Cisco Optical Reverse Transmitter Module for Compact Nodes

Installation and Operation Guide

For Your Safety

Explanation of Warning and Caution Icons

Avoid personal injury and product damage! Do not proceed beyond any symbol until you fully understand the indicated conditions.

The following warning and caution icons alert you to important information about the safe operation of this product:

You may find this symbol in the document that accompanies this product. This symbol indicates important operating or maintenance instructions.

You may find this symbol affixed to the product. This symbol indicates a live terminal where a dangerous voltage may be present; the tip of the flash points to the terminal device.

You may find this symbol affixed to the product. This symbol indicates a protective ground terminal.

You may find this symbol affixed to the product. This symbol indicates a chassis terminal (normally used for equipotential bonding).

You may find this symbol affixed to the product. This symbol warns of a potentially hot surface.

You may find this symbol affixed to the product and in this document. This symbol indicates an infrared laser that transmits intensity-modulated light and emits invisible laser radiation or an LED that transmits intensity-modulated light.

Important

Please read this entire guide. If this guide provides installation or operation instructions, give particular attention to all safety statements included in this guide.

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Copyright

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Contents, Continued

Important Safety Instructions

Read and Retain Instructions

Carefully read all safety and operating instructions before operating this equipment, and retain them for future reference.

Follow Instructions and Heed Warnings

Follow all operating and use instructions. Pay attention to all warnings and cautions in the operating instructions, as well as those that are affixed to this equipment.

Terminology

The terms defined below are used in this document. The definitions given are based on those found in safety standards.

Service Personnel-The term service personnel applies to trained and qualified individuals who are allowed to install, replace, or service electrical equipment. The service personnel are expected to use their experience and technical skills to avoid possible injury to themselves and others due to hazards that exist in service and restricted areas.

User and Operator-The terms user and operator apply to persons other than service personnel.

Ground(ing) and Earth(ing)-The terms ground(ing) and earth(ing) are synonymous. This document uses ground(ing) for clarity, but it can be interpreted as having the same meaning as earth(ing).

Electric Shock Hazard

This equipment meets applicable safety standards. Refer to this equipment's data sheet for details about regulatory compliance approvals.

⚠️ **WARNING:**

Avoid electric shock! Opening or removing the equipment cover may expose you to dangerous voltages. Refer all servicing to qualified service personnel only.

Electric shock can cause personal injury or even death. Avoid direct contact with dangerous voltages at all times.

Know the following safety warnings and guidelines:

* Only qualified service personnel are allowed to perform equipment installation or replacement.
* Only qualified service personnel are allowed to remove equipment covers and access any of the components inside the chassis.

Important Safety Instructions

Equipment Placement

> ⚠️ **WARNING:**
>
> **Avoid personal injury and damage to this equipment. An unstable mounting surface may cause this equipment to fall.**

To protect against equipment damage or injury to personnel, comply with the following:

Install this equipment in a restricted access location (access restricted to service personnel).

Make sure the mounting surface or rack is stable and can support the size and weight of this equipment.

Strand (Aerial) Installation

> ⚠️ **CAUTION:**
>
> **Be aware of the size and weight of strand-mounted equipment during the installation operation.**
>
> **Ensure that the strand can safely support the equipment's weight.**

Pedestal Installation

> ⚠️ **WARNING:**
>
> **Avoid possibility of personal injury. Ensure proper handling/lifting techniques are employed when working in confined spaces with heavy equipment.**

Ensure this equipment is securely fastened to the mounting surface or rack where necessary to protect against damage due to any disturbance and subsequent fall.

Ensure the mounting surface or rack is appropriately anchored according to manufacturer's specifications.

Ensure the installation site meets the ventilation requirements given in the equipment's data sheet to avoid the possibility of equipment overheating.

Ensure the installation site and operating environment is compatible with the equipment's International Protection (IP) rating specified in the equipment's data sheet.

Connecting to Utility AC Power

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(s).

Important Safety Instructions, Continued

- 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 pull on the plug or the connector to disconnect a cable. Never pull on the cable itself.

Connection to Network Power Sources

Refer to this equipment's specific installation instructions in this manual or in companion manuals in this series for connection to network ferro-resonant AC power sources.

Grounding (Utility AC Powered Equipment in Pedestals, Service Closets, etc.)

This section provides instructions for verifying that the equipment is properly grounded.

Safety Plugs（USA Only）

This equipment is equipped with either a 3-terminal (grounding-type) safety plug or a 2-terminal (polarized) safety plug. The wide blade or the third terminal is provided for safety. Do not defeat the safety purpose of the grounding-type or polarized safety plug.

To properly ground this equipment, follow these safety guidelines:

Grounding-Type Plug

For a 3-terminal plug (one terminal on this plug is a protective grounding pin), insert the plug into a grounded main, 3-terminal outlet.

Note: This plug fits only one way. If this plug cannot be fully inserted into the outlet, contact an electrician to replace the obsolete 3-terminal outlet.

Polarized Plug

For a 2-terminal plug (a polarized plug with one wide blade and one narrow blade), insert the plug into a polarized mains, 2-terminal outlet in which one socket is wider than the other.

Note: If this plug cannot be fully inserted into the outlet, try reversing the plug.

Important Safety Instructions, Continued

If the plug still fails to fit, contact an electrician to replace the obsolete 2-terminal outlet.

Grounding Terminal

If this equipment is equipped with an external grounding terminal, attach one end of an 18-gauge wire (or larger) to the grounding terminal; then, attach the other end of the wire to a ground, such as a grounded equipment rack.

Safety Plugs (European Union)

Class I Mains Powered Equipment

Provided with a 3-terminal AC inlet and requires connection to a 3-terminal mains supply outlet via a 3-terminal power cord for proper connection to the protective ground.

Note: The equipotential bonding terminal provided on some equipment is not designed to function as a protective ground connection.

Class II Mains Powered Equipment

Provided with a 2-terminal AC inlet that maybe connected by a 2-terminal power cord to the mains supply outlet. No connection to the protective ground is required as this class of equipment is provided with double or reinforced and/or supplementary insulation in addition to the basic insulation provided in Class I equipment.

Note: Class II equipment, which is subject to EN 50083-1, is provided with a chassis mounted equipotential bonding terminal. See the section titled Equipotential Bonding for connection instructions.

Equipotential Bonding

If this equipment is equipped with an external chassis terminal marked with the IEC 60417-5020 chassis icon ([⊥]), the installer should refer to CENELEC standard EN 50083-1 or IEC standard IEC 60728-11 for correct equipotential bonding connection instructions.

Important Safety Instructions, Continued

General Servicing Precautions

> ⚠️ **WARNING:**
>
> **Avoid electric shock! Opening or removing the equipment cover may expose you to dangerous voltages. Refer all servicing to qualified service personnel only.**

> ⚠️ **CAUTION:**
>
> **These servicing precautions are for the guidance of qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.**

Be aware of the following general precautions and guidelines:

- Servicing - Servicing is required when this equipment has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into this equipment, this equipment has been exposed to rain or moisture, does not operate normally, or has been dropped.
- Wristwatch and Jewelry - For personal safety and to avoid damage of this equipment during service and repair, do not wear electrically conducting objects such as a wristwatch or jewelry.
- Lightning - Do not work on this equipment, or connect or disconnect cables, during periods of lightning.
- Labels - Do not remove any warning labels. Replace damaged or illegible warning labels with new ones.
- Covers - Do not open the cover of this equipment and attempt service unless instructed to do so in the instructions. Refer all servicing to qualified service personnel only.
- Moisture - Do not allow moisture to enter this equipment.
- Cleaning - Use a damp cloth for cleaning.
- Safety Checks - After service, assemble this equipment and perform safety checks to ensure it is safe to use before putting it back into operation.

Electrostatic Discharge

Electrostatic discharge (ESD) results from the static electricity buildup on the human body and other objects. This static discharge can degrade components and cause failures.

Take the following precautions against electrostatic discharge:

- Use an anti-static bench mat and a wrist strap or ankle strap designed to safely ground ESD potentials through a resistive element.
- Keep components in their anti-static packaging until installed.
- Avoid touching electronic components when installing a module.

Important Safety Instructions, Continued

Fuse Replacement

- To replace a fuse, comply with the following:
- Disconnect the power before changing fuses.
- Identify and clear the condition that caused the original fuse failure.
- Always use a fuse of the correct type and rating. The correct type and rating are indicated on this equipment.

Modifications

This equipment has been designed and tested to comply with applicable safety, laser safety, and EMC regulations, codes, and standards to ensure safe operation in its intended environment. Refer to this equipment's data sheet for details about regulatory compliance approvals.

Do not make modifications to this equipment. Any changes or modifications could void the user's authority to operate this equipment.

Modifications have the potential to degrade the level of protection built into this equipment, putting people and property at risk of injury or damage. Those persons making any modifications expose themselves to the penalties arising from proven non-compliance with regulatory requirements and to civil litigation for compensation in respect of consequential damages or injury.

Accessories

Use only attachments or accessories specified by the manufacturer.

Preface

About This Guide

Purpose

This guide provides instructions for installing, operation and troubleshooting the transmitter.

Who Should Use This Document

This document is intended for authorized service personnel who have experience working with similar equipment. The service personnel should have appropriate background and knowledge to complete the procedures described in this document.

Qualified Personnel

> ⚠ **CAUTION:**
>
> **Allow only qualified and skilled personnel to install, operate, maintain, and service this product. Otherwise, personal injury or equipment damage may occur.**

Only appropriately qualified and skilled personnel should attempt to install, operate, maintain, and service this product.

Scope

This guide discusses the following topics.

- Description
- Installation
- Operation
- Troubleshooting
- Customer Support Information

Document Version

This is the first release of this guide (Rev A).

Chapter 1
Introduction

Overview

Introduction

This chapter provides an overview of this guide and of the Optical Reverse Transmitter (transmitter), including general description, overview and block diagram.

In This Chapter

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Overview	1-3
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Description

General Description

The Reverse Optical Transmitter is a 5 – 300 MHz return path transmitter which plugs into the compact nodes. The module converts the upstream RF signals coming from the subscriber's cable modem (CM) into an optical signal. To follow the evolving market requirements such as lower cost of ownership, reliability and performance it requires redesign of current module.

Features

The transmitter has the following features:

- Bandwidth 5~300MHz.

- DFB lasers with 0dBm , 3dBm and 6dBm and up to 16 CWDM wavelengths.

- Simplified setup reduces installation time and expertise requirements.

- Distance- and temperature-independent link performance simplifies engineering and maintenance requirements.

- Switch the mode of the transmitter between burst/normal via Mode Switch in transmitter front panel.

- Burst mode for RFoG applications.

Overview

Product Overview

The Reverse Optical Transmitter is a 5 – 300 MHz return path transmitter which plugs into many types of Node, like EGC FFDN and EGC Segmentation family, used for transmitting reverse signals from the node back to the headend. The transmitter features thermal compensation such that the drive level to the laser is held relatively stable over the full operating temperature range.

The main functionality of the transmitter will be to convert the RF upstream signal into an optical signal. The optical signal will be AM-modulated with RF signal. The module will also be capable of generating a 5MHz pilot tone. The Reverse Transmitter is available with Fabry-Perot, DFB or CWDM lasers.

Electrical connections are made to the node via the interface connection pins. Signals on this connector include +24V and +5V powering, RF input, ground and optical test point monitor. The transmitter is mounted to the node using a mounting screw on the heat sink.
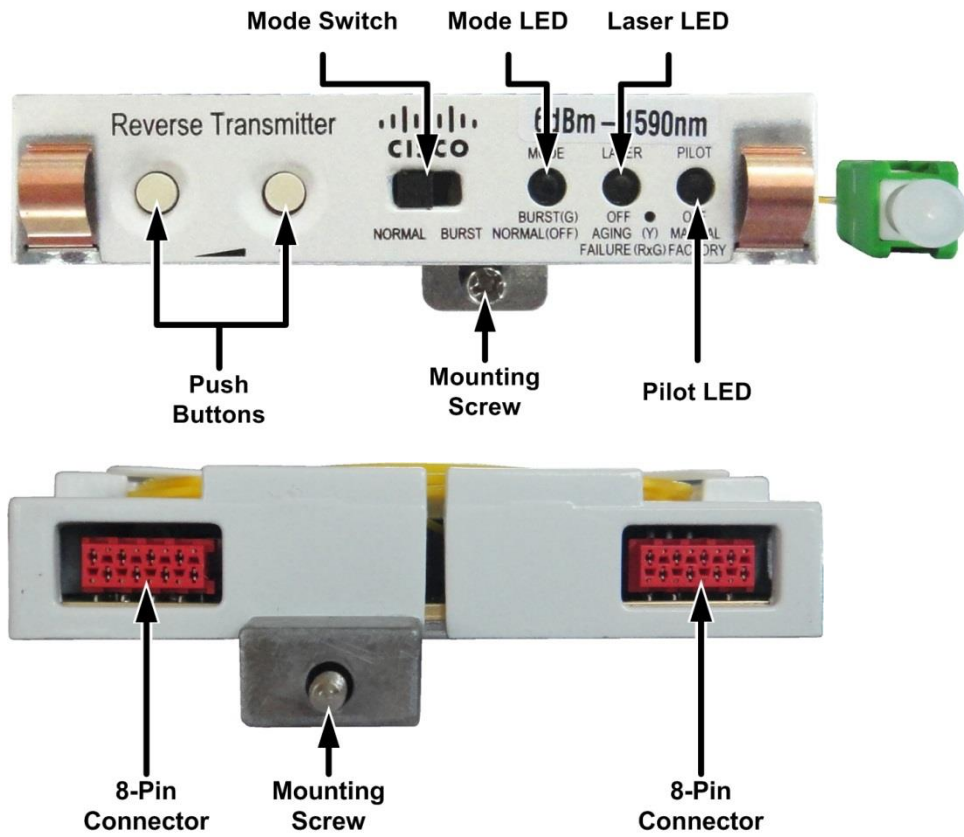
The optical reverse transmitters are to be compatible with the following nodes.

- A90201 Compact GaN EGC Segmentable node
- A90200 Compact EGC Segmentable node
- A90100 Compact EGC Fiber deep node
- A90300 Compact EGC Outdoor Fiber deep node

Overview, Continued

Panel Illustration

The following illustration shows panels of the optical reverse transmitter.

Overview, Continued

Panel Functions

The following table lists the functions of the front panel indicators on the optical reverse transmitter.

Description	Function	
MODE LED	Green/OFF Indicator	Green: Transmitter is working on the Burst mode
		OFF: Transmitter is working on the Normal mode
LASER LED	OFF/Green/Yellow /RED Indicator	OFF: Laser is switched off
		Green: Laser is switched on
		Yellow: Laser aging - The laser is aged and uses more current than it did when it was installed. The transmitter should be replaced as soon as possible
		Red: Laser failure - The laser does not function. The transmitter must be replaced Immediately
PILOT LED	OFF/Green/Yellow Indicator	OFF: The pilot tone is switched off or laser is switch off
		Green: The pilot tone is switched on and set to standard level
		Yellow: The pilot tone is switched on and not set to standard level

The following table lists other functions of the optical reverse transmitter front panel.

| Description	Function
Push Buttons	Adjust the input level and pilot level
Mode Switch	Switch the mode of the transmitter between burst/normal.
Mounting Screw	Mounts the transmitter in the compact node.

The following table lists the functions of the optical reverse transmitter rear panel.

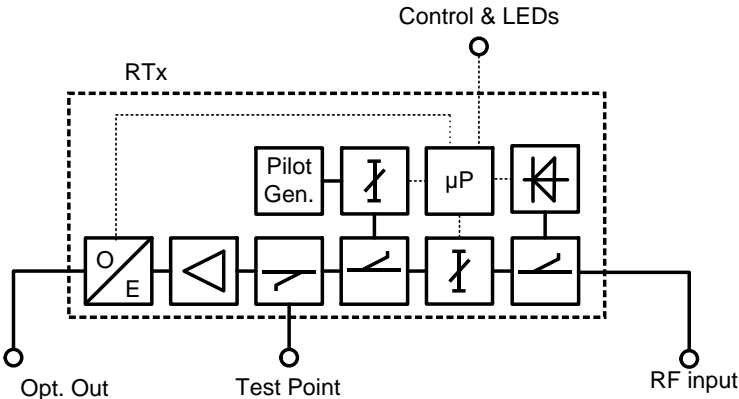| Description	Function
8-Pin Connectors	Provides electrical connections from the transmitter to the node

Overview, Continued

Fiber Tray

The Fiber Tray secures any excess fiber and provides a location for storing SC fiber optical connector pairs.

Fiber Tray
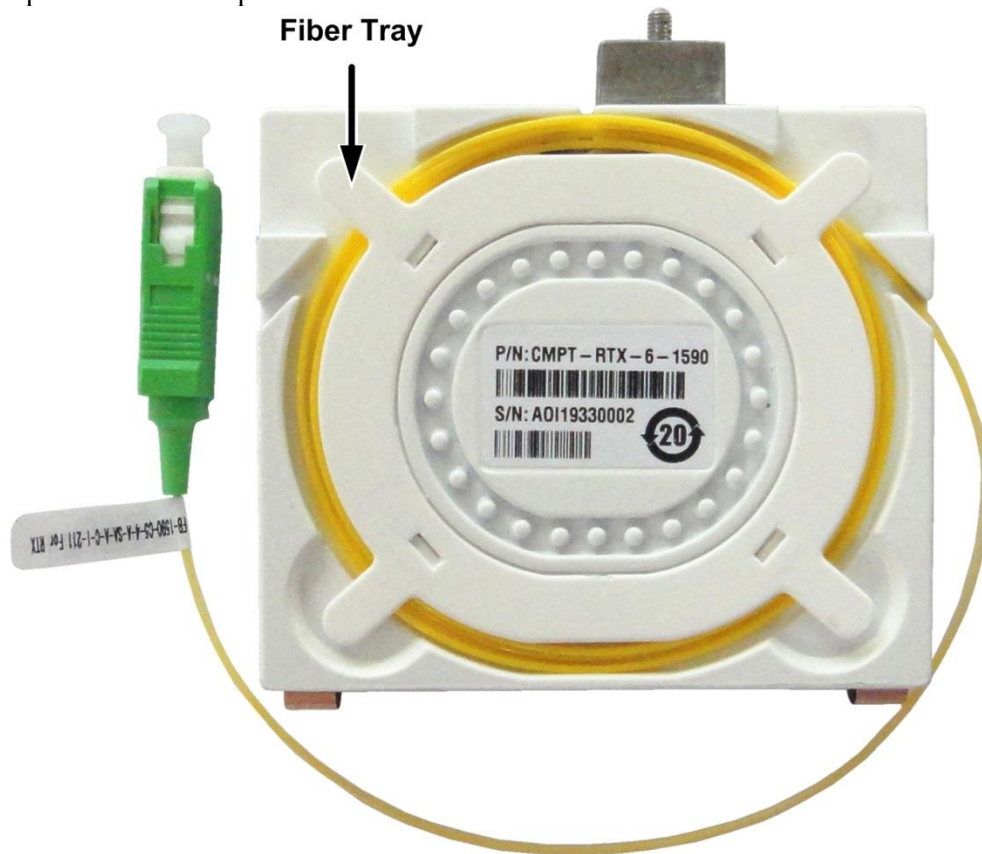
Block Diagram

The following is a block diagram of the optical reverse transmitter.

Chapter 2
Installation

Overview

Introduction

This chapter provides instructions for installing the Optical Reverse Transmitter in the Compact Node.

In This Chapter

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Before You Begin

Overview

The procedures in this chapter assume that you have completed the following:

- Prepared the installation site
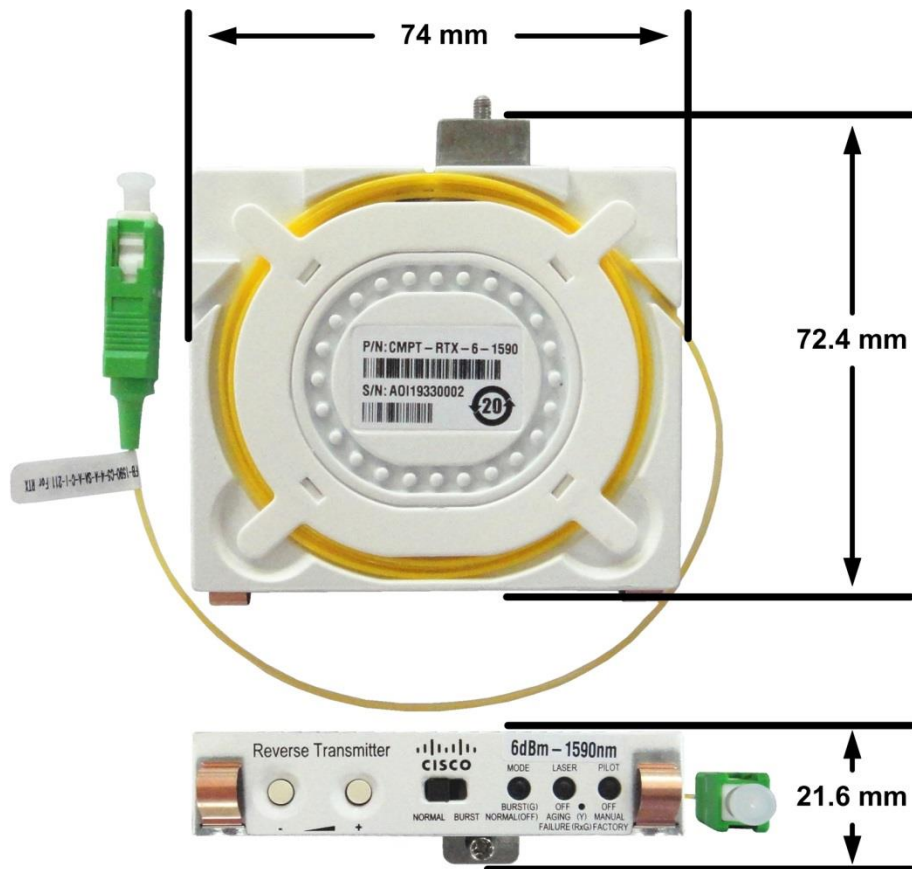- Prepared the Cisco device to install the transmitter
- Install the device correctly

Tools

Before you start, make sure that you have the following tools:
- Torque wrench with a 1/2-inch socket
- Cross screwdriver

Dimensions

The following illustration shows dimensions of the optical reverse transmitter.

Installing and Remove Optical Reverse Transmitter

To Install and Remove the Transmitter

> ⚠️ **CAUTION:**
>
> **Make sure enough space is reserved for installing the transmitter. Remove any items both on the mainboard and on the lid if the node cannot be closed.**

Complete the following steps to install or remove the optical reverse transmitter to the optical section.

1. Open the node housing.
2. Open the fiber clip on the metal cover and wire the fiber in the fiber guide.
3. Insert the optical reverse transmitter in the slot and ensure that the transmitter is seated properly. (Where to insert the transmitter is described in the instruction for the compact node)
4. Use a cross screwdriver to tighten the mounting screw.

Mounting Screw   **Fiber Connecter**
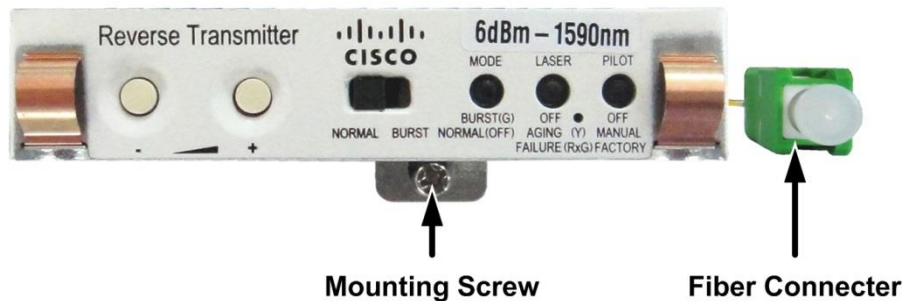
5. Bind the fiber in the fiber tray.
6. Clean the tips of the fiber connectors.
7. Insert the fiber connector into the optical adapter.
   a) If you don't need remove the transmitter at this time, proceed to step 11.
   b) If you need remove the transmitter at this time, proceed to step 9.
8. Disconnect the fiber connecter from the optical adapter, and cover the fiber connecter and optical adapter with dust caps immediately.
9. Use a cross screwdriver loosen the mounting screw to remove the transmitter, and put the module in a proper place
10. Connect the power plug.
11. Close the node housing.

Chapter 3
Operation

Overview

Introduction

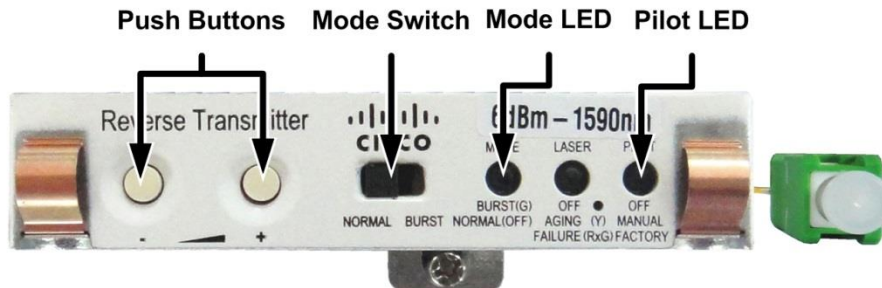This chapter provides information on how to set up the Optical Reverse Transmitter.

In This Chapter

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Preparation

Before You Begin

The transmitter can be set up using the two push buttons and the mode switch on the transmitter.

Setting Up

The transmitter must be adjusted in order to ensure an optimal function. The adjustment of the mode takes place by means of the Mode Switch on the transmitter. The adjustment of the RF input level and the pilot tone level takes place by means of the keys (+) and (-) on the transmitter. A short press on the key will change the level in small steps. If the key is pressed constantly, the level will change in major steps. Five seconds after releasing the key the actual set-up will automatically be stored in the memory.

Note: The set-up of the transmitter will also be saved even though the supply voltage disappears.

Note: The parameters can also be set by the handheld A91200 and LCI tool. Refer to the manual of the node for further instruction.

To set up the Mode

Switch the Mode Switch to set the mode of the transmitter between Burst/Normal. And then the Mode LED will show you the corresponding colors.

Description	Function	
MODE LED	Green/OFF Indicator	Green: Module is working on the Burst mode
		OFF: Module is working on the Normal mode

To set up the RF input level

The keys (+) or (-) can change the input level by 0-10 dB in steps of 0.1 dB. If the key is pressed constantly, the level will change in major steps. The RF input level at the transmitter can be measured at the test point to the reverse path - named TP-R on the node.

The RF level in the transmitter must be adjusted according to the number of channels (carriers) that have to be transferred. This RF level together with the incoming signal to the reverse receiver determines the output level at the receiver. The coherence between these values is shown in the table at below.

Optical Modulation Index	Reverse level measured on testpoint*	Min. level at module input Attenuator = 0 dB
9%	49	59
9%	49	59
9%	49	59
10%	50	60
11%	51	61
13%	52	62
14%	53	63
18%	55	65
22%	57	67
32%	60	70
40%	62	72
79%	68	78

**Note**: The level is including test point loss.

The corresponding RF input value for RFoG mode is shown in the table at below.

Optical Modulation Index	Reverse level measured on testpoint	Min. level at module input Attenuator = 0 dB
9%	61	71
10%	62	72
11%	63	73
13%	64	74
14%	65	75
18%	67	77
22%	69	79
32%	72	82
40%	74	84
79%	80	90

To set up the Pilot Level

The level in the pilot tone can be changed ± 5 dB. The standard setting is 40 dBμV at the test point. This level corresponds to 10 dB below the carrier at 10% modulation.

In order to change the level, the keys (+) and (-) are activated simultaneously. Now the pilot LED flashes to indicate that the level can be changed by pressing the key (+) or (-). A short press changes the level 0.1 dB. If the key is pressed constantly, the level is changed in major steps. Five seconds after releasing the key, the LED will flash quickly and the current set-up is stored in the memory.
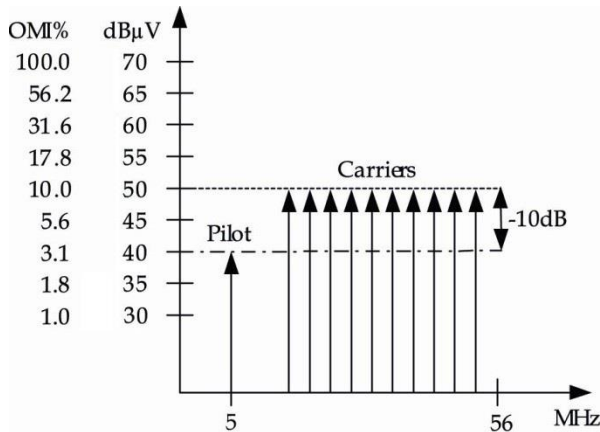
To switch the Pilot Tone ON/OFF

The pilot tone is switched off by activating both keys (+) and (-) simultaneously twice. Then the pilot LED is switched off indicating that the pilot has been switched off.

In order to switch on the pilot tone both keys (+) and (-) are pressed simultaneously only once. Thus the pilot LED flashes and the level can be changed. If the level is correct, the LED will flash quickly after 5 seconds and the current set-up is stored in the memory.

Chapter 4
Troubleshooting

Overview

This chapter describes the steps you may take to troubleshoot the Optical Reverse Transmitter for Cisco Compact Node.

In This Chapter

Transmitter Signaling

To Troubleshoot from the LEDs

The following table lists the solutions with regard to the issues shown from the transmitter's LED signaling.

Problem Description	Solution
The Laser LED is OFF	Verify the status of laser is off/on.
	Verify the power supply of the node.
	Verify that connectors of the transmitter are clicked into the interface connectors in the mainboard slot.
	Replace the transmitter in use with a new one in case it is broken.
The Laser LED is Yellow	Replace the transmitter in use with a new one as soon as possible.
The Laser LED is Red	Replace the transmitter in use with a new one in case it is broken.

Further Assistance

Contact Cisco for Support

If you still cannot find the appropriate solution after performing the recommended solutions in this chapter, contact Cisco for support. Refer to Chapter 5, *Customer Support Information*.

Chapter 5
Customer Support Information

If You Have Questions

If you have technical questions, call Cisco Services for assistance. Follow the menu options to speak with a service engineer.

Access your company's extranet site to view or order additional technical publications. For accessing instructions, contact the representative who handles your account. Check your extranet site often as the information is updated frequently.