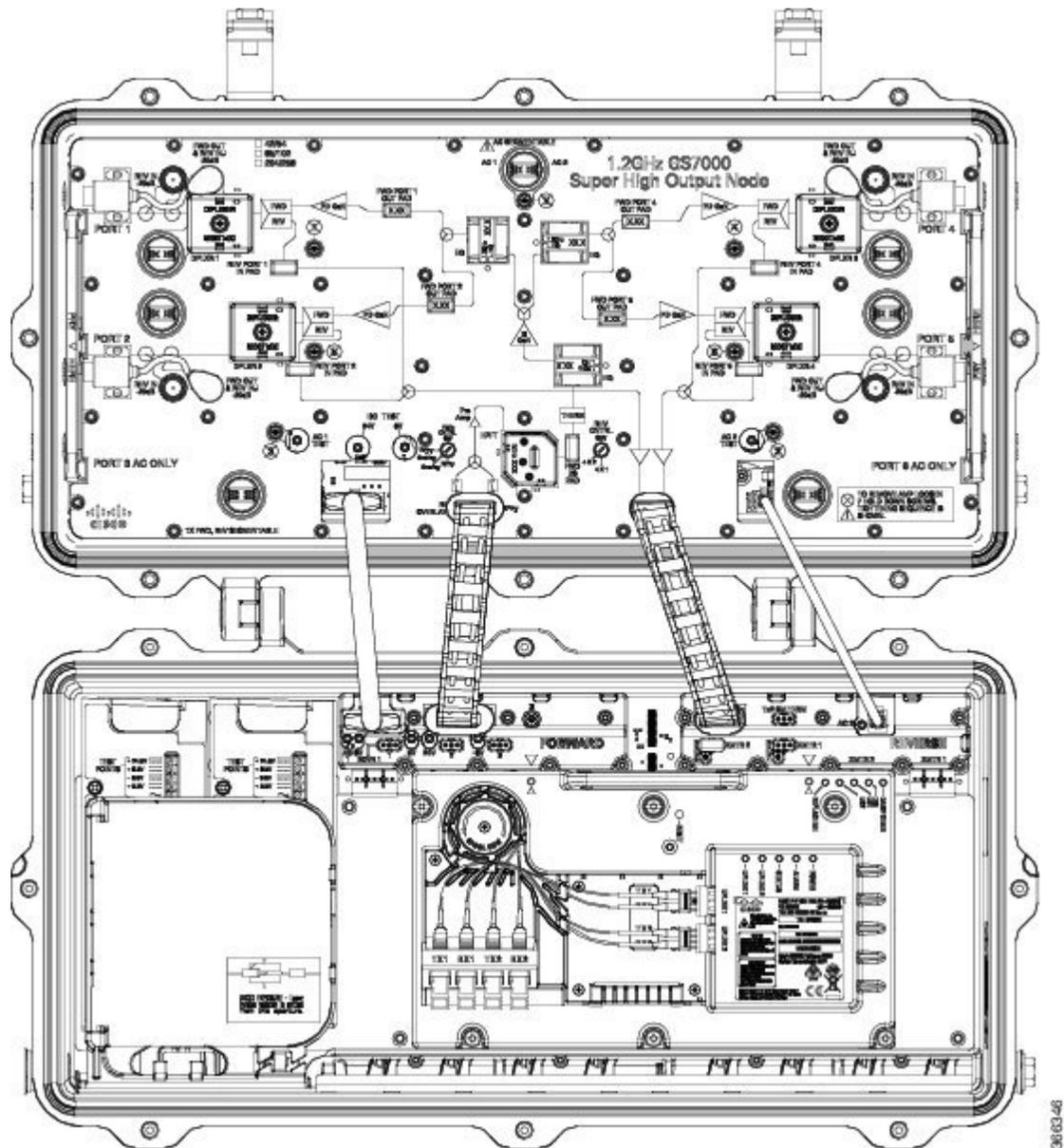
- Step 1** Open the Cisco GS7000 node; remove all the transmitter and receiver modules (if any).
- Step 2** Insert the location pin on the OIB of the Cisco GS7000 node into the location hole on the Cisco RPD. Tighten the screws on the Cisco RPD with recommended torque.



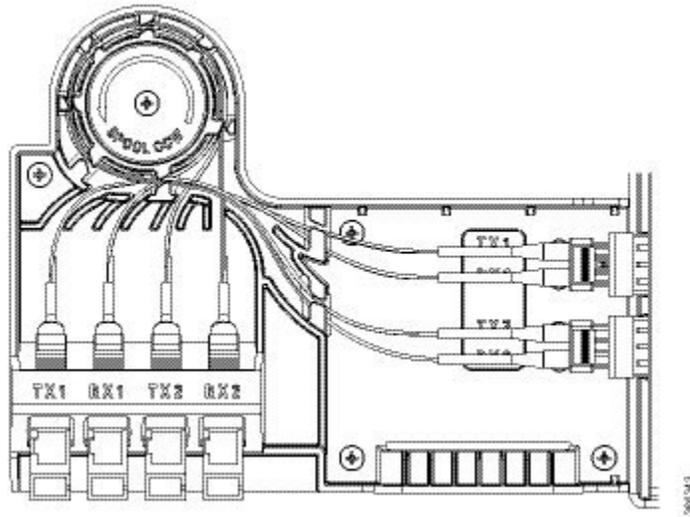
1	Locating Pin		
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1	Screw	2	Locating Hole
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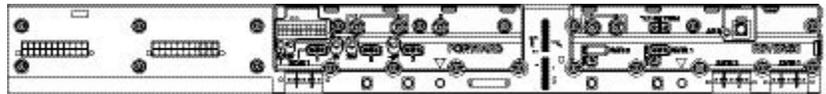
- Step 3** Insert the SC connector of the fiber cable into the SC adapter. Insert the LC connector of the fiber cable into the SFP+ module. The SC connector marked with “TX” on the label needs to be installed into the SC adapter marked with “TX” on top of the fiber tray. The SC connector marked with “RX” on the label needs to be installed into the SC adapter marked with “RX” on top of the fiber tray.



Setting Up Cisco Remote PHY Device on the Cisco GS7000 Node

Procedure

- Step 1** Change the Forward Control Switch in launch amp to Rphy option.
- Step 2** Change the Reverse Control Switch to 4x1 or 4x2 based on your network.
- Step 3** Place the ≥ 6 dB pad at forward path and 0dB pad at reverse path on the OIB.



Note For the Cisco GS7000 node to work in RPHY mode, plug in the pad in the reverse path on the OIB vertically.

- Step 4** For Reverse Path (4x2 mode):
 - a) RF Port 1 and 2 will be routed to RPD US2 Port
 - b) RF Port 4 and 5 will be routed to RPD US1 Port

Configuration Definition

Table 5: Launch FWD CNTRL SW Configuration

Mode Selection	Description
Rphy+Overlay	Routing both Rphy RF signal and Overlay RF signal to launch board

Mode Selection	Description
Overlay	Routing only Overlay RF signal to launch board
Rphy	Routing only Rphy RF signal to launch board

Table 6: Launch REV CNTRL SW Configuration

Mode Selection	Description
4x2	Routing Port1 and Port2 RF signal to XMTR2 or RPD US2 (depends on the OIB PAD direction). Routing Port4 and Port5 RF signal to XMTR1 or RPD US1 (depends on the OIB PAD direction)
4x1	Routing Port1, Port2, Port4, Port5 RF signal to XMTR1, XMTR2 or RPD US1, US2 (depend on the OIB PAD direction)

Table 7: OIB FWD Pad Configuration

FWD Attenuator Pads	Description
Pad 1	Bridging RCVR1 RF signal to launch board, the loss (in dB) produced by an attenuator pad is equal to the value printed on the top of the attenuator pad.
Pad 2	Bridging RPD RF signal to launch board, the loss (in dB) produced by an attenuator pad is equal to the value printed on the top of the attenuator pad.
Pad 3	Reserved

Table 8: OIB REV Pad Configuration

REV Pads	Description
Pad 1 (horizontal)	Bridging launch board RF signal to XMTR1, the loss (in dB) produced by an attenuator pad is equal to the value printed on the top of the attenuator pad.
Pad 2 (horizontal)	Bridging launch board RF signal to XMTR2, the loss (in dB) produced by an attenuator pad is equal to the value printed on the top of the attenuator pad.

REV Pads	Description
Pad 1 (vertical)	Bridging launch board RF signal to RPD US1, the loss (in dB) produced by an attenuator pad is equal to the value printed on the top of the attenuator pad.
Pad 2 (vertical)	Bridging launch board RF signal to RPD US2, the loss (in dB) produced by an attenuator pad is equal to the value printed on the top of the attenuator pad.
Tx2 SM TERM Pad	Only used as a terminator with 75 Ω printed on the top when both XMTR1 and XMTR2 are installed.

Powering Up the Cisco GS7000 Node

For more information, see the [Cisco 1.2 GHz Super High Output \(SHO\) GS7000 Node Installation and Operation Guide](#).

Closing the Cisco GS7000 Node

For more information, see the [Cisco 1.2 GHz Super High Output \(SHO\) GS7000 Node Installation and Operation Guide](#).



Configuring the Cisco Remote-PHY Solution

- [Prerequisites for Configuring the Cisco Remote-PHY Solution, page 27](#)
- [Restrictions for Configuring the Cisco Remote-PHY Solution, page 27](#)
- [How to Configure the Cisco Remote-PHY Solution, page 27](#)
- [Configuration Example for the Cisco Remote-PHY Solution, page 28](#)

Prerequisites for Configuring the Cisco Remote-PHY Solution

- The Cisco CMTS must have at least one DOCSIS Timing, Communication, and Control (DTCC) card configured in the DOCSIS Timing Interface (DTI) mode for the Cisco cBR RF line card to work with the Cisco GS7000 node.

Restrictions for Configuring the Cisco Remote-PHY Solution

- Adding or removing the upstream or downstream channels in the channel group may trigger the Cisco GS7000 to reset.
- The Cisco cBR RF line card supports only static DEPI configuration.
- The Cisco cBR RF line card does not support Spectrum Management, Inter Line Card RF Spanning, and High Availability.

How to Configure the Cisco Remote-PHY Solution

For detailed instructions, see the Cisco Remote-PHY Configuration Guide.

Configuration Example for the Cisco Remote-PHY Solution

Cisco Remote-PHY RPD CM Online Basic Configuration Example

```

interface TenGigabitEthernet0/1/0
 ip address 209.165.200.225 255.255.255.224
 ip helper-address 209.165.200.226

cable downstream controller-profile 3
 max-carrier 32
 base-channel-power 41
 rf-chan 0 31
  rf-output NORMAL
  type DOCSIS
  frequency 111000000
  gam-profile 1
  power-adjust 0
  docsis-channel-id 1

cable upstream controller-profile 3
 us-channel 0 channel-width 3200000 3200000
 us-channel 0 docsis-mode atdma
 us-channel 0 frequency 11400000
 us-channel 0 minislots-size 2
 us-channel 0 modulation-profile 221
 no us-channel 0 shutdown
 us-channel 1 channel-width 3200000 3200000
 us-channel 1 docsis-mode atdma
 us-channel 1 frequency 14600000
 us-channel 1 minislots-size 2
 us-channel 1 modulation-profile 221
 no us-channel 1 shutdown
 us-channel 2 channel-width 3200000 3200000
 us-channel 2 docsis-mode atdma
 us-channel 2 frequency 17800000
 us-channel 2 minislots-size 2
 us-channel 2 modulation-profile 221
 no us-channel 2 shutdown
 us-channel 3 channel-width 3200000 3200000
 us-channel 3 docsis-mode atdma
 us-channel 3 frequency 21000000
 us-channel 3 minislots-size 2
 us-channel 3 modulation-profile 221
 no us-channel 3 shutdown
 us-channel 4 channel-width 3200000 3200000
 us-channel 4 docsis-mode atdma
 us-channel 4 frequency 24200000
 us-channel 4 minislots-size 2
 us-channel 4 modulation-profile 221
 no us-channel 4 shutdown
 us-channel 5 channel-width 3200000 3200000
 us-channel 5 docsis-mode atdma
 us-channel 5 frequency 27400000
 us-channel 5 minislots-size 2
 us-channel 5 modulation-profile 221
 no us-channel 5 shutdown

interface Cable0/0/0
 load-interval 30
 downstream Downstream-Cable 0/0/0 rf-channel 0-23
 upstream 0 Upstream-Cable 0/0/0 us-channel 0
 upstream 1 Upstream-Cable 0/0/0 us-channel 1
 upstream 2 Upstream-Cable 0/0/0 us-channel 2
 upstream 3 Upstream-Cable 0/0/0 us-channel 3
 upstream 4 Upstream-Cable 0/0/0 us-channel 4
 upstream 5 Upstream-Cable 0/0/0 us-channel 5
 cable upstream bonding-group 1
 upstream 0

```

```

upstream 1
upstream 2
upstream 3
attributes 80000001
cable upstream bonding-group 2
upstream 2
upstream 3
upstream 4
upstream 5
attributes 80000001
cable upstream bonding-group 3
upstream 0
upstream 1
upstream 4
upstream 5
attributes 80000001
cable bundle 1
cable ip-init dual-stack

interface Wideband-Cable0/0/0:0
cable bundle 1
cable rf-channels channel-list 0-7 bandwidth-percent 10

interface Wideband-Cable0/0/0:1
cable bundle 1
cable rf-channels channel-list 8-15 bandwidth-percent 10

cable fiber-node 200
downstream Downstream-Cable 0/0/0
upstream Upstream-Cable 0/0/0

cable rpd node1
identifier 0004.9f03.0061
core-interface Te0/1/0
rpd-ds 0 downstream-cable 0/0/0 profile 3
rpd-us 0 upstream-cable 0/0/0 profile 3
r-dti 1
rpd-event profile 0

interface Loopback1588
ip address 209.165.200.228 255.255.255.224
interface TenGigabitEthernet5/1/3 (connect to ASR903)
ip address 209.165.200.229 255.255.255.224

ip route 209.165.200.250 255.255.255.254 209.165.200.251 (route to ASR903 loopback ip)

ptp clock ordinary domain 0
servo tracking-type R-DTI
clock-port slave-from-903 slave
delay-req interval -4
sync interval -5
sync one-step
transport ipv4 unicast interface Lo1588 negotiation
clock source 209.165.200.250 (ASR903 loopback ip)

ptp r-dti 1
ptp-domain 0_(same domain number with ptp server)_
clock-port 1
ethernet 1_(default value is same index with clock-port index, for RPD, ethernet 1=vbh0,
ethernet 2=vbh1)_
clock-source 209.165.200.250 gateway 209.165.200.253 (clock-source is ASR093 loopback
ip, gw is ASR903 BDI ID for node)

```

Cisco Remote-PHY RPD with Controller Profile Configuration Example

```

cable downstream controller-profile 101
multicast-pool 127
max-ofdm-spectrum 384000000
rf-chan 0 23
type DOCSIS
frequency 381000000

```

```
rf-output NORMAL
gam-profile 1
docsis-channel-id 1
rf-chan 158
ofdm channel-profile 109 start-frequency 1011000000 width 192000000 plc 1017000000
!

cable upstream controller 201
us-channel 0 channel-width 1600000 1600000
us-channel 0 docsis-mode atdma
us-channel 0 frequency 11400000
us-channel 0 minislots-size 4
us-channel 0 modulation-profile 221
no us-channel 0 shutdown
.....
us-channel 3 docsis-mode atdma
us-channel 3 frequency 30600000
us-channel 3 minislots-size 4
us-channel 3 modulation-profile 221
no us-channel 3 shutdown
!

cable fiber-node 1
downstream controller 3/0/0
upstream controller 3/0/0
cable fiber-node 2
downstream controller 3/0/0
upstream controller 3/0/1
!

cable rpd sjc_block22
description rpd for sjc block22
identifier 0011.2233.4455
core-interface Te3/0/0
principal
rpd-ds 0 controller downstream-cable 3/0/0 profile 101
rpd-us 0 controller upstream 3/0/0 profile 201
rpd-us 1 controller upstream 3/0/1 profile 201
r-dti 1
```



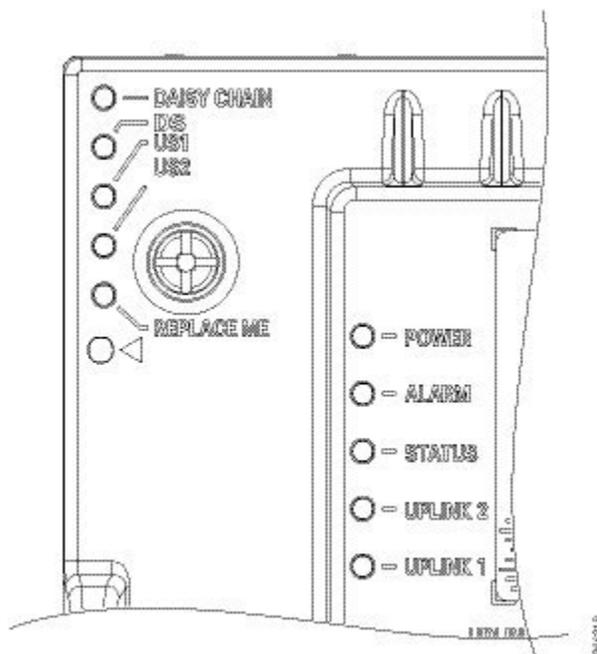
CHAPTER 6

Monitoring the Cisco Remote-PHY Solution

- [Verifying the Cisco RPD Using the LEDs, page 31](#)
- [Verifying the Cisco RPD Using the CLI, page 33](#)

Verifying the Cisco RPD Using the LEDs

Verify the following LEDs located inside the Cisco GS7000 node to check if the RPD is operational.



LED	Status	Description
PWR	Off	The Cisco GS7000 node is not powered up.
	Green	The Cisco GS7000 node is powered up.
UPLINK 1	Off	TenGigabit port link is not connected.
	Green	TenGigabit port link is active.
UPLINK 2	Off	TenGigabit port link is not connected.
	Green	TenGigabit port link is active.
DS RF	Off	Downstream controller is disabled but RF of RPD is enabled.
	Green	Downstream controller is enabled.
US RF	Off	All upstream RF channels are disabled.
	Green	Upstream RF channel is enabled.
Replace Me	Off	The Cisco RPD is working.
	On	The Cisco RPD is not working and must be replaced.
STATUS	Green	The Cisco GS7000 node is connected to the Cisco CMTS and has received an IP address.
	Green (blinking)	The Cisco RPD is in bootup mode and running the power-on self-test.
ALARM	Off	The Cisco RPD is working.
	Yellow (major alarm)	Indicates one of the following: <ul style="list-style-type: none"> • Voltage or current has exceeded the major threshold value. • Temperature has exceeded the major threshold value. • Switching on FPGA is not working and the Cisco RPD cannot be accessed. • The CPU on the Cisco RPD is not working.

Verifying the Cisco RPD Using the CLI

To verify the Cisco RPD status and configuration, use the **show cable rpd** command. For more information, see the [Cisco CMTS Cable Command Reference](#) guide.



Monitoring the Interface Card in the Cisco cBR Chassis

- [Monitoring the Interface Line Cards in the Cisco cBR Chassis using LEDs, page 35](#)
- [Monitoring the Digital Physical Interface Cards in the Cisco cBR Chassis using LEDs, page 36](#)

Monitoring the Interface Line Cards in the Cisco cBR Chassis using LEDs

Table 9: Verifying the LEDs on the Interface Line Cards

LED	Status	Description
STATUS	Off	The line card has not initialized correctly.
	Yellow	The line card has initialized, but HA fault is detected. Possible hardware fault.
	Green	The line card is operational.
PROTECT	Off	The Interface line card is not a Protect card.
	Blue	The Interface line card is configured as a Protect card.
	Green	The Protect card is operational and traffic is flowing.

LED	Status	Description
REPLACE	Off	The Interface line card is operational and does not require replacement.
	White	The Interface line card requires replacement.

Monitoring the Digital Physical Interface Cards in the Cisco cBR Chassis using LEDs

Table 10: Verifying the LEDs on the Cisco DPIC

LED	Status	Description
STATUS	Off	The card is not powered up.
	On	The card is operational.
10GE Link Status	Off	The specific link is down or the optical module is absent.
	On	The specific link is up.
REPLACE	Off	The card is operational and does not require replacement.
	On	The card requires replacement.



Troubleshooting the Cisco Remote-PHY Solution

- [Troubleshooting: Cisco cBR-CCAP-LC-40G Line Card Link LED Does Not Illuminate, page 37](#)
- [Troubleshooting: Cisco GS7000 Node Resets After DHCP Timeout, page 37](#)
- [Troubleshooting: Cisco GS7000 Node is Not Working, page 38](#)
- [Troubleshooting: The Cisco cBR-CCAP-LC-40G Line Card is Not Working, page 38](#)
- [Troubleshooting: The DTI Timer is Not Working, page 39](#)

Troubleshooting: Cisco cBR-CCAP-LC-40G Line Card Link LED Does Not Illuminate

Problem After inserting the network cable into the SFP module of the Cisco cBR-CCAP-LC-40G line card, the LINK LED of the line card does not illuminate.

Possible Cause Dirt or skin oil is accumulated on the network cable plug faceplate generating significant attenuation and reducing the optical power levels below threshold levels. This could result in link failure.

Solution Clean the plug faceplate with a lint-free tissue soaked in 99 percent pure isopropyl alcohol and then with a dry lint-free tissue. Remove any residual dust from the faceplate with compressed air before installing the network cable.

Troubleshooting: Cisco GS7000 Node Resets After DHCP Timeout

Problem The Cisco GS7000 node is reset after DHCP timeout.

Possible Cause The DHCP server address is not specified in the Gigabit Ethernet interface of the Cisco cBR-CCAP-LC-40G line card.

Solution Verify the Gigabit Ethernet Interface configuration on the Cisco cBR-CCAP-LC-40G line card. To specify the DHCP server address, use the **ip helper-address** command.

Troubleshooting: Cisco GS7000 Node is Not Working

Problem The Cisco GS7000 node is online but the cable modem fails to come online.

Possible Cause The Cisco cBR-CCAP-LC-40G line card is not properly configured.

Solution Verify the configuration on the Cisco cBR-CCAP-LC-40G line card.

Possible Cause The Cisco GS7000 node is not properly connected to the line card.

Solution Verify the connection between Cisco cBR-CCAP-LC-40G line card and Cisco GS7000 node.

Troubleshooting: The Cisco cBR-CCAP-LC-40G Line Card is Not Working

Problem The Cisco cBR-CCAP-LC-40G line card is not working.

Possible Cause The Cisco cBR-CCAP-LC-40G line card is not connected to the power supply.

Solution Verify if the power LED is illuminated and the power supply is connected to the Cisco cBR-CCAP-LC-40G line card. Connect to the power supply, if not connected.

Possible Cause The Cisco cBR-CCAP-LC-40G line card is not configured on the Cisco CMTS.

Solution Configure the Cisco cBR-CCAP-LC-40G line card.

Possible Cause The captive screws are not secured on the faceplate and the ejector levers are not properly closed.

Solution Close the ejector levers and tighten the captive screws with your fingers. Then, use either a T-10 Torx or a common flathead screwdriver to tighten the captive screws from 5 to 7 in-lbs.

Possible Cause The Cisco cBR-CCAP-LC-40G line card is not firmly seated in the chassis.

Solution Unscrew the top and bottom captive screws on the line card using a T-10 Torx driver tool or flathead screwdriver. Simultaneously pivot both ejector levers away from the line card to disengage the line card. Slide the line card partially out of the slot in the chassis and slide it back in until it is firmly seated in the chassis. Close the ejector levers and tighten the captive screws with your fingers. Then, use either a T-10 Torx or a common flathead screwdriver to tighten the captive screws from 5 to 7 in-lbs.

Possible Cause The network cable connectors are not properly seated in the ports on the Cisco cBR-CCAP-LC-40G line card and cables are broken.

Solution Verify if the cables are broken. Replace the cables, if broken and insert the network cable connector into the SFP module port until it clicks and locks into place to ensure proper seating.

Possible Cause Incorrect or inappropriate software license is configured on the Cisco cBR-CCAP-LC-40G line card.

Solution Reinstall or rehost the appropriate license on the Cisco cBR-CCAP-LC-40G line card.

Possible Cause Power on Self Test (POST) fails when the line card is installed in the chassis.

Solution Verify the power supply connection and if the problem persists, contact the Technical Assistance Center (TAC) for further assistance.

Troubleshooting: The DTI Timer is Not Working

Problem The DOCSIS Timing Interface (DTI) timer is not working correctly and the cable modems are not in init() state.

Possible Cause DTI-based timing is disabled on the active card.

Solution Use the **show cable clock** command to identify the active card and enable the DTI-based timing using the **cable clock dti** command.

