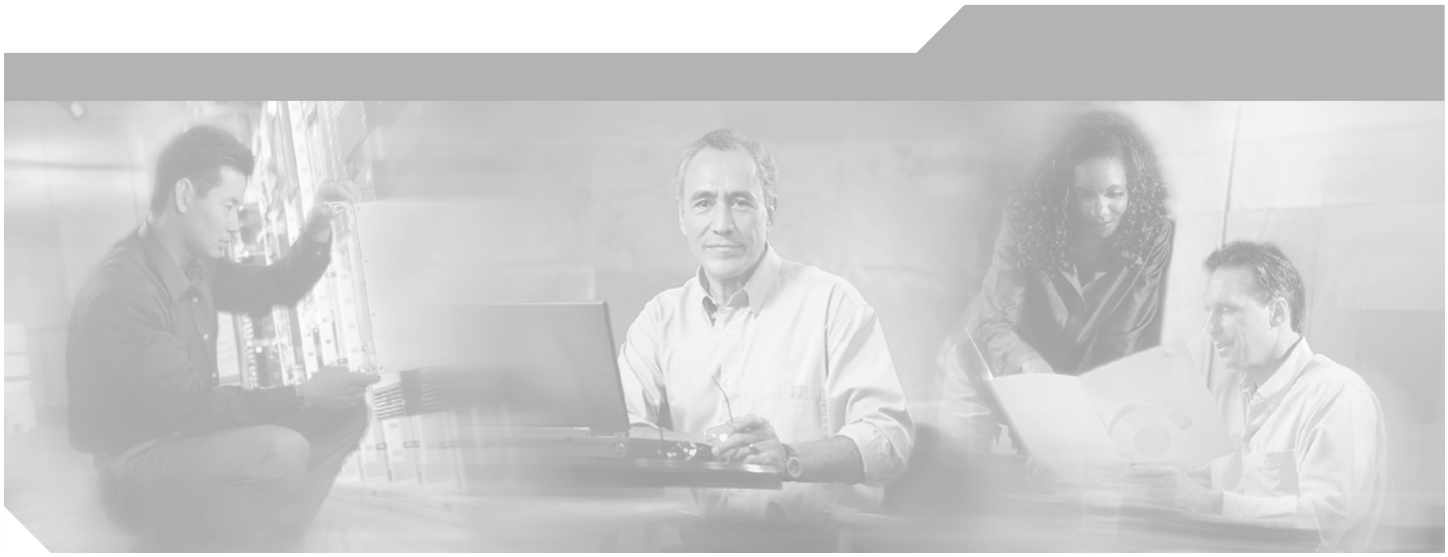

Cisco ONS 15540 ESPx Optical Transport Turn-Up and Test Guide

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Cisco ONS 15540 ESPx Optical Transport Turn-Up and Test Guide

Preface

This preface describes the purpose, intended audience, organization, and conventions for the *Cisco ONS 15540 ESPx Optical Transport Turn-Up and Test Guide*.

Purpose

The *Cisco ONS 15540 ESPx Optical Transport Turn-Up and Test Guide* describes acceptance testing procedures for nodes and networks. These procedures allow an installer to verify the installation of a network of Cisco ONS 15540 ESPx nodes.

These procedures are performed following hardware installation and initial software configuration, as described in this guide.

For more hardware installation information, refer to the *Cisco ONS 15540 ESPx Hardware Installation Guide*. For more detailed software configuration information, refer to the *Cisco ONS 15540 ESPx Configuration Guide*. For more detailed command information, refer to the *Cisco ONS 15540 ESPx Command Reference* publication.

Audience

This guide helps installers verify the installation of a network of Cisco ONS 15540 ESPx nodes.

Organization

The chapters of this guide are as follows:

Chapter	Title	Description
Chapter 1	Safety Information and Preinstallation Tasks	Describes safety considerations for operating the Cisco ONS 15540 ESPx. Describes procedures that should be performed prior to installation of hardware.
Chapter 2	Hardware Installation Procedures	Describes procedures for installing essential hardware components.
Chapter 3	Software Setup Procedures	Describes basic software configuration procedures.

Chapter	Title	Description
Chapter 4	Basic Node Verification Procedures	Describes procedures for verification of each node in the network.
Chapter 5	Basic Network Verification Procedures	Describes procedures for network-level verification. Perform these procedures after completing the node verification procedures.
Appendix A	Node Data Record	Provides tables for keeping track of essential data for each node.
Appendix B	Test Results Tables	Provides tables for recording test results and verifying that tests are completed successfully.

Related Documentation

This guide is part of a documentation set that supports the Cisco ONS 15540 ESPx. The other documents in the set are as follows:

- *Regulatory Compliance and Safety Information for the Cisco ONS 15500 Series*
- *Cisco ONS 15540 ESPx Planning Guide*
- *Cisco ONS 15540 ESPx Hardware Installation Guide*
- *Cisco ONS 15540 ESPx Cleaning Procedures for Fiber Optic Connections*
- *Cisco ONS 15540 ESPx Configuration Guide*
- *Cisco ONS 15540 ESPx Command Reference*
- *Cisco ONS 15540 ESPx System Alarms and Error Messages*
- *Network Management for the Cisco ONS 15540 ESPx*
- *Cisco ONS 15540 ESPx TL1 Command Reference*
- *MIB Quick Reference for the Cisco ONS 15500 Series*
- *Cisco ONS 15540 ESPx Software Upgrade Guide*

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

International Cisco websites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

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You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpck/pdi.htm

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  http://www.cisco.com/en/US/partner/ordering/index.shtml

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You can submit e-mail comments about technical documentation to bug-doc@cisco.com.

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We appreciate your comments.

Obtaining Technical Assistance

For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, the Cisco Technical Assistance Center (TAC) provides 24-hour-a-day, award-winning technical support services, online and over the phone. Cisco.com features the Cisco TAC website as an online starting point for technical assistance. If you do not hold a valid Cisco service contract, please contact your reseller.

Cisco TAC Website

The Cisco TAC website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The Cisco TAC website is available 24 hours a day, 365 days a year. The Cisco TAC website is located at this URL:

http://www.cisco.com/tac

Accessing all the tools on the Cisco TAC website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a login ID or password, register at this URL:

http://tools.cisco.com/RPF/register/register.do

Opening a TAC Case

Using the online TAC Case Open Tool is the fastest way to open P3 and P4 cases. (P3 and P4 cases are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Case Open Tool automatically recommends resources for an immediate solution. If your issue is not resolved using the recommended resources, your case will be assigned to a Cisco TAC engineer. The online TAC Case Open Tool is located at this URL:

http://www.cisco.com/tac/caseopen

For P1 or P2 cases (P1 and P2 cases are those in which your production network is down or severely degraded) or if you do not have Internet access, contact Cisco TAC by telephone. Cisco TAC engineers are assigned immediately to P1 and P2 cases to help keep your business operations running smoothly.

To open a case by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

For a complete listing of Cisco TAC contacts, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

TAC Case Priority Definitions

To ensure that all cases are reported in a standard format, Cisco has established case priority definitions.

Priority 1 (P1)—Your network is “down” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Priority 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Priority 3 (P3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Priority 4 (P4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- Cisco Marketplace provides a variety of Cisco books, reference guides, and logo merchandise. Go to this URL to visit the company store:

  http://www.cisco.com/go/marketplace/

- The Cisco *Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the Cisco Product Catalog at this URL:

  http://cisco.com/univercd/cc/td/doc/pcat/

- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press online at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access Packet magazine at this URL:

  http://www.cisco.com/packet

- *iQ Magazine* is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

  http://www.cisco.com/ipj

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

  http://www.cisco.com/en/US/learning/index.html

Safety Information and Preinstallation Tasks

This chapter describes safety information and procedures that should be performed prior to installation of hardware.

This chapter contains the following major sections:

Note Before you install, operate, or service the system, read the *Regulatory Compliance and Safety Information for the Cisco ONS 15500 Series* for important safety information you should know before working with the system.

For more information on hardware, refer to the *Cisco ONS 15540 ESPx Hardware Installation Guide*.

For more information on software, refer to the *Cisco ONS 15540 ESPx Configuration Guide* and *Cisco ONS 15540 ESPx Command Reference* publication.

For more information on cleaning procedures, refer to the *Cisco ONS 15540 ESPx Cleaning Procedures for Fiber Optic Connections*.

Safety Information

This section describes safety considerations for operating the Cisco ONS 15540 ESPx. This section includes critical safety warnings, precautions, and ESD guidelines.

Critical Safety Warnings

This section includes warnings that may appear in the Cisco ONS 15540 ESPx product documents.

Wrist Strap Warning

Warning During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.

Restricted Area Warning

Warning This unit is intended for installation in restricted access areas. A restricted access area is where access can only be gained by service personnel through the use of a special tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.

Qualified Personnel Warning

Warning Only trained and qualified personnel should be allowed to install or replace this equipment.

Card Handling Warning

Warning High-performance devices on this card can get hot during operation. To remove the card, hold it by the faceplate and bottom edge. Allow the card to cool before touching any other part of it or before placing it in an antistatic bag.

Warning Definition

Warning This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the Regulatory Compliance and Safety Information document that accompanied this device.

Disconnect Device Warning

Warning A readily accessible disconnect device must be incorporated in the building's installation wiring.

DC Protection

Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a Listed and Certified fuse or circuit breaker 25A, minimum 60VDC, is used on all current-carrying conductors.

Laser Radiation Warning

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

General Safety Precautions

General safety precautions are not related to any specific procedures and do not appear elsewhere in this publication. Personnel must understand and apply the following precautions during installation and testing of the Cisco ONS 15540 ESPx.

- Know standard electrical safety and electrical wiring and connection practices.
- Be familiar with cardio-pulmonary resuscitation (CPR). Obtain this information through the appropriate national authority (such as the Red Cross or the local equivalent). This knowledge is imperative for personnel working with or near voltages with levels capable of causing injury or death.

Recommended Safety Precautions

The following precautions are recommended when working on the Cisco ONS 15540 ESPx:

- Do not lift an object alone that could be too heavy for one individual.
- Keep your work area tidy and free of obstructing objects at all times.
- Do not wear loose clothing, jewelry, or other items that could be caught in the components during installation or use.
- Use the equipment only in accordance with the electrical power rating.
- Do not work alone if hazardous conditions may exist in your workplace.
- Install the Cisco ONS 15540 ESPx components in compliance with the following local and national electrical codes:
  - In the United States: National Fire Protection Association (NFPA) 70; US National Electrical Code
  - In Canada: Canadian Electrical Code, part I, CSA C22.1
  - Elsewhere: International Electrotechnical Commission (IEC) 364, part 1-7
- Properly ground the equipment.
- Connect only a DC power source that complies with the safety extra-low voltage (SELV) requirements in UL1950, CSA 950, EN 60950, and IEC950 to Cisco ONS 15540 DC power supply input.
- Terminate all laser outputs properly before connecting laser inputs.
- Disconnect the input end of an optical fiber jumper cable before disconnecting the output end.
- Handle glass fiber with care. Glass fiber can be broken if mishandled. Using broken fiber can result in permanent equipment damage.
- Protect skin from exposed glass fiber. It can penetrate the skin.

- Limit the number of personnel that have access to lightwave transmission systems. Personnel should be authorized and properly trained if access to laser emissions is required.
- Limit the use of laser test equipment to authorized, trained personnel during installation and service. This precaution includes using optical loss test (OLT) set, optical spectrum analyzer, and optical time domain reflectometer (OTDR) equipment.
- Exclude any unauthorized personnel from the immediate laser radiation area during service and installation when there is a possibility that the system may become energized. Consider the immediate service area to be a temporary laser-controlled area.
- The Cisco ONS 15540 ESPx functions in the 1310 – 1550 nm window, which is considered invisible radiation. You cannot see the laser light being emitted by a fiber, a pigtail, or a bulkhead connector. Use appropriate eye protection during fiber-optic system installation or maintenance whenever there is potential for laser radiation exposure, as recommended by the company's health and safety procedures. Observe this precaution whether or not warning labels have been posted.

Preventing ESD Damage

Electrostatic discharge (ESD) damage occurs when electronic cards or components are mishandled and can result in complete or intermittent failures. Note the following guidelines before you install or service the system:

- Always wear an ESD-preventive wrist or ankle strap when handling electronic components. Connect one end of the strap to an ESD jack or an unpainted metal component on the system (such as a captive installation screw).
- Handle cards by the faceplates and edges only; avoid touching the printed circuit board and connector pins.
- Place any removed component on an antistatic surface or in a static shielding bag.
- Avoid contact between the cards and clothing. The wrist strap only protects the card from ESD voltages on the body; ESD voltages on clothing can still cause damage.

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

Required Equipment

This section lists the required system equipment, cable, and test equipment.

System Requirements

The following equipment is assumed to be present and installed:

- Cisco ONS 15540 chassis and external AC power supply if needed
- Processor cards (1 or 2)
- Air inlet
- Fan tray

Cable Requirements

This section lists the cable requirements for the Cisco ONS 15540 ESPx. The Cisco ONS 15540 ESPx chassis requires the following cables and drawers:

- Mux/demux module cabling:
  - Add/drop mux/demux cabling: short cable with MU-MU connectors
- Transponder module to client cables: medium size cable with SC connectors
  - SM transponder modules: SC to SC SM cable or SC to ST SM cable, 1.0 m or 3.0 m
  - MM transponder modules: SC to SC MM cable or SC to ST MM cable, 1.0 m or 3.0 m
  - Type 2 extended range transponder modules: cable depends on SFP optics. See Table 1-1 for fixed rate SFP optics and Table 1-2 for variable rate SFP optics.
  - Y-cables: Multimode or single mode y-cable

Table 1-1 Fixed Rate SFP Optics

Part Number	Supported Protocols	Fiber Type	Wavelength	Connector Type
15500-XVRA-01A2	ESCON, SONET OC-3 SR, SDH STM-1	MM 62.5/125 µm	1310 nm	MT-RJ
15500-XVRA-02C1	Gigabit Ethernet[1], Fibre Channel (1 Gbps[2])	MM 50/125 µm MM 62.5/125 µm	850 nm	LC
15500-XVRA-02C2	Fibre Channel (2 Gbps[3])	MM 50/125 µm MM 62.5/125 µm	850 nm	LC
15500-XVRA-03B1	Gigabit Ethernet[4], Fibre Channel (1 Gbps[5])	SM 9/125 µm	1310 nm	LC
15500-XVRA-03B2	Gigabit Ethernet, Fibre Channel (1 Gbps[6] and 2 Gbps[7])	SM 9/125 µm	1310 nm	LC
15500-XVRA-06B1	SONET OC-12 SR[8], SDH STM-4	SM 9/125 µm	1310 nm	LC
15500-XVRA-07B1	SONET OC-48 SR, SDH STM-16	SM 9/125 µm	1310 nm	LC

1. 1000BASE-SX
2. FC-0-100-M5-SN-S and FC-0-100-M6-SN-S standards
3. FC-0-200-M5-SN-S and FC-0-200-M6-SN-S standards
4. 1000BASE-LX
5. FC-0-100-SM-LC-S standard
6. FC-0-100-SM-LC-S standard
7. FC-0-200-SM-LC-S standard
8. SR = short range

Table 1-2 Variable Rate SFP Optics

Part Number	Supported Protocols	Fiber Types	Wavelength	Connector Type
15500-XVRA-10A1	Low-band 8 Mbps to 200 Mbps	MM 50/125 µm MM 62.5/125 µm	1310 nm	LC
15500-XVRA-10B1	Low-band 8 Mbps to 200 Mbps	SM 9/125 µm	1310 nm	LC

- Trunk cables: MU-to-SC patch cable or MU-to-ST patch cable, 1.0 m or 3.0 m
- Cabling required if connecting by direct cross connection:
  - One MTP-to-MTP cable required per nonsplitter 2.5-Gbps line card motherboard
  - Two MTP-to-MTP cables required per splitter 2.5-Gbps line card motherboard
  - One MTP-to-MTP cable required per nonsplitter 10-Gbps line card motherboard
  - Two MTP-to-MTP cables required per splitter 2.5-Gbps line card motherboard
  - One MTP-to-2 MTP cable required to connect two 10-Gbps line card motherboards to a mux/demux module
- Cabling required if connecting through the cross connect drawer:
  - Cross connect drawer (one cross connect drawer is required per 16 unprotected channels or 8 protected channels)
  - One MTP-to-MU breakout cable from the mux/demux module to the cross connect drawer per channel band
  - One MTP-to-MU breakout cable required per channel band for no splitter 2.5-Gbps line card motherboards
  - Two MTP-to-MU breakout cables required per channel band for splitter 2.5-Gbps line card motherboards
  - One MTP-to-MU breakout cable required per channel band for no splitter 2.5-Gbps line card motherboards
  - One MTP-to-4MU breakout cable required per channel band for 10-Gbps line card motherboards
  - For each band being cross connected, you need 8 MU-to-MU patch cables (8 in. length).
- Cable storage drawers (one or more drawers depending on system requirement)

Test Equipment Requirements

The following test equipment is required:

- Optical Spectrum Analyzer (OSA) capable of reading wavelengths between 1530 nm and 1563 nm
- Optical Time Domain Reflectometer (OTDR)
- Hand-held optical power meter
- Data test set (Ethernet packet generator and analyzer, BERT)
- Fiber cleaning kit

- Optical fiber scope
- Cable installation tool

Before Installing

Before you install the shelf, you must complete the following tasks:

- Unpack and inspect the shelf.
- Maintain a network record.

Caution Use extreme care when removing or installing connectors so you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

NTP-1 Unpack and Inspect the Shelf

Purpose	This procedure describes how to unpack and inspect the shelf.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Take inventory. Compare the equipment inside with the packing slip and the equipment list provided by customer service. If there are any discrepancies, notify the Customer Service Center.

Step 2 Check for external damage. Visually check all components and immediately report any shipping damage to your customer service representative. Have the following information ready:

- Invoice number of shipper (see packing slip)
- Model and serial number of the damaged unit
- Description of damage
- Effect of damage on the installation

Fiber Plant Characterization

To verify fiber characteristics in the network, proper testing is required.

The test measurement results must be documented and are referred to during acceptance testing of a network, as described in this guide.

This test measurement data can also be used to determine whether your network can support higher bandwidth services such as OC-192, and it can help determine network requirements for dispersion compensator modules or amplifiers.

Fiber-optic testing procedures must be performed to measure the following parameters:

- Link loss (attenuation)
- Optical return loss (ORL)
- Polarization mode dispersion (PMD)
- Chromatic dispersion
- Fiber length

For more information on fiber plant characterization, refer to the *Cisco ONS 15540 ESPx Planning Guide*.

Cleaning Information

Cleaning the fiber optic components of the Cisco ONS 15540 ESPx is important for maintaining the system. Any contamination in the fiber connection can cause failure of the component or failure of the entire system.

Microscopic dust particles can cause a variety of problems for optical connectors. A particle that partially or completely blocks the fiber core generates strong back reflections, which can cause instability in the laser system. Dust particles trapped between two fiber faces can scratch the glass surfaces. Even if a particle is only situated on the cladding or the ferrule, it can cause an air gap or misalignment between the fiber cores that can significantly degrade the optical signal.

- A 1-micrometer dust particle on a single-mode core can block up to 1% of the light (a 0.05 dB loss).
- A 9-micrometer speck is too small to see without a microscope, but it could completely block the fiber core.

By comparison, a typical human hair is 50 to 75 micrometers in diameter, as much as 8 times larger. So, even though dust may not be visible, it is still present in the air and can deposit onto the connector.

In addition to dust, other types of contamination must also be cleaned off the fiber. Such materials include:

- Oils (frequently from human hands)
- Film residues (condensed from vapors in the air)
- Powdery coatings (left after water or other solvents evaporate away)

These contaminants can be more difficult to remove than dust particles.

Caution With 1- to 200-mW power in a fiber (0 to 23 dBm) now in use for communications systems, any contaminant can be burned into the fiber end face if it blocks the core while the laser is turned on. This burning may damage the optical surface such that it cannot be cleaned.

When cleaning fiber components, procedures must be followed precisely and carefully with the goal of eliminating any dust or contamination. A clean component connects properly; a dirty component may transfer contamination to the connector, or it may even damage the optical contacts.

Inspecting, cleaning, and reinspecting are critical steps that must be done before making any fiber connection.

Inspection Equipment

It is important that every fiber connector be inspected with a microscope before a connection is made as many of the contaminants are too small to see with the naked eye. The fiber inspection scopes (not included in the Cisco ONS 15540 ESPx cleaning kit) described in this section are designed to magnify and display the critical portion of the ferrule where the connection is made.

Video and Optical Fiberscopes

Fiberscopes are customized microscopes used to inspect optical fiber components. Figure 1-1 and Figure 1-2 show examples of available fiber scopes . The scope you chose should provide at least 200x magnification. Specific adapters are needed to properly inspect the ferrule faces of some connector types (such as the MPO, E2000, or MU connectors). In instances where multiple connector types need inspection, it may be more efficient to have a dedicated scope for each type of adapter.

Note To ensure personal eye safety, we strongly recommend that a video fiberscope be used for inspections. Be certain that optical fiberscopes have the appropriate wavelength band filters to protect the user.

Figure 1-1 Video Fiberscope—Desktop

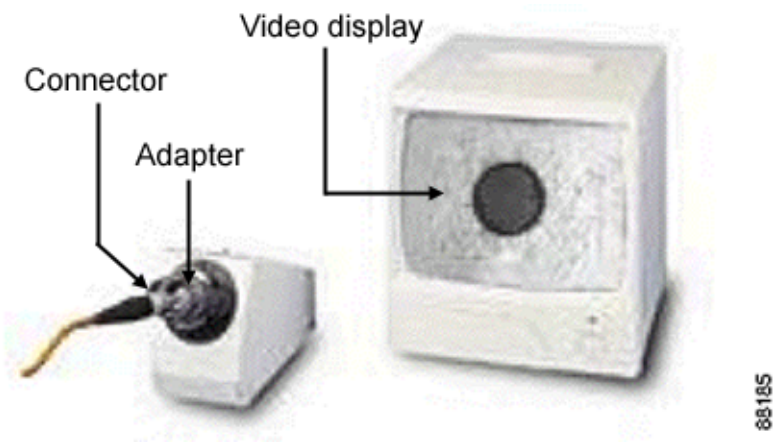


Figure 1-2 Optical Fiberscopes—Handheld

Bulkhead Fiberscope

The bulkhead fiberscope is a handheld fiberscope used to inspect connectors in bulkhead ports. (See Figure 1-3.) The scope should provide at least 200x magnification displayed on a video monitor. Specific adapters are needed to properly inspect the ferrule faces of some connector types (such as the MPO, E2000, or MU connectors).

Figure 1-3 Bulkhead Fiberscope—Handheld

Laser Safety Glasses

Laser safety glasses can protect a person's eyes from laser light while handling fiber. They are intended to provide a level of protection across specific wavelengths. Be sure that the glasses are matched to the laser’s wavelength. Laser safety glasses must meet federal and state regulations.

Cisco ONS 15540 ESPx Cleaning Kits

The Cisco ONS 15540 ESPx cleaning kit is available in two versions. The 2.5-Gbps transponder kit is used in systems with SM (single-mode), MM (multimode), and extended range transponder modules. Table 1-3 lists the contents of this kit. The 10-GE transponder kit is used in systems with the 10-GE transponder module. Table 1-4 lists the contents of this kit.

Table 1-3 2.5-Gbps Transponder Cleaning Kit Contents

Quantity	Part Number	Item Description
20	51-3507-01	Cleaning adapter for MU connector with cutout
5	51-3357-01	Cleaning adapter for MPO/MTP connector
1	74-3168-01	Cartridge cleaner (OPTIPOP) one slot
1	74-3167-01	Cartridge cleaner (OPTIPOP) for MPO/MTP with pins
1	51-3513-01	Package of 50 optical cleaning lint-free swabs (1.25 mm)
1	51-3359-01	Package of 250 optical cleaning lint-free swabs (2.5 mm)
1	800-22001-01	2.5-Gbps transponder cleaning module with dust caps

Table 1-4 10-GE Transponder Cleaning Kit Contents

Quantity	Part Number	Item Description
20	51-3507-01	Cleaning adapter for MU connector with cutout
5	51-3357-01	Cleaning adapter for MPO/MTP connector
1	51-3613-01	Cartridge cleaner (OPTIPOP) one slot
1	51-3612-01	Cartridge cleaner (OPTIPOP) for MPO/MTP with pins
1	51-3513-01	Package of 50 optical cleaning lint-free swabs (1.25 mm)
1	51-3359-01	Package of 250 optical cleaning lint-free swabs (2.5 mm)
1	800-22481-01	10-Gbps transponder cleaning module with dust caps

Cartridge Cleaners

Cartridge cleaners contain a roll of woven material packaged in a cassette (see Figure 1-4). When a lever is pressed, a shutter opens to provide access to a fresh span of cleaning material. The following cartridges are included in the cleaning kit:

- Cartridge cleaner (OPTIPOP) MPO/MTP with pins

  Used to perform dry cleaning of MPO/MTP male connectors. It has two guide slots in the cleaning window. When the lever is pressed a shutter opens to provide a new section of the cleaning material.

- Cartridge cleaner (OPTIPOP) with one slot

  Used to perform dry cleaning of 2.5-mm (SC, FC, and so on) and 1.25-mm (MU, LC, and so on) ferrule connectors and female multi-fiber connectors such as MT-RJ. When the lever is pressed, a shutter opens to provide a new section of the cleaning material.

Note The ferrule is the part of the connector that keeps the fiber accurately aligned within the connector.

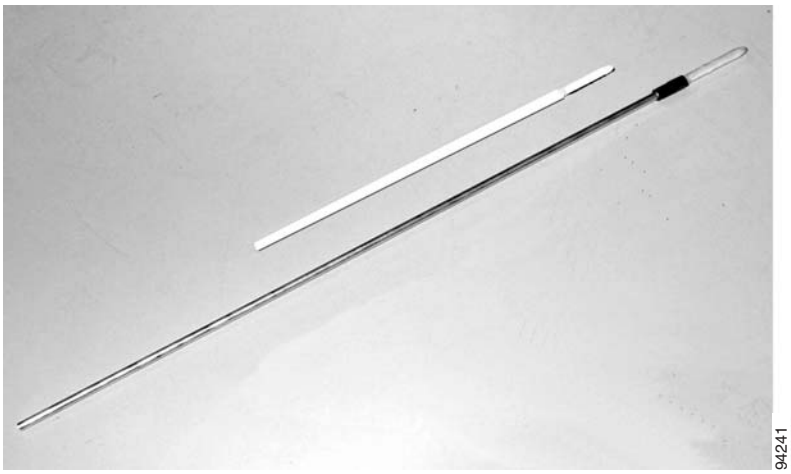
Figure 1-4 Cartridge Cleaner

Lint-Free Swabs

Swabs have a fabric tip at the end of a long stick. Lint-free swabs should be stored in a clean container to avoid contamination of the tip. Be sure to use a swab sized properly for the ferrule type (1.25 mm or 2.5 mm). See Figure 1-5.

Caution Never reuse a swab, it could transfer dirt or oils from one connector to another.

Figure 1-5 1.25-mm and 2.5-mm Lint-Free Swabs



Inspecting the Cisco ONS 15540 ESPx Fiber Optic Connections

Inspecting the fiber optic connectors for dust particles or other contaminants before bringing the card or module online can help to prevent system failures. Always work carefully around lasers and fiber optic connections. Keep the following information in mind.

- Always turn off any laser sources before you inspect fiber connectors or optical components.
- Always inspect the connectors or adapters before you clean.
- Always inspect and clean the connectors before you make a connection.
- Always use the connector housing to plug or unplug a fiber.
- Always keep the protective cap on unplugged fiber connectors.
- Always store unused protective caps in a resealable box and locate them near the connectors for easy access.
- Always discard used lint-free swabs properly.
- Always wear appropriate safety glasses when required in your production area.
- Never look into a fiber while the system lasers are on.
- Never use unfiltered handheld magnifiers or focusing optics to inspect fiber connectors.
- Never connect a fiber to a fiberscope while the system lasers are on.
- Never touch the end face of the fiber connectors.
- Never twist or pull forcefully on the fiber cable.
- Never reuse any lint-free swab or OPTIPOP cartridge cleaner reel.
- Never touch the clean area of a lint-free swab or OPTIPOP cartridge cleaner.

Warning **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.**

Hardware Installation Procedures

This chapter describes procedures for installing essential hardware components. This section describes common hardware installation and verification procedures and tasks. Refer to the *Cisco ONS 15540 ESPx Hardware Installation Guide* for complete hardware installation instructions.

Before You Begin

This section lists the chapter non-trouble procedures (NTPs). Turn to a procedure for applicable tasks or detailed level procedures (DLPs).

Step 1 NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1—Complete this procedure to install the chassis in the rack.

Step 2 NTP-3 Install the Cable Management System, page 2-4—Complete this procedure to install the optional fiber routing management system.

Step 3 NTP-4 Install Processor Cards, Line Card Motherboards, and Modules, page 2-12—Complete this procedure to install all line cards, modules, and motherboards in the shelf.

Step 4 NTP-5 Connect the Hardware, page 2-26—Complete this procedure to make the network and fiber optic connections on the shelf.

Step 5 NTP-6 Ground the Shelf, page 2-55—Complete this procedure before continuing with the "DLP-24 Clean Optical Connectors" task on page 2-31.

Step 6 NTP-7 Power Up the Shelf, page 2-57—Complete this procedure to install the power supplies, connect the power, and power up the shelf.

Step 7 NTP-8 Verify Installation of Hardware, page 2-66—Complete this procedure to verify that the hardware is properly installed.

NTP-2 Install the Cisco ONS 15540 ESPx Chassis

Purpose	This procedure describes how to install the Cisco ONS 15540 ESPx chassis.
Tools/Equipment	19-inch rack-mounting kit Number 1 Phillips screwdriver
Prerequisite Procedures	NTP-1 Unpack and Inspect the Shelf, page 1-7

Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Complete the "DLP-1 Flush-Mount the Cisco ONS 15540 ESPx" task on page 2-2.

Step 2 Continue with the "NTP-3 Install the Cable Management System" procedure on page 2-4.

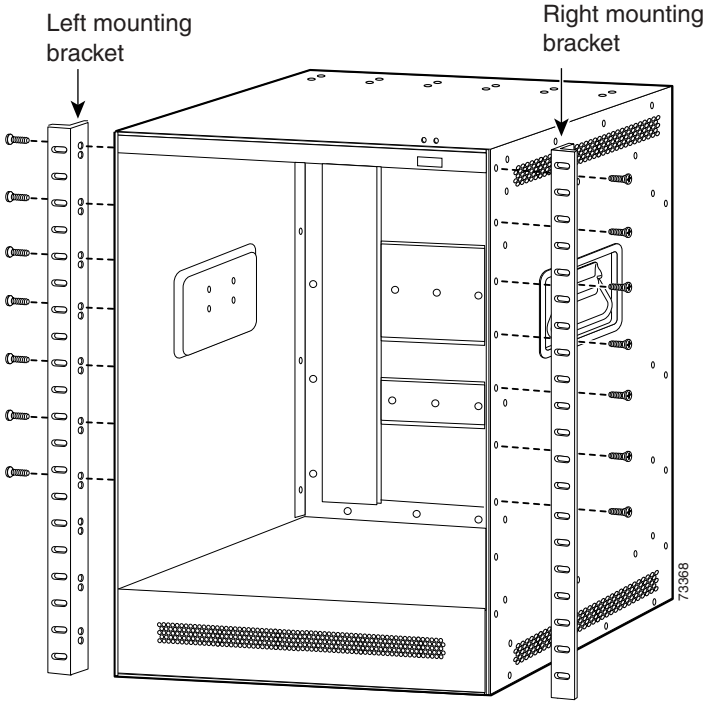
DLP-1 Flush-Mount the Cisco ONS 15540 ESPx

Purpose	This task installs the Cisco ONS 15540 ESPx chassis in a rack.
Tools/Equipment	Rack-mounting kit Number 1 Phillips screwdriver
Prerequisite Procedures	NTP-1 Unpack and Inspect the Shelf, page 1-7
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Warning **At least three people are required to mount the chassis in the equipment rack: two people are needed to hold the chassis in place while a third person tightens the mounting screws. When handling the chassis, always follow proper lifting practices.**

Step 1 Attach the mounting brackets to the shelf (see Figure 2-1).

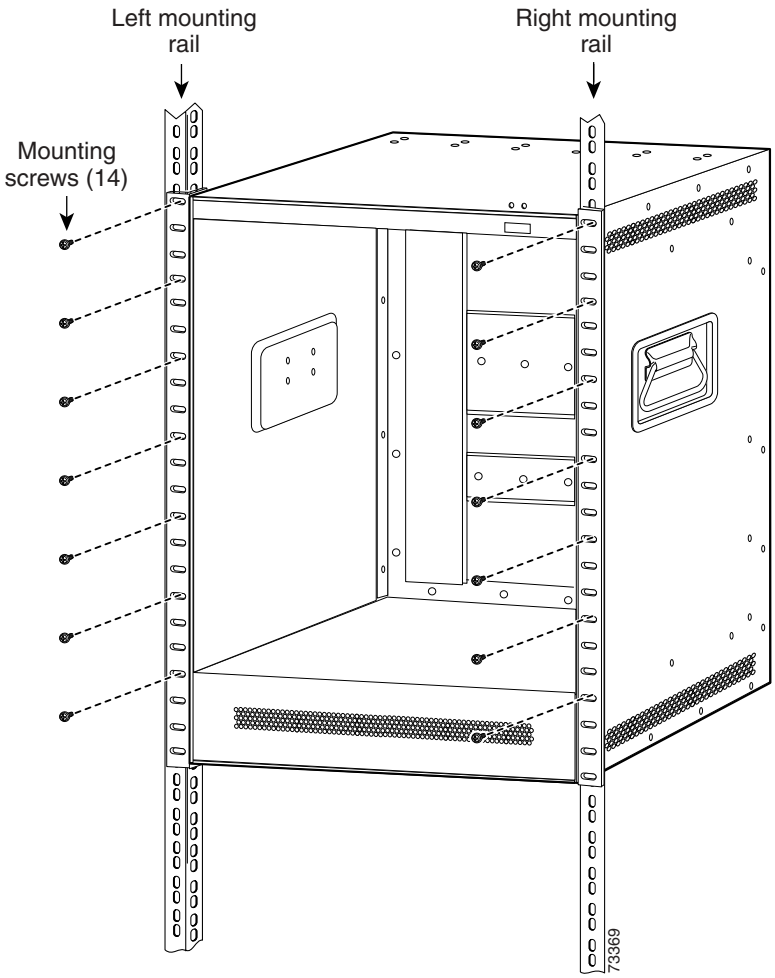
Figure 2-1 Attaching Mounting Brackets to Shelf



Step 2 Lift the shelf into position between the rack posts (requires two people).

Step 3 Align the mounting bracket holes with the rack post holes (see Figure 2-2) and attach the shelf to the rack (performed by the third person).

Figure 2-2 Attaching Shelf to Equipment Rack



Step 4 Use the number 12-24 screws shipped with the chassis to mount the chassis in the rack. (See Figure 2-2.) Use seven screws on each L bracket on the sides of the chassis. Start with the first screw at the top of the chassis and use a screw every 2 RU to equally space the screws out and safely secure the chassis in the rack.

NTP-3 Install the Cable Management System

Purpose	This procedure describes how to install the cable management tray.
Tools/Equipment	Number 1 Phillips screwdriver 12-24 screws
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1

Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Complete the "DLP-2 Install the Cable Management Tray" task on page 2-5.

Step 2 Complete the "DLP-3 Install the Cable Management Drawer" task on page 2-6.

Step 3 Complete the "DLP-4 Install Adapters in the Cross Connect Panel" task on page 2-7.

Step 4 Complete the "DLP-5 Install the Vertical Cable Guide" task on page 2-10.

Step 5 Continue with the "NTP-4 Install Processor Cards, Line Card Motherboards, and Modules" procedure on page 2-12.

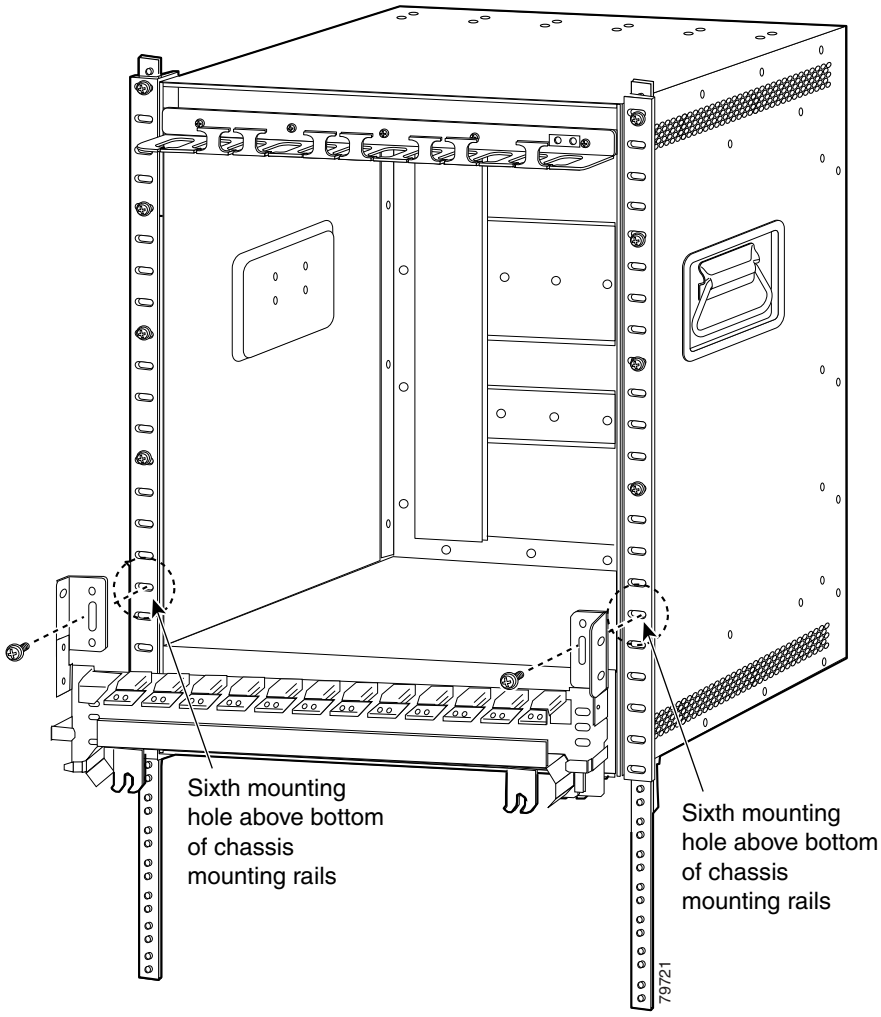
DLP-2 Install the Cable Management Tray

Purpose	This task installs the cable management tray.
Tools/Equipment	Number 1 Phillips screwdriver Four 12-24 screws
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Place the cable management tray over the fan assembly, ensuring that the tray is just under the chassis slots.

Step 2 Secure the cable management tray to the rack with four 12-24 screws, two on each side. To ensure correct placement of the tray, install the second of the two screws in the sixth slot from the bottom of the chassis rack up on each side of the cable management tray. (See Figure 2-3.)

Figure 2-3 Installing the Cable Management Tray

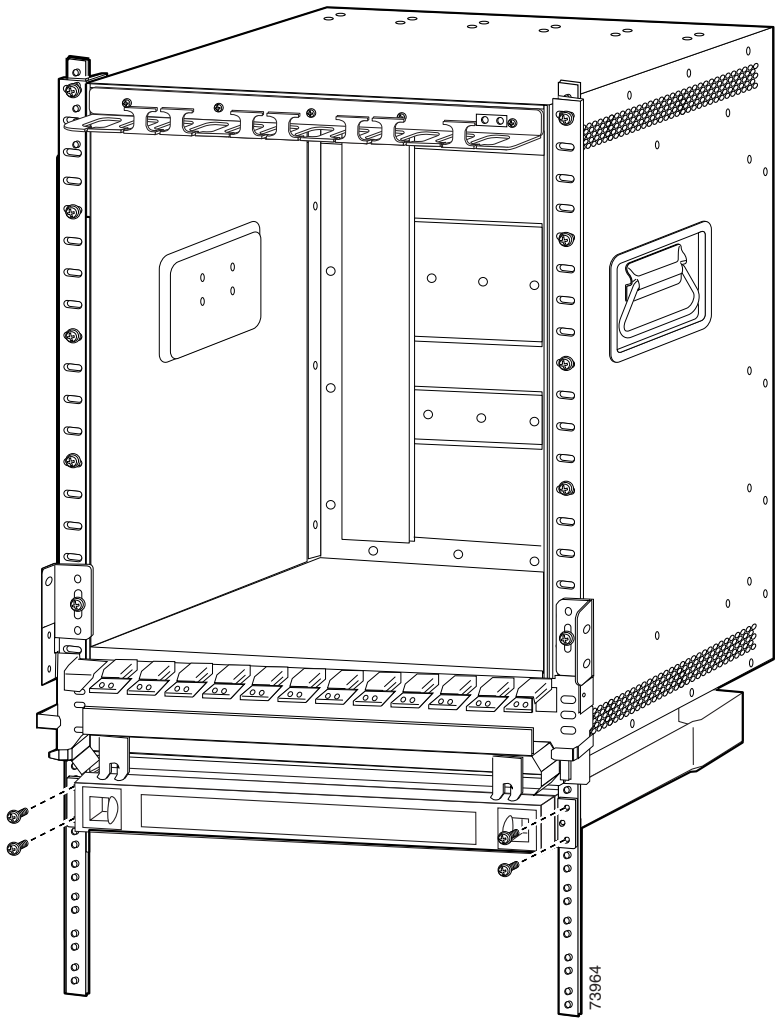


DLP-3 Install the Cable Management Drawer

Purpose	This task installs the cable management drawer.
Tools/Equipment	Number 1 Phillips screwdriver Four 12-24 screws
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1 DLP-2 Install the Cable Management Tray, page 2-5
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Hold the drawer with both hands and position the drawer in the rack beneath the chassis. See Figure 2-4.

Figure 2-4 Installing the Fiber Routing Drawer



Step 2 Align the mounting holes on the bracket with the mounting holes in the equipment rack.

Step 3 Use a number 1 Phillips screwdriver to install the 12-24 screws through the elongated holes in the brackets and into the threaded holes in the mounting post. Repeat this step for the other side.

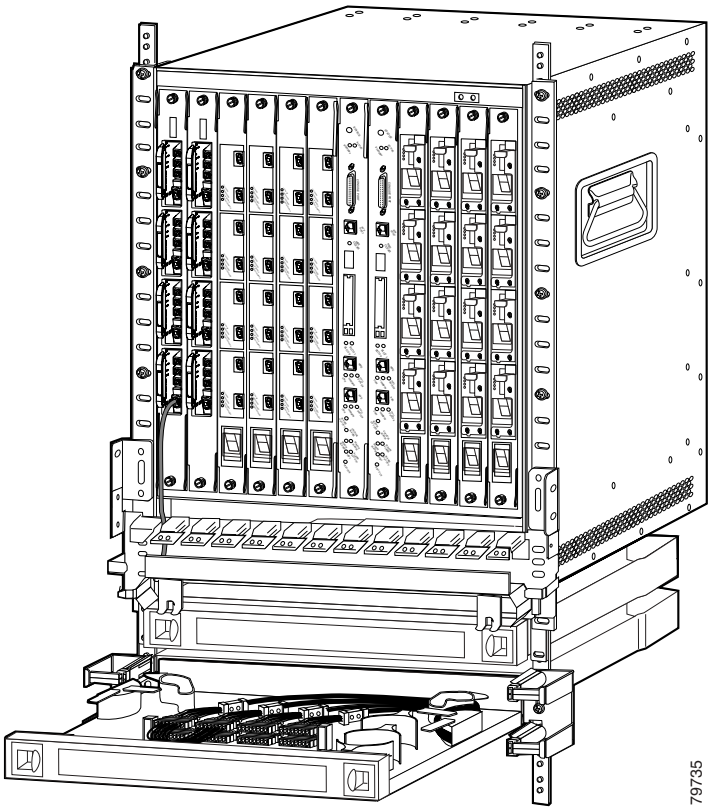
DLP-4 Install Adapters in the Cross Connect Panel

Purpose	This task installs the adapter in a cross connect drawer.
Tools/Equipment	Number 1 Phillips screwdriver Four 12-24 screws

Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1 DLP-2 Install the Cable Management Tray, page 2-5 DLP-3 Install the Cable Management Drawer, page 2-6
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

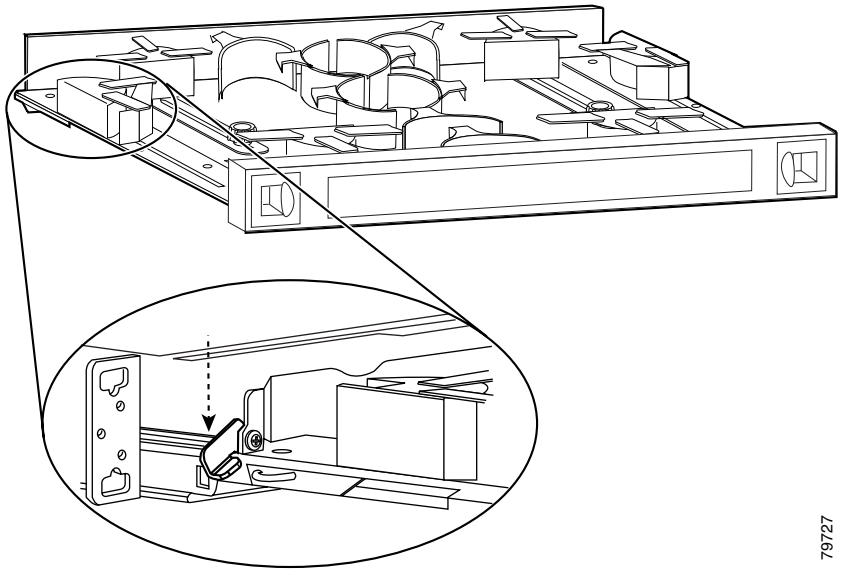
Step 1 Open the cross connect drawer. (See Figure 2-5.)

Figure 2-5 Pulling out the Cross Connect Drawer



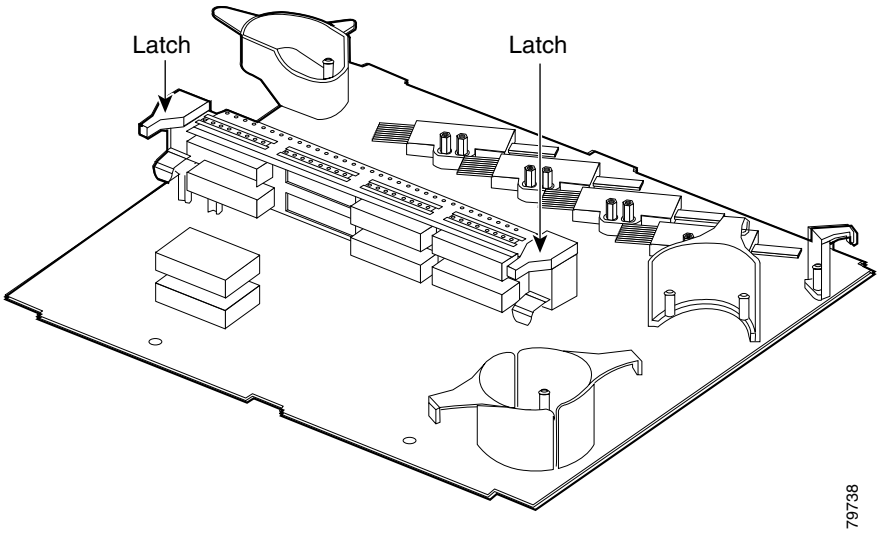
Step 2 Lock the drawer in the open position by pushing the lever at the back left of the drawer down in the lock position. (See Figure 2-6.)

Figure 2-6 Locking the Drawer



Step 3 Pull the cross connect panel up by flipping the latches up and using them to pull the panel up simultaneously. (See Figure 2-7.)

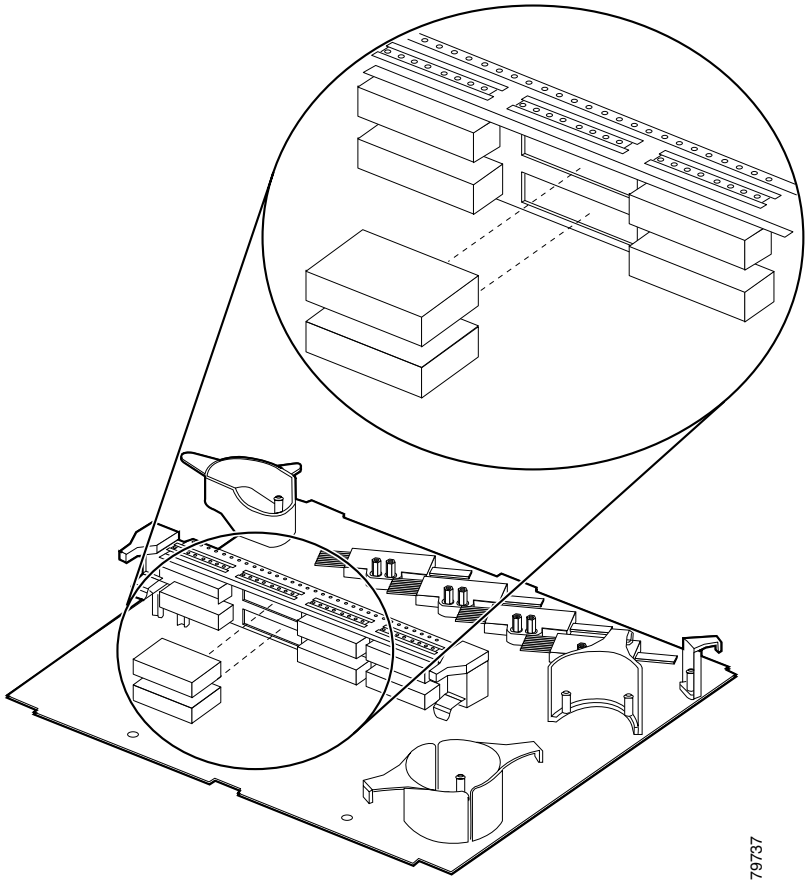
Figure 2-7 Pulling up the Cross Connect Panel



Step 4 Remove the adapter from its packaging.

Step 5 Insert the adapter into the panel from the front as shown in Figure 2-8.

Figure 2-8 Inserting the Adapter



Step 6 Flip the latches down and push the panel down when all desired adapters have been installed.

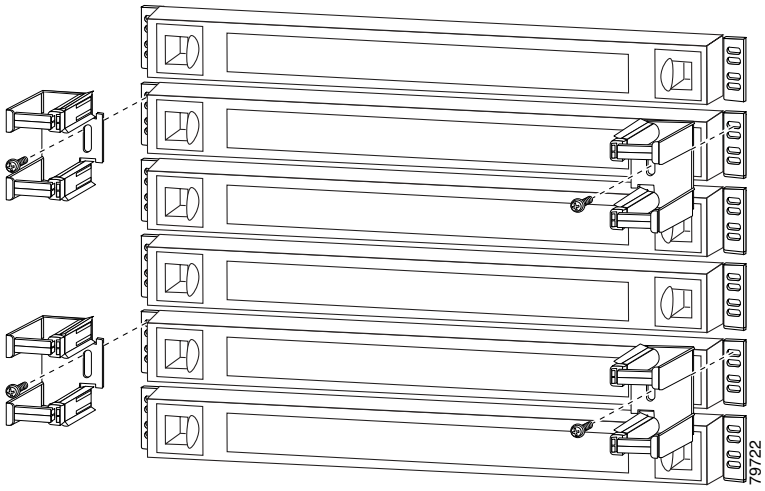
DLP-5 Install the Vertical Cable Guide

Purpose	This task installs the vertical cable guide to the rack.
Tools/Equipment	Number 1 Phillips screwdriver Four 12-24 screws
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1 DLP-2 Install the Cable Management Tray, page 2-5 DLP-3 Install the Cable Management Drawer, page 2-6
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Make sure you have the correct vertical cable guide for the side of the rack you are installing on.

Step 2 Hold the vertical cable guide over the rack next to the correct storage or cross connect drawer. See Figure 2-9 for placement guidelines.

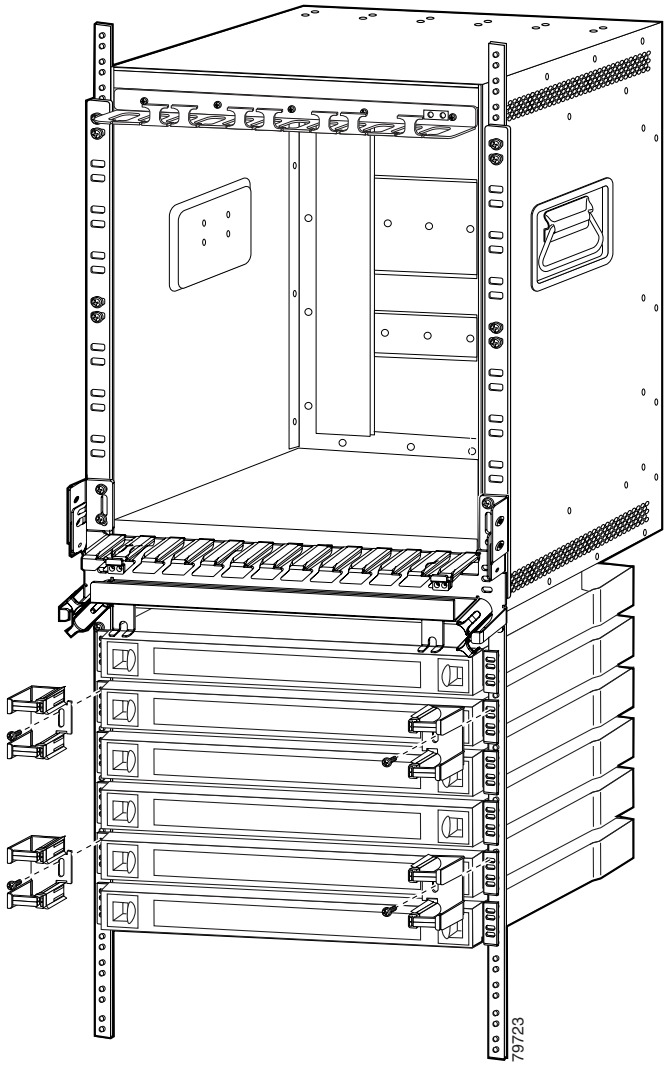
Figure 2-9 Placing the Vertical Cable Guides



Step 3 Align the mounting holes on the vertical cable guide with the mounting holes in the equipment rack.

Step 4 Secure the vertical cable guides with 12-24 or 10-32 screws. (See Figure 2-10.)

Figure 2-10 Installing the Vertical Cable Guides



NTP-4 Install Processor Cards, Line Card Motherboards, and Modules

Purpose	This procedure describes how to install the processor cards, line card motherboards, and modules supported by the Cisco ONS 15540 ESPx.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 To install the processor card in the shelf, complete the "DLP-6 Install the Processor Card" task on page 2-13.

Step 2 To install the optional redundant processor card in the shelf, complete the "DLP-7 Install the Redundant Processor Card" task on page 2-15 as needed.

Step 3 As needed, complete the "DLP-8 Install the Mux/Demux Motherboard" task on page 2-15 before continuing to the "DLP-9 Install the 4-Channel Mux/Demux Module" task on page 2-17, "DLP-10 Install the 8-Channel Mux/Demux Module" task on page 2-17, or the "DLP-12 Install the PSM" task on page 2-18.

Step 4 As needed, complete the "DLP-11 Install the 32-Channel Terminal Mux/Demux Module" task on page 2-17.

Step 5 As needed, complete the "DLP-13 Install the 2.5-Gbps Line Card Motherboard" task on page 2-19 before continuing to the "DLP-15 Install the Type 1 SM Transponder Module" task on page 2-21 or the "DLP-16 Install the Type 1 MM Transponder Module" task on page 2-22.

Step 6 As needed, complete the "DLP-14 Install the 10-Gbps Line Card Motherboard" task on page 2-20 before continuing to the "DLP-17 Install the 10-GE Transponder Module" task on page 2-23.

Step 7 As needed, complete the "DLP-18 Install the Type 2 Extended Range Transponder Module" task on page 2-24.

Step 8 As needed, complete the "DLP-19 Install the SFP Optics" task on page 2-25.

DLP-6 Install the Processor Card

Purpose	This task installs the processor card.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-2 Install the Cable Management Tray, page 2-5
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Insert the processor card carefully into chassis slot 6. Guide the upper and lower edges of the processor card in the tracks until its connectors come into contact with the backplane.

Step 2 Use your thumb and forefinger of each hand to simultaneously push the processor card in until it is fully seated in the backplane connector.

Step 3 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the module.

Step 4 Check the LEDs listed in Table 2-1 while powered to ensure proper installation.

Table 2-1 Processor Card LEDs

LED	Status	Description
STATUS	Red	A board resets or initially powers on.
	Orange	System initialization.
	Green	Full initialization and operational.
ACTIVE	Green	This board is the primary processor and is running IOS software.
STANDBY	Green	This board is the secondary processor.
SLOT 0	Green	Flash PC Card is present.
SLOT 1	Green	Flash PC Card is present.
NME[1]		
FULL DUPLEX	Green	Full duplex is running.
	Off	Half duplex is running.
100MBPS	Green	Operating at 100 Mbps.
	Off	Operating at 10 Mbps.
LINK	Green	Link is up.
	Off	Link is down.
ASE[2]		
FULL DUPLEX	Green	Full duplex is running.
	Off	Half duplex is running.
100MBPS	Green	Operating at 100 Mbps.
	Off	Operating at 10 Mbps.
LINK	Green	Link is up.
	Off	Link is down.
CRITICAL ALARM	Yellow	A critical alarm condition exists.
MAJOR ALARM	Yellow	A major alarm condition exists.
MINOR ALARM	Yellow	A minor alarm condition exists.
ALARM CUT OFF	Yellow	A major or minor alarm condition exists and the cutoff button has been pushed. Turns off by software when the original alarm clears or any new alarm occurs.
HIST	Yellow	A major or minor alarm occurred. Clears if the History Clear button is pushed and no alarm exists.

1. NME = network management Ethernet
2. ASE = aggregation shelf Ethernet

Step 5 Insert a blank card into slot 7 if you are not installing a redundant processor card. Otherwise, continue with the "DLP-7 Install the Redundant Processor Card" task on page 2-15.

DLP-7 Install the Redundant Processor Card

Purpose	This task installs the redundant processor card.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Insert the redundant processor card carefully into chassis slot 7. Guide the upper and lower edges of the redundant processor card in the tracks until its connectors come into contact with the backplane.

Step 2 Use your thumb and forefinger of each hand to simultaneously push the redundant processor card in until it is fully seated in the backplane connector.

Step 3 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the module.

Step 4 Check the LEDs listed in Table 2-1 while powered to ensure proper installation.

DLP-8 Install the Mux/Demux Motherboard

Purpose	This task installs the mux/demux motherboard, which is used for the mux/demux modules.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13
Required/As Needed	Required for mux/demux modules.
Onsite/Remote	Onsite
Security Level	None

Step 1 Select chassis slot 0 for west or slot 1 for east to install the mux/demux motherboard and remove the card or filler in the slot.

Step 2 Take the new mux/demux motherboard from the shipping container.

Step 3 Remove the dust covers from the module and clean the optical connectors.

Caution Wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.

Step 4 Insert the mux/demux motherboard carefully into the chassis slot while guiding the upper and lower edges of the mux/demux motherboard in the tracks until its connectors come into contact with the backplane.

Step 5 Use the release levers to push the mux/demux motherboard in until it is fully seated in the backplane connector.

Step 6 Push the release levers in simultaneously to lock the mux/demux motherboard into the slot.

Step 7 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the mux/demux motherboard.

Step 8 Check the LEDs listed in Table 2-2 while powered to ensure proper installation.

Note Mux/demux motherboards without OSC have no LEDs.

Table 2-2 Mux/Demux Motherboard with OSC LEDs

LED	Status	Description
STATUS	Blinking green	The motherboard has a good system clock from the primary processor and is out of the reset state.
	Orange	System clock is not present.
	Solid green	Software initialization is successful.
	Off	Board failure.
TX	Solid green	OSC is present and the optical laser output is enabled.
	Off	OSC is not present and the optical laser output is disabled.
RX	Solid green	OSC is present and the optical data stream is received.
	Off	OSC is not present and the optical data stream is not received.

DLP-9 Install the 4-Channel Mux/Demux Module

Purpose	This task installs the mux/demux module in the mux/demux motherboard.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13 DLP-8 Install the Mux/Demux Motherboard, page 2-15
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take a new mux/demux module from the shipping container.

Step 2 Insert the mux/demux module carefully into the mux/demux motherboard slot while guiding the upper and lower edges of the mux/demux module in the tracks until its connectors come into contact with the backplane connectors.

DLP-10 Install the 8-Channel Mux/Demux Module

Purpose	This task installs the mux/demux module in the mux/demux motherboard.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13 DLP-8 Install the Mux/Demux Motherboard, page 2-15
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take a new mux/demux module from the shipping container.

Step 2 Insert the mux/demux module carefully into the mux/demux motherboard slot while guiding the upper and lower edges of the mux/demux module in the tracks until its connectors come into contact with the backplane connectors.

DLP-11 Install the 32-Channel Terminal Mux/Demux Module

Purpose	This task installs the 32-channel terminal mux/demux module.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13
Required/As Needed	As needed

Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new 32-channel terminal mux/demux module from the shipping container.

Step 2 Insert the 32-channel terminal mux/demux module carefully into the desired slot while guiding the upper and lower edges of the 32-channel terminal mux/demux module in the tracks until its connectors come into contact with the backplane connectors. The 32-channel terminal mux/demux module can be installed in slots 0 or 1.

Step 3 Use the release levers to push the motherboard in until it is fully seated in the backplane connector.

Step 4 Push the release levers in simultaneously to lock the motherboard into the slot.

Step 5 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the mux/demux motherboard.

Step 6 Check the LEDs listed in Table 2-3 while powered to ensure proper installation.

Table 2-3 32-Channel Terminal Mux/Demux Module OSC LEDs

LED	Status	Description
STATUS	Orange	Reset.
	Blinking green	The motherboard has a good system clock from the primary processor and is out of the reset state.
	Steady green	Software initialization is successful.
Rx	Green	OSC is present and the optical data stream is received.
	Off	Board failure.
Tx	Green	OSC is present and the optical laser output is enabled.
	Off	Board failure.

DLP-12 Install the PSM

Purpose	This task installs the PSM (protection switch module) in a mux/demux motherboard.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-8 Install the Mux/Demux Motherboard, page 2-15, if needed
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new PSM from the shipping container.

Step 2 Insert the PSM carefully into the motherboard subslot while guiding the upper and lower edges of the PSM in the tracks until its connectors come into contact with the backplane connectors.

Step 3 Check that the LED on the left is green and the LED on the right is off to ensure that the software initialization is successful.

DLP-13 Install the 2.5-Gbps Line Card Motherboard

Purpose	This task installs the 2.5-Gbps line card motherboard.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new 2.5-Gbps line card motherboard from the shipping container.

Step 2 Remove the dust covers from the module and clean the optical connectors.

Caution Failure to remove these dust covers may cause damage to the system.

Step 3 Select a chassis slot to install the 2.5-Gbps line card motherboard. A 2.5-Gbps line card motherboard can be installed in slots 2 through 5 and slots 8 through 11.

Step 4 Insert the 2.5-Gbps line card motherboard carefully into the chassis slot while guiding the upper and lower edges of the 2.5-Gbps line card motherboard in the tracks until its connectors come into contact with the backplane.

Step 5 Use the release levers to push the 2.5-Gbps line card motherboard in until it is fully seated in the backplane connector.

Step 6 Push the release levers in simultaneously to lock the 2.5-Gbps line card motherboard into the slot.

Step 7 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the line card motherboard.

Step 8 Check the LEDs listed in Table 2-4 while powered to ensure proper installation.

Table 2-4 2.5-Gbps Line Card Motherboard LEDs

LED	Status	Description
STATUS	Blinking green	Motherboard has a good system clock from the primary processor and is out of the reset state.
	Solid green	Software initialization is successful.
	Orange	System clock is not present. Board is unavailable.
	Off	Board failure.

DLP-14 Install the 10-Gbps Line Card Motherboard

Purpose	This task installs the 10-Gbps line card motherboard.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new 10-Gbps line card motherboard from the shipping container.

Step 2 Remove the dust covers from the module and clean the optical connectors.

Caution Failure to remove these dust covers may cause damage to the system.

Step 3 Select a chassis slot to install the 10-Gbps line card motherboard. A 10-Gbps line card motherboard can be installed in slots 2 through 5 and slots 8 through 11.

Step 4 Insert the 10-Gbps line card motherboard carefully into the chassis slot while guiding the upper and lower edges of the 10-Gbps line card motherboard in the tracks until its connectors come into contact with the backplane.

Step 5 Use the release levers to push the 10-Gbps line card motherboard in until it is fully seated in the backplane connector.

Step 6 Push the release levers in simultaneously to lock the 10-Gbps line card motherboard into the slot.

Step 7 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the 10-Gbps line card motherboard.

Step 8 Check the LEDs listed in Table 2-5 while powered to ensure proper installation.

Table 2-5 10-Gbps Line Card Motherboard LEDs

LED	Status	Description
STATUS	Blinking green	Motherboard has a good system clock from the primary processor and is out of the reset state.
	Solid green	Software initialization is successful.
	Orange	System clock is not present. Board is unavailable.
	Off	Board failure.

DLP-15 Install the Type 1 SM Transponder Module

Purpose	This task installs the Type 1 SM transponder module.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-13 Install the 2.5-Gbps Line Card Motherboard, page 2-19
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new Type 1 SM transponder module from the shipping container.

Step 2 Insert the Type 1 SM transponder module carefully into the line card motherboard while guiding the upper and lower edges of the Type 1 SM transponder module in the tracks until its connectors come into contact with the backplane.

Step 3 Use the release levers to push the Type 1 SM transponder module in until it is fully seated in the backplane connector.

Step 4 Push the release levers in simultaneously to lock the Type 1 SM transponder module into the motherboard.

Step 5 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the module.

Step 6 Check the LEDs listed in Table 2-6 while powered to ensure proper installation.

Table 2-6 Type 1 SM Transponder Module LEDs

LED	Status	Description
LCL RX OK	Green	Data is received on the client side.
TRUNK RX OK	Green	Data is received on the trunk side.
LCL TX ENABLE	Green	Client side transmit laser is enabled.
TRUNK TX ENABLE	Green	Trunk side transmit laser is enabled.

DLP-16 Install the Type 1 MM Transponder Module

Purpose	This task installs the Type 1 MM transponder module.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-13 Install the 2.5-Gbps Line Card Motherboard, page 2-19
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new Type 1 MM transponder module from the shipping container.

Step 2 Insert the Type 1 MM transponder module carefully into the line card motherboard while guiding the upper and lower edges of the Type 1 MM transponder module in the tracks until its connectors come into contact with the backplane.

Step 3 Use the release levers to push the Type 1 MM transponder module in until it is fully seated in the backplane connector.

Step 4 Push the release levers in simultaneously to lock theType 1 MM transponder module into the motherboard.

Step 5 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the module.

Step 6 Check the LEDs listed in Table 2-7 while powered to ensure proper installation.

Table 2-7 MM Transponder Module LEDs

LED	Status	Description
LCL RX OK	Green	Data is received on the client side.
TRUNK RX OK	Green	Data is received on the trunk side.
LCL TX ENABLE	Green	Client side transmit laser is enabled.
TRUNK TX ENABLE	Green	Trunk side transmit laser is enabled.

DLP-17 Install the 10-GE Transponder Module

Purpose	This task installs the 10-GE transponder module.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-14 Install the 10-Gbps Line Card Motherboard, page 2-20
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new 10-GE transponder module from the shipping container.

Step 2 Insert the 10-GE transponder module carefully into the line card motherboard while guiding the upper and lower edges of the 10-GE transponder module in the tracks until its connectors come into contact with the backplane.

Step 3 Use the release levers to push the 10-GE transponder module in until it is fully seated in the backplane connector.

Step 4 Push the release levers in simultaneously to lock the 10-GE transponder module into the 10-Gbps line card motherboard.

Step 5 Use a number 1 Phillips screwdriver to tighten the captive installation screws.

Note Captive installation screws must be tightened to guarantee proper seating of the module.

Step 6 Check the LEDs listed in Table 2-8 while powered to ensure proper installation.

Table 2-8 10-GE Transponder Module LEDs

LED	State	Description
CLIENT RX	Off	No frame lock on the PCS 64B66B decoder
	Green	Frame lock = '1' on PCS 64B66B decoder
TRUNK RX	Off	No frame lock on the PCS 64B66B decoder
	Green	Frame lock = '1' on PCS 64B66B decoder
CLIENT TX	On	Laser is transmitting an optical signal.
	Off	Laser is shut and is not transmitting an optical signal.
TRUNK TX	On	Laser is transmitting an optical signal
	Off	Laser is shut and is not transmitting an optical signal.

DLP-18 Install the Type 2 Extended Range Transponder Module

Purpose	This task installs the Type 2 extended range transponder module.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-13 Install the 2.5-Gbps Line Card Motherboard, page 2-19
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Take the new Type 2 extended range transponder module from the shipping container.

Step 2 Insert the Type 2 extended range transponder module carefully into the line card motherboard while guiding the upper and lower edges of the Type 2 extended range transponder module in the tracks until its connectors come into contact with the backplane.

Step 3 Check the LEDs listed in Table 2-9 while powered to ensure proper installation.

Table 2-9 Type 2 Extended Range Transponder Module LEDs

LED	Status	Description
CLIENT RX	Green	Data is received on the client side.
TRUNK RX	Green	Data is received on the trunk side.
CLIENT TX	Green	Client side transmit laser is enabled.
TRUNK TX	Green	Trunk side transmit laser is enabled.

DLP-19 Install the SFP Optics

Purpose	This task installs the SFP optics.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-18 Install the Type 2 Extended Range Transponder Module, page 2-24
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Select an SFP optic to install.

Note Only use Cisco-certified SFP optics for the Type 2 extended range transponder modules.

Step 2 Insert the SFP optic into the Type 2 extended range transponder module.

Step 3 Push the SFP until you hear a click. The click indicates that it is securely set in the module.

NTP-5 Connect the Hardware

Purpose	This procedure describes to how connect the processor card ports and how to connect the optical fiber cables between the optical cards and modules.
Tools/Equipment	Straight-through EIA/TIA Straight-through RJ-45 Auxiliary port cable Optical cables
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1 NTP-3 Install the Cable Management System, page 2-4 NTP-4 Install Processor Cards, Line Card Motherboards, and Modules, page 2-12
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Complete the "DLP-20 Connect the Console Port" task on page 2-27 for privileged shelf management access.

Step 2 Complete the "DLP-21 Connect the NME Port on the Processor Card" task on page 2-27 for LAN-based network management access to the shelf.

Step 3 As needed, complete the "DLP-22 Connect the Auxiliary Port on the Processor Card" task on page 2-28 for modem access to the shelf.

Step 4 Complete the "DLP-23 Select Optical Cables" task on page 2-28.

Step 5 Complete the "DLP-24 Clean Optical Connectors" task on page 2-31 whenever you make optical connections on the shelf.

Step 6 As needed, complete the "DLP-25 Use Cable Storage Drawers" task on page 2-32.

Step 7 As needed, complete the "DLP-26 Connect the OSC to the Mux/Demux Module" task on page 2-34.

Step 8 As needed, complete the "DLP-27 Interconnect the Mux/Demux Modules" task on page 2-36.

Step 9 As needed, complete the "DLP-28 Connect the PSM to a Remote PSM" task on page 2-36.

Step 10 As needed, complete the "DLP-29 Connect the Transponder Modules to Client Equipment" task on page 2-39.

Step 11 As needed, complete the "DLP-30 Direct Connect the Mux/Demux Module to the 2.5-Gbps Line Card Motherboard" task on page 2-40.

Step 12 As needed, complete the "DLP-31 Connect the Mux/Demux Module to the 2.5-Gbps Line Card Motherboard Using the Cross Connect Drawers" task on page 2-42.

Step 13 As needed, complete the "DLP-32 Direct Connect the Mux/Demux Module to the 10-Gbps Line Card Motherboard" task on page 2-47.

Step 14 As needed, complete the "DLP-33 Direct Connect the Mux/Demux Module to the 10-Gbps Line Card Motherboards Using Y Cables" task on page 2-49.

Step 15 As needed, complete the "DLP-34 Connect the Mux/Demux Module to the 10-Gbps Line Card Motherboard Using the Cross Connect Drawer" task on page 2-52.

DLP-20 Connect the Console Port

Purpose	This task connects the console port on the processor card.
Tools/Equipment	Straight-through EIA/TIA for the DB-25 console port
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13 DLP-7 Install the Redundant Processor Card, page 2-15, if redundancy is desired
Required/As Needed	Required for local console connection and for remote management connection
Onsite/Remote	Onsite
Security Level	None

Step 1 Place the DB-25 connector in front of the console port on the processor card faceplate.

Step 2 Align the male DB-25 connector with the female console port.

Step 3 Gently push the DB-25 connector into the console port and secure it into place by tightening the side screws on the DB-25 connector.

Step 4 Route the fiber cables down through the cutout holes on the cable management tray out of the right side of the shelf assembly.

DLP-21 Connect the NME Port on the Processor Card

Purpose	This task connects the NME (network management Ethernet) port on the processor card.
Tools/Equipment	Straight-through RJ-45 for the NME (network management Ethernet) port
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13 DLP-7 Install the Redundant Processor Card, page 2-15, if redundancy is desired
Required/As Needed	Required for10/100BASE-T network management LAN access.
Onsite/Remote	Onsite
Security Level	None

Step 1 Place the RJ-45 connector in front of the NME port on the processor card.

Step 2 Align the keyed ridge of the cable connector with the receiving slot on the processor card connection point.

Step 3 Gently push the RJ-45 cable connector into the faceplate connection point until the connector snaps into place.

Step 4 Route the fiber cables down through the cutout holes on the cable management tray out of the right side of the shelf assembly.

DLP-22 Connect the Auxiliary Port on the Processor Card

Purpose	This task connects the auxiliary port on the processor card.
Tools/Equipment	Aux port cable that ships with the shelf for the auxiliary port
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13 DLP-7 Install the Redundant Processor Card, page 2-15, if redundancy is desired
Required/As Needed	Required for modem access.
Onsite/Remote	Onsite
Security Level	None

Step 1 Place the auxiliary port cable connector in front of the auxiliary port on the processor card faceplate.

Step 2 Align the keyed ridge of the cable connector with the receiving slot on the faceplate connection point.

Step 3 Gently push the cable connector into the faceplate connection point until the connector snaps into place.

Step 4 Route the fiber cables down through the cutout holes on the cable management tray out of the right side of the shelf assembly.

DLP-23 Select Optical Cables

Purpose	This task selects the optical patch cables before you connect the hardware.
Tools/Equipment	None
Prerequisite Procedures	NTP-3 Install the Cable Management System, page 2-4
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Check the placement of the line cards and modules in the shelf. Table 2-10 lists the cable kits available. Select the appropriate mux/demux, intra-chassis, and inter-chassis patch cables from those listed in Table 2-11 to Table 2-15.

Table 2-10 Optical Cable Kits

Part Number	Description
15500-CAB-KIT1	Cable Kit 1 - (order 1x for LCMB without splitter, order 2x for line card motherboard with splitter): 2x MTP-8MU, 2x MU adapter, 8x MU-MU

Table 2-10 Optical Cable Kits (continued)

Part Number	Description
15500-CAB-KIT2	Cable Kit 2 - 10G lower channels - (order 1x for every 10G line card motherboard with without splitter, order 2x for line card motherboard with with splitter): 1x MTP-8MU, 1x MTP-4MU, 2x MU adapter, 4x MU-MU
15500-CAB-KIT3	Cable Kit 3 - 10G higher channels - (order 1x for every 10G line card motherboard with with out splitter, order 2x for LCMB with splitter): 1x MTP-8MU, 1x MTP-4MU, 2x MU adapter, 4x MU-MU

Table 2-11 Optical Mux/Demux and Intra-Chassis Cables (Simplex)

Part Number	Description
15500-CAB-MMU-01=	10-in. (0.25-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-02=	14-in. (0.35-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-03=	17-in. (0.45-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-04=	20-in. (0.5-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-05=	40-in. (1.0-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-09=	46-in. (1.16-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-06=	60-in (1.5-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-07=	79-in (2.0-m) tuned low loss MU to MU SM OADM patch cable
15500-CAB-MMU-08=	98-in (2.5-m) tuned low loss MU to MU SM OADM patch cable

Step 2 Check the connectors and placement of the equipment at your site. Select the appropriate optical trunk cables from those listed in Table 2-12.

Table 2-12 Optical Trunk Cables

Part Number	Description
15500-CAB-MSC01=	40-in. (1.0-m) tuned low loss MU to SC SM patch cable
15500-CAB-MSC02=	118-in. (3.0-m) tuned low loss MU to SC SM patch cable
15500-CAB-MST03=	40-in. (1.0-m) tuned low loss MU to ST SM patch cable
15500-CAB-MST04=	118-in. (3.0-m) tuned low loss MU to ST SM patch cable

Step 3 Check the connectors and placement of the equipment at your site. Select the appropriate optical client cables from those listed in Table 2-13.

Table 2-13 Optical Client Cables (Simplex)

Part Number	Description
15500-CAB-SC11=	40-in. (1.0-m) SC to SC 62.5/125µm MM cable
15500-CAB-SC19=	40-in. (1.0-m) SC to SC 50/125µm MM cable
15500-CAB-SC12=	40-in. (1.0-m) SC to SC SM cable

Table 2-13 Optical Client Cables (Simplex) (continued)

Part Number	Description
15500-CAB-SC13=	40-in. (1.0-m) (3.0-m) SC to SC 62.5/125µm MM cable
15500-CAB-SC20=	118-in. (3.0-m) SC to SC 50/125µm MM cable
15500-CAB-SC14=	118-in. (3.0-m) SC to SC SM cable
15500-CAB-ST15=	40-in. (1.0-m) SC to ST 62.5/125µm MM cable
15500-CAB-ST21=	40-in. (1.0-m) SC to ST 50/125µm MM cable
15500-CAB-ST16=	40-in. (1.0-m) SC to ST SM cable
15500-CAB-ST17=	118-in. (3.0-m) SC to ST 62.5/125µm MM cable
15500-CAB-ST22=	118-in. (3.0-m) SC to ST 50/125µm MM cable
15500-CAB-ST18=	118-in. (3.0-m) SC to ST SM cable

Step 4 Check the connectors and placement of the equipment at your site. Select the MTP cables from those listed in Table 2-14.

Table 2-14 MTP Cables

Part Number	Description
15500-CAB-MTP-01=	86-in. (2.18-m) MTP to MTP cable - 2.5-Gbps line card motherboard
15500-CAB-MTPMU-M	86-in. (2.18-m) MTP to 8 MU optical cable - mux/demux to cross connect drawer - (Gray)
15500-CAB-MTPMU-L	86-in. (2.18-m) MTP to 8 MU optical cable - line card to cross connect drawer - (Green)
15500-CAB-MTPMU-1	86-in. (2.18-m) MTP to 4 MU optical cable-10-Gbps Ch 1/2 (Aqua)
15500-CAB-MTPMU-2	86-in. (2.18-m) MTP to 4 MU optical cable- 10-Gbps Ch 3/4 (Rose)
15500-CAB-MTP-01,	86-in. (2.18-m) MTP to MTP cable- 2.5-Gbps line card motherboard (Blue)
15500-CAB-MTP-02	86-in. (2.18-m) MTP to MTP cable - 10-Gbps line card motherboard-Ch. 1/2 (Aqua)
15500-CAB-MTP-03	86-in. (2.18-m) MTP to MTP cable - 10-Gbps line card motherboard-Ch. 3/4 (Rose)
15500-CAB-MTP-04	86-in. (2.18-m) MTP to 2x MTP cable - 10-Gbps line card motherboard Y-cable (Violet)

Step 5 If the shelf is configured for y-cable protection, check the type of equipment at your site. Select the appropriate optical y patch cables from those listed in Table 2-15.

Table 2-15 Optical Y Patch Cables

Part Number	Description
15500-CAB-YMM-SC=	50/125 micrometer MM y-cable with SC for channel protection
15500-CAB-YMM2-SC=	62.5/125 micrometer MM y-cable with SC for channel protection
15500-CAB-YSM-SC=	SM y-cable with SC for channel protection

DLP-24 Clean Optical Connectors

Purpose	This task describes how to clean optical connectors.
Tools/Equipment	Alcohol pad Magnifying glass Canned, dry, oil-free, compressed air
Prerequisite Procedures	None
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Wipe the ferrules and end-face surfaces of the connector gently with an alcohol pad from the cleaning kit. Be sure that the pad makes full contact with the end-face surfaces. Wait five seconds for the surfaces to dry and repeat.

Step 2 Blow dry the connectors with canned, dry, oil-free, compressed air.

Step 3 Use a magnifying glass to inspect the ferrule.

The connectors used inside the system have been cleaned by the manufacturer and connected to the adapters in the proper manner. The operation of the system should be error free if the customer provides clean connectors on the application side, follows the previous directions, and ensures the following:

- Clean the connectors using lens tissues before connecting to the adapters. Use pure alcohol to remove soil.
- Do not clean the inside of the connector adapters. Do not use force or quick movements when connecting the fiber optic connectors in the adapters.
- Cover the connector adapters to avoid soiling or contaminating the inside of the adapters while cleaning the chassis. When not using the connectors, cover the connectors and adapters to avoid the inside of the adapters or the surface of the connectors from getting dirty.

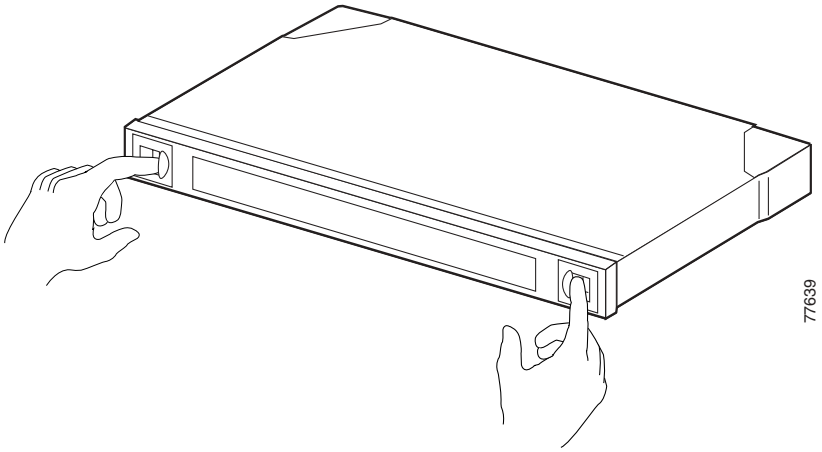
Note If the surface is not clean or does not have a uniform shine, repeat the process using a fresh surface of the alcohol pad.

DLP-25 Use Cable Storage Drawers

Purpose	This task describes how to use the cable storage drawers.
Tools/Equipment	None
Prerequisite Procedures	NTP-3 Install the Cable Management System, page 2-4
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

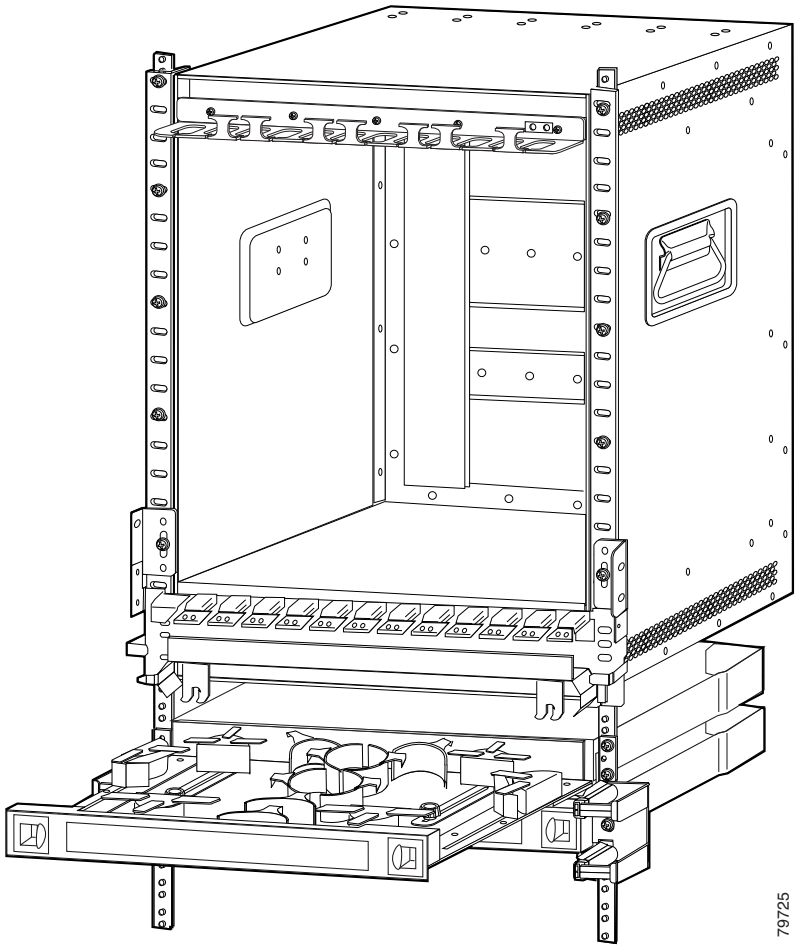
Step 1 Open the cable storage drawer by pushing the tabs in to release the lock on the drawer (see Figure 2-11).

Figure 2-11 Opening the Cable Storage Drawer



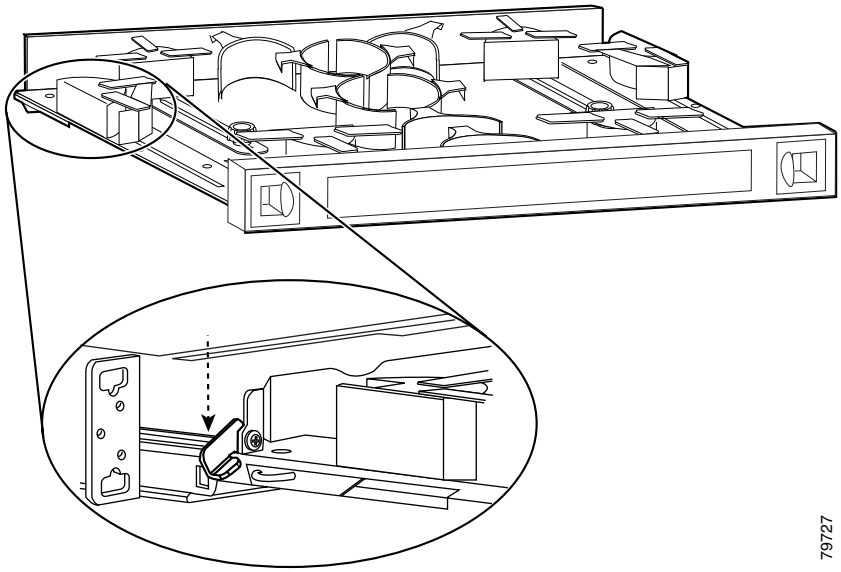
Step 2 Pull out the cable storage drawer (see Figure 2-12).

Figure 2-12 Pulling out the Cable Storage Drawer



Step 3 Lock the drawer in the open position by pushing the latch at the back left of the drawer down into the locked position (see Figure 2-13).

Figure 2-13 Locking the Drawer



Step 4 Push the connector of the cable into the adapter until the connector snaps into place.

Step 5 Route the cable down through the cutout holes on the cable management tray on the bottom of the shelf assembly. Pull the cable out of the left side of the tray.

Step 6 Route the cable down the left side of the chassis and into the drawer. Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 7 Pull the cable up out of the right side of the drawer and then back up through the cutout holes on the cable management tray.

Step 8 Insert the connector into the desired card or module.

Step 9 Unlock the drawer to close it by moving the latch back into an upright position.

DLP-26 Connect the OSC to the Mux/Demux Module

Purpose	This task connects the OSC to the mux/demux module.
Tools/Equipment	Two MU-to-MU cables per OSC module
Prerequisite Procedures	DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17 DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17 DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17 DLP-23 Select Optical Cables, page 2-28 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

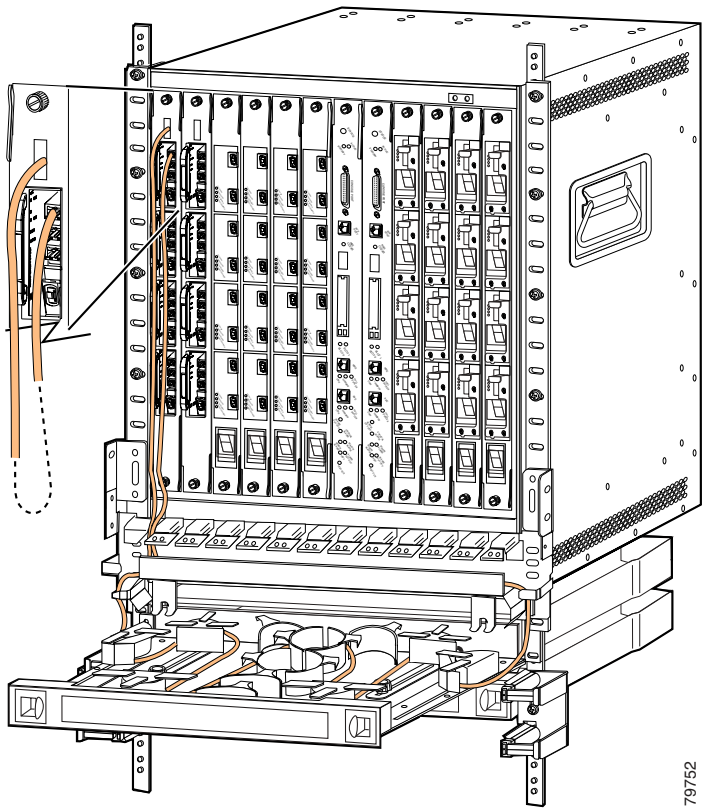
Step 1 Route the fiber cable from the top OSC Tx connector on the motherboard down through the cable management tray. (See Figure 2-14.)

Step 2 Route the cable out of the left side of the tray, down the vertical cable guides and in through the left side of the cable storage drawer.

Step 3 Route the cable through the cable storage drawer and out the right side. Bring the cable up and into the right side of the cable management tray and continue to route the cable through until you come to the OSC In of the desired mux/demux module.

Step 4 Connect OSC Rx from the motherboard to OSC Out on the module.

Figure 2-14 OSC Cabling



Step 5 Bring the cable up to the desired connection point on the module and insert the connector. Repeat these steps to connect the OSC Rx from the motherboard to the OSC Out on the module.

DLP-27 Interconnect the Mux/Demux Modules

Purpose	This task interconnects the mux/demux modules by daisy chaining the cables.
Tools/Equipment	MU-to-MU connectors (short fiber length)
Prerequisite Procedures	DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17 or DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17 or DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17. DLP-23 Select Optical Cables, page 2-28 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Connect the Thru Out of the module with the DWDM Trunk to Trunk In of the next module in slot 0.

Step 2 Connect the Thru Out of the remaining modules to Trunk In of the next module in slot 0.

Step 3 Perform Step 1 and Step 2 for Thru In and Trunk Out in the same slot. Repeat these steps above for slot 1.

Step 4 Connect the trunk fiber to the mux/demux module.

DLP-28 Connect the PSM to a Remote PSM

Purpose	This task connects the PSM to a remote PSM.
Tools/Equipment	Two MU-to-MU cables to connect to the mux/demux modules Four MU-to-MU cables to connect east and west trunks to the remote PSM
Prerequisite Procedures	DLP-12 Install the PSM, page 2-18 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Use MU connector cables to make your east and west connections from the PSM to the remote PSM module.

Step 2 Attach MU connectors to the mux/demux out/in connections on the PSM.

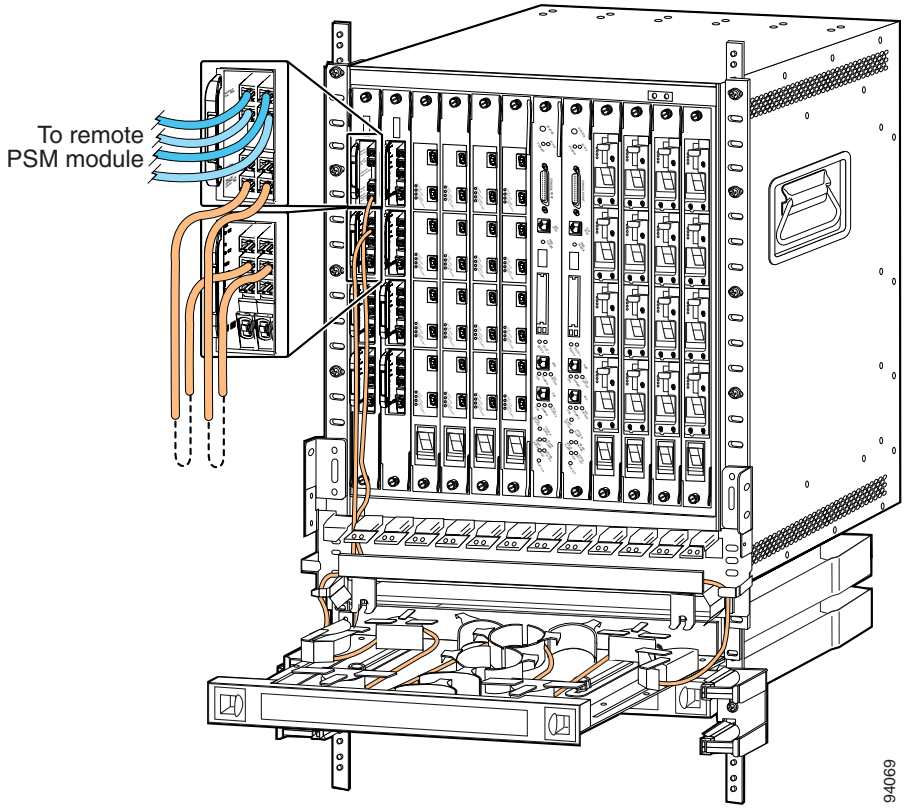
Step 3 Route the cables down through the vertical cable guides and in through the left side of the cable storage drawer.

Step 4 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 5 Pull the cable up out of the right side of the drawer and back up through the cable management tray.

Step 6 Insert the other end of the MU connectors into the Trunk In/Out ports on the desired mux/demux module. Figure 2-15 shows the connections described in these steps with the PSM in slot 0, subslot 0, and an 8-channel mux/demux module in slot 0, subslot 1.

Figure 2-15 Cabling the PSM



DLP-78 Connect the PSM to Transponder Modules

Purpose	This task connects the PSM to transponder modules using the cross connect drawer.
Tools/Equipment	Two MU-to-MU cables to connect the PSM to the line card motherboard through the cross connect drawer. One MTP-to-8 MU cables to connect the transponder module to the PSM
Prerequisite Procedures	DLP-12 Install the PSM, page 2-18 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Connect the MTP connector into the East or West port on the desired line card motherboard.

Step 2 Route the cables down through the vertical cable guides and in through the right side of the cross connect drawer.

Step 3 Connect the cables to the top half of the appropriate adapter LINECARD connections on the inner side of the cross connect panel. These are color coded and should be connected by matching the color on the panel to the colored wires out of the transition box.

Note The adapters in the cross connect drawer match the subcard slots. For example, the adapter on the far left would match subcard 0.

Step 4 Connect one end of the MU-to-MU cable to the mux/demux out and in ports on the PSM.

Step 5 Route the cables down through the vertical cable guides and in through the left side of the cable storage drawer.

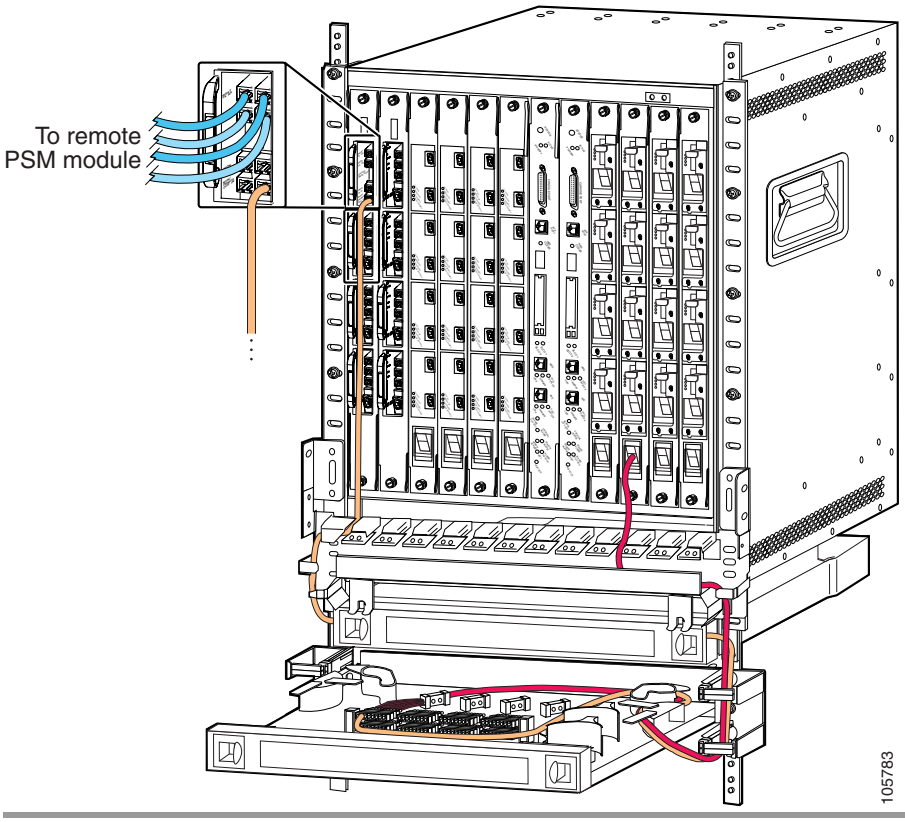
Step 6 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 7 Route the cable out of the right side of the cable storage drawer and down into right side of the cross conect drawer.

Step 8 Connect the end of the MU-to-MU cable to the Tx and Rx ports of the first channel on the outer side of the LINECARD connections on the panel.

Figure 2-16 shows an example of cabling a PSM to a line card motherboard.

Figure 2-16 Cabling PSM to Line Card Motherboards



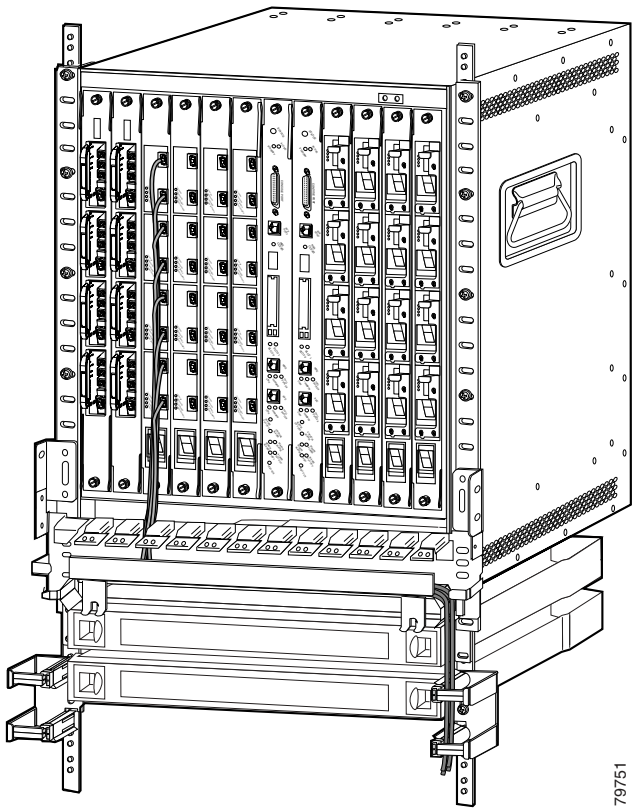
DLP-29 Connect the Transponder Modules to Client Equipment

Purpose	This task connects the transponder modules to the client equipment.
Tools/Equipment	MU-to-MU cables
Prerequisite Procedures	DLP-15 Install the Type 1 SM Transponder Module, page 2-21 or DLP-16 Install the Type 1 MM Transponder Module, page 2-22 or DLP-17 Install the 10-GE Transponder Module, page 2-23 or DLP-18 Install the Type 2 Extended Range Transponder Module, page 2-24 DLP-19 Install the SFP Optics, page 2-25 DLP-23 Select Optical Cables, page 2-28 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Connect the MU connector to the Rx port on the transponder module.

Step 2 Route the fiber cables down through the cable management tray out of the right side of the shelf assembly. (See Figure 2-17.)

Figure 2-17 Cabling Transponder Modules



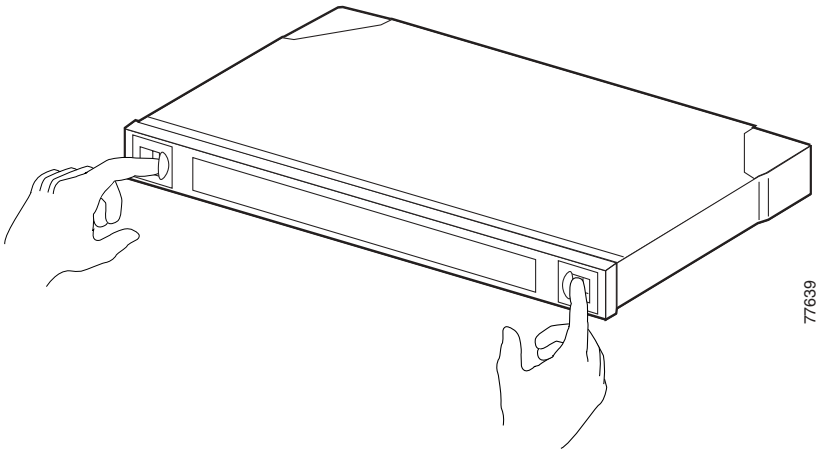
Step 3 Connect the cables to your equipment according to your configuration.

DLP-30 Direct Connect the Mux/Demux Module to the 2.5-Gbps Line Card Motherboard

Purpose	This task directly connects the mux/demux module to the line card motherboard using the cable storage drawer.
Tools/Equipment	MTP-to-MTP cable, blue MTP cable installation tool
Prerequisite Procedures	DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17 or DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17 or DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17 DLP-13 Install the 2.5-Gbps Line Card Motherboard, page 2-19 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

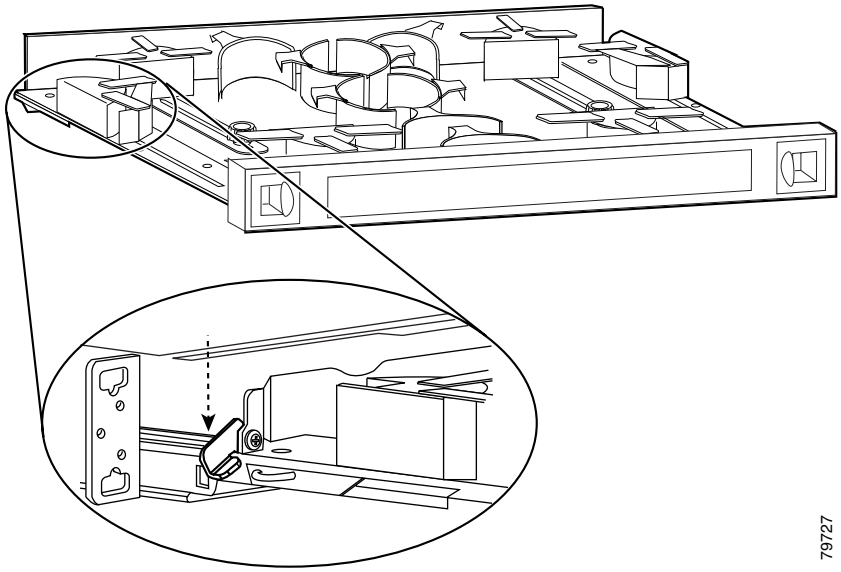
Step 1 Open the cable storage drawer by pushing the tabs in to release the lock on the drawer. (See Figure 2-18.) Pull out the drawer.

Figure 2-18 Opening the Cable Storage Drawer



Step 2 Lock the drawer in the open position by pushing the latch at the back left of the drawer down into the lock position. (See Figure 2-19.)

Figure 2-19 Locking the Drawer



Step 3 Use the MTP cable installation tool to push the MTP connector of the cable into the MPO 1 or MPO 2 on the mux/demux module until the connector snaps into place.

Step 4 Route the MTP cable down through the cable management tray. Pull the cable out the left side of the trayand into the drawer.

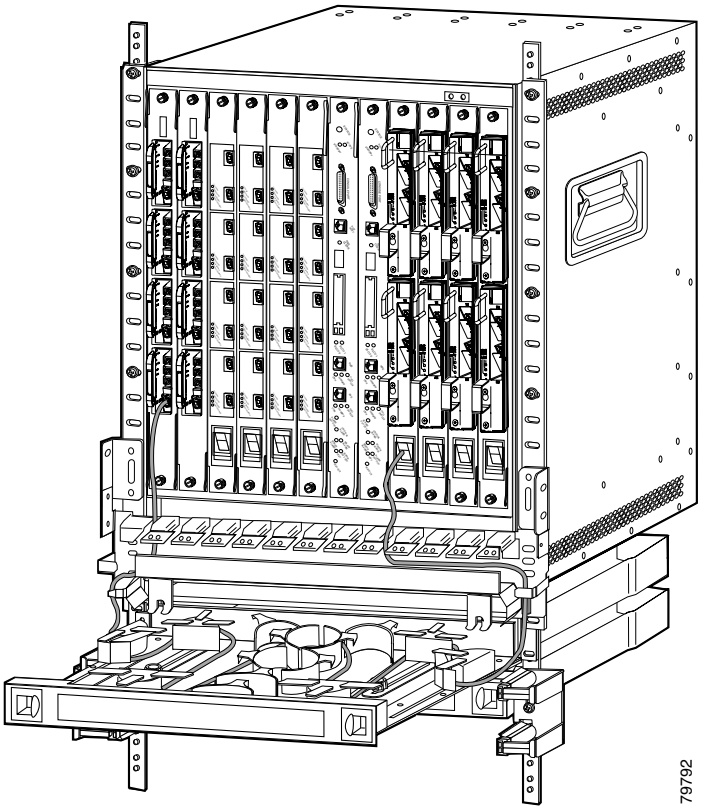
Step 5 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 6 Pull the cable up out of the right side of the drawer and back up through the cable management tray.

Step 7 Insert the MTP connector into the MTP adapter labeled East, West, EO, or WO on the desired line card motherboard. (See Figure 2-20.)

Repeat Steps 1 through 4 to continue cabling the system without the cross connect panel.

Figure 2-20 Routing the MTP-to-MTP Cable



Step 8 Unlock the drawer by moving the latch back into an upright position and close the drawer.

Tip You can use the client clips shipped with the chassis to clip together cables for easy handling and organization.

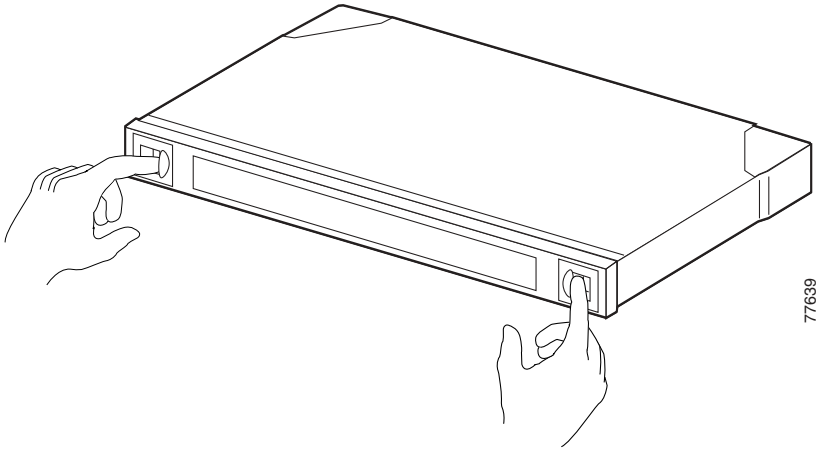
DLP-31 Connect the Mux/Demux Module to the 2.5-Gbps Line Card Motherboard Using the Cross Connect Drawers

Purpose	This task connects the mux/demux module to the 2.5-Gbps line card motherboard using the cross connect drawer.
Tools/Equipment	MTP-to-8MU cable, gray MTP-to-8MU cable, green MU-to-MU cable MTP cable installation tool
Prerequisite Procedures	DLP-8 Install the Mux/Demux Motherboard, page 2-15 DLP-13 Install the 2.5-Gbps Line Card Motherboard, page 2-19 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed

Onsite/Remote	Onsite
Security Level	None

Step 1 Open the cable storage drawer by pushing the tabs in to release the lock on the drawer. (See Figure 2-21.) Pull out the drawer.

Figure 2-21 Opening the Cable Storage Drawer



Step 2 Lock the drawer in the open position by pushing the latch at the back left of the drawer down into the lock position.

Step 3 Use the MTP cable installation tool to push the MTP connector of the gray cable into the MPO 1 or MPO 2 on the mux/demux module until the connector snaps into place.

Step 4 Route the MTP cable down through the cable management tray. Pull the cable out the left side of the tray and into the drawer.

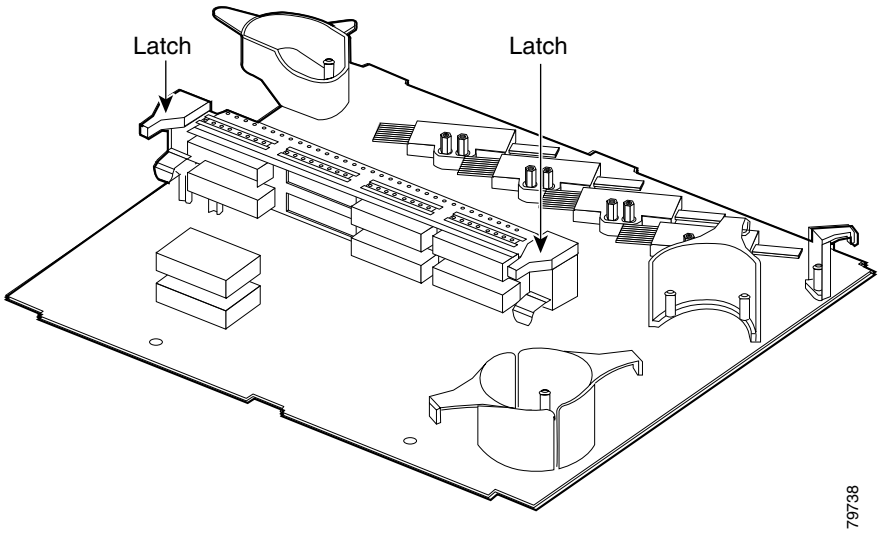
Step 5 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 6 Close the cable storage drawer once the cables are routed out of the right side and you unlock the drawer.

Step 7 Open the cross connect drawer appropriate for your system configuration. See Step 1 and Step 2 for drawer opening details.

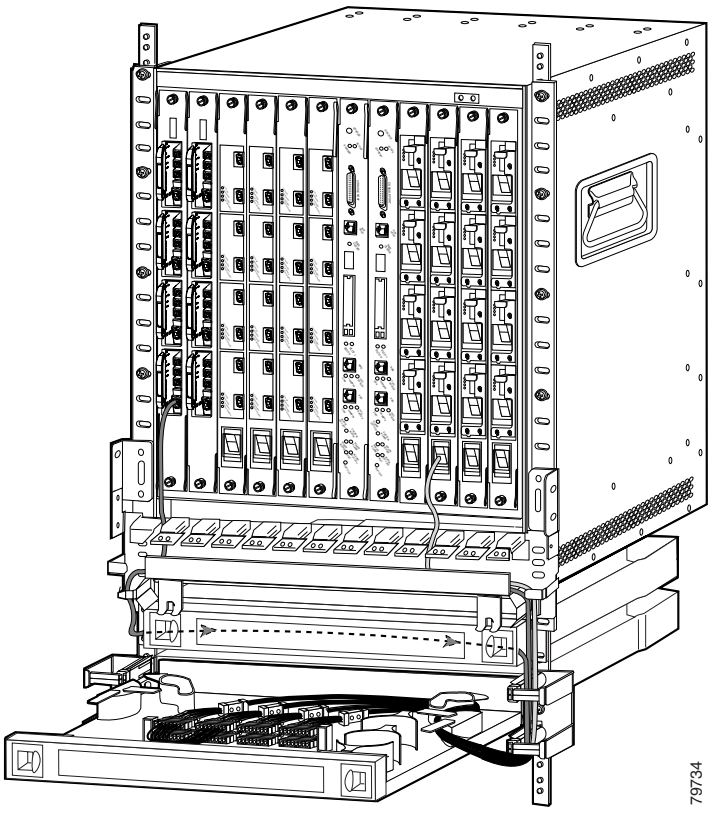
Step 8 Flip the latches on the cross connect panel up and use them to pull the panel up. (See Figure 2-22.)

Figure 2-22 Pulling Up the Cross Connect Panel



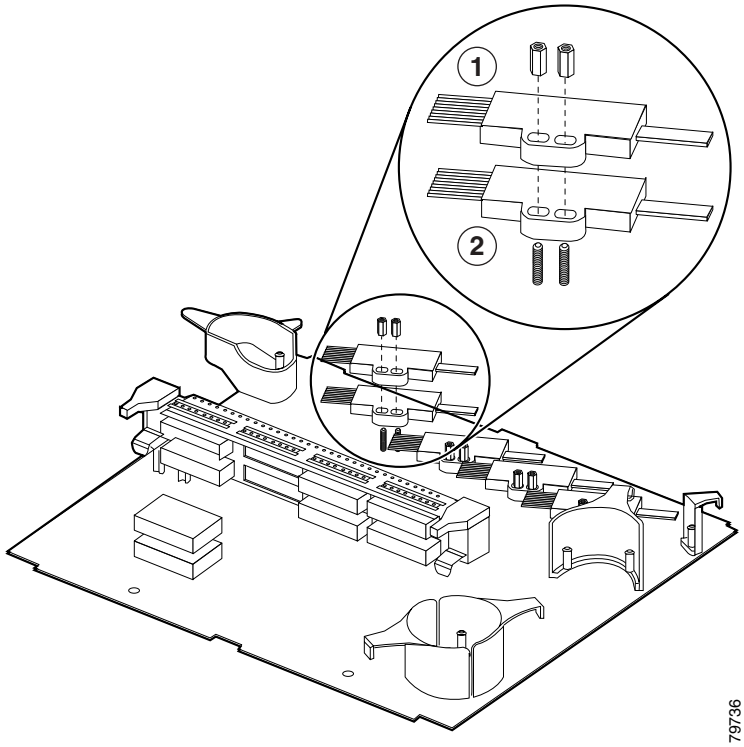
Step 9 Route the MU breakout end of the gray cable in through the right side of the drawer. (See Figure 2-23.)

Figure 2-23 Routing the Cross Connect Cables



Step 10 Mount the transition box as shown in Figure 2-24.

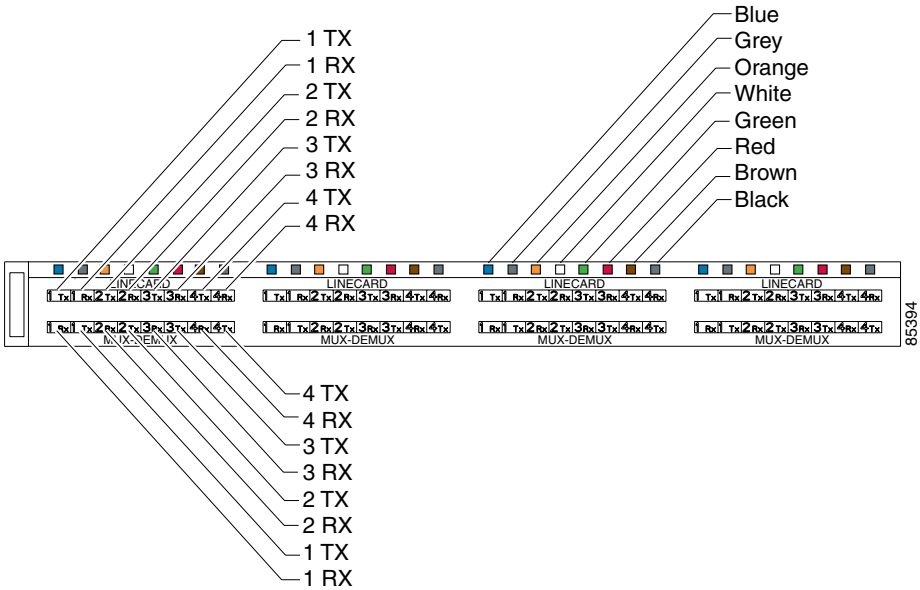
Figure 2-24 Mounting the Transition Box



1	Line card motherboard connections
2	Mux/demux motherboard connections

Step 11 Connect the cables to the bottom half of the desired adapter mux/demux connections on the inner side of the cross connect panel. These are color coded and should be connected by matching the color on the panel to the colored wires out of the transition box.

Figure 2-25 Cross Connect Panel



Step 12 Connect the MU connectors on the outer side of the panel. Connect the Tx from the line card to the Tx on the mux/demux side. Connect the Rx line card side to the Rx on the mux/demux side.

Step 13 Connect the 8 MU breakout cables on the green cable to the LINECARD connections on the cross connect panel. These are color coded and should be connected by matching the color on the panel to the colored wires out of the transition box.

Step 14 Pull the cable up out of the right side of the drawer and back up through the cable management tray.

Step 15 Insert the MTP connector into the MTP adapter labeled East, West, EO, or WO on the desired line card motherboard.

Step 16 Unlock the drawer by moving the latch back into an upright position and close the drawer.

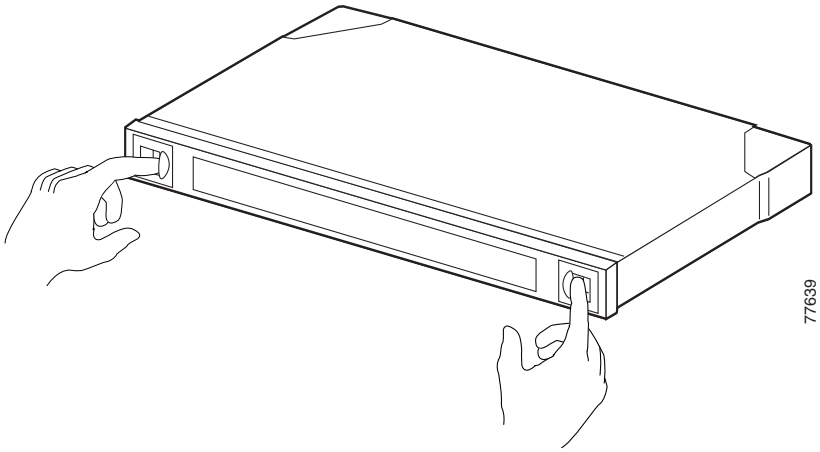
Tip You can use the client clips shipped with the chassis to clip together cables for easy handling and organization.

DLP-32 Direct Connect the Mux/Demux Module to the 10-Gbps Line Card Motherboard

Purpose	This task directly connects the mux/demux modules to the 10-Gbps line card motherboard using the cable storage drawer.
Tools/Equipment	Aqua MTP-to-MTP cable to connect lower channel 10-GE transponder module (channels 1/2, 5/6, 9/10, 13/14, 17/18, 21/22, 25/26, or 29/30) Rose MTP-to-MTP cable to connect higher channel 10-GE transponder module (channels 3/4, 7/8, 11/12, 15/16, 19/20, 23/24, 27/28, or 31/32) MTP cable installation tool
Prerequisite Procedures	DLP-8 Install the Mux/Demux Motherboard, page 2-15 DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17 DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17 DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17 DLP-14 Install the 10-Gbps Line Card Motherboard, page 2-20 DLP-23 Select Optical Cables, page 2-28 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

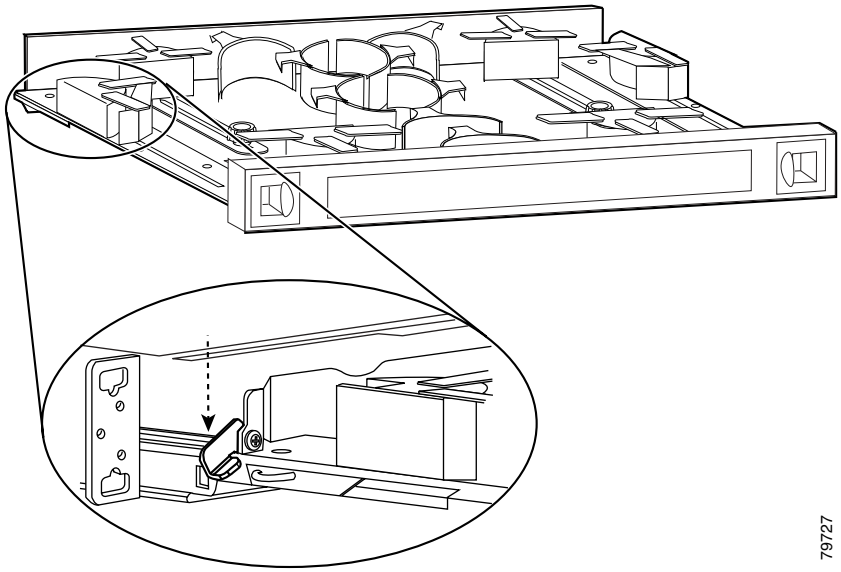
Step 1 Open the cable storage drawer by pushing the tabs in to release the lock on the drawer. (See Figure 2-26.) Pull out the drawer.

Figure 2-26 Opening the Cable Storage Drawer



Step 2 Lock the drawer in the open position by pushing the latch at the back left of the drawer down into the lock position. (See Figure 2-27.)

Figure 2-27 Locking the Drawer



Step 3 Use the MTP cable installation tool to push the MTP connector of the cable into the MPO 1 or MPO 2 on the mux/demux module until the connector snaps into place.

Note The 10-GE transponder modules must be in increasing order in the 10-Gbps line card motherboard for these connections to function correctly. Be sure that the modules supporting the first channel in the channel pair is in the top subslot and the module supporting the second channel in the channel pair is in the bottom subslot.

Step 4 Route the MTP cable down through the cable management tray. Pull the cable out of the left side of the tray and into the drawer.

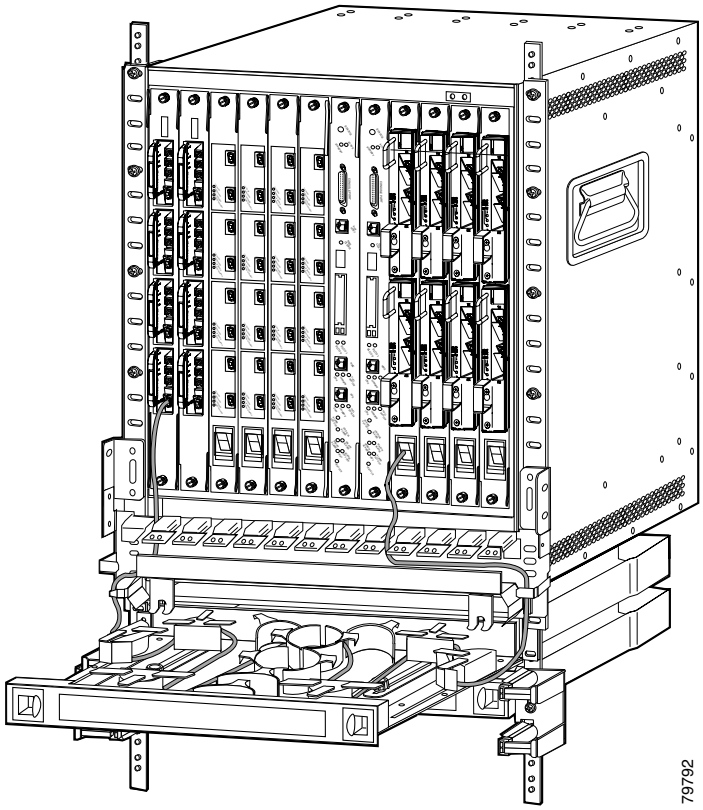
Step 5 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 6 Pull the cable up out of the right side of the drawer and back up through the cable management tray.

Step 7 Insert the MTP connector into the MTP adapter labeled East, West, EO, or WO on the desired line card motherboard. (See Figure 2-28.)

Repeat Steps 1 through 4 to continue cabling the system without the cross connect panel.

Figure 2-28 Routing the MTP-to-MTP Cable



Step 8 Unlock the drawer by moving the latch back into an upright position and close the drawer.

Tip You can use the client clips shipped with the chassis to clip together cables for easy handling and organization.

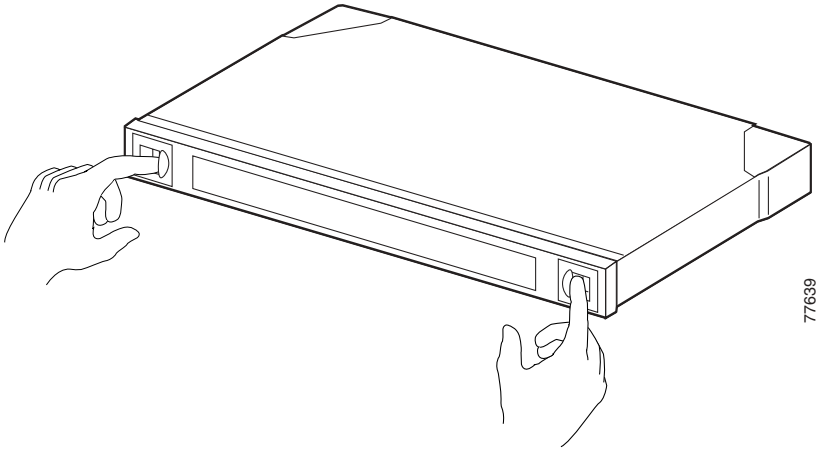
DLP-33 Direct Connect the Mux/Demux Module to the 10-Gbps Line Card Motherboards Using Y Cables

Purpose	This task directly connects the mux/demux modules to the 10-Gbps line card motherboards using the y cable and the cable storage drawer.
Tools/Equipment	Blue MTP-to-2MTP cable MTP cable installation tool
Prerequisite Procedures	DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17 DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17 DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed

Onsite/Remote	Onsite
Security Level	None

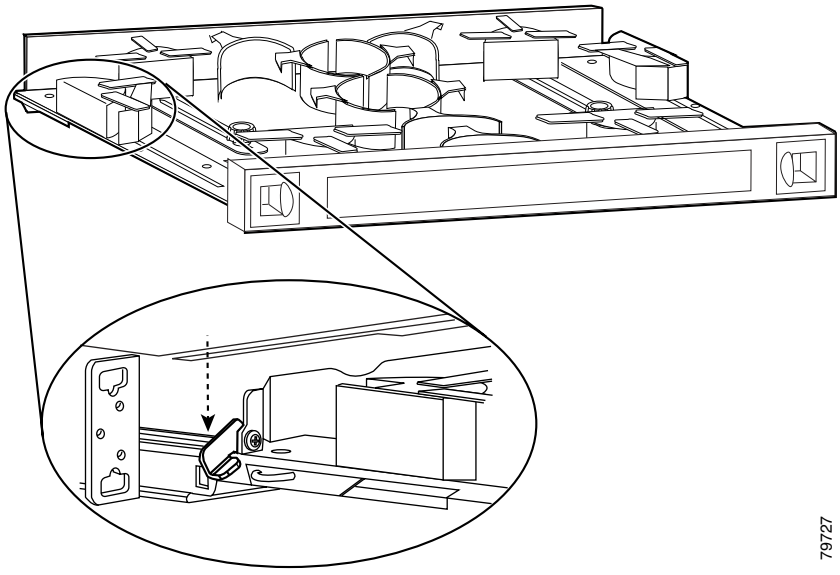
Step 1 Open the cable storage drawer by pushing the tabs in to release the lock on the drawer. (See Figure 2-29.) Pull out the drawer.

Figure 2-29 Opening the Cable Storage Drawer



Step 2 Lock the drawer in the open position by pushing the latch at the back left of the drawer down into the lock position. (See Figure 2-30.)

Figure 2-30 Locking the Drawer



Step 3 Use the MTP cable installation tool to push the MTP connector of the cable into the MPO 1 or MPO 2 on the mux/demux module until the connector snaps into place.

Note The 10-GE transponder modules must be in increasing order in the 10-Gbps line card motherboard for these connections to function correctly. Be sure that the modules supporting the first channel in the channel pair is in the top subslot and the module supporting the second channel in the channel pair is in the bottom subslot.

Step 4 Route the MTP cable down through the cable management tray. Pull the cable out the left side of the tray.and into the drawer.

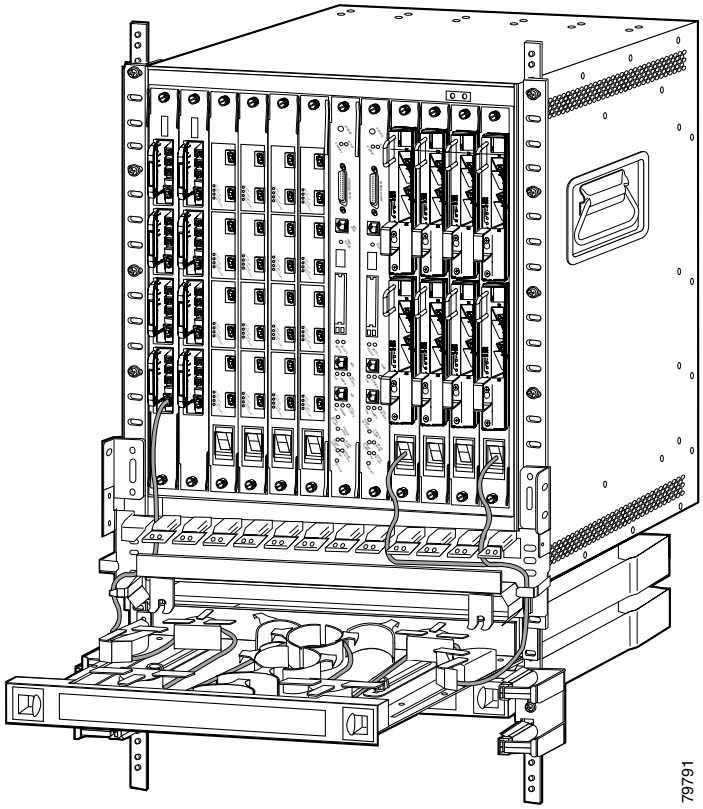
Step 5 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 6 Pull the cable up out of the right side of the drawer and back up through the cable management tray.

Step 7 Insert one MTP connector into the MTP adapter labeled East, West, EO, or WO on the desired line card motherboard. (See Figure 2-31.)

Step 8 Insert the other MTP in a different 10-Gbps line card motherboard.

Figure 2-31 Routing the MTP-to-2 MTP Cable



Step 9 Unlock the drawer by moving the latch back into an upright position and close the drawer.

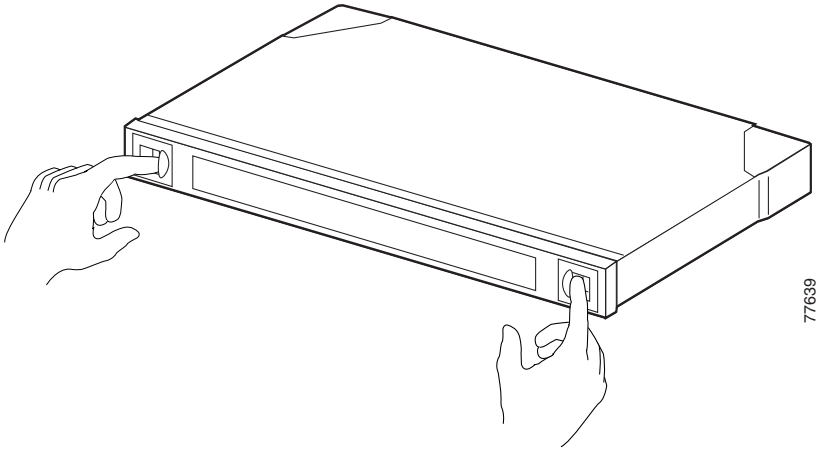
Tip You can use the client clips shipped with the chassis to clip together cables for easy handling and organization.

DLP-34 Connect the Mux/Demux Module to the 10-Gbps Line Card Motherboard Using the Cross Connect Drawer

Purpose	This task connects the mux/demux modules to the 10-Gbps line card motherboards using the cross connect drawer.
Tools/Equipment	Aqua MTP-to-4 MU cables Rose MTP-to-4 MU cables MTP cable installation tool
Prerequisite Procedures	DLP-14 Install the 10-Gbps Line Card Motherboard, page 2-20 DLP-17 Install the 10-GE Transponder Module, page 2-23 DLP-24 Clean Optical Connectors, page 2-31
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Open the cable storage drawer by pushing the tabs in to release the lock on the drawer. (See Figure 2-32.) Pull out the drawer.

Figure 2-32 Opening the Cable Storage Drawer



Step 2 Lock the drawer in the open position by pushing the latch at the back left of the drawer down into the lock position.

Step 3 Use the MTP cable installation tool to push the MTP connector of the gray cable into the MPO 1 or MPO 2 on the mux/demux module until the connector snaps into place.

Step 4 Route the MTP cable down through the cable management tray. Pull the cable out the left side of the tray.and into the drawer.

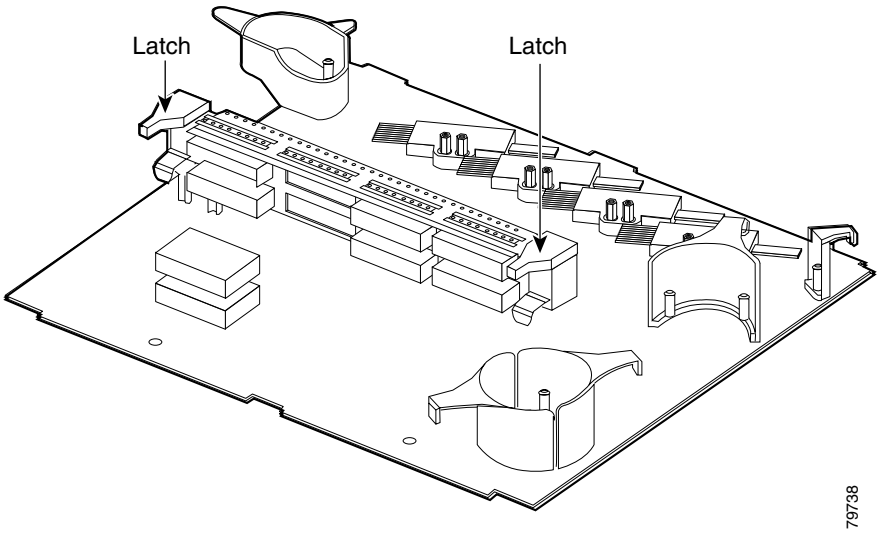
Step 5 Continue to route the cable through the drawer around the round cable retainers to the right side.

Step 6 Close the cable storage drawer once the cables are routed out of the right side and you unlock the drawer.

Step 7 Open the cross connect drawer appropriate for your system configuration. See Step 1 and Step 2 for drawer opening details.

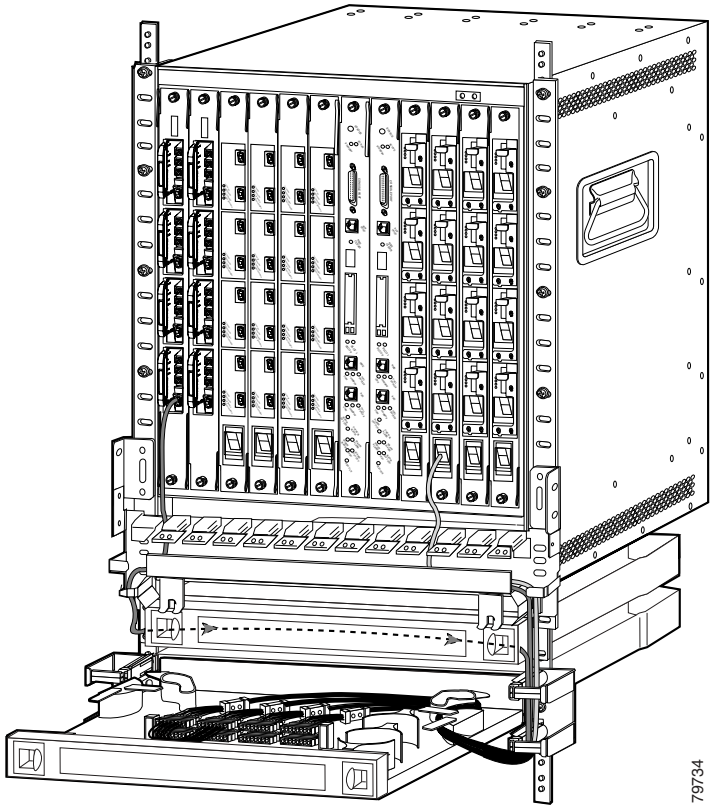
Step 8 Flip the latches on the cross connect panel up and use them to pull the panel up. (See Figure 2-33.)

Figure 2-33 Pulling Up the Cross Connect Panel



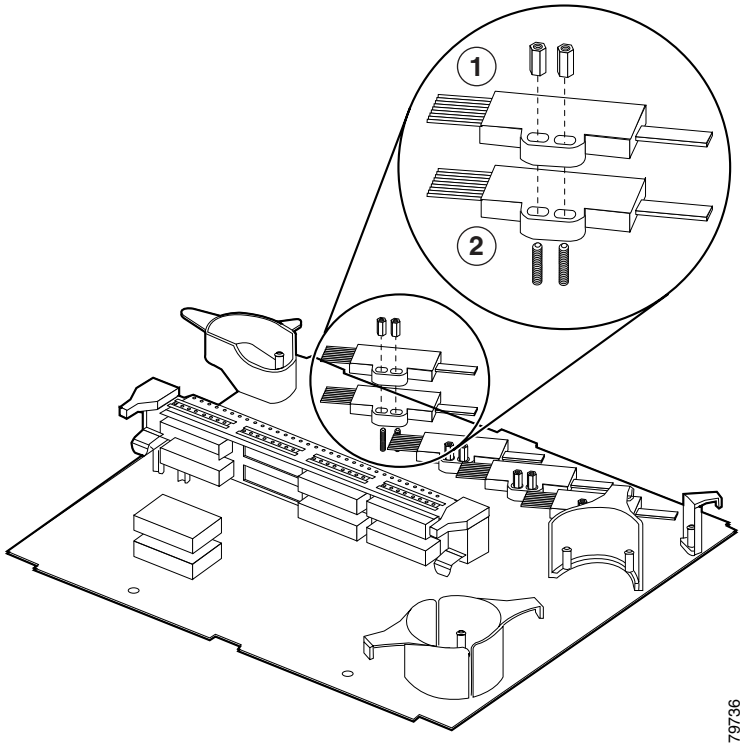
Step 9 Route the MU breakout end of the gray cable in through the right side of the drawer. (See Figure 2-34.)

Figure 2-34 Routing the Cross Connect Cables



Step 10 Mount the transition box as shown in Figure 2-35.

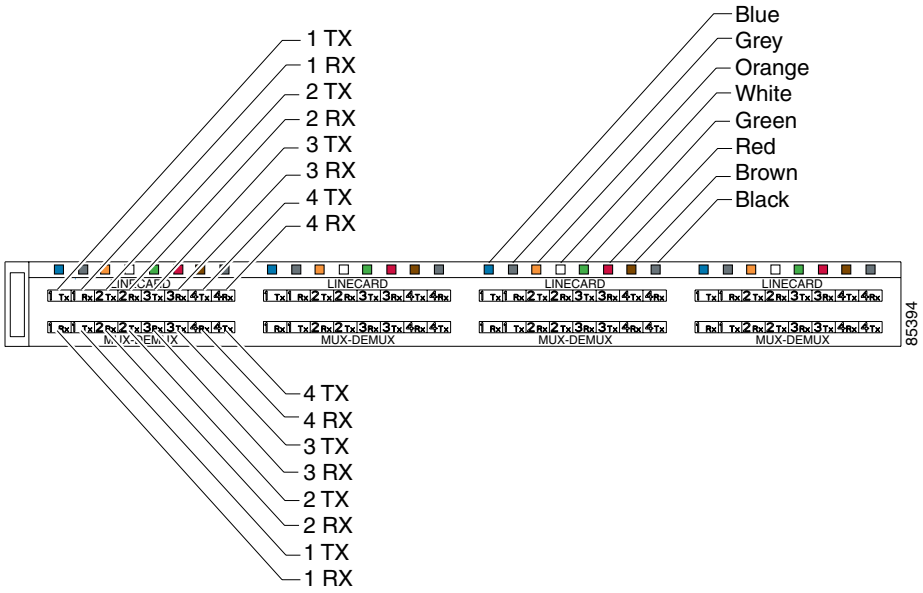
Figure 2-35 Mounting the Transition Box



1	Line card motherboard connections
2	Mux/demux motherboard connections

Step 11 Connect the cables to the bottom half of the desired adapter mux/demux connections on the inner side of the cross connect panel. These are color coded and should be connected by matching the color on the panel to the colored wires out of the transition box. (See Figure 2-36.)

Figure 2-36 Cross Connect Panel



Step 12 Connect the MU connectors on the outer side of the panel. Connect the Tx from the line card to the Tx on the mux/demux side. Connect the Rx line card side to the Rx on the mux/demux side.

Step 13 Connect the 8 MU breakout cables on the green cable to the LINECARD connections on the cross connect panel. These are color coded and should be connected by matching the color on the panel to the colored wires out of the transition box.

Step 14 Pull the cable up out of the right side of the drawer and back up through the cable management tray.

Step 15 Insert the MTP connector into the MTP adapter labeled East, West, EO, or WO on the desired line card motherboard.

Step 16 Unlock the drawer by moving the latch back into an upright position and close the drawer.

Tip You can use the client clips shipped with the chassis to fasten the cables for easy handling and organization.

NTP-6 Ground the Shelf

Purpose	This procedure grounds the shelf to the earth ground.
Tools/Equipment	Wire-stripping tool Crimping tool Two grounding lugs Number 1 Phillips screwdriver Two 12-24 screw
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1
Required/As Needed	Required

Onsite/Remote	Onsite
Security Level	None

Tip If you use the cable management guides, install the grounding equipment after you install the top cable management guide.

Step 1 Use a wire-stripping tool to remove approximately 0.75 inch (20 mm) of the covering from the end of the grounding wire.

Step 2 Insert the stripped end of the grounding wire into the open end of the grounding lug.

Step 3 Use the crimping tool to secure the grounding wire in place in the grounding lug.

Step 4 Locate the grounding receptacle on the chassis.

Step 5 Remove the label that covers the grounding receptacle.

Note Step 6 is optional if you are not using the top cable management guide.

Step 6 Place the lug mounting adapter against the grounding receptacle at the top of the chassis.

Step 7 Place the grounding lug against the lug mounting adapter.

Step 8 Insert two 12-24 screws through the holes in the grounding lug and the grounding receptacle. Ensure that the grounding lug does not interfere with other hardware or rack equipment.

Step 9 Install the locking washers and nuts; use a number 1 Phillips screwdriver to tighten the grounding lug to the grounding receptacle.

Step 10 Prepare the other end of the grounding wire and connect it to an appropriate grounding point in your site to ensure adequate earth ground for the Cisco ONS 15540 ESPx.

NTP-7 Power Up the Shelf

Purpose	This procedure describes how to install the power supplies and power up the shelf.
Tools/Equipment	–48 VDC or 120–240 VAC power supplies Wire-stripping tool AC power cord
Prerequisite Procedures	DLP-6 Install the Processor Card, page 2-13 NTP-6 Ground the Shelf, page 2-55
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 As needed, complete the "DLP-35 Rack-Mount the 15540-PWR-AC External Power Shelf" task on page 2-57.

Step 2 As needed, complete the "DLP-36 Rack-Mount the 15540-ACPS-N-E External Power Shelf" task on page 2-58.

Step 3 Complete the "DLP-37 Connect DC-Input Power from the 15540-ACPS-N-E External Power Shelf" task on page 2-59 for DC power supplies.

Step 4 Complete the "DLP-38 Install the 15540-ACPS-N-E External Power Supply" task on page 2-63 for AC power supplies.

Step 5 Complete the "DLP-39 Connect the 15540-ACPS-N-E External Power Supply" task on page 2-65 for AC power supplies.

Step 6 Complete the "DLP-40 Verify the Powerup" task on page 2-66 after connecting the power.

DLP-35 Rack-Mount the 15540-PWR-AC External Power Shelf

Purpose	This task installs the external power shelf.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	NTP-6 Ground the Shelf, page 2-55
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

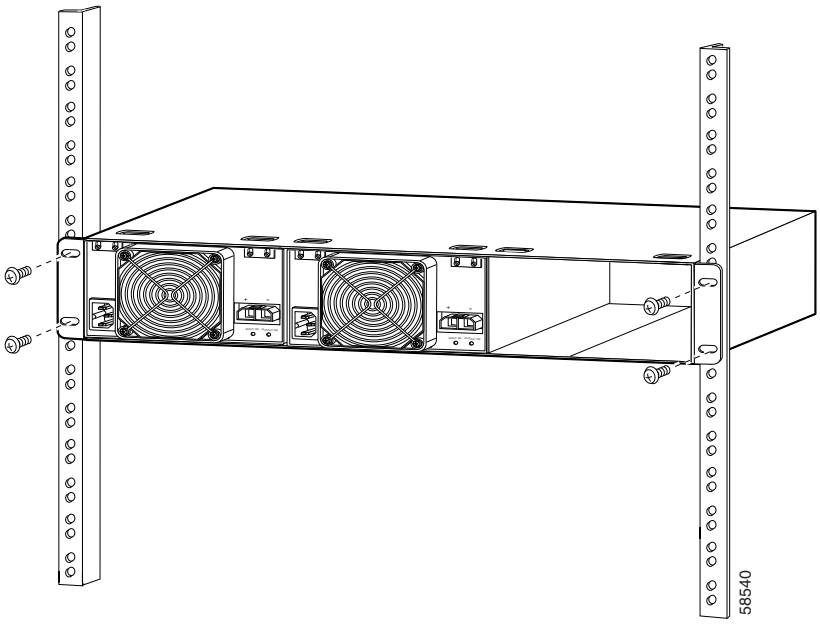
Step 1 Choose a rack space that is close enough to your chassis so that you can connect all power cords to the chassis and to the power outlet.

Note We recommend that you install the 15540-PWR-AC external power shelf directly above your Cisco ONS 15540 chassis, leaving one half inch of space between the chassis and the power shelf or in a directly adjacent rack. The external power shelf is a 19-inch (483 mm) wide rack mount shelf, 3.5 inches (86 mm) high and 12 inches (305 mm) deep.

Step 2 Align the mounting holes in the L brackets with the mounting holes in the equipment rack.

Step 3 Secure the 15540-PWR-AC external power shelf using four (two per side) 12-24 x 3/4-inch screws through the elongated holes in the L bracket and into the threaded holes in the mounting post. (See Figure 2-37.)

Figure 2-37 Installing the 15540-PWR-AC External Power Shelf in the Rack



Step 4 Use a tape measure and level to ensure that the 15540-PWR-AC external power shelf is installed straight and level.

DLP-36 Rack-Mount the 15540-ACPS-N-E External Power Shelf

Purpose	This task installs the external power shelf.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	NTP-6 Ground the Shelf, page 2-55
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

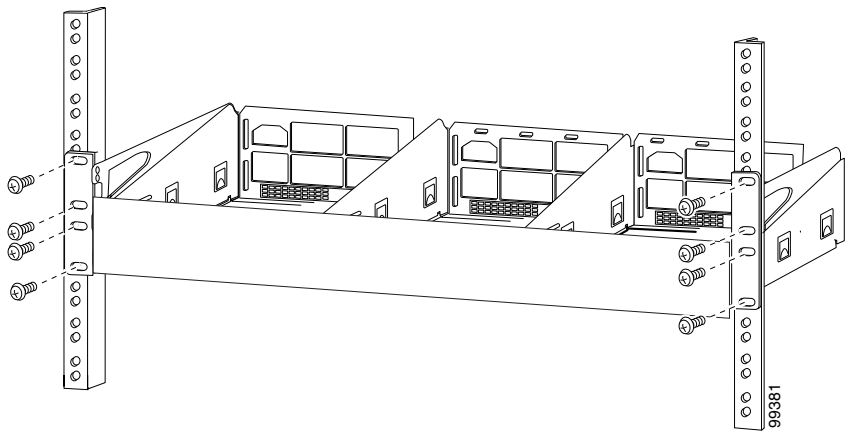
Step 1 Choose a rack space that is close enough to your chassis so that you can connect all power cords to the chassis and to the power outlet.

Note We recommend that you install the 15540-ACPS-N-E external power shelf directly above your Cisco ONS 15540 chassis, leaving one-half inch of space between the chassis and the power shelf or in a directly adjacent rack. The external power shelf is a 19-inch (483 mm) wide rack mount shelf, 3.5 inches (86 mm) high and 12 inches (305 mm) deep.

Step 2 Align the mounting holes of the external power shelf with the mounting holes in the equipment rack.

Step 3 Secure the external power shelf using eight (four per side) 12-24 x 3/4-inch screws through the holes in the external power shelf and into the threaded holes in the mounting post. (See Figure 2-38.)

Figure 2-38 Installing the 15540-ACPS-N-E External Power Shelf in the Rack



Step 4 Use a tape measure and level to ensure that the external power shelf is installed straight and level.

Step 5 Remove the spacer bar after the external power shelf is secured to the rack.

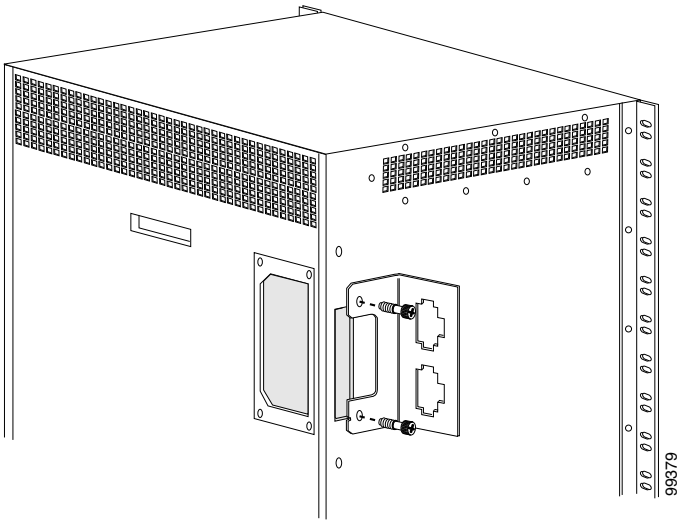
DLP-37 Connect DC-Input Power from the 15540-ACPS-N-E External Power Shelf

Purpose	This task connects the external power shelf.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	NTP-6 Ground the Shelf, page 2-55
Required/As Needed	As needed

Onsite/Remote	Onsite
Security Level	None

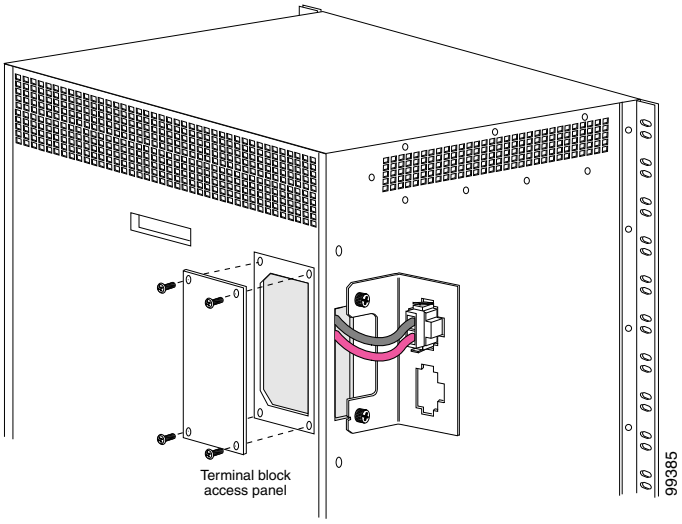
Step 1 Attach the cable strain relief bracket to the side of the Cisco ONS 15540 ESPx chassis. (See Figure 2-39.)

Figure 2-39 Installing the Cable Strain Relief Bracket



Step 2 Remove the four screws from the terminal block access panel on the back panel of the chassis. (See Figure 2-40.)

Figure 2-40 Removing the Terminal Block Access Panel



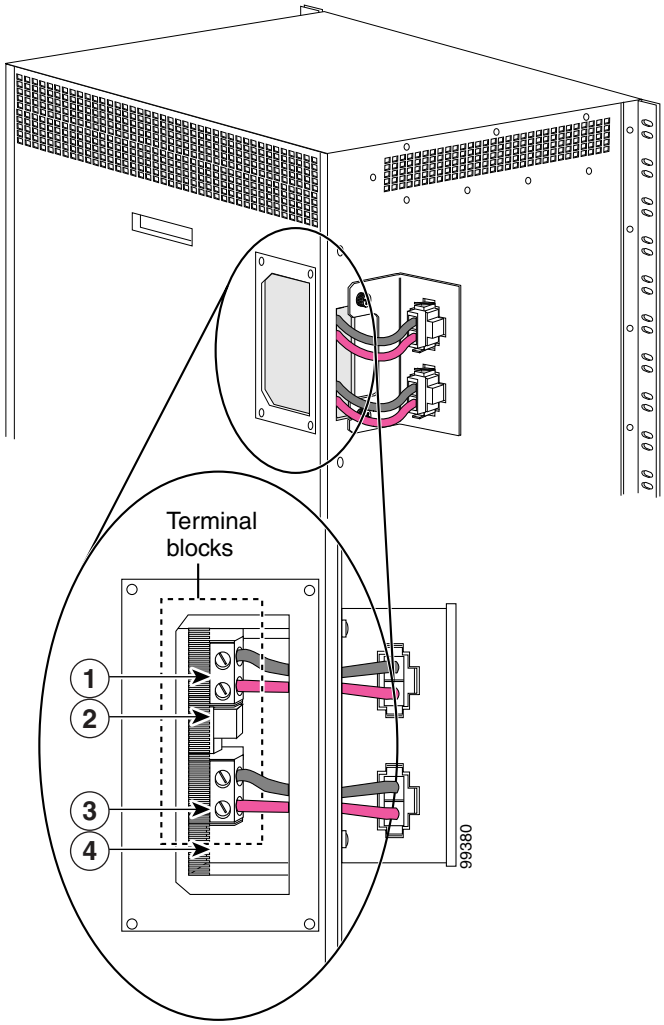
Step 3 Snap the cable connector of the short DC power cable into the cable strain relief bracket. (See Figure 2-40.)

Step 4 Insert the cable through the left rear of the chassis and connect the leads to the terminal blocks (see Figure 2-41) in the following sequence:

- Black lead to RTNA.
- Red lead to side A with –48V.

Note The ground connections should always be connected first and disconnected last.

Figure 2-41 Connecting Cable Wires to the Terminal Blocks



1	RTNA	**3**	RTNB
2	-48VA	**4**	-48VB

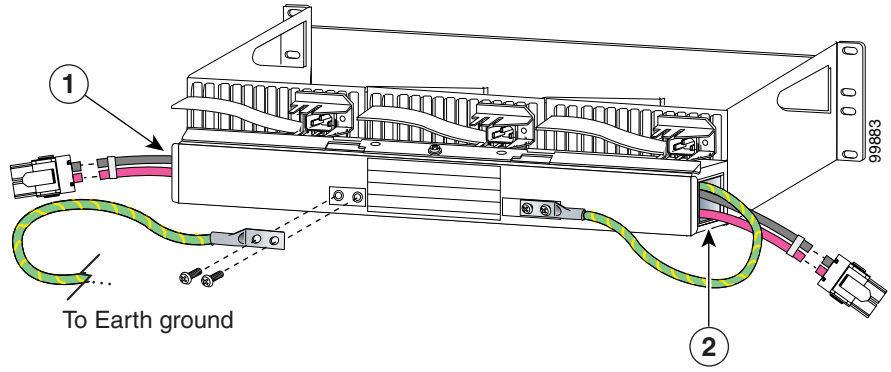
Step 5 Repeat Step 3 and Step 4, connecting the second set of cables in the following sequence:

- Black lead to RTNB.
- Red lead to –48B.

Step 6 Reinstall the terminal block access panel onto the chassis. Use the same four screws used in Step 2 to secure the panel. (See Figure 2-40.)

Step 7 Use two number 10 screws to attach the earth ground lead to the ground lugs on the rear of the 15540-ACPS-N-E external power shelf. (See Figure 2-42.)

Figure 2-42 Installing the DC Power Cable

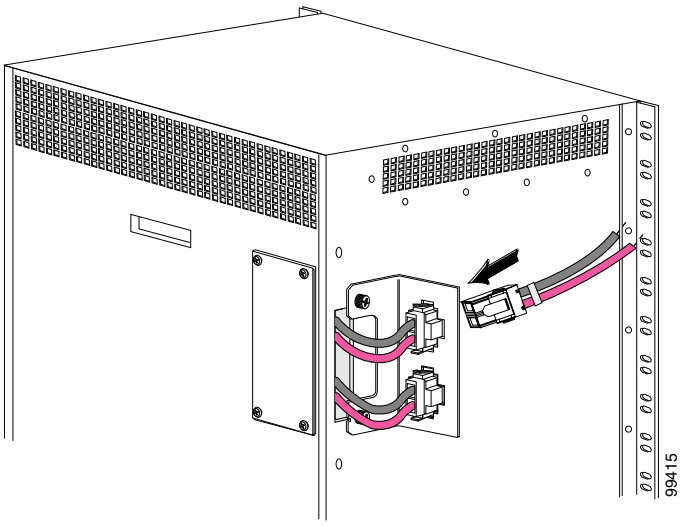


1	Side B	**2**	Side A

Step 8 Connect the earth ground lead to an appropriate ground source.

Step 9 Attach the side A and side B cable ends to the short DC power cables at the cable strain relief bracket. (See Figure 2-43.)

Figure 2-43 Connecting the DC Power Cables

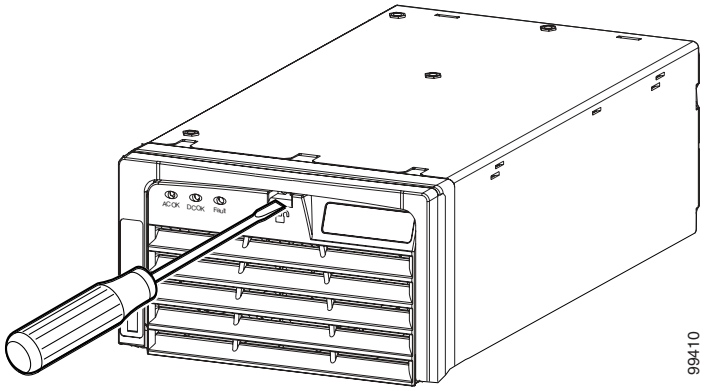


DLP-38 Install the 15540-ACPS-N-E External Power Supply

Purpose	This task installs the external power supply.
Tools/Equipment	Number 1 Phillips screwdriver
Prerequisite Procedures	DLP-36 Rack-Mount the 15540-ACPS-N-E External Power Shelf, page 2-58
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

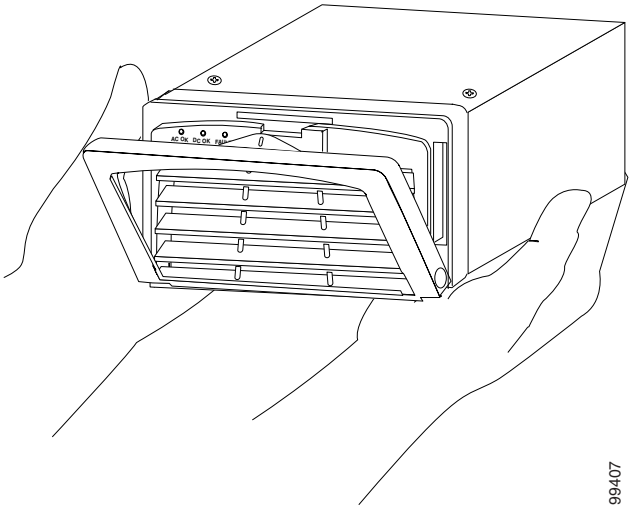
Step 1 Use a flat blade screwdriver to push in on the release handle latch until the release handle opens. (See Figure 2-44.)

Figure 2-44 Opening the Release Handle



Step 2 With the release handle partially open, place both hands underneath the bottom of the external power supply and carry it to the external power shelf. (See Figure 2-45.)

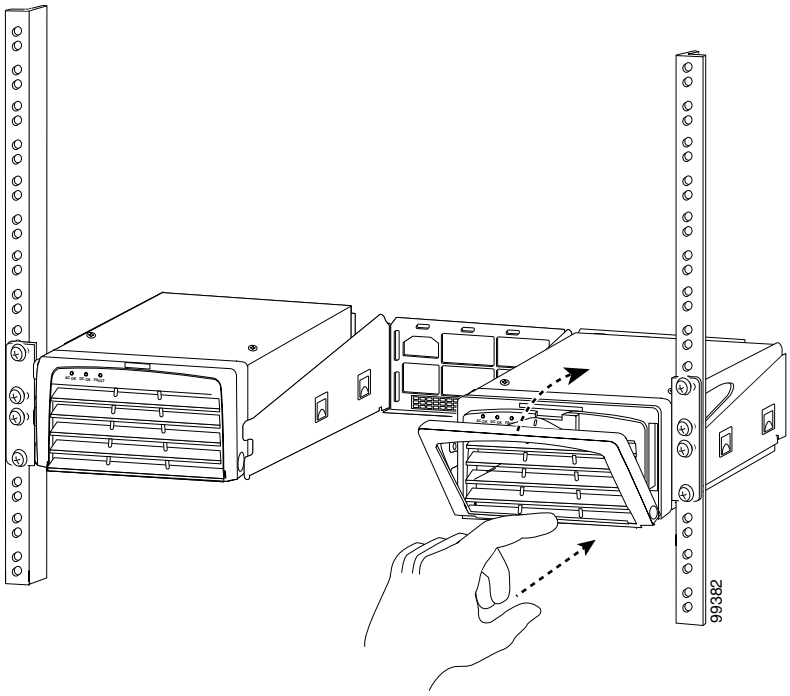
Figure 2-45 Handling the 15540-ACPS-N-E Power Supply



Caution Use both hands to install and remove the 15540-ACPS-N-E power supply.

Step 3 Slide the 15540-ACPS-N-E power supply all the way into the 15540-ACPS-N-E external power shelf bay until the release handle closes. (See Figure 2-46.)

Figure 2-46 Installing the 15540-ACPS-N-E Power Supply



Step 4 Ensure that all site power and grounding requirements described in the *Regulatory Compliance and Safety Information for the Cisco ONS 15500 Series* have been met before you connect the 15540-ACPS-N-E power supply to a power source.

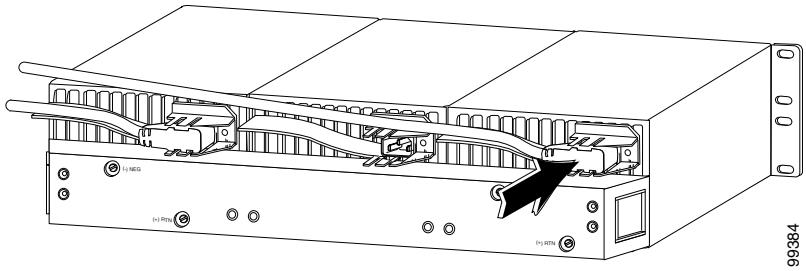
Caution In a system with multiple power supplies, connect each power supply to a separate AC-input power source. In case of a power source failure, the second source is still available.

DLP-39 Connect the 15540-ACPS-N-E External Power Supply

Purpose	This task connects the external power shelf.
Tools/Equipment	Power cord
Prerequisite Procedures	NTP-6 Ground the Shelf, page 2-55 DLP-36 Rack-Mount the 15540-ACPS-N-E External Power Shelf, page 2-58
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	None

Step 1 Connect the power cord to the 15540-ACPS-N-E external power shelf. (See Figure 2-47.)

Figure 2-47 Installing the AC Power Cord



Step 2 Verify 15540-ACPS-N-E power supply operation by checking the power supply front panel LEDs:

- AC OK LED is on.
- DC OK LED is on.

Step 3 Check the external power supply status from the system console by entering the **show hardware** command. For more information on commands, refer to the *Cisco ONS 15540 ESPx Configuration Guide* and the *Cisco ONS 15540 ESPx Command Reference*.

DLP-40 Verify the Powerup

Purpose	This task verifies the LEDs on the shelf after powerup.
Tools/Equipment	None
Prerequisite Procedures	DLP-37 Connect DC-Input Power from the 15540-ACPS-N-E External Power Shelf, page 2-59 or DLP-39 Connect the 15540-ACPS-N-E External Power Supply, page 2-65
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Verify that the Status LED is yellow.

Step 2 Verify that the Active LED on the primary processor and the Standby LED on the standby processor are both green.

Step 3 Verify that alarm LEDs are off.

Step 4 Verify that LEDs on the mux/demux modules and the transponder modules are green.

Step 5 Perform a **show hardware** command to verify the status of both power supplies. The status for both power supplies should be OK.

```
Power-Supply Module

Power-Supply A is : OK
Power-Supply B is : OK
```

NTP-8 Verify Installation of Hardware

Purpose	This procedure verifies the hardware installation.
Tools/Equipment	Console
Prerequisite Procedures	NTP-2 Install the Cisco ONS 15540 ESPx Chassis, page 2-1 NTP-3 Install the Cable Management System, page 2-4 NTP-4 Install Processor Cards, Line Card Motherboards, and Modules, page 2-12 NTP-5 Connect the Hardware, page 2-26 NTP-6 Ground the Shelf, page 2-55 NTP-7 Power Up the Shelf, page 2-57
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	None

Step 1 Connect to the console port on the processor card through your PC or network.

The CLI (command-line interface) on the console prompts you to enter the initial configuration dialog. Answer **no** to this prompt as follows:

```
Would you like to enter the initial dialog? [yes]: no
```

Note If there are several prompts, answer no until you come to the EXEC prompt.

Step 2 Type enable at the user EXEC prompt to enter privilege EXEC mode:

```
Switch> enable
Switch#
```

Step 3 Verify that all hardware is correctly installed in the proper slots by performing a **show hardware** command. The following example shows the command output.

```
Switch# show hardware

------------------------------------------------------------------------------
CN_Tower_Backplane named Switch, Date: 12:44:21 UTC Fri Nov 14 2003
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Back-Plane Information
------------------------------------------------------------------------------
Orderable Product No. MAC-Address       MAC-Size Serial No.   Mfg. Date  H/W V
--------------------- ----------------- -------- ------------ ---------- -----
15540-CHSA            00-00-16-44-3e-b7 16       TBC04501952  01/09/2002 3.0

------------------------------------------------------------------------------
Slot Orderable Product No.     Part No.   Rev Serial No.   Mfg. Date  H/W Ver.
---- ------------------------- ---------- --- ------------ ---------- --------
0/*  15540-LCMB-UNKNOWN        73-7793-02 11  CAB0604MD7A  2/20/2002  1.0
0/2  15540-MDXC-16EH=          74-2858-01 01  ANX0614000N  06/18/2002 1.0
1/*  15540-LCMB-UNKNOWN        73-7793-01 11  CAB0604MD7R  01/29/2002 1.0
1/0  15440-MDXD-16AD=          74-2857-01 A1  404049       03/04/2002 1.0
1/2                                       0   403416       01/18/2002 0.1
3/*  15540-TBD                 73-7789-01 03  CAB0543L2SX  11/5/2001  5.0
3/0  N/A                       68-1105-02 02  CAB0513HGV6  02/23/2001 2.32
3/1  N/A                       68-1105-02 02  CAB0512HGPA  02/23/2001 2.32
3/2  15540-TSP2-0300=          68-1342-06 A1  CNH0716004N  04/22/2003 5.1
3/3  15540-TSP2-0300=          68-1342-06 A1  CNH0716003V  04/22/2003 5.1
4/*  15540-TBD                 73-7789-03 A0  CAB0605MF0P  02/06/2002 2.3
4/0  15540-MDXE-0203           05-1197-01 C^N¦ DIF07420102  01/01/2000 1.0
4/1  15540-MDXE-OSC            05-1211-01 C^N¦ DIF07430109  10/22/2003 1.0
4/2  15540-MDXE-0204           05-1198-01 C^N¦ DIF07430108  10/22/2003 1.0
4/3  15540-04              05-1194-01 C^N¦ DIF07400104  01/01/2000 1.0
6/*  15540-CPU=                73-5621-06 A1  CAB0553M51D  01/11/2002 6.2
7/*  N/A                       73-5621-02 02  CAB0505GZH3  02/15/2001 2.5
8/*  15540-LCMB-1100=          68-1672-03 A0  CAB06310XYA  09/23/2002 2.2
8/0  15540-MDXE-OSC            05-1211-01 C^N¦ DIF07430110  10/22/2003 1.0
8/1  15540-MDXE-0201           05-1195-01 C^N¦ DIF07430107  10/22/2003 1.0
8/2  15540-MDXE-0201           05-1195-01 C^N¦ DIF07420107  01/01/2000 1.0
8/3  15540-04             05-1194-01 C^N¦ DIF07410105  01/01/2000 1.0


------------------------------------------------------------------------------
Power-Supply Module
------------------------------------------------------------------------------
Power-Supply A is : OK
Power-Supply B is : Not working
ESPx-ALPHA#
```

Step 4 Verify that the modules have the correct hardware version and software version by performing a **show hardware detail** command. The follow example shows the command output.

```
Switch# show hardware detail

----------------------------------------------------------------------------

----------------------------------------------------------------------------
Back-Plane Information
----------------------------------------------------------------------------
Orderable Product No. MAC-Address       MAC-Size Serial No.   Mfg. Date  H/W Ve
--------------------- ----------------- -------- ------------ ---------- ------
15540-CHSA            00-00-16-44-3e-b7 16       TBC04501952  01/09/2002 3.0

----------------------------------------------------------------------------
Slot Orderable Product No.     Part No.   Rev Serial No.   Mfg. Date  H/W Ver.
---- ------------------------- ---------- --- ------------ ---------- ---------
0/*  15540-LCMB-UNKNOWN        73-7793-02 11  CAB0604MD7A  2/20/2002  1.0
0/2  15540-MDXC-16EH=          74-2858-01 01  ANX0614000N  06/18/2002 1.0
1/*  15540-LCMB-UNKNOWN        73-7793-01 11  CAB0604MD7R  01/29/2002 1.0
1/0  15440-MDXD-16AD=          74-2857-01 A1  404049       03/04/2002 1.0
1/2                                       0   403416       01/18/2002 0.1
3/*  15540-TBD                 73-7789-01 03  CAB0543L2SX  11/5/2001  5.0
3/0  N/A                       68-1105-02 02  CAB0513HGV6  02/23/2001 2.32
3/1  N/A                       68-1105-02 02  CAB0512HGPA  02/23/2001 2.32
3/2  15540-TSP2-0300=          68-1342-06 A1  CNH0716004N  04/22/2003 5.1
3/3  15540-TSP2-0300=          68-1342-06 A1  CNH0716003V  04/22/2003 5.1
4/*  15540-TBD                 73-7789-03 A0  CAB0605MF0P  02/06/2002 2.3
4/0  15540-MDXE-0203           05-1197-01 C^N¦ DIF07420102  01/01/2000 1.0
4/1  15540-MDXE-OSC            05-1211-01 C^N¦ DIF07430109  10/22/2003 1.0
4/2  15540-MDXE-0204           05-1198-01 C^N¦ DIF07430108  10/22/2003 1.0
4/3  15540-04              05-1194-01 C^N¦ DIF07400104  01/01/2000 1.0
6/*  15540-CPU=                73-5621-06 A1  CAB0553M51D  01/11/2002 6.2
7/*  N/A                       73-5621-02 02  CAB0505GZH3  02/15/2001 2.5
8/*  15540-LCMB-1100=          68-1672-03 A0  CAB06310XYA  09/23/2002 2.2
8/0  15540-MDXE-OSC            05-1211-01 C^N¦ DIF07430110  10/22/2003 1.0
8/1  15540-MDXE-0201           05-1195-01 C^N¦ DIF07430107  10/22/2003 1.0
8/2  15540-MDXE-0201           05-1195-01 C^N¦ DIF07420107  01/01/2000 1.0
8/3  15540-04              05-1194-01 C^N¦ DIF07410105  01/01/2000 1.0


----------------------------------------------------------------------------
Power-Supply Module
----------------------------------------------------------------------------
Power-Supply A is : OK
Power-Supply B is : Not working
ESPx-ALPHA#sh hardware detail
----------------------------------------------------------------------------
CN_Tower_Backplane named Switch, Date: 12:47:08 UTC Fri Nov 14 2003
----------------------------------------------------------------------------

----------------------------------------------------------------------------
Back-Plane Information
----------------------------------------------------------------------------
Slot Number             : N/A
Controller Type         : 0x1006
On-Board Description    : CN_Tower_Backplane
Orderable Product Number: 15540-CHSA
Board Part Number       : 73-5655-03
Board Revision          : 02
Serial Number           : TBC04501952
Manufacturing Date      : 01/09/2002
Hardware Version        : 3.0
RMA Number              : 0x00
```

```
RMA Failure Code        : 0x00

Optical Back-Plane Type : Patchable Optical BackplaneMAC Address
: 00-00-16-44-3e-b7
MAC Address Block Size  : 16

--------------------------------------------------------------------------------
Slot Number             : 0/*
Controller Type         : 0x101A
On-Board Description    : CN_TOWER_MUX/DEMUX_OSC
Orderable Product Number: 15540-LCMB-UNKNOWN
Board Part Number       : 73-7793-02
Board Revision          : 11
Serial Number           : CAB0604MD7A
Manufacturing Date      : 2/20/2002
Hardware Version        : 1.0
RMA Number              : 0x00
RMA Failure Code        : 0x00
Functional Image Version: 2.67
Function-ID             : 0
--------------------------------------------------------------------------------
Slot Number             : 0/2
Controller Type         : 0x1025
On-Board Description    : Mux_16Channel
Orderable Product Number: 15540-MDXC-16EH=
Board Part Number       : 74-2858-01
Board Revision          : 01
Serial Number           : ANX0614000N
Manufacturing Date      : 06/18/2002
Hardware Version        : 1.0
RMA Number              :
RMA Failure Code        :
--------------------------------------------------------------------------------
Slot Number             : 1/*
Controller Type         : 0x101A
On-Board Description    : CN_TOWER_MUX/DEMUX_OSC
Orderable Product Number: 15540-LCMB-UNKNOWN
Board Part Number       : 73-7793-01
Board Revision          : 11
Serial Number           : CAB0604MD7R
Manufacturing Date      : 01/29/2002
Hardware Version        : 1.0
RMA Number              : 0x00
RMA Failure Code        : 0x00
Functional Image Version: 2.67
Function-ID             : 0
--------------------------------------------------------------------------------
```

Software Setup Procedures

This chapter describes procedures for basic software configuration.

Note The procedures and tasks in this chapter assume that you are familiar with the Cisco IOS CLI (command-line interface) and that you have access to the Cisco ONS 15540 ESPx technical documentation. The technical documentation is available at the following URL:

http://www.cisco.com/en/US/products/hw/optical/ps2011/ps4002/index.html

Before You Begin

This section lists the chapter non-trouble procedure (NTPs). Turn to a procedure for applicable tasks or detailed level procedures (DLPs).

Step 1 NTP-9 Configure Management Access, page 3-2—Complete this procedure to configure network management access to the shelves in the network.

Step 2 NTP-10 Configure Interfaces, page 3-12—Complete this procedure to configure the interfaces on the line cards.

Step 3 NTP-11 Configure Patch Connections, page 3-18—Complete this procedure to configure the optical patch connections in command-line interface.

Step 4 NTP-12 Configure APS, page 3-25—Complete this procedure to configure splitter, y-cable, and trunk fiber based APS (Automatic Protection Switching).

Step 5 NTP-13 Configure SNMP, page 3-30—Complete this procedure to configure and verify SNMP trap messages.

Step 6 NTP-14 Verify the System Configuration, page 3-31—Complete this procedure to verify the system configuration before continuing.

Use the data checklist forms to record such information as IP address and host name for each node. Refer to this information when performing the procedures in this section.

Refer to the *Cisco ONS 15540 ESPx Configuration Guide* and the *Cisco ONS 15540 ESPx Command Reference* for more detailed configuration information.

NTP-9 Configure Management Access

Purpose	This procedure describes how to configure the enable password, secret password, IP access on the NME interface, and host name.
Tools/Equipment	None
Prerequisite Procedures	NTP-8 Verify Installation of Hardware, page 2-66
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Complete the "DLP-41 Configure the Enable Password" task on page 3-2.

Step 2 As needed, complete the "DLP-42 Configure the Enable Secret Password" task on page 3-3.

Step 3 To establish network access to the shelves in the node, complete the "DLP-43 Configure IP Access on the NME Interfaces" task on page 3-4.

Step 4 To create a meaningful name for the shelf, complete the "DLP-44 Configure Host Name" task on page 3-5.

Step 5 To set the system time and time zone, complete the "DLP-45 Configure System Time, Time Zone, and System Log Time Stamps" task on page 3-6.

Step 6 As needed, complete the "DLP-46 Configure IP on the OSC Using the Loopback Interface" task on page 3-8.

Step 7 As needed, complete the "DLP-47 Configure IP on the OSC Using the NME Fastethernet 0 Interface" task on page 3-10.

DLP-41 Configure the Enable Password

The enable password is a nonencrypted password. It can contain any number of uppercase and lowercase alphanumeric characters. Give the enable password only to users permitted to make configuration changes.

Purpose	This task configures the unencrypted enable password, which allow users to make configuration changes.
Tools/Equipment	None
Prerequisite Procedures	NTP-8 Verify Installation of Hardware, page 2-66
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **enable password** [**level** *level*] *password*	Sets the enable password. You can specify one of 16 privilege levels, using numbers 0 through 15. Level 1 is normal EXEC-mode user privileges. The default level is 15 (traditional enable privileges).

DLP-42 Configure the Enable Secret Password

Purpose	This task configures the secure, encrypted enable secret password, which prevent both configuration changes and entrance to ROM monitor mode.
Tools/Equipment	None
Prerequisite Procedures	DLP-41 Configure the Enable Password, page 3-2
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **enable secret** [**level** *level*] *password*	Configures the enable secret password. The password contains from 1 to 25 uppercase and lowercase alphanumeric characters. The first character cannot be a number. Spaces are valid password characters. Leading spaces are ignored; trailing spaces are recognized. You can specify one of 16 privilege levels, using numbers 0 through 15. Level 1 is normal EXEC-mode user privileges. The default level is 15 (traditional enable privileges). **Note** For maximum security, the enable secret password should be different from the enable password.
Step 4	Switch(config)# **privilege** *mode* {**level** *level* | **reset**} *command-string*	Configures or resets the privilege level to allow access to a specific command. **Note** Configure the password for a privilege level defined using the **privilege** command with the **enable secret** command.

DLP-43 Configure IP Access on the NME Interfaces

Purpose	This task configures IP access on the NME (network management Ethernet) interfaces on the active processor cards. This allows multiple, simultaneous remote Telnet or SNMP network management sessions.
Tools/Equipment	None
Prerequisite Procedures	DLP-41 Configure the Enable Password, page 3-2 Obtain an IP address and IP subnet mask for the NME interface on the active processor card and a separate IP address and IP subnet mask for the NME interface on the standby processor card, if any.
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **interface fastethernet 0** Switch(config-if)#	Enters interface configuration mode on interface fastethernet 0, the NME port on the active processor card.
Step 4	Switch(config-if)# **ip address** *ip-address subnet-mask*	Specifies the IP address and IP subnet mask for the management port interface.
Step 5	Switch(config-if)# **speed** {**10** | **100** | **auto**}	Specifies the transmission speed. The default is **auto** (autonegotiation). (Optional)
Step 6	Switch(config-if)# **duplex** {**auto** | **full** | **half**}	Specifies the duplex mode. The default is **auto** (autonegotiation). (Optional)
Step 7	Switch(config-if)# **exit** Switch(config)#	Returns to global configuration mode.
Step 8	Switch(config)# **interface fastethernet-sby 0** Switch(config-if)#	Enters interface configuration mode on interface fastethernet-sby 0, the NME port on the standby processor card, if present.
Step 9	Switch(config-if)# **ip address** *ip-address subnet-mask*	Specifies the IP address and IP subnet mask for the standby management port interface. **Note** The IP address and subnet mask must be different from the IP address and subnet mask for the NME interface on the active processor.
Step 10	Switch(config-if)# **speed** {**10** | **100** | **auto**}	Specifies the transmission speed. The default is **auto** (autonegotiation).
Step 11	Switch(config-if)# **duplex** {**auto** | **full** | **half**}	Specifies the duplex mode. The default is **auto** (autonegotiation).

	Command	Purpose
Step 12	Switch(config-if)# **exit** Switch(config)#	Returns to global configuration mode.
Step 13	Switch(config)# **ip default-gateway** *ip-address*	Specifies the address of the default IP gateway node.
Step 14	Switch(config)# **end** Switch#	Returns to privileged EXEC mode. The prompt indicates that the host name has been set to the new name.
Step 15	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure IP access on the NME interface fastethernet 0:

```
Switch# configure terminal
Switch(config)# interface fastethernet 0
Switch(config-if)# ip address 192.31.7.18 255.255.255.0
Switch(config-if)# exit
Switch(config)# ip default-gateway 192.31.7.1
Switch(config)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-44 Configure Host Name

Purpose	This task configures the system host name, which allows you to keep track of the nodes in your network.
Tools/Equipment	None
Prerequisite Procedures	DLP-41 Configure the Enable Password, page 3-2 Obtain a host name for the system.
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **hostname** *name*	Specifies the system host name.

	Command	Purpose
Step 4	*name*(config)# **end** *name*#	Returns to privileged EXEC mode. The prompt indicates that the host name has been set to the new name.
Step 5	*name*# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure the host name:

```
Switch# configure terminal
Switch(config)# hostname node1
node1(config)# end
node1# copy system:running-config nvram:startup-config
```

DLP-45 Configure System Time, Time Zone, and System Log Time Stamps

Purpose	This task configures the system time and time zone for the system, and enables time stamps for the system log entries.
Tools/Equipment	None
Prerequisite Procedures	DLP-41 Configure the Enable Password, page 3-2 Obtain a host name for the system.
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **clock set** *hh*:*mm*:*ss day month year* or Switch# **clock set** *hh*:*mm*:*ss month day year*	Sets the system clock.
Step 3	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 4	Switch(config)# **clock timezone** *zone hours-offset* [*minutes-offset*]	Sets the time zone. The *zone* argument is the name of the time zone (typically a standard acronym). The *hours-offset* argument is the number of hours the time zone is different from UTC. The *minutes-offset* argument is the number of minutes the time zone is different from UTC.

	Command	Purpose
Step 5	Switch(config)# **clock summer-time** *zone* **recurring** [*week day month hh*:*mm week day month hh*:*mm* [*offset*]] or Switch(config)# **clock summer-time** *zone* **date** *month day year hh*:*mm month day year hh*:*mm* [*offset*] or Switch(config)# **clock summer-time** *zone* **date** *day month year hh*:*mm day month year hh*:*mm* [*offset*]	Configures a recurring summer time start and end dates. The *offset* argument is used to indicate the number of minutes to add to the clock during summer time. Configures a specific summer time start and end dates. The *offset* argument is used to indicate the number of minutes to add to the clock during summer time.
Step 6	Switch(config)# **service timestamps log datetime msec localtime show-timezone**	Enables log time stamps.
Step 7	Switch(config)# **end**	Returns to privileged EXEC mode.
Step 8	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure the host name:

```
Switch# clock set 10:30:00 1 nov 2003
Switch# configure terminal
Switch(config)# timezone pst -8
Switch(config)# clock summer-time pdt recurring last sun apr 2:00 last sun oct 2:00 60
Switch(config)# service timestamps log datetime msec localtime show-timezone
Switch(config)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-46 Configure IP on the OSC Using the Loopback Interface

Purpose	This task configures IP access on the OSC for network management using the loopback interface as a reference. The loopback interface is a software-only virtual interface that is always up and allows routing protocol sessions to stay up even if the OSC wave interface is down.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4 DLP-8 Install the Mux/Demux Motherboard, page 2-15, with OSC Obtain an IP address for loopback interface with a subnet separate from the NME fastethernet 0 interface.
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **interface loopback 1** Switch(config-if)#	Selects the loopback interface to configure and enters interface configuration mode.
Step 4	Switch(config-if)# **ip address** *ip-address subnet-mask*	Configures the IP address and subnet for the interface.
Step 5	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 6	Switch(config)# **interface wave 0** Switch(config-if)#	Selects the first of the OSC wave interfaces
Step 7	Switch(config-if)# **ip unnumbered loopback 1**	Configures an unnumbered interface referencing the loopback interface.
Step 8	Switch(config-if)# **no shutdown**	Enables the interface.
Step 9	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 10	Switch(config)# **interface wave 1** Switch(config-if)#	Selects the second OSC wave interface, if present.
Step 11	Switch(config-if)# **ip unnumbered loopback 1**	Configures an unnumbered interface referencing the loopback interface.
Step 12	Switch(config-if)# **no shutdown**	Enables the interface.
Step 13	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.

	Command	Purpose
Step 14	Switch(config)# **ip route** *prefix prefix-mask interface*	Configures IP static routes for some or all destinations.
	or	
	Switch(config)# **router ospf** *process-id*	Configures OSPF as the routing protocol.
	Switch(config-router)# **network** *network-address wildcard-mask* **area** *area-id*	
	or	
	Switch(config)# **router eigrp** *as-number*	Configures EIGRP as the routing protocol.
	Switch(config-router)# **network** *network-number* [*network-mask*]	
	or	
	Switch(config)# **router bgp** *as-number*	Configures BGP as the routing protocol.
	Switch(config-router)# **network** *network-number* [**mask** *network-mask*]	
	Switch(config-router)# **neighbor** {*ip-address* | *peer-group-name*} **remote-as** *number*	
Step 15	Switch(config-router)# **end**	Returns to privileged EXEC mode.
Step 16	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure IP on an OSC wave interface:

```
Switch# configure terminal
Switch(config)# interface loopback 1
Switch(config-if)# ip address 192.31.7.18 255.255.255.0
Switch(config-if)# exit
Switch(config)# interface wave 0
Switch(config-if)# ip unnumbered loopback 1
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wave 1
Switch(config-if)# ip unnumbered loopback 1
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# router ospf 109
Switch(config-router)# network 192.31.20.0 0.0.0.255 area 10.9.50.0
Switch(config-router)# network 192.31.0.0 0.0.255.255 area 2
Switch(config-router)# network 192.31.10.0 0.0.0.255 area 3
Switch(config-router)# network 0.0.0.0 255.255.255.255 area 0
Switch(config-router)# end
Switch# copy system:running-config nvram:startup-config
```

Note For detailed information about configuring routing protocols, refer to the *Cisco IOS IP and IP Routing Configuration Guide*.

DLP-47 Configure IP on the OSC Using the NME Fastethernet 0 Interface

Purpose	This task configures IP access on the OSC for network management using the NME fastethernet 0 interface as a reference.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4 DLP-8 Install the Mux/Demux Motherboard, page 2-15, with OSC
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **interface wave 0** Switch(config-if)#	Selects the first of the OSC wave interfaces
Step 4	Switch(config-if)# **ip unnumbered fastethernet 0**	Configures an unnumbered interface referencing the NME fastethernet 0 interface.
Step 5	Switch(config-if)# **no shutdown**	Enables the interface.
Step 6	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 7	Switch(config)# **interface wave 1** Switch(config-if)#	Selects the second OSC wave interface.
Step 8	Switch(config-if)# **ip unnumbered fastethernet 0**	Configures an unnumbered interface referencing the NME fastethernet 0 interface.
Step 9	Switch(config-if)# **no shutdown**	Enables the interface.
Step 10	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.

	Command	Purpose
Step 11	Switch(config)# **ip route** *prefix prefix-mask interface* or Switch(config)# **router ospf** *process-id* Switch(config-router)# **network** *network-address wildcard-mask* **area** *area-id* or Switch(config)# **router eigrp** *as-number* Switch(config-router)# **network** *network-number* [*network-mask*] or Switch(config)# **router bgp** *as-number* Switch(config-router)# **network** *network-number* [**mask** *network-mask*] Switch(config-router)# **neighbor** {*ip-address* | *peer-group-name*} **remote-as** *number*	Configures IP static routes for some or all destinations. Configures OSPF as the routing protocol. Configures EIGRP as the routing protocol. Configures BGP as the routing protocol.
Step 12	Switch(config)# **end** Switch#	Returns to privileged EXEC mode.
Step 13	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure IP on an OSC wave interface:

```
Switch# configure terminal
Switch(config)# interface wave 0
Switch(config-if)# ip unnumbered fastethernet 0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wave 1
Switch(config-if)# ip unnumbered fastethernet 0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# router ospf 109
Switch(config-router)# network 131.108.20.0 0.0.0.255 area 10.9.50.0
Switch(config-router)# network 131.108.0.0 0.0.255.255 area 2
Switch(config-router)# network 131.109.10.0 0.0.0.255 area 3
Switch(config-router)# network 0.0.0.0 255.255.255.255 area 0
Switch(config-router)# network 0.0.0.0 255.255.255.255 area 0
Switch(config-router)# end
Switch# copy system:running-config nvram:startup-config
```

Note For detailed information about configuring routing protocols, refer to the *Cisco IOS IP and IP Routing Configuration Guide*.

NTP-10 Configure Interfaces

Purpose	This procedure describes how to configure interfaces on the shelf.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 As needed, complete the "DLP-48 Configure 2.5-Gbps Transponder Module Interfaces" task on page 3-12.

Step 2 As needed, complete the "DLP-49 Configure 10-GE Transponder Module Interfaces" task on page 3-15.

Step 3 As needed, complete the "DLP-50 Configure PSM Interfaces" task on page 3-17.

DLP-48 Configure 2.5-Gbps Transponder Module Interfaces

Purpose	This task configures the 2.5-Gbps transponder module interfaces for client data transmission and network topology management.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **interface transparent** *slot*/*subcard*/**0** Switch(config-if)#	Selects the interface to configure and enters interface configuration mode.

	Command	Purpose
Step 4	Switch(config-if)# **encapsulation** {**fastethernet** | **fddi** | **gigabitethernet** | **escon**}	Specifies Fast Ethernet, FDDI, Gigabit Ethernet, or ESCON. OFC is disabled.
	or	
	Switch(config-if)# **encapsulation sysplex clo**	Specifies Sysplex CLO[1]. OFC[2] is disabled. Forward laser control is enabled on both the transparent and wave interfaces. OFC is disabled.
	or	
	Switch(config-if)# **encapsulation sysplex etr**	Specifies Sysplex ETR[3]. OFC is disabled.
	or	
	Switch(config-if)# **encapsulation sysplex isc** {**compatibility** | **peer [1g** | **2g]**}	Specifies ISC[4] compatibility mode (1 Gbps) or peer mode (1 Gbps or 2 Gbps). OFC is enabled for compatibility mode and disabled for peer mode.
	or	
	Switch(config-if)# **encapsulation ficon** {**1g** | **2g**}	Specifies FICON encapsulation and rate. OFC is disabled.
	or	
	Switch(config-if)# **encapsulation sonet** {**oc3** | **oc12** | **oc48**}	Specifies SONET as the signal protocol and OC-3, OC-12, or OC-48 as the transmission rate. OFC is disabled.
	or	
	Switch(config-if)# **encapsulation sdh** {**stm-1** | **stm-4** | **stm-16**}	Specifies SDH as the signal protocol and STM-1, STM-4, or STM-16 as the transmission rate. OFC is disabled.
	or	
	Switch(config-if)# **encapsulation fibrechannel** {**1g** | **2g**} [**ofc** {**enable** | **disable**}]	Specifies Fibre Channel as the signal protocol and 1 Gbps or 2 Gbps as the transmission rate. Enables or disables OFC. OFC is disabled by default.
	or	
	Switch(config-if)# **clock rate** *value*	Specifies the signal transmission clock rate without an associated protocol. OFC is disabled.
Step 5	Switch(config-if)# **monitor enable**	Enables protocol monitoring. Protocol monitoring is supported only for certain protocol encapsulations.
Step 6	Switch(config-if)# **topology neighbor** {**name** *node-name* | **ip-address** *node-ip-address* | **mac-address** *node-mac-address*} {**port** {**name** *port-name* | **ip-address** *port-ip-address* | **mac-address** *port-mac-address*}} [**receive** | **transmit**]	Configures the network topology information for the client equipment.
Step 7	Switch(config-if)# **topology neighbor agent ip-address** *ip-address*	Specifies the address of the network topology agent on a neighboring node.
Step 8	Switch(config-if)# **no shutdown**	Enables the interface.
Step 9	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 10	Switch(config)# **interface wave** *slot*/*subcard* Switch(config-if)#	Selects the interface to configure and enters interface configuration mode.

	Command	Purpose
Step 11	Switch(config-if)# **laser frequency** *number*	Selects the frequency for the trunk transmit laser. The default is the lower channel frequency for the 2.5-Gbps transponder module in even numbered subslots and the higher channel frequency for the 2.5-Gbps transponder module in the odd numbered subslots.
Step 12	Switch(config-if)# **no shutdown**	Enables the interface.
Step 13	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 14	Switch(config)# **interface wavepatch** *slot*/*subcard*/**0** Switch(config-if)#	Selects the interface to configure and enters global configuration mode. **Note** Perform this step for both splitter and nonsplitter modules.
Step 15	Switch(config-if)# **no shutdown**	Enables the interface.
Step 16	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 17	Switch(config)# **interface wavepatch** *slot*/*subcard*/**1** Switch(config-if)#	Selects the interface to configure and enters global configuration mode. **Note** Perform this step for splitter modules only.
Step 18	Switch(config-if)# **no shutdown**	Enables the interface.
Step 19	Switch(config-if)# **end** Switch#	Returns to privileged EXEC mode.
Step 20	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

1. CLO = control link oscillator
2. OFC = open fiber control
3. ETR = external timer reference
4. ISC = InterSystem Channel links

Example

The following example shows how to configure the 2.5-Gbps transponder module interfaces:

```
Switch# configure terminal
Switch(config)# interface transparent 2/0/0
Switch(config-if)# encapsulation sonet oc48
Switch(config-if)# monitor enable
Switch(config-if)# topology neighbor ip-address 192.31.7.11 port ip-address 192.31.7.13
Switch(config-if)# topology neighbor agent ip-address 192.31.7.20
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wave 2/0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wavepatch 2/0/0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wavepatch 2/0/1
Switch(config-if)# no shutdown
Switch(config-if)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-49 Configure 10-GE Transponder Module Interfaces

Purpose	This task configures the 10-GE transponder module interfaces for client data transmission.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **interface tengigethernetphy** *slot/subcard* Switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 4	Switch(config-if)# **no shutdown**	Enables the interface.
Step 5	Switch(config-if)# **no laser shutdown**	Turns on the client-side laser.
Step 6	Switch(config-if)# **topology neighbor** {**name** *node-name* | **ip-address** *node-ip-address* | **mac-address** *node-mac-address*} {**port** {**name** *port-name* | **ip-address** *port-ip-address* | **mac-address** *port-mac-address*}} [**receive** | **transmit**]	Configures the network topology information for the client equipment.

	Command	Purpose
Step 7	Switch(config-if)# **topology neighbor agent ip-address** *ip-address*	Specifies the address of the network topology agent on the client equipment.
Step 8	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode and returns to global configuration mode.
Step 9	Switch(config)# **interface waveethernetphy** *slot*/*subcard* Switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 10	Switch(config-if)# **no shutdown**	Enables the interface.
Step 11	Switch(config-if)# **no laser shutdown**	Turns on the ITU laser. **Note** A 10-Gbps laser must warm up for 2 minutes before carrying traffic.
Step 12	Switch(config-if)# **exit** Switch(config)	Returns to global configuration mode.
Step 13	Switch(config)# **interface wavepatch** *slot*/**0/0** Switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 14	Switch(config-if)# [**no**] **shutdown**	Enables or disables the interface. Repeat Step 13 and Step 14 on **wavepatch** *slot*/**0/1** for splitter 10-GE transponder modules.
Step 15	Switch(config-if)# **end** Switch#	Returns to privileged EXEC mode.
Step 16	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure the 10-GE transponder module interfaces:

```
Switch# configure terminal
Switch(config)# interface tengigethernetphy 9/0
Switch(config-if)# no shutdown
Switch(config-if)# no laser shutdown
Switch(config-if)# exit
Switch(config)# interface waveethernetphy 9/0
Switch(config-if)# no shutdown
Switch(config-if)# no laser shutdown
Switch(config-if)# exit
Switch(config)# interface wavepatch 9/0/0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wavepatch 9/0/1
Switch(config-if)# no shutdown
Switch(config-if)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-50 Configure PSM Interfaces

Purpose	This task configures the PSM interfaces.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch(config)# **interface wdmsplit** *slot*/*subcard*/**0** Switch(config-if)#	Specifies the west wdmsplit interface and enters interface configuration mode.
Step 2	Switch(config-if)# **optical threshold power receive {low | high} {alarm | warning}** *value* **[severity {critical | major | minor | not alarmed | not reported}]**	Specifies the optical power threshold value in units of 0.1 dBm. The range is –280 to 0. The default values are as follows: Low alarm: –22 dBm Low warning: –20 dBm Alarm severity: **major** Warning severity: **not alarmed**
Step 3	Switch(config-if)# **topology neighbor** {**name** *node-name* | **ip-address** *node-ip-address* | **mac-address** *node-mac-address*} {**port** {**name** *port-name* | **ip-address** *port-ip-address* | **mac-address** *port-mac-address*}}	Configures the network topology information for the neighboring node.
Step 4	Switch(config-if)# **topology neighbor agent ip-address** *ip-address*	Specifies the IP address of the network topology agent on the neighboring node.
Step 5	Switch(config-if)# **no shutdown**	Enables the interface.
Step 6	Switch(config-if)# **exit** Switch(config)#	Returns to global configuration mode.
Step 7	Switch(config)# **interface wdmsplit** *slot*/*subcard*/**1** Switch(config-if)#	Specifies the east wdmsplit interface and enters interface configuration mode.
Step 8	Switch(config-if)# **optical threshold power receive {low | high} {alarm | warning}** *value* **[severity {critical | major | minor | not alarmed | not reported}]**	Specifies the optical power threshold value in units of 0.1 dBm.

	Command	Purpose
Step 9	Switch(config-if)# **topology neighbor** {**name** *node-name* | **ip-address** *node-ip-address* | **mac-address** *node-mac-address*} {**port** {**name** *port-name* | **ip-address** *port-ip-address* | **mac-address** *port-mac-address*}}	Configures the network topology information for the neighboring node.
Step 10	Switch(config-if)# **topology neighbor agent ip-address** *ip-address*	Specifies the IP address of the network topology agent on the neighboring node.
Step 11	Switch(config-if)# **no shutdown**	Enables the interface.
Step 12	Switch(config-if)# **end** Switch#	Returns to privileged EXEC mode.
Step 13	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to enable wdmsplit interfaces:

```
Switch(config)# interface wdmsplit 0/0/0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# interface wdmsplit 0/0/1
Switch(config-if)# no shutdown
Switch(config-if)# end
Switch# copy system:running-config nvram:startup-config
```

NTP-11 Configure Patch Connections

Purpose	This procedure configures the patch connections on the CLI.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Configure the patch connections between the mux/demux modules (required).

Step 2 Configure the patch connections between the wave interface on the OSC modules and the mux/demux modules (required if using the OSC).

Step 3 Configure the patch connections between the mux/demux modules and the transponder modules (required).

Step 4 Configure the patch connection between the mux/demux modules and the PSM (required if using the PSM).

Table 3-1 describes the types of patch connections on the Cisco ONS 15540 ESPx.

Table 3-1 Patch Connection Types

Patch Connection	Description
Thru interface to wdm interface or wdm interface to thru interface	Connection between the mux/demux modules in an unprotected configuration
Thru interface to thru interface	Connection between the thru interfaces on mux/demux modules in a protected configuration
Wdmrelay interface to wdm interface or Wdm interface to wdmrelay interface	Connection between a mux/demux module and a PSM
OSC wave interface to oscfilter interface or oscfilter interface to OSC wave interface	Connection between the OSC wave interface on a mux/demux motherboard and the oscfilter interface on a mux/demux module
Wavepatch interface to filter interface or filter interface to wavepatch interface	Connection between a wavepatch interface on a transponder module and the filter interface on a mux/demux module

Figure 3-1 and Figure 3-2 show examples of 2.5-Gbps transponder module interfaces and their optical patch connections to mux/demux modules.

Figure 3-1 Optical Patch Connection Example for Splitter Protection With 2.5-Gbps Transponder Modules

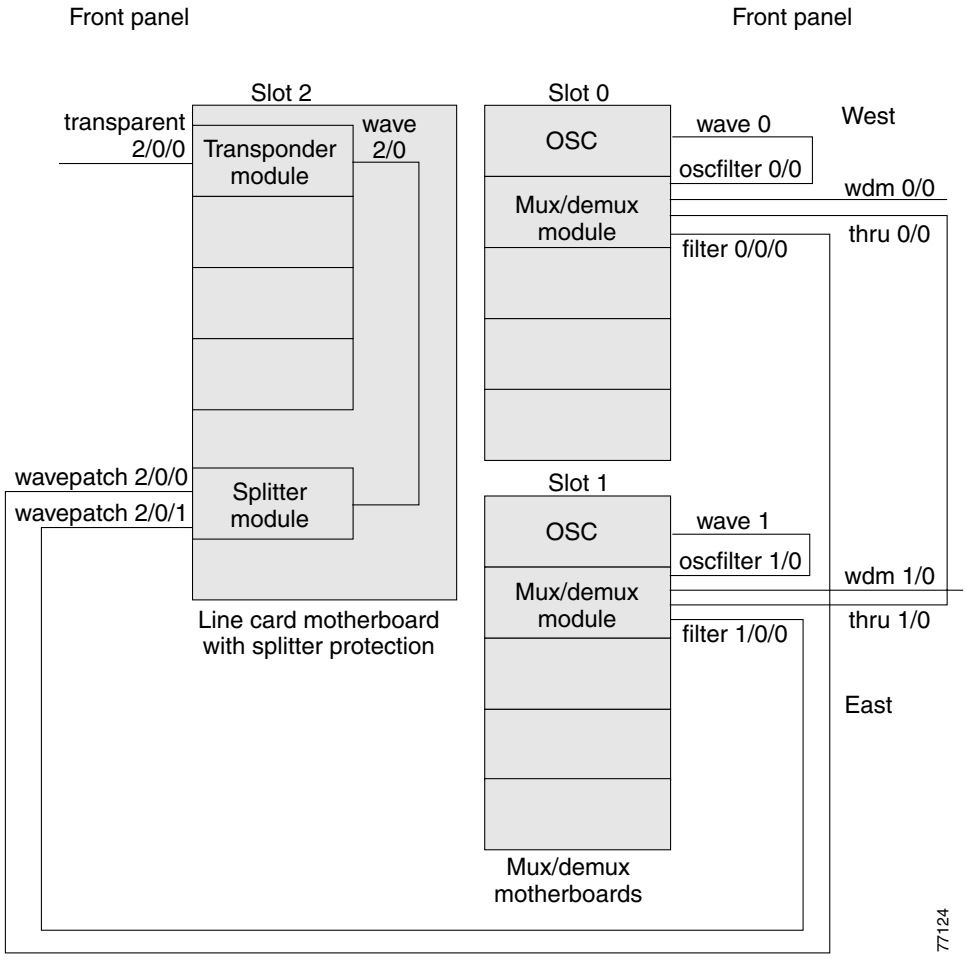


Figure 3-2 Optical Patch Connection Example for Y-Cable Protection With 2.5-Gbps Transponder Modules

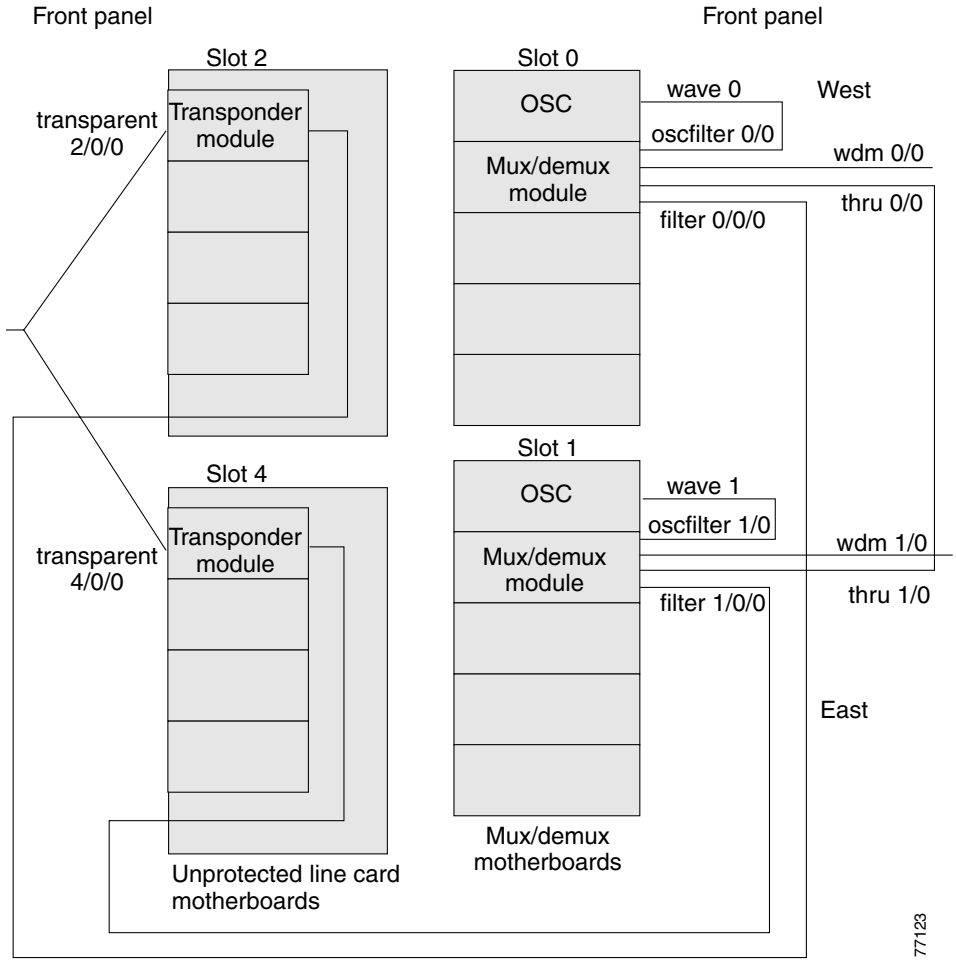


Figure 3-3 and Figure 3-4 show examples of 10-GE transponder module interfaces and their optical patch connections to mux/demux modules.

Figure 3-3 Optical Patch Connection Example for Splitter Protection With 10-GE Transponder Modules

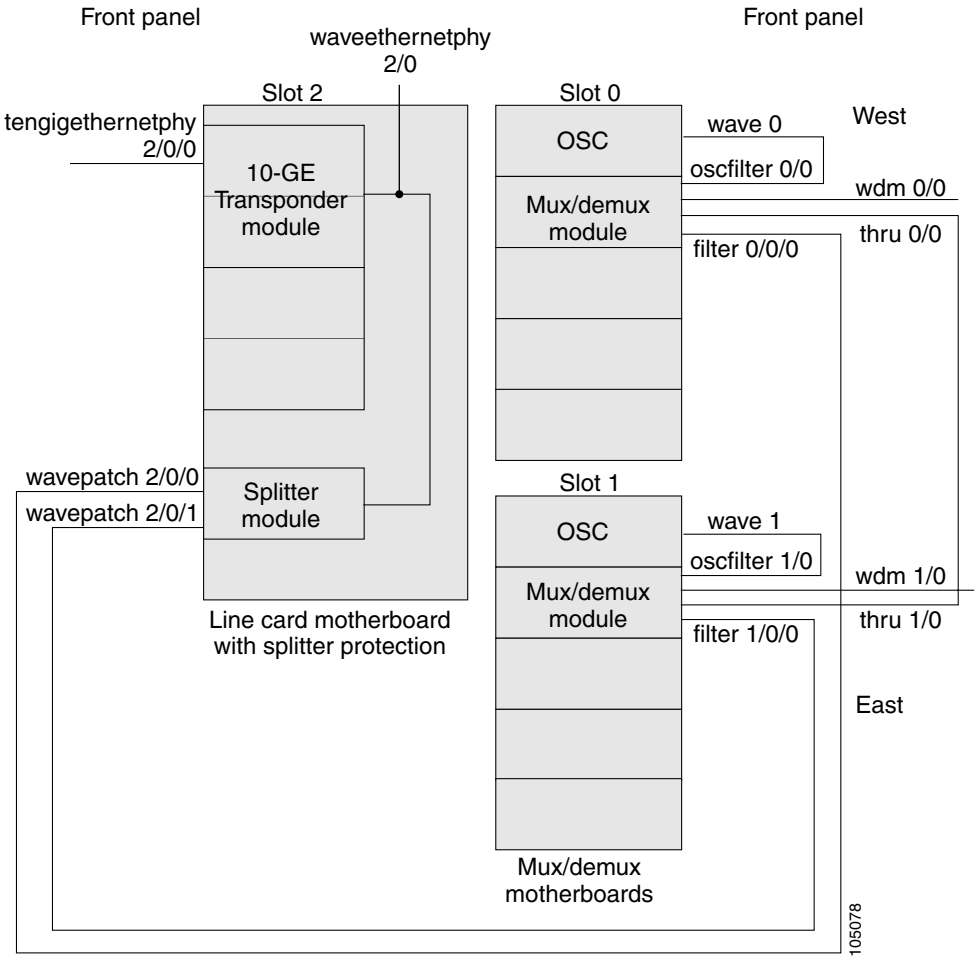


Figure 3-4 Optical Patch Connection Example for Y-Cable Protection With 10-GE Transponder Modules

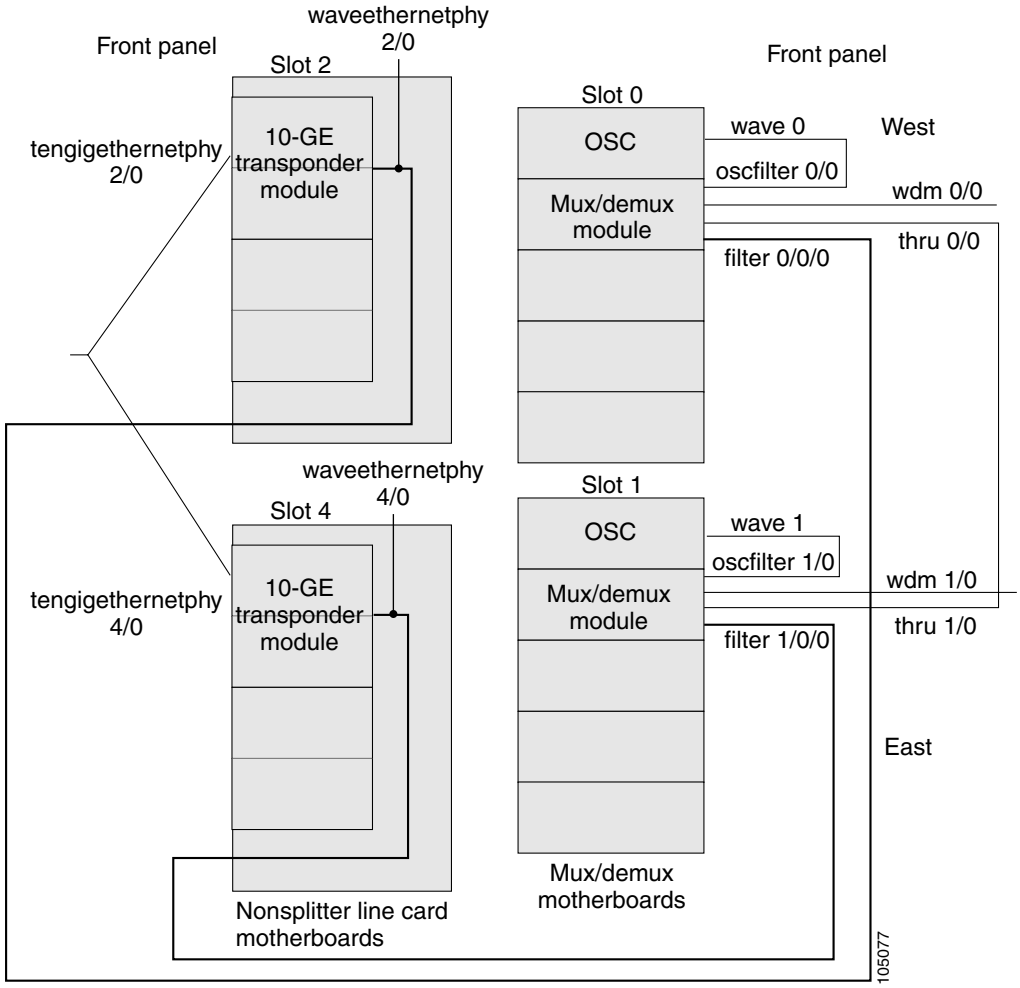
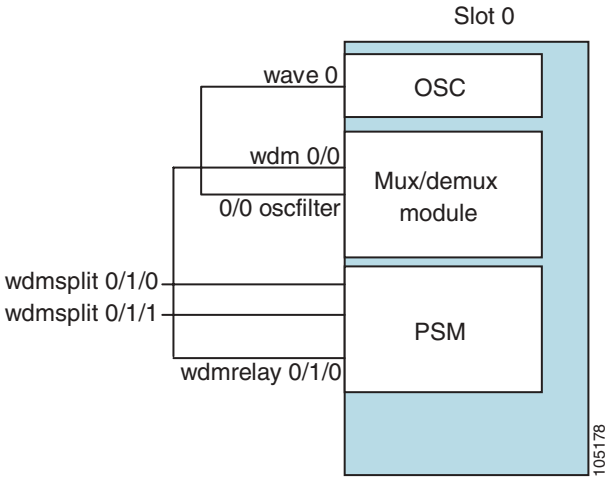


Figure 3-5 shows an example of PSM interfaces and their optical patch connections to a 4-channel or 8-channel mux/demux module.

Figure 3-5 Optical Patch Connection Example Between a PSM and a 4-Channel or 8-Channel Mux/Demux Module



	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	**patch thru** *slot/subcard1* **wdm** *slot/subcard2* or **patch wdm** *slot/subcard1* **thru** *slot/subcard2*	Configures the patch connection between the mux/demux modules in an unprotected configuration.
Step 4	**patch thru** *slot/subcard1* **thru** *slot/subcard2*	Configures the patch connection between the mux/demux modules in a protected configuration.
Step 5	**patch wave** *slot* **oscfilter** *slot/subcard* or **patch oscfilter** *slot/subcard* **wave** *slot*	Configures the patch connection between the OSC wave interface on an OSC module and the oscfilter interface on a mux/demux module.
Step 6	**patch wdm** *slot/subcard1* **wdmrelay** *slot/subcard2/port* or **patch wdmrelay** *slot/subcard1/port* **wdm** *slot/subcard2*	Configures the patch connection between a PSM and a mux/demux module.

	Command	Purpose
Step 7	**patch wavepatch** *slot1/subcard1/port1* **filter** *slot2/subcard2/port2* or **patch filter** *slot1/subcard1/port1* **wavepatch** *slot2/subcard2/port2*	Configures the patch connection between a wavepatch interface on a transponder module and a filter interface on a mux/demux module.
Step 8	Switch(config)# **end** Switch#	Returns to privileged EXEC mode.
Step 9	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Note If you correctly patch your mux/demux modules, the **patch** command configuration is not necessary for the signal to pass from the client to the trunk fiber. However, without a correct **patch** command configuration, the **show topology neighbor** command will not display correct information and bidirectional path switching for APS will not function correctly. For more information on network monitoring, refer to the *Cisco ONS 15540 ESPx Configuration Guide* and the *Cisco ONS 15540 ESPx Command Reference*.

Example

The following example shows how to configure the patch connections between modules:

```
Switch# configure terminal
Switch(config)# patch thru 0/0 thru 1/0
Switch(config)# patch wavepatch 3/0/0 filter 0/0/1
Switch(config)# patch wavepatch 3/1/0 filter 1/0/1
Switch(config)# patch wave 0 oscfilter 0/0
Switch(config)# patch wave 1 oscfilter 1/0
Switch(config)# end
Switch# copy system:running-config nvram:startup-config
```

NTP-12 Configure APS

Purpose	This procedure describes how to configure APS groups for protection.
Tools/Equipment	None
Prerequisite Procedures	DLP-48 Configure 2.5-Gbps Transponder Module Interfaces, page 3-12 DLP-49 Configure 10-GE Transponder Module Interfaces, page 3-15
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 As needed, complete the "DLP-51 Configure Splitter Protection" task on page 3-26.

Step 2 As needed, complete the "DLP-52 Configure Y-Cable Line Card Protection" task on page 3-27.

Step 3 As needed, complete the "DLP-53 Configure Trunk Fiber Based Protection" task on page 3-28.

Step 4 As needed, complete the "DLP-54 Configure Path Switching" task on page 3-29.

For more information on APS, refer to the *Cisco ONS 15540 ESPx Configuration Guide* and the *Cisco ONS 15540 ESPx Command Reference*.

DLP-51 Configure Splitter Protection

Purpose	This task configures splitter protection, which provides facility protection.
Tools/Equipment	None
Prerequisite Procedures	DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17, or DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17, or DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17, for two mux/demux modules DLP-15 Install the Type 1 SM Transponder Module, page 2-21, or DLP-16 Install the Type 1 MM Transponder Module, page 2-22, or DLP-17 Install the 10-GE Transponder Module, page 2-23, or DLP-18 Install the Type 2 Extended Range Transponder Module, page 2-24, in a splitter line card motherboard for the APS group NTP-10 Configure Interfaces, page 3-12
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **redundancy** Switch(config-red)#	Enters redundancy configuration mode.
Step 4	Switch(config-red)# **associate group** *name* Switch(config-red-aps)#	Specifies an APS group name and enters APS configuration mode. **Note** The group name is case sensitive.
Step 5	Switch(config-red-aps)# **aps working wavepatch** *slot/subcard/port*	Configures the working path interface.
Step 6	Switch(config-red-aps)# **aps protection wavepatch** *slot/subcard/port*	Configures the protection path interface.

	Command	Purpose
Step 7	Switch(config-red-aps)# **aps enable**	Enables APS activity between the interfaces.
Step 8	Switch(config-red-aps)# **end** Switch#	Returns to privileged EXEC mode.
Step 9	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Examples

This example shows how to associate wavepatch interfaces for splitter protection.

```
Switch# configure terminal
Switch(config)# redundancy
Switch(config-red)# associate group dallas1
Switch(config-red-aps)# aps working wavepatch 3/0/0
Switch(config-red-aps)# aps protection wavepatch 3/0/1
Switch(config-red-aps)# aps enable
Switch(config-red-aps)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-52 Configure Y-Cable Line Card Protection

Purpose	This task configures y-cable protection, which provides facility and line card protection.
Tools/Equipment	None
Prerequisite Procedures	DLP-9 Install the 4-Channel Mux/Demux Module, page 2-17, or DLP-10 Install the 8-Channel Mux/Demux Module, page 2-17, or DLP-11 Install the 32-Channel Terminal Mux/Demux Module, page 2-17, for two mux/demux modules DLP-15 Install the Type 1 SM Transponder Module, page 2-21, or DLP-16 Install the Type 1 MM Transponder Module, page 2-22, or DLP-17 Install the 10-GE Transponder Module, page 2-23, or DLP-18 Install the Type 2 Extended Range Transponder Module, page 2-24, for two transponder modules, each in a separate nonsplitter line card motherboard, for the APS group NTP-10 Configure Interfaces, page 3-12
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.

	Command	Purpose
Step 3	Switch(config)# **redundancy** Switch(config-red)#	Enters redundancy configuration mode.
Step 4	Switch(config-red)# **associate group** *name* Switch(config-red-aps)#	Specifies an APS group name and enters APS configuration mode. **Note** The group name is case sensitive.
Step 5	Switch(config-red-aps)# **aps working** {**transparent** *slot/subcard/port* | **tengigethernetphy** *slot/subcard*}	Configures the working path interface.
Step 6	Switch(config-red-aps)# **aps protection** {**transparent** *slot/subcard/port* | **tengigethernetphy** *slot/subcard*}	Configures the protection path interface.
Step 7	Switch(config-red-aps)# **aps y-cable**	Enables y-cable protection. The default state is no y-cable protection (disabled).
Step 8	Switch(config-red-aps)# **aps enable**	Enables APS activity between the interfaces.
Step 9	Switch(config-red-aps)# **end** Switch#	Returns to privileged EXEC mode.
Step 10	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Caution Do not configure y-cable protection with Sysplex CLO, Sysplex ETR, or ISC compatibility protocol encapsulation, or with the OFC safety protocol.

Example

This example shows how to associate two transparent interfaces for y-cable line card protection.

```
Switch# configure terminal
Switch(config)# redundancy
Switch(config-red)# associate group Yosemite
Switch(config-red-aps)# aps working transparent 3/0/0
Switch(config-red-aps)# aps protection transparent 4/0/0
Switch(config-red-aps)# aps y-cable
Switch(config-red-aps)# aps enable
Switch(config-red-aps)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-53 Configure Trunk Fiber Based Protection

Purpose	This task configures y-cable protection, which provides facility and line card protection.
Tools/Equipment	None
Prerequisite Procedures	DLP-28 Connect the PSM to a Remote PSM, page 2-36 DLP-50 Configure PSM Interfaces, page 3-17
Required/As Needed	As needed

Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch(config)# **redundancy** Switch(config-red)#	Enters redundancy mode.
Step 2	Switch(config-red)# **associate group** *name* Switch(config-red-aps)#	Specifies an APS group name and enters APS configuration mode. **Note** The group name is case sensitive.
Step 3	Switch(config-red-aps)# **aps working wdmsplit** *slot*/*subcard*	Configures the working path interface.
Step 4	Switch(config-red-aps)# **aps protection wdmsplit** *slot*/*subcard*	Configures the protection path interface.
Step 5	Switch(config-red-aps)# **aps message-channel** {**auto-select** | **inband dcc** | **ip** | **osc**} **far-end** *name*	Configures the name of the corresponding APS group on the other node in the topology.
Step 6	Switch(config-red-aps)# **aps enable**	Enables APS activity between the interfaces.

Examples

The following example shows how to configure trunk fiber protection:

```
Switch(config)# redundancy
Switch(config-red)# associate group psm-group
Switch(config-red-aps)# aps working wdmsplit 0/1/0
Switch(config-red-aps)# aps protection wdmsplit 0/1/1
Switch(config-red-aps)# aps message-channel ip far-end group-name psm-group ip-address
172.18.44.93
Switch(config-red-aps)# aps enable
Switch(config-red-aps)# end
Switch# copy system:running-config nvram:startup-config
```

DLP-54 Configure Path Switching

Purpose	This task configures path switching behavior for an APS group.
Tools/Equipment	None
Prerequisite Procedures	DLP-51 Configure Splitter Protection, page 3-26 or DLP-52 Configure Y-Cable Line Card Protection, page 3-27 DLP-53 Configure Trunk Fiber Based Protection, page 3-28 NTP-11 Configure Patch Connections, page 3-18
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Note Both nodes in the network that support the APS group must have the same APS configuration. Specifically, both must have the same path switching behavior, and working and protection paths.

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **redundancy** Switch(config-red)#	Enters redundancy configuration mode.
Step 4	Switch(config-red)# **associate group** *name* Switch(config-red-aps)#	Selects the interfaces to associate and enters APS configuration mode. **Note** The group name is case sensitive.
Step 5	Switch(config-red-aps)# **aps disable**	Disables APS activity between the interfaces.
Step 6	Switch(config-red-aps)# **aps direction** {**unidirectional** | **bidirectional**}	Specifies the type of path switching. The default behavior is unidirectional.
Step 7	Switch(config-red-aps)# **aps enable**	Enables APS activity between the interfaces.
Step 8	Switch(config-red-aps)# **end** Switch#	Returns to privileged EXEC mode.
Step 9	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

This example shows how to configure bidirectional path switching.

```
Switch# configure terminal
Switch(config)# redundancy
Switch(config-red)# associate group Yosemite
Switch(config-red-aps)# aps disable
Switch(config-red-aps)# aps direction bidirectional
Switch(config-red-aps)# aps enable
Switch(config-red-aps)# end
Switch# copy system:running-config nvram:startup-config
```

NTP-13 Configure SNMP

Purpose	This procedure configures SNMP trap messages for the system.
Tools/Equipment	None
Prerequisite Procedures	DLP-43 Configure IP Access on the NME Interfaces, page 3-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

	Command	Purpose
Step 1	Switch> **enable** Password: Switch#	Enters privileged EXEC mode.
Step 2	Switch# **configure terminal** Switch(config)#	Enters global configuration mode.
Step 3	Switch(config)# **snmp-server community** *string* [**ro** | **rw**]	Defines the password-like community access string sent with the notification. The default access for the string is read-only.
Step 4	Switch(config)# **snmp-server host** *host-addr* [**traps** | **informs**] [**version** {**1** | **2c** | **3**}] *community-string* [*notification-type*]	Specifies whether to send the SNMP notifications as traps or informs, the version of SNMP to use, the security level of the notifications (for SNMPv3), and the recipient (host) of the notifications.
Step 5	Switch(config)# **snmp-server enable traps**	Enables SNMP trap notifications.
Step 6	Switch(config)# **interface** {**transparent** *slot*/*subcard*/**0** | **tengigethernetphy** *slot*/*subcard*} Switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 7	Switch(config-if)# **shutdown**	Disables the interface to generate an entity trap.
Step 8	Switch(config-if)# **no shutdown**	Enables the interface to generate an entity trap.
Step 9	Switch(config-if)# **end** Switch#	Returns to privileged EXEC mode.
Step 10	Switch# **copy system:running-config nvram:startup-config**	Saves your configuration changes to NVRAM.

Example

The following example shows how to configure and test SNMP functionality:

```
Switch# configure terminal
Switch(config)# snmp-server community public RO
Switch(config)# snmp-server community private RW
Switch(config)# snmp-server host 172.30.2.160 public snmp alarms
Switch(config)# snmp-server enable traps
Switch(config)# interface transparent 8/0/0
Switch(config-if)# shutdown
Switch(config-if)# no shutdown
Switch(config-if)# end
Switch# copy system:running-config nvram:startup-config
```

NTP-14 Verify the System Configuration

Purpose	This procedure describes how to verify the software configuration for the system.
Tools/Equipment	None

Prerequisite Procedures	NTP-9 Configure Management Access, page 3-2 NTP-10 Configure Interfaces, page 3-12 NTP-11 Configure Patch Connections, page 3-18 NTP-12 Configure APS, page 3-25, if APS is desired NTP-13 Configure SNMP, page 3-30, if SNMP traps are desired
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Start session on the console or the LAN connection, if one is not already available.

Step 2 Enter privileged EXEC mode using the **enable** command.

Step 3 Start a session log.

Step 4 Verify that the system is correctly configured, use the **show config** command.

```
Switch# show config
Using 4489 out of 522232 bytes
!
version 12.2
no service pad
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime
no service password-encryption
service internal
!
hostname Switch
!
boot system flash bootflash:ons15540-i-mz.122-18.SV
boot bootldr bootflash:ons15540-i-mz
logging snmp-authfail
enable secret 5 $1$jCgk$nksh2kGZligtPKMnhNsZ9.
enable password lab
!
no environment-monitor shutdown fan
diag online
ip subnet-zero
no ip routing
no ip domain-lookup
!
!
redundancy
 standby privilege-mode enable
!
!
interface FastEthernet0
 ip address 172.25.22.60 255.255.255.254
 no ip route-cache
 duplex auto
 speed auto
 no cdp enable
!
interface Fastethernet-sby0
 ip address 172.25.22.61 255.255.255.254
 no ip route-cache
 duplex auto
 speed auto
!
```

```
interface Filter0/3/0
 no ip address
 no ip route-cache
!
interface Filter0/2/0
 no ip address
!
interface Filter0/0/0
 no ip address
 no ip route-cache
!
interface Oscfilter0/3
 no ip address
 no ip route-cache
!
interface Oscfilter0/2
 no ip address
!
interface Oscfilter0/0
 no ip address
 no ip route-cache
!
interface Thru0/3
 no ip address
 no ip route-cache
!
interface Thru0/2
 no ip address
!
interface Thru0/0
 no ip address
 no ip route-cache
!
interface Wave0
 no ip address
 no ip route-cache
 shutdown
!
interface Wdm0/3
 no ip address
 no ip route-cache
!
interface Wdm0/2
 no ip address
!
interface Wdm0/0
 no ip address
 no ip route-cache
!
interface WdmRelay0/1/0
 no ip address
!
interface WdmSplit0/1/0
 no ip address
 shutdown
!
interface Filter0/3/1
 no ip address
 no ip route-cache
!
interface Filter0/2/1
 no ip address
!
interface Filter0/0/1
```

```
 no ip address
 no ip route-cache
!
interface WdmSplit0/1/1
 no ip address
 shutdown
!
interface Filter0/3/2
 no ip address
 no ip route-cache
!
interface Filter0/2/2
 no ip address
!
interface Filter0/0/2
 no ip address
 no ip route-cache
!
interface Filter0/3/3
 no ip address
 no ip route-cache
!
interface Filter0/2/3
 no ip address
!
interface Filter0/0/3
 no ip address
 no ip route-cache
!
interface Filter0/2/4
 no ip address
!
interface Filter0/2/5
 no ip address
!
interface Filter0/2/6
 no ip address
!
interface Filter0/2/7
 no ip address
!
interface Filter1/0/0
 no ip address
 no ip route-cache
!
interface Filter1/3/0
 no ip address
 no ip route-cache
!
interface Oscfilter1/0
 no ip address
 no ip route-cache
!
interface Thru1/0
 no ip address
 no ip route-cache
!
interface Thru1/3
 no ip address
 no ip route-cache
!
interface Wave1
 no ip address
 no ip route-cache
```

```
 shutdown
!
interface Wdm1/0
 no ip address
 no ip route-cache
!
interface Wdm1/3
 no ip address
 no ip route-cache
!
interface WdmRelay1/1/0
 no ip address
!
interface WdmSplit1/1/0
 no ip address
 shutdown
!
interface Filter1/0/1
 no ip address
 no ip route-cache
!
interface Filter1/3/1
 no ip address
 no ip route-cache
!
interface WdmSplit1/1/1
 no ip address
 shutdown
!
interface Filter1/0/2
 no ip address
 no ip route-cache
!
interface Filter1/3/2
 no ip address
 no ip route-cache
!
interface Filter1/0/3
 no ip address
 no ip route-cache
!
interface Filter1/3/3
 no ip address
 no ip route-cache
!
interface Filter1/3/4
 no ip address
 no ip route-cache
!
interface Filter1/3/5
 no ip address
 no ip route-cache
!
interface Filter1/3/6
 no ip address
 no ip route-cache
!
interface Filter1/3/7
 no ip address
 no ip route-cache
!
interface EthernetDcc3/0/0
 no ip address
!
```

```
interface EthernetDcc3/1/0
 no ip address
 no ip route-cache
 shutdown
!
interface TenGigEthernetPhy3/0
 no ip address
!
interface TenGigEthernetPhy3/1
 no ip address
 no ip route-cache
!
interface WaveEthernetPhy3/0
 no ip address
!
interface WaveEthernetPhy3/1
 no ip address
 no ip route-cache
!
interface Wavepatch3/0/0
 no ip address
 shutdown
!
interface Wavepatch3/1/0
 no ip address
 no ip route-cache
!
interface Wavepatch3/0/1
 no ip address
!
interface Wavepatch3/1/1
 no ip address
 no ip route-cache
!
interface Transparent9/3/0
 no ip address
 encapsulation fibreChannel 2G
 monitor enable
 laser control forward enable
!
interface Wave9/3
 no ip address
 laser control forward enable
!
interface Wavepatch9/3/0
 no ip address
!
interface Wavepatch9/3/1
 no ip address
!
ip classless
no ip http server
!
!
snmp-server engineID local 8000000903000008A35D7A31
snmp-server community public RW
snmp-server enable traps tty
snmp-server enable traps rf
!
control-plane
!
!
line con 0
 exec-timeout 0 0
```

```
line aux 0
line vty 0 4
 exec-timeout 0 0
 password lab
 login
 length 0
!
!
end
```

Step 5 Close the session log and save for future reference.

Basic Node Verification Procedures

This chapter describes the procedures for basic node verification.

Before performing the procedures in this chapter, you must install the chassis, power it up, and complete the hardware installation described in Chapter 2, "Hardware Installation Procedures," and complete the software setup and verification tasks described in Chapter 3, "Software Setup Procedures."

Note This chapter contains preliminary procedures for node installation and setup verification and does not cover the final turn-up procedures for an entire network.

Before You Begin

This section lists the chapter non-trouble procedures (NTPs). Turn to a procedure for applicable tasks or detailed level procedures (DLPs).

Step 1 NTP-15 Verify the Interface Status, page 4-2—Complete this procedure to verify the status and configuration of the interfaces in the system.

Step 2 NTP-16 Verify the Optical Patch Configuration, page 4-11—Complete this procedure to verify the configuration of the patch connections in the system.

Step 3 NTP-17 Verify the Cross Connect Status, page 4-11—Complete this procedure to verify the status of the cross connects in the system.

Step 4 NTP-18 Verify the ITU Laser Frequency, page 4-12—Complete this procedure to verify the ITU laser frequency transmitted on cards with tunable lasers.

Step 5 NTP-19 Verify the Optical Power and Frequency, page 4-15—Complete this procedure to verify the optical power frequency.

Step 6 NTP-20 Verify the Optical Transmission Quality, page 4-23—Complete this procedure to verify the signal quality between nodes.

Step 7 NTP-21 Verify the Alarm Status, page 4-27—Complete this procedure to check the function of the alarm messages on the system.

Step 8 NTP-22 Verify the Status of Redundant Processor Cards, page 4-28—Complete this procedure to verify the redundancy of the processor cards, if a redundant switch module is present on the system.

You need the following test equipment:

- Handheld OPM (optical power meter)
- OSA (optical spectrum analyzer)
- Fiber cleaning kit
- Attenuators
- MU-SC connector (per DWDM interface)
- Traffic generator for BER (bit error rate) testing (for 2.5-Gbps traffic)
- Native 10-GE traffic generator and traffic analyzer set (for 10-GE traffic)

NTP-15 Verify the Interface Status

Purpose	This procedure describes how to verify the interface status.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Complete the "DLP-55 Verify the Transparent Interface Status" task on page 4-3.

Step 2 Complete the "DLP-56 Verify the 2.5-Gbps Transponder Module Wave Interface Status" task on page 4-3.

Step 3 As needed, complete the "DLP-57 Verify the OSC Wave Interface Status" task on page 4-4.

Step 4 As needed, complete the "DLP-58 Verify the 2.5-Gbps Transponder Module Wavepatch Interface Status" task on page 4-5.

Step 5 As needed, complete the "DLP-59 Verify the Tengigethernetphy Interface Status" task on page 4-6.

Step 6 As needed, complete the "DLP-60 Verify the Waveethernetphy Interface Status" task on page 4-7.

Step 7 As needed, complete the "DLP-61 Verify the 10-GE Transponder Module Wavepatch Interface Status" task on page 4-7.

Step 8 As needed, complete the "DLP-92 Verify the Ethernetdcc Interface Status" task on page 4-8.

Step 9 As needed, complete the "DLP-62 Verify the Wdmsplit Interface Status" task on page 4-9.

Step 10 Complete the "DLP-63 Verify the Fastethernet 0 Interface Status" task on page 4-10.

Note For more information on interfaces and interface configuration, refer to the *Cisco ONS 15540 ESPx Configuration Guide* and the *Cisco ONS 15540 ESPx Command Reference*.

DLP-55 Verify the Transparent Interface Status

Purpose	This task verifies the status of the transparent interface on the client side of the 2.5-Gbps transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the transparent interfaces on the system.

Step 2 Use the **show interfaces transparent** command to display the status and configuration of the client side interface on the 2.5-Gbps transponder module. The interface and line protocol should be up and the encapsulation or clock rate should be correct.

```
Switch# show interfaces transparent 10/0/0
Transparent10/0/0 is up, line protocol is up
  Signal quality: Signal degrade threshold exceeded
  Encapsulation: Sonet    Rate: oc3
  Signal monitoring: on
  Forward laser control: Off
  Configured threshold Group: None
  Section code violation error count(bip1): 3714369135
  Number of errored seconds(es): 57209
  Number of severely errored seconds(ses): 57209
  Number of severely errored framing seconds(sefs): 0
  Number of times SEF alarm raised: 0
 Number of times SF threshold exceeded: 0
  Number of times SD threshold exceeded: 0
  Loopback not set
  Last clearing of "show interface" counters never
  Hardware is transparent
```

Step 3 If there are problems with the interface status or configuration, see the "DLP-48 Configure 2.5-Gbps Transponder Module Interfaces" task on page 3-12.

DLP-56 Verify the 2.5-Gbps Transponder Module Wave Interface Status

Purpose	This task verifies the status of the wave interface on the ITU side of the 2.5-Gbps transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output and the **show hardware** command output to locate the 2.5-Gbps transponder module wave interfaces on the system.

Step 2 Use the **show interfaces wave** command to display the status and configuration of the DWDM side interface on the 2.5-Gbps transponder module. The interface and line protocol should be up.

```
Switch# show interfaces wave 10/0
Wave10/0 is up, line protocol is up
  Channel: 25   Frequency: 195.1 Thz    Wavelength: 1536.61 nm
  Splitter Protected: No
  Receiver power level: -7.0 dBm
  Laser safety control: Off
  Forward laser control: Off
  Osc physical port: No
  Wavelength used for inband management: No
  Configured threshold Group: None
  Section code violation error count(bip1): 929326
  Number of errored seconds(es): 30
  Number of severely errored seconds(ses): 30
  Number of severely errored framing seconds(sefs): 0
  Number of times SEF alarm raised: 0
  Number of times SF threshold exceeded: 0
 Number of times SD threshold exceeded: 0
  Loopback not set
  Last clearing of "show interface" counters never
  Hardware is data_only_port
```

DLP-57 Verify the OSC Wave Interface Status

Purpose	This task verifies the status of the wave interface on the OSC module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output and the **show hardware** command output to locate the OSC wave interfaces on the system.

Step 2 Use the **show interfaces wave** command to display the status and configuration of the DWDM side interface on the OSC module. The interface and line protocol should be up.

```
Switch# show interfaces wave 2/0
Wave2/0 is up, line protocol is up
  Patched Interface(s) :Oscfilter0/0
  Channel:0    Frequency:191.9 Thz   Wavelength:1562.23 nm
  Signal quality        :Good
  Laser safety control     :Off
  Osc physical port        :Yes
  Wavelength used for inband management:No
  Threshold monitored for:None
  CDL HEC error count:0
  Code violation and running disparity error count( 8b10b cvrd):0
```

```
Last clearing of "show interface" counters never
Hardware is OSC_phy_port
Internet address is 10.0.0.15/24
MTU 1492 bytes, BW 10000000 Kbit, DLY 0 usec,
   reliability 255/255, txload 1/255, rxload 1/255
Encapsulation SNAP, loopback not set
Last input 00:00:02, output never, output hang never
Last clearing of "show interface" counters never
Input queue:0/75/0/0 (size/max/drops/flushes); Total output drops:0
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
   89371 packets input, 6640468 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   94418 packets output, 6589506 bytes, 0 underruns
   0 output errors, 0 collisions, 0 interface resets
   0 output buffer failures, 0 output buffers swapped out
```

DLP-58 Verify the 2.5-Gbps Transponder Module Wavepatch Interface Status

Purpose	This task checks the status of the wavepatch interfaces on the ITU side of the 2.5-Gbps transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the wavepatch interfaces on the system. The 2.5-Gbps transponder module wavepatch interfaces connect the 2.5-Gbps transponder module to the filter interfaces on the mux/demux modules.

Step 2 Use the **show interfaces wavepatch** command to verify the status of the wavepatch *slot*/*subcard*/0 interface.

```
Switch# show interfaces wavepatch 4/0/0
Wavepatch4/0/0 is up, line protocol is up
  Receiver power level: -21.84 dBm

  Optical threshold monitored for : Receive Power (in dBm)
  Low alarm value            = -28.0 dBm  (default)
  Low Alarm Severity         = major
  Low warning value          = -24.0 dBm  (default)
  Low Warning Severity       = not alarmed
  High alarm value           = -8.0 dBm  (default)
  High Alarm Severity        = major
  High warning value         = -10.0 dBm  (default)
  High Warning Severity      = not alarmed
  Hardware is passive_port
```

Step 3 For splitter 2.5-Gbps transponder modules, use the **show interfaces wavepatch** command to verify the status of the wavepatch *slot*/*subcard*/1 interface.

```
Switch# show interfaces wavepatch 4/0/1
Wavepatch4/0/1 is up, line protocol is up
  Receiver power level: -21.32 dBm

  Optical threshold monitored for : Receive Power (in dBm)
  Low alarm value            = -28.0 dBm  (default)
  Low Alarm Severity         = major
  Low warning value          = -24.0 dBm  (default)
  Low Warning Severity       = not alarmed
  High alarm value           = -8.0 dBm  (default)
  High Alarm Severity        = major
  High warning value         = -10.0 dBm  (default)
  High Warning Severity      = not alarmed
  Hardware is passive_port
```

DLP-59 Verify the Tengigethernetphy Interface Status

Purpose	This task checks the status of the waveethernetphy and wavepatch interfaces on the 10-GE transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the tengigethernetphy interfaces on the system.

Step 2 Use the **show interfaces tengigethernetphy** command to display the status and configuration of the tengigethernetphy interface on the 10-GE transponder module. The interface and line protocol should be up.

```
Switch# show interfaces tengigethernetphy 3/0
TenGigEthernetPhy3/0 is up, line protocol is up
  Signal quality         : Good
  Laser shut down        : No
  Forward laser control  : Off
  CDL Enabled            : Off
  Threshold monitored for: None
  Code violation and running disparity error count( 64b66b cvrd): 0
  TenGige Non CDL Pkt count: 0
  Loopback not set
  Last clearing of "show interface" counters 17:02:20
  Hardware is data_enabled_port
```

DLP-60 Verify the Waveethernetphy Interface Status

Purpose	This task checks the status of the waveethernetphy interfaces on the 10-GE transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the waveethernetphy interfaces on the system.

Step 2 Use the **show interfaces waveethernetphy** command to display the status and configuration of the waveethernetphy interface on the 10-GE transponder module. The interface and line protocol should be up.

```
Switch# show interfaces waveethernetphy 3/0
WaveEthernetPhy3/0 is up, line protocol is up
  Channel: 17   Frequency: 194.1 Thz   Wavelength: 1544.53 nm
  Active Wavepatch          : Wavepatch3/0/1
  Splitter Protected        : No
  Signal quality            : Good
  Receive power level       : -18.92 dBm
  Transmit condition        : Good
  Laser shut down           : No
  Forward laser control     : Off
  Osc physical port         : No
  Wavelength capable for inband management: Yes
  Loopback not set
  Threshold monitored for: None
  Code violation and running disparity error count( 64b66b cvrd): 104568
  TenGige Non CDL Pkt count: 1
  CDL HEC error count: 608
  TenGige CDL idle Pkt count: 4020834390

  Defect Indication Status      : up
  Configured Node Behavior      : None
  Current Node Behavior         : Path Terminating
  Defect Indication Receive     : FDI-E
  Defect Indication Transmit    :          None

  Last clearing of "show interface" counters 17:03:17
  Hardware is data_and_cdl_enabled_port
```

DLP-61 Verify the 10-GE Transponder Module Wavepatch Interface Status

Purpose	This task checks the status of the wavepatch interfaces on the 10-GE transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed

Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the 10-GE transponder module wavepatch interfaces on the system.

Step 2 Use the **show interfaces wavepatch** command to verify the status of the wavepatch *slot*/*subcard*/0 interface.

```
Switch# show interfaces wavepatch 3/0/0
Wavepatch3/0/0 is down, line protocol is down
  Receiver power level: Unknown

  Optical threshold monitored for : Receive Power (in dBm)
  Low alarm value            = -22.0 dBm  (default)
  Low Alarm Severity         = major
  Low warning value          = -20.0 dBm  (default)
  Low Warning Severity       = not alarmed
  High alarm value           = -8.0 dBm  (default)
  High Alarm Severity        = major
  High warning value         = -10.0 dBm  (default)
  High Warning Severity      = not alarmed
  Hardware is passive_port
```

Step 3 For splitter 10-GE transponder modules, use the **show interfaces wavepatch** command to verify the status of the wavepatch *slot*/*subcard*/1 interface.

```
Switch# show interfaces wavepatch 3/0/1
Wavepatch3/0/1 is up, line protocol is up
  Receiver power level: -18.92 dBm

  Optical threshold monitored for : Receive Power (in dBm)
  Low alarm value            = -22.0 dBm  (default)
  Low Alarm Severity         = major
  Low warning value          = -20.0 dBm  (default)
  Low Warning Severity       = not alarmed
  High alarm value           = -8.0 dBm  (default)
  High Alarm Severity        = major
  High warning value         = -10.0 dBm  (default)
  High Warning Severity      = not alarmed
  Hardware is passive_port
```

DLP-92 Verify the Ethernetdcc Interface Status

Purpose	This task checks the status of the ethernetdcc interfaces on the 10-GE transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the 10-GE transponder module ethernetdcc interfaces on the system.

Step 2 Use the **show interfaces ethernetdcc** command to verify the status of the ethernetdcc *slot*/*subcard*/0 interface.

```
Switch# show interfaces ethernetdcc 3/0/0
EthernetDcc3/0/0 is up, line protocol is up
This is the message channel interface on WaveEthernetPhy3/0
  Hardware is cdl_enabled_port
  MTU 1492 bytes, BW 500000 Kbit, DLY 0 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation SNAP, loopback not set
  Last input 00:00:01, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     62 packets input, 4491 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     24499 packets output, 1422496 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Step 3 If CDL is enabled on the tengigethernetphy interface, use the **show interfaces ethernetdcc** command to verify the status of the ethernetdcc *slot*/*subcard*/1 interface.

```
Switch# show interfaces ethernetdcc 3/0/1
EthernetDcc3/0/1 is up, line protocol is up
This is the message channel interface on Tengigethernetphy3/0
  Hardware is cdl_enabled_port
  MTU 1492 bytes, BW 500000 Kbit, DLY 0 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation SNAP, loopback not set
  Last input 00:00:01, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     62 packets input, 4491 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     24499 packets output, 1422496 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

DLP-62 Verify the Wdmsplit Interface Status

Purpose	This task checks the status of the wdmsplit interfaces on the PSMs.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed

Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show config** command output to locate the wdmsplit interfaces on the system.

Step 2 Use the **show interfaces waveethernetphy** command to display the status and configuration of the wdmsplit interface on the PSM. The interface and line protocol should be up.

```
Switch# show interfaces wdmsplit 0/1/0
WdmSplit0/1/0 is up, line protocol is up
  Status                : Active
  Signal quality           : Good
  Received power        : -16.20 dBm (A1A)
  Threshold Value       : -22.00 dBm (89F)

  Optical threshold monitored for : Receive Power (in dBm)
  Low alarm value            = -22.0 dBm  (default)
  Low Alarm Severity         = major
  Low warning value          = -18.0 dBm  (default)
  Low Warning Severity       = not alarmed
  Hardware is split wavelength_add_drop
```

DLP-63 Verify the Fastethernet 0 Interface Status

Purpose	This task verifies the status of the NME fastethernet 0 interface.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show interfaces fastethernet 0** command to display the status and configuration of the fastethernet 0 interface. The interface and line protocol should be up.

```
Switch# show intefaces fastethernet 0
FastEthernet0 is up, line protocol is up
  Hardware is AmdFE, address is 0008.a35d.7a80 (bia 0008.a35d.7a80)
  Internet address is 172.25.22.59/31
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 10Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:09, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 2000 bits/sec, 3 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     18340 packets input, 1413069 bytes
     Received 17327 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
```

```
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog
0 input packets with dribble condition detected
1179 packets output, 181490 bytes, 0 underruns
0 output errors, 10 collisions, 2 interface resets
0 babbles, 0 late collision, 12 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```

NTP-16 Verify the Optical Patch Configuration

Purpose	This procedure verifies the optical patch configuration on the system.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show patch detail** command to verify the patch connections configured on the system.

```
Switch# show patch detail
Patch Interface     Patch Interface     Type        Dir   Error
------------------  ------------------  ----------  ----  -----------------
Filter0/0/0         Wavepatch1/0/0      USER        Both
Filter1/1/0         Wavepatch1/0/1      USER        Both
Filter0/0/1         Wavepatch2/0/0      USER        Both
Filter1/1/1         Wavepatch2/0/1      USER        Both
Oscfilter0/0        Wave0               USER        Both
Oscfilter1/1        Wave1               USER        Both
```

Step 2 Check that the patch configuration shown in the command output matches the actual system cable connections. If it does not match or there is an error condition, correct the configuration with the **patch** command or correct the cabling on the system.

NTP-17 Verify the Cross Connect Status

Purpose	This procedure verifies the status of the cross connection on the system.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-16 Verify the Optical Patch Configuration, page 4-11
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Perform a **show connect intermediate** command. This command shows the complete path of the traffic through all components and interfaces.

```
Switch# show connect intermediate
client/       wave          wave           wdm
wave          client        patch   filter  trk  channel
------------  ------------  -------  ------  ---  -------
Trans3/0/0    Wave3/0       3/0/0*  0/0/4   0/0    5
                            3/0/1
Trans3/1/0    Wave3/1       3/1/0*  0/0/5   0/0    6
                            3/1/1
Trans3/2/0    Wave3/2       3/2/0*  0/0/6   0/0    7
                            3/2/1
Trans3/3/0    Wave3/3       3/3/0*  0/0/7   0/0    8
                            3/3/1
```

Note The asterisk after the interface identifiers in the wave patch column indicate the active wavepatch interface.

Step 2 Perform a **show connect edges** command. This command shows the edge connection information.

```
Switch# show connect edges
client/
wave         wdm  channel
----------   ---  -----
Trans3/0/0   0/0    5
Trans3/1/0   0/0    6
Trans3/2/0   0/0    7
Trans3/3/0   0/0    8
```

Step 3 Check that the connections appear as expect. If they do not, recheck the channels supported by the transponder module, the laser frequency configured on the 2.5-Gbps transponder module wave interface, and the channel supported by the port on the mux/demux module cabled to the transponder module.

NTP-18 Verify the ITU Laser Frequency

Purpose	This procedure describes how to verify the ITU laser frequency on cards with tunable lasers.
Tools/Equipment	OSA (optical spectrum analyzer)
Prerequisite Procedures	NTP-15 Verify the Interface Status, page 4-2 NTP-17 Verify the Cross Connect Status, page 4-11 NTP-16 Verify the Optical Patch Configuration, page 4-11
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 As needed, complete the "DLP-64 Verify the 2.5-Gbps Transponder Module Laser Frequency" task on page 4-13.

DLP-64 Verify the 2.5-Gbps Transponder Module Laser Frequency

Purpose	This task verifies the ITU laser frequency current configured on the 2.5-Gbps transponder module wave interface. The ITU laser can be tuned to one of two channel frequencies. The frequencies correspond to the channel number in the part number listed on the front panel of the 2.5-Gbps transponder module.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-16 Verify the Optical Patch Configuration, page 4-11
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 Verify which channels the 2.5-Gbps transponder module supports.

Look at the front panel of the transponder module and locate the part number. The part number format is 15540-TSP1-*ccmz* or 15540-TSP2-*cc*00, where *cc* indicates the lower channel number of the two channels supported by the transponder module, *m* indicates multimode (value A) or single-mode (value B), and *z* is the SC connector (value 3). For example, 15540-TSP1-03B3 is the part number for a single-mode transponder module with an SC connector that supports channels 3 or 4. This transponder module should be connected to either CH3_IN and CH3_OUT or CH4_IN and CH4_OUT ports on the mux/demux module.

Step 2 Verify the current channel configured on the 2.5-Gbps transponder module using the **show interfaces wave** command.

```
Switch# show interfaces wave 10/0
Wave10/0 is up, line protocol is up
  Channel: 31   Frequency: 195.8 Thz   Wavelength: 1530.33 nm
<Information deleted>
```

Step 3 Compare the frequency information with channel frequency supported by the filter interface on the mux/demux module using the **show interfaces filter** command.

```
Switch# show interfaces filter 0/0/3
Filter0/0/3 is up, line protocol is up
  Patched Interface(s) :Wavepatch10/0/0
  Channel:32 Frequency:195.9 Thz    Wavelength:1530.33 nm
  Hardware is filter
```

Step 4 Change an incorrectly configured frequency using the **laser frequency** command.

```
Switch# global configuration
Switch(config)# interface wave 10/0
Switch(config-if)# laser frequency 195900
```

Table 4-1 lists the channels, wavelengths, and frequencies for each band.

Table 4-1 Channel to Wavelength Mapping

Cisco ONS 15540 ESPx Band	Cisco ONS 15540 ESPx Channel	ITU Channel	ITU Wavelength (nm)	ITU Frequency (THz)
OSC		19	1562.23	191.9000
A	1	21	1560.61	192.100
	2	22	1559.79	192.200
	3	23	1558.98	192.300
	4	24	1558.17	192.400
B	5	26	1556.55	192.600
	6	27	1555.75	192.700
	7	28	1554.94	192.800
	8	29	1554.13	192.900
C	9	31	1552.52	193.100
	10	32	1551.72	193.200
	11	33	1550.92	193.300
	12	34	1550.12	193.400
D	13	36	1548.51	193.600
	14	37	1547.72	193.700
	15	38	1546.92	193.800
	16	39	1546.12	193.900
E	17	41	1544.53	194.100
	18	42	1543.73	194.200
	19	43	1542.94	194.300
	20	44	1542.14	194.400
F	21	46	1540.56	194.600
	22	47	1539.77	194.700
	23	48	1538.98	194.800
	24	49	1538.19	194.900
G	25	51	1536.61	195.100
	26	52	1535.82	195.200
	27	53	1535.04	195.300
	28	54	1534.25	195.400
H	29	56	1532.68	195.600
	30	57	1531.90	195.700
	31	58	1531.12	195.800
	32	59	1530.33	195.900

NTP-19 Verify the Optical Power and Frequency

Purpose	This procedure describes how to verify the power and frequency of the data channel.
Tools/Equipment	OSA (optical spectrum analyzer)
Prerequisite Procedures	NTP-15 Verify the Interface Status, page 4-2 NTP-16 Verify the Optical Patch Configuration, page 4-11 NTP-17 Verify the Cross Connect Status, page 4-11
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 Complete the "DLP-65 Verify the Power Levels at the DWDM Trunk Signal" task on page 4-15.

Step 2 As needed, complete the "DLP-66 Verify the Power Levels on the 2.5-Gbps Transponder Module Client Interfaces" task on page 4-18.

Step 3 As needed, complete the "DLP-67 Verify the Power Levels on the 10-GE Transponder Module Client Interfaces" task on page 4-22.

DLP-65 Verify the Power Levels at the DWDM Trunk Signal

Purpose	This task verifies the power levels of the channel signal transmitted from the shelf on the trunk fiber.
Tools/Equipment	OSA (optical spectrum analyzer)
Prerequisite Procedures	NTP-8 Verify Installation of Hardware, page 2-66
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 Power up the OSA and make sure that the OSA wavelength value range is set in the 1530 to 1563 nm range.

Step 2 Connect an OSA to the TRUNK_OUT port on the mux/demux module.

Step 3 Check and record all power levels and frequencies.

Step 4 Compute the minimum transmit power (in dBm) by subtracting the maximum loss (in dBm) from the recorded powers, using Table 4-2 through Table 4-4.

Step 5 Verify that the transmit optical power measurements recorded in Step 3 are greater than the figure computed in Step 4.

Step 6 Loop back the TRUNK_OUT port to the TRUNK_IN port on the mux/demux module with a adequate attenuation.

Caution You must add attenuation to ensure that the optical signal power at the TRUNK_IN port is less than the receiver overload value for the transponder modules (–8 dBm). Use the optical power values measured in Step 4 to determine the amount of attenuation needed on the loopback.

Step 7 For 2.5-Gbps transponder modules, issue **show interfaces wave** commands to check the optical power.

Note For accurate power transmit levels from the transponder modules, ensure that correct protocol encapsulation and monitoring are configured using the **show interfaces transparent** command, and that the client equipment connected to the transponder module is sending valid data.

Step 8 For 10-GE transponder modules, issue **show interfaces waveethernetphy** commands to check the optical power.

Step 9 See the optical budget losses in Table 4-5 through Table 4-9 to compute total losses for connectors and mux/demux modules, in both the transmit and receive directions.

Step 10 Verify that the optical power figure listed in the **show interfaces** command output is greater than the following calculation:

Minimum Tx power (dBm) – total losses

where

Total losses = maximum link loss (dBm) + attenuation + other insertion losses

Step 11 Repeat Step 7 through Step 10 for each interface.

Step 12 If another mux/demux module is connected to the trunk in the opposite direction, repeat Step 1 through Step 11 for that module.

Table 4-2 Trunk Side Specifications for Type 1 MM and SM Transponder Modules (2.5-Gbps)

Specification	Minimum	Maximum
Receive sensitivity	–28 dBm	
Receive overload		–8 dBm
Input wavelength	1260 nm	1580 nm
Transmitter power	4 dBm	8 dBm

Table 4-3 Trunk Side Specifications for Type 2 Extended Range Transponder Modules (2.5-Gbps)

Specification	Minimum	Maximum
Receive sensitivity	–28 dBm	
Receive overload		–8 dBm
Input wavelength	1430 nm	1580 nm
Transmitter power	5 dBm	10 dBm

Table 4-4 Trunk Side Specifications for 10-GE Transponder Modules

Specification	Minimum	Maximum
Receive sensitivity	–22 dBm	
Receive overload		–8 dBm
Input wavelength	1430 nm	1580 nm
Transmitter power	1 dBm	6 dBm

Table 4-5 Optical Loss for 2.5-Gbps Line Card Motherboards

Line Card Motherboard Type and Direction	Loss (dB)
Splitter motherboard Tx	4.5
Splitter motherboard Rx	1.8
Unprotected motherboard Tx	1.0
Unprotected motherboard Rx	1.0

Table 4-6 Optical Loss for 10-Gbps Line Card Motherboards

Protection Type and Direction	Loss (dB)
Splitter Tx	3.5
Splitter Rx	0.8
Nonsplitter Tx	0.5
Nonsplitter Rx	0.5

Table 4-7 Optical Loss for Data Channels Through the OADM Modules

Optical Mux/Demux Module Type	Trunk IN to Line Card Motherboard (Data Drop) in dB	Line Card Motherboard to Trunk OUT (Data Add) in dB	Trunk IN to Thru OUT (Pass Through Drop) in dB	Thru IN to Trunk OUT (Pass Through Add) in dB
4-channel with OSC	4.1	4.1	1.5	1.5
8-channel with OSC	4.8	4.8	2.0	2.0
4-channel without OSC	4.1	4.1	1.0	1.0
8-channel without OSC	4.8	4.8	1.5	1.5

Table 4-8 Optical Loss for Data Channels Through the 32-Channel Terminal Mux/Demux Modules

Optical Mux/Demux Module Type	IN to Line Card Motherboard (Data Drop) in dB	Line Card Motherboard to OUT (Data Add) in dB
32-channel (channels 1–32)	5.4	5.4

Table 4-9 Optical Loss for the OSC Through the Optical Mux/Demux Modules

Optical Mux/Demux Module Type	Trunk IN to OSC Transceiver (dB)	OSC Transceiver to Trunk OUT (dB)
4-channel with OSC	2.8	2.8
8-channel with OSC	3.3	3.3
32-channel with OSC	7.1	7.1

DLP-66 Verify the Power Levels on the 2.5-Gbps Transponder Module Client Interfaces

Purpose	This task verifies the power levels of the client side signal on the 2.5-Gbps transponder module.
Tools/Equipment	OPM (optical power meter)
Prerequisite Procedures	NTP-8 Verify Installation of Hardware, page 2-66
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 Run a jumper cable from the client Tx port of the first 2.5-Gbps transponder module to the external power meter.

Note When using a jumper cable to test, the cable should be pretested for its own loss and the same cable should be used for all tests.

Step 2 Set the wavelength on the OPM to 1310 nm.

Step 3 Measure and record the OPM of the client side transmitter.

Step 4 Compare the measured power with the specifications provided in Table 4-10, Table 4-11, and Table 4-12.

Table 4-10 Client Side Specifications for SM Transponder Modules and MM Transponder Modules

Specification	SM[1] Transponder Module		MM[2] Transponder Module	
	Minimum	Maximum	Minimum	Maximum
Bit rate	16 Mbps	2.5 Gbps	16 Mbps	622 Mbps
Receive sensitivity	–19 dBm		–25 dBm	
Receive overload		–1.5 dBm		–8 dBm
Input wavelength	1249 nm[3]	1600 nm	1249 nm	1600 nm
Transmitter power	–5 dBm	0 dBm	–5 dBm	0 dBm
Output wavelength	1260 nm	1360 nm	1260 nm	1360 nm

1. SM = single mode
2. MM = multimode
3. nm = nanometers

Table 4-11 Specifications for Fixed Rate SFP Optics for Type 2 Extended Range Transponder Modules

Part Number	Specification	Minimum	Maximum
15500-XVRA-01A2	Bit rate	155 Mbps	200 Mbps
	Receive sensitivity	–33 dBm	–14 dBm
	Input wavelength	1280 nm	1380 nm
	Transmitter power	–19.5 dBm	–15 dBm
	Output wavelength	1280 nm	1380 nm
15500-XVRA-02C1	Bit rate	1.0625 Gbps	1.25 Gbps
	Receive sensitivity	–18 dBm	
	Stressed receive sensitivity	–13.5 dBm	
	Input wavelength	770 nm	860 nm
	Transmitter power	–9.5 dBm	–4 dBm
	Output wavelength	830 nm	860 nm
15500-XVRA-03B1	Bit rate	1.0625 Gbps	1.25 Gbps
	Receive sensitivity	–20.5 dBm	
	Receive overload		–3 dBm
	Input wavelength	1270 nm	1600 nm
	Transmitter power	–9.5 dBm	–3 dBm
	Output wavelength	1275 nm	1350 nm

Table 4-11 Specifications for Fixed Rate SFP Optics for Type 2 Extended Range Transponder Modules (continued)

Part Number	Specification	Minimum	Maximum
15500-XVRA-03B2	Bit rate	1.0625 Gbps	2.125 Gbps
	Receive sensitivity	–20.5 dBm	
	Input wavelength	1270 nm	1600 nm
	Transmitter power	–9.5 dBm	–3 dBm
	Output wavelength	1275 nm	1350 nm
15500-XVRA-02C2	Bit rate	2.125 Gbps	2.125 Gbps
	Receive sensitivity	–15 dBm	
	Stressed receive sensitivity	–12.1 dBm	
	Input wavelength	770 nm	860 nm
	Transmitter power	–9 dBm	–4 dBm
	Output wavelength	830 nm	860 nm
15500-XVRA-06B1	Bit rate	622 Mbps	622 Mbps
	Receive sensitivity	–28 dBm	
	Receive overload		–7 dBm
	Input wavelength	1100 nm	1600 nm
	Transmitter power	–15 dBm	–8 dBm
	Output wavelength	1260 nm	1360 nm
15500-XVRA-07B1	Bit rate	2.488 Mbps	2.488 Mbps
	Receive sensitivity	–18 dBm	
	Receive overload		–3 dBm
	Input wavelength	1270 nm	1600 nm
	Transmitter power	–9.5 dBm	–3 dBm
	Output wavelength	1285 nm	1340 nm

Table 4-12 Specifications for Variable Rate SFP Optics for Type 2 Extended Range Transponder Modules

Part Number	Specification	Minimum	Maximum
15500-XVRA-10A1	Bit rate range	8 Mbps	200 Mbps
	Receive sensitivity@10–12 BER[1]	–32 dBm	
	Receive sensitivity@10–15 BER	–29 dBm	
	Receive overload @10–12 BER		–3 dBm
	Input wavelength	1100 nm	1600 nm
	Transmitter power	–19 dBm	–14 dBm
	Output wavelength	1260 nm	1360 nm
15500-XVRA-10B1	Bit rate range	8 Mbps	200 Mbps
	Receive sensitivity@10–12 BER	–32 dBm	
	Receive sensitivity@10–15 BER	–29 dBm	
	Receive overload @10–12 BER		–14 dBm
	Input wavelength	1100 nm	1600 nm
	Transmitter power	–8 dBm	–4 dBm
	Output wavelength	1280 nm	1380 nm

1. BER = bit error rate

Step 5 Repeat these steps for all other 2.5-Gbps transponder modules.

DLP-67 Verify the Power Levels on the 10-GE Transponder Module Client Interfaces

Purpose	This task verifies the power levels of the client side signal on the 10-GE transponder module.
Tools/Equipment	OPM (optical power meter)
Prerequisite Procedures	NTP-8 Verify Installation of Hardware, page 2-66
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 Run a jumper cable from the client Tx port of the first 10-GE transponder module to the external power meter.

Note When using a jumper cable to test, the cable should be pretested for its own loss and the same cable should be used for all tests.

Step 2 Set the wavelength on the OPM to 1310 nm.

Step 3 Measure and record the OPM of the client side transmitter.

Step 4 Compare the measured power with the specifications provided in Table 4-13.

Table 4-13 Client Side Specifications for 10-GE Transponder Modules

Specification	Minimum	Maximum
Receive sensitivity	–13.23 dBm	
Receive overload		0.5 dBm
Stressed receive sensitivity	–10.3 dBm	
Input wavelength	1249 nm[1]	1600 nm
Transmitter power	–5.2 dBm	0.5 dBm
Output wavelength	1260 nm	1355 nm

1. nm = nanometers.

Step 5 Repeat these steps for all other 10-GE transponder modules.

NTP-20 Verify the Optical Transmission Quality

Purpose	This procedure describes how to test the quality of the optical transmission from the node for transponder modules.
Tools/Equipment	BER test set for 2.5-Gbps transponder modules Native 10-GE traffic generator and traffic analyzer set for 10-GE transponder modules
Prerequisite Procedures	NTP-19 Verify the Optical Power and Frequency, page 4-15 DLP-65 Verify the Power Levels at the DWDM Trunk Signal, page 4-15
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 As needed, complete the "DLP-68 Verify the Optical Transmission Quality for 2.5-Gbps Transponder Modules" task on page 4-23.

Step 2 As needed, complete the "DLP-69 Verify the Optical Transmission Quality for 10-GE Transponder Modules" task on page 4-25.

DLP-68 Verify the Optical Transmission Quality for 2.5-Gbps Transponder Modules

Purpose	This task verifies the quality of the optical transmission from the node for 2.5-Gbps transponder modules.
Tools/Equipment	BER test set
Prerequisite Procedures	NTP-19 Verify the Optical Power and Frequency, page 4-15 DLP-65 Verify the Power Levels at the DWDM Trunk Signal, page 4-15
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

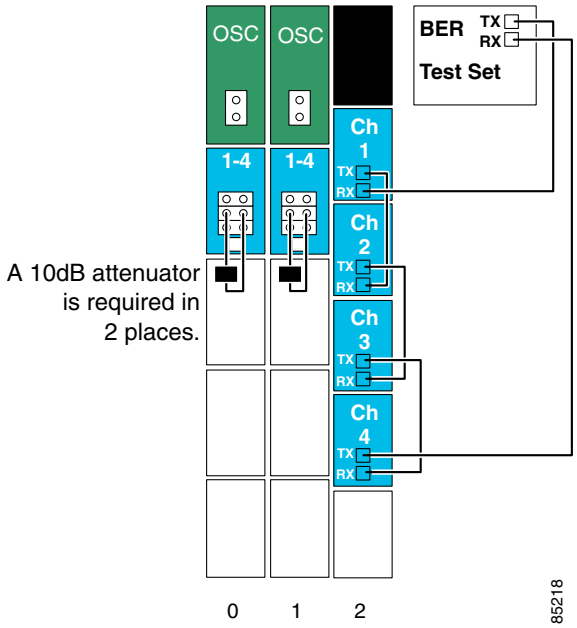
Step 1 Connect the BER test set transmit port to the receive port of the first transponder interface to be tested.

Note Measure the power level on the BER test set transmit port and use appropriate attenuation.

Step 2 Measure the power level on the ITU TX port on each 2.5-Gbps transponder module using the optical power meter and record the results.

Step 3 Daisy chain the client interfaces with the appropriate attenuation. Connect the client TX port of the first 2.5-Gbps transponder module to the receive port of the BER test set. Connect the client RX port of the last 2.5-Gbps transponder module to the transmit port of the BER test set. See the example in Figure 4-1.

Figure 4-1 Example Setup for Testing Bit Error Rate for 2.5-Gbps Transponder Modules



Note You can daisy chain as many as four 2.5-Gbps transponder modules.

Step 4 Loop back the TRUNK_OUT port to the TRUNK_IN port on the mux/demux modules (see the example in Figure 4-1).

Caution Add adequate attenuation, if necessary, to ensure that the optical signal power at the TRUNK_IN port is less than the receiver overload value for the 2.5-Gbps transponder modules (–8 dBm), minus the insertion loss (see Table 4-5, Table 4-7, and Table 4-8). Use the optical power values measured in the "DLP-65 Verify the Power Levels at the DWDM Trunk Signal" task on page 4-15 to determine the amount of attenuation needed on the loopback.

Step 5 Issue the **encapsulation** command on each transparent interface using a SONET protocol encapsulation supported by the client side interface.

Step 6 Set the data rate on the BER test set for the encapsulation configured on the transparent interface.

Step 7 Clear all errors on the BER test set.

Step 8 Start the BER test, and verify that the test runs error free for 15 minutes.

If there are errors within the 15-minute test period, remove the daisy chain configuration and try to isolate the problem by performing the BER test on each individual channel.

Step 9 If the system supports splitter protection, perform the following steps:

a. Issue **shutdown** commands on the active wavepatch interfaces.

b. Issue **no shutdown** commands on the standby wavepatch interfaces.

c. Repeat Step 7 through Step 8 on the new active wavepatch interfaces.

Step 10 Issue an **encapsulation** command or **clock rate** command on each transparent interface to revert to the original protocol or clock rate.

DLP-69 Verify the Optical Transmission Quality for 10-GE Transponder Modules

Purpose	This task verifies the quality of the optical transmission from the node for 10-GE transponder modules.
Tools/Equipment	Native 10-GE traffic generator and traffic analyzer set
Prerequisite Procedures	NTP-19 Verify the Optical Power and Frequency, page 4-15 DLP-65 Verify the Power Levels at the DWDM Trunk Signal, page 4-15
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

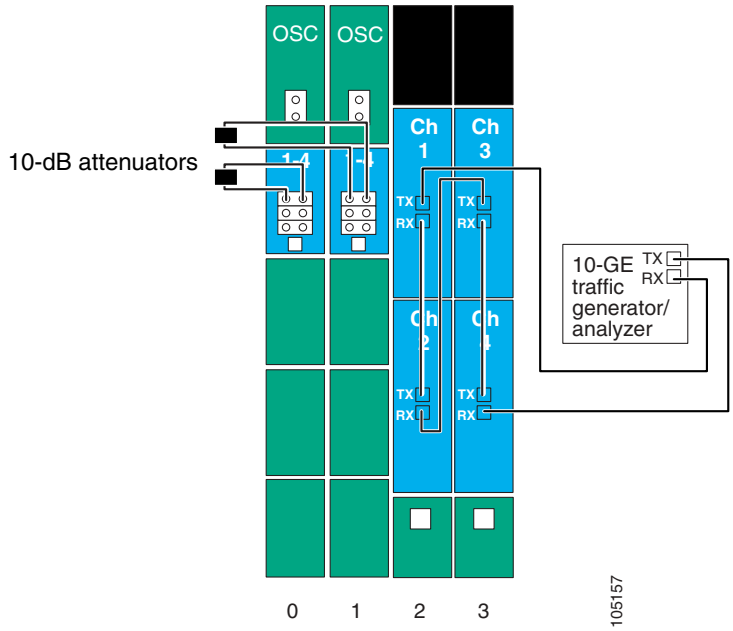
Step 1 Connect the BER test set transmit port to the receive port of the first transponder interface to be tested.

Note Measure the power level on the BER test set transmit port and use appropriate attenuation.

Step 2 Measure the power level on the ITU TX port on each 10-GE transponder module using the optical power meter and record the results.

Step 3 Daisy chain the client interfaces with the appropriate attenuation. Connect the client TX port of the first 10-GE transponder module to the receive port of the traffic analyzer. Connect the client RX port of the last 10-GE transponder module to the transmit port of the traffic generator. See the example in Figure 4-2.

Figure 4-2 Example Setup for Testing Bit Error Rate for 10-GE Transponder Modules



Note You can daisy chain as many as four 10-GE transponder modules.

Step 4 Loop back the TRUNK_OUT port to the TRUNK_IN port on the mux/demux modules (see the example in Figure 4-2).

Caution Add adequate attenuation, if necessary, to ensure that the optical signal power at the TRUNK_IN port is less than the receiver overload value for the 10-GE transponder modules (–8 dBm), minus the insertion loss (see Table 4-6, Table 4-7, and Table 4-8). Use the optical power values measured in the "DLP-65 Verify the Power Levels at the DWDM Trunk Signal" task on page 4-15 to determine the amount of attenuation needed on the loopback.

Step 5 Clear all errors on the traffic analyzer.

Step 6 Start the traffic generator, and verify that the test runs error free for 15 minutes.

If there are errors within the 15-minute test period, remove the daisy chain configuration and try to isolate the problem by performing the test on each individual channel.

Step 7 If the system supports splitter protection, perform the following steps:

a. Issue **shutdown** commands on the active wavepatch interfaces.

b. Issue **no shutdown** commands on the standby wavepatch interfaces.

c. Repeat Step 7 through Step 8 on the new active wavepatch interfaces.

NTP-21 Verify the Alarm Status

Purpose	This procedure verifies the operation and status of the alarms on the shelf.
Tools/Equipment	SONET analyzer
Prerequisite Procedures	NTP-9 Configure Management Access, page 3-2
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 As needed, complete the "DLP-70 Verify the Alarm Status for 2.5-Gbps Transponder Modules" task on page 4-27.

Step 2 As needed, complete the "DLP-71 Verify the Alarm Status for 10-GE Transponder Modules" task on page 4-28.

DLP-70 Verify the Alarm Status for 2.5-Gbps Transponder Modules

Purpose	This task verifies the operation and status for 2.5-Gbps transponder module.
Tools/Equipment	SONET analyzer
Prerequisite Procedures	NTP-9 Configure Management Access, page 3-2
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Remove the client Rx and verify that a Loss of Light alarm is generated. A Loss of Lock alarm on the client Rx should appear in the **show facility-alarm status** command output.

Step 2 Remove the trunk cable and verify a Loss of Light alarm on the wave interface of the 2.5-Gbps transponder module. A Loss of Light alarm on the wave interface should appear in the **show facility-alarm status** command output.

Step 3 Use a SONET analyzer to inject errors on a 2.5-Gbps transponder module, such as Loss of Frame, and verify that corresponding alarms are generated.

Note To perform this test, you must have a 2.5-Gbps transponder module configured for SONET protocol encapsulation.

Alarms for the injected errors should appear in the **show facility-alarm status** command output.

DLP-71 Verify the Alarm Status for 10-GE Transponder Modules

Purpose	This task verifies the operation and status of the alarms for 10-GE transponder modules.
Tools/Equipment	None
Prerequisite Procedures	NTP-9 Configure Management Access, page 3-2
Required/As Needed	As needed.
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Remove the client Rx and verify that a Loss of Light alarm is generated. A Loss of Lock alarm on the client Rx should appear in the **show facility-alarm status** command output.

Step 2 Remove the trunk cable and verify a Loss of Lock alarm on the waveethernetphy interface of the 10-GE transponder module. A Loss of Lock alarm on the waveethernetphy interface should appear in the **show facility-alarm status** command output.

NTP-22 Verify the Status of Redundant Processor Cards

Purpose	This procedure verifies the status of the redundant processor cards.
Tools/Equipment	None
Prerequisite Procedures	NTP-9 Configure Management Access, page 3-2
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Verify that the conditions in Table 4-14 have been met. If all the conditions are not met, then the system is only conditionally redundant, not fully redundant.

Table 4-14 Conditions for Full Redundancy

Requirement	Notes
Two processor cards are required. The processor cards have identical hardware configurations.	Verify that both processor cards have identical configurations such as DRAM size with the **show redundancy capability** command.
Both processor cards have the same functional image.	Verify after power-up that both processor cards have the same functional image with the **show hardware detail** command.
Both processor cards are running compatible system images.	Verify that the system images are compatible across one major release with the **show version** command.
Both the running and startup configurations are automatically synchronized between the processor cards.	Verify that the running and startup configurations are listed as synchronized using the **show redundancy** command.
Both processor cards are set to autoboot (default setting).	Verify that the configuration register reads 0x2102 using the **show version** command.

Step 2 Use the **show redundancy capability** command to display capabilities for the active and standby processor cards. Verify that all results in the Sby Compat columns are OK.

```
Switch# show redundancy capability

CPU capability support

 Active CPU  Sby CPU    Sby Compat        CPU capability description
 ---------- ---------- ----------- ----------------------------------------
    96 MB       96 MB   OK          CPU DRAM size
    32 MB       32 MB   OK          CPU PMEM size
   512 KB      512 KB   OK          CPU NVRAM size
    16 MB       16 MB   OK          CPU Bootflash size
    3.5          2.1    OK          CPU hardware major.minor version
    1.27        1.27    OK          CPU functional major.minor version

Linecard driver major.minor versions, (counts: Active=43, Standby=43)

 Active CPU  Sby CPU   Sby Compat  Drv/Ch/F ID  Driver description
 ---------- ---------- ----------- ----------- ----------------------------
    1.1         1.1     OK          0x1000/0/0  CPU w/o Switch Fabric
    1.1         1.1     OK          0x1001/1/0  Fixed Transponder, w/monitor
    1.1         1.1     OK          0x1002/0/0  Fixed Transponder, no monitor
    1.1         1.1     OK          0x1003/1/0  Pluggable Transponder, w/monit
    1.1         1.1     OK          0x1004/0/0  Pluggable Transponder, no moni
    2.1         2.1     OK          0x1005/0/0  Line Card Motherboard
    1.1         1.1     OK          0x1006/0/0  Backplane
    1.1         1.1     OK          0x1007/0/0  32-ch Mux/Demux
    1.1         1.1     OK          0x1008/0/0  Fixed 4-ch Mux/Demux, no OSC
    1.1         1.1     OK          0x1009/0/0  Fixed 8-ch Mux/Demux, no OSC
    1.1         1.1     OK          0x100A/0/0  Modular 4-ch Mux/Demux, no OSC
    1.1         1.1     OK          0x100B/0/0  Modular 8-ch Mux/Demux, no OSC
    1.1         1.1     OK          0x100C/0/0  32-ch Array Wave Guide
    2.1         2.1     OK          0x100D/0/0  Mux/Demux Motherboard
    1.1         1.1     OK          0x100E/0/0  Modular 4-ch Mux/Demux plus OS
```

```
   1.1        1.1     OK          0x100F/0/0  Modular 8-ch Mux/Demux plus OS
   2.1        2.1     OK          0x1010/0/0  Mux-Demux Motherboard, no OSC
   2.1        2.1     OK          0x1011/0/0  Line Card Motherboard, no prot
   3.1        3.1     OK          0x1012/0/0  Down Link Motherboard
   1.1        1.1     OK          0x1013/0/0  OC192 Down Link DaughterCard
   2.1        2.1     OK          0x1014/1/0  10G Down Link DaughterCard
   1.1        1.1     OK          0x1015/0/0  Modular 16-ch Mux/Demux, no OS
   1.1        1.1     OK          0x1016/0/0  Modular 16-ch Mux/Demux plus O
Active CPU  Sby CPU   Sby Compat  Drv/Ch/F ID  Driver description
---------- ---------- ----------- ----------- ------------------------------
   2.1        2.1     OK          0x1017/0/0  Line Card Motherboard, no prot
   1.1        1.1     OK          0x1018/1/0  Low bit rate Type-1 transponde
   2.1        2.1     OK          0x1019/0/0  CN Tower Line Card Motherboard
   2.1        2.1     OK          0x101A/0/0  Mux/Demux Motherboard
   1.1        1.1     OK          0x101B/0/0  Modular 4-ch Mux/Demux no OSC
   1.1        1.1     OK          0x101C/0/0  Modular 4-ch Mux/Demux plus OS
   1.1        1.1     OK          0x101D/0/0  Modular 8-ch Mux/Demux no OSC
   1.1        1.1     OK          0x101E/0/0  Modular 8-ch Mux/Demux plus OS
   1.1        1.1     OK          0x101F/0/0  32-ch Array Wave Guide
   2.1        2.1     OK          0x1020/0/0  Mux/Demux Motherboard, no OSC
   1.1        1.1     OK          0x1021/0/0  POM Adapter
   2.1        2.1     OK          0x1022/0/0  Down Link Motherboard, no prot
   2.1        2.1     OK          0x1023/0/0  Down Link Motherboard, no prot
   2.1        2.1     OK          0x1024/0/0  Line Card Motherboard, no prot
   1.1        1.1     OK          0x1025/0/0  Modular 16-ch Mux/Demux, no OS
   1.1        1.1     OK          0x1026/0/0  Modular 16-ch Mux/Demux plus O
   1.1        1.1     OK          0x1027/0/0  PSM Trunk switch proctection m
   1.1        1.1     OK          0x1028/1/0  non-plug type1 xpder with cont
   1.1        1.1     OK          0x1029/1/0  Low bit rate type-1 xpdr w/con
   1.1        1.1     OK          0x1000/0/1  ONS15540 Rommon

Software sync client versions, listed as version range X-Y.
 X indicates the oldest peer version it can communicate with.
 Y indicates the current sync client version.
 Sync client counts: Active=6, Standby=6

 Active CPU  Sby CPU   Sby Compat  Cl ID  Redundancy Client description
 ---------- ---------- ----------- -----  -----------------------------------
 ver  1-2   ver  1-2   OK          17     CPU Redundancy
 ver  1-1   ver  1-1   OK          19     Interface Sync
 ver  1-1   ver  1-1   OK          36     MetOpt Password Sync
 ver  1-2   ver  1-2   OK          18     Online Diagnostics
 ver  1-2   ver  1-2   OK          6      OIR Client
 ver  1-1   ver  1-1   OK          27     metopt cm db sync

Backplane IDPROM comparison
 Backplane IDPROM field      Match Local CPU            Peer CPU
 --------------------------- ----- -------------------- --------------------
 idversion                   YES   1                    1
 magic                       YES   153                  153
 card_type                   YES   4102                 4102
 order_part_num_str          YES   15540-CHSB=          15540-CHSB=
 description_str             YES   15540_Chassis_with_external_patch_support

15540_Chassis_with_external_patch_support
 board_part_num_str          YES   73-5655-04           73-5655-04
 board_revision_str          YES   A0                   A0
 serial_number_str           YES   TBC07392048          TBC07392048
 date_of_manufacture_str     YES   10/07/2003           10/07/2003
 deviation_numbers_str       YES   0                    0
 manufacturing_use           YES   0                    0
 rma_number_str              YES   0x00                 0x00
 rma_failure_code_str        YES   0x00                 0x00
 oem_str                     YES   Cisco_Systems        Cisco_Systems
```

```
clei_str                    YES   0                   0
snmp_oid_substr             YES   0                   0
schematic_num_str           YES   92-4113-03          92-4113-03
hardware_major_version      YES   3                   3
hardware_minor_version      YES   2                   2
engineering_use_str         YES   0                   0
crc16                       OK    46433               21421
user_track_string           YES   0                   0
diagst                      YES   ^A                   ^A
board_specific_revision     YES   1                   1
board_specific_magic_number YES   153                 153
board_specific_length       YES   57                  57
mac_address_block_size      YES   16                  16
mac_address_base_str        YES   000c302228a0        000c302228a0
cpu_number                  OK    0                   1
optical_backplane_type      YES   2                   2
```

Step 3 Use the **show redundancy summary** command to verify that the running and startup configurations are synchronized.

```
Switch# show redundancy summary

Redundant system information
-----------------------------
Available Uptime:              1 day, 20 hours, 36 minutes
sysUpTime (switchover clears): 1 day, 20 hours, 36 minutes
Switchover Count:              0

Inter-CPU Communication State: UP
Last Restart Reason:           Normal boot

Last Running Config sync:      46 minutes
Running Config sync status:    In Sync
Last Startup Config sync:      1 day, 20 hours, 36 minutes
Startup Config sync status:    In Sync

This CPU is the Active CPU.
-------------------------------
Slot:                          6
Time since CPU Initialized:    1 day, 20 hours, 36 minutes
Image Version:                 ONS-15540 Software (ONS15540-I-M), Version 12.2(18)SV,
EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Image File:                    bootflash:ons15540-i-mz.122-18.SV
Software Redundancy State:     ACTIVE
Hardware State:                ACTIVE
Hardware Severity:             0

Peer CPU is the Standby CPU.
-------------------------------
Slot:                          7
Time since CPU Initialized:    1 day, 20 hours, 25 minutes
Image Version:                 ONS-15540 Software (ONS15540-I-M), Version 12.2(18)SV,
EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Image File (on sby-CPU):       bootflash:ons15540-i-mz.122-18.SV
Software Redundancy State:     STANDBY HOT
Hardware State:                STANDBY
Hardware Severity:             0
Privilege Mode:                Enabled
```

Basic Network Verification Procedures

This chapter describes the procedures for basic network-level verification.

Note Before performing the procedures in this chapter, the nodes must have been installed and configured. All cabling must be complete.

Note This chapter contains preliminary procedures for network installation and setup verification and does not cover the final turn-up procedures for an entire network.

Before You Begin

This section lists the chapter non-trouble procedures (NTPs). Turn to a procedure for applicable tasks or detailed level procedures (DLPs).

Step 1 NTP-23 Verify the Optical Power Budget Between Nodes, page 5-2—Complete this procedure to verify the power of the signal between two nodes.

Step 2 NTP-24 Verify the Connectivity Between OSC Modules, page 5-3—Complete this procedure to verify the connectivity between the OSC modules on separate nodes.

Step 3 NTP-25 Verify the Topology Neighbor Connectivity, page 5-4—Complete this procedure to verify the network topology connectivity on the network.

Step 4 NTP-26 Verify the Power Levels, page 5-4—Complete this procedure to verify the channel power levels on the node.

Step 5 NTP-27 Test the Optical Transmission Quality, page 5-5—Complete this procedure to verify the status of the optical signal transmission between nodes.

Step 6 NTP-28 Verify the Optical Signal Protection Configuration, page 5-8—Complete this procedure to verify the correct configuration and functioning of APS on the network.

You need the following test equipment:

- OSA (optical spectrum analyzer)
- BER test set (for 2.5-Gbps traffic)
- SONET analyzer or Ethernet analyzer (for 2.5-Gbps traffic)
- Native 10-GE traffic generator and traffic analyzer set (for 10-GE traffic)

NTP-23 Verify the Optical Power Budget Between Nodes

Purpose	This procedure verifies the optical power budget between the nodes.
Tools/Equipment	Traffic generator OSA (optical spectrum analyzer)
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Note Record the test measurements in Table A-4 in Appendix A, "Node Data Record."

Note Prior to performing this procedure, each node must be installed and configured and all cabling must be completed. To optimize the power budget, OADM module cabling should be done to minimize insertion loss.

Step 1 Set the data rate on the traffic generator based on the protocol rate or clock rate configured on the interfaces.

Step 2 Connect a traffic generator to the client ports on the local node and loop back the client TX and RX ports at the remote peer node.

Step 3 Use an OSA to measure and record the wavelengths and the optical power of the band added and dropped on the shelf. Take measurements at the TRUNK_OUT port on the OADM module local node, and at the TRUNK_IN port on the OADM module on the remote peer node.

Step 4 On systems with splitter protected configurations, perform a **shutdown** command on the active interface on node 1, and a **no shutdown** command on the standby interface. For example:

```
Switch# configure terminal
Switch(config)# interface wavepatch 2/0/0
Switch(config-if)# shutdown
Switch(config-if)# exit
Switch(config)# interface wavepatch 2/0/1
Switch(config-if)# no shutdown
```

Repeat Step 3.

Step 5 For 2.5-Gbps transponder modules, issue **show interfaces wave** commands on each node for all wave interfaces and record wavelength and power displayed in the command outputs.

Step 6 For 10-GE transponder modules, issue **show interfaces waveethernetphy** commands on each node for all waveethernetphy interfaces and record wavelength and power displayed in the command outputs.

Step 7 Compare the expected results from the network design, the results recorded in Step 3, and the results from the command outputs.

If the results for a particular wavelength do not match, make sure the connectors are fully inserted and the transponder modules are correctly installed. Clean the fibers and connectors, if necessary. Rerun the test.

If the results still do not match, there might be a hardware problem or incorrect calibration in the transponder module IDPROM.

Step 8 Go to the remote peer node and repeat Step 2 through Step 7 for the opposite direction.

NTP-24 Verify the Connectivity Between OSC Modules

Purpose	This procedure verifies the connectivity between the OSC modules on two adjacent nodes.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show oscp interface** command to display OSCP (Optical Supervisory Channel Protocol) status information for the OSC interfaces.

```
Switch# show oscp interface wave 0
Codes: Bndl - bundling identifier, Pri - OSCP selection priority
       OSCP - dedicated wavelength channel, CDL - in-band wavelength channel

OSCP Interface(s)
 Local Port    Port ID Type Status  OSCP St Bndl Pri  Rem Port ID Rem Node Id
 ~~~~~~~~~~~~ ~~~~~~~ ~~~~ ~~~~~~  ~~~~~~~ ~~~~ ~~~  ~~~~~~~~~~~ ~~~~~~~~~~~~~~
  Wave0        1000000 OSCP  Active  2way      0   0  1000000     0000.1644.28fb
```

Step 2 Verify that Active is displayed in the Status column. This indicates that the local port status is active.

If the status is not active, the interface is not enabled. Perform a **no shutdown** command on the OSC wave interface.

Step 3 Verify that 2way is displayed in the OSCP St column. This indicates that the local node has received Hello messages from the neighbor node and verifies that the neighbor has received Hello packets from the local node.

NTP-25 Verify the Topology Neighbor Connectivity

Purpose	This procedure verifies connectivity of neighboring nodes in the network topology.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Use the **show topology neighbor detail** command to verify network neighbors in the topology.

```
Switch# show topology neighbor detail
Physical Topology:

Local Port: Wdm0/0
Neighbor Node         : node3
Neighbor Port         : Wdm1/0
Neighbor Agent Address: 172.20.50.21
Neighbor Discovery    : Via CDP (Proxy Port: Wave1)
Link Direction        : Both

Local Port: Wdm1/0
Neighbor Node         : node1
Neighbor Port         : Wdm0/0
Neighbor Agent Address: 172.20.42.27
Neighbor Discovery    : Via CDP (Proxy Port: Wave0)
Link Direction        : Both
```

Step 2 Use the **ping** command on the IP addresses listed for the network neighbors to verify connectivity.

Step 3 If the **ping** command fails, recheck the IP configuration on each node.

NTP-26 Verify the Power Levels

Purpose	This procedure verifies the expected power levels provided by a network design.The measured power should be within an acceptable range from the expected power
Tools/Equipment	OSA (optical spectrum analyzer)
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-15 Verify the Interface Status, page 4-2
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 Connect the OSA to the TAP.

Step 2 Use the wavelength spectrum application to verify the channel count and power on the wavelength screen of the OSA.

Step 3 Verify the channel power equalization. The wavelength screen displays the power peaks and the table format screen displays the measurements.

Step 4 Verify the optical signal-to-noise ratio (OSNR) of each channel on each line fiber. The OSNR figures are listed in the table format screen on the OSA.

Step 5 Repeat these steps for all nodes in the topology.

NTP-27 Test the Optical Transmission Quality

Purpose	This procedure tests optical transmission quality between the nodes that add and drop the same channel.
Tools/Equipment	BER test set for 2.5-Gbps transponder modules
	Native 10-GE traffic analyzer for 10-GE transponder modules
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
	NTP-19 Verify the Optical Power and Frequency, page 4-15
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Privileged

Step 1 As needed, complete the "DLP-72 Test 2.5-Gbps Transponder Module Transmission Quality" task on page 5-5.

Step 2 As needed, complete the "DLP-73 Test 10-GE Transponder Module Transmission Quality" task on page 5-7.

DLP-72 Test 2.5-Gbps Transponder Module Transmission Quality

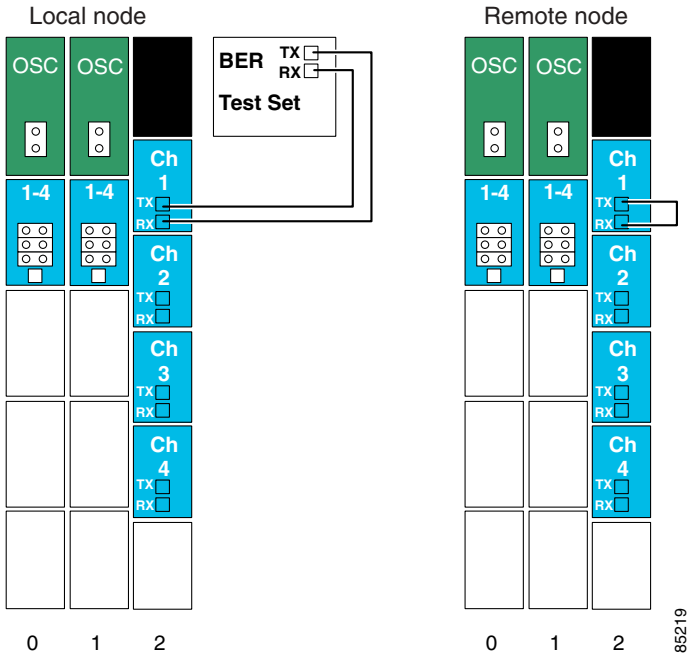
Purpose	This task tests optical transmission quality of 2.5-Gbps transponder modules between the nodes that add and drop the same channel.
Tools/Equipment	BER test set
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
	NTP-19 Verify the Optical Power and Frequency, page 4-15
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Connect the BER test set transmit port and receive port to the client RX port and client TX port, respectively, on the 2.5-Gbps transponder module on the local node.

Step 2 Loop back the client TX port to the client RX port on the 2.5-Gbps transponder module supporting the same channel on the remote node with appropriate attenuation. See the example setup in Figure 5-1.

Note Determine the attenuation using the power values recorded in the "DLP-66 Verify the Power Levels on the 2.5-Gbps Transponder Module Client Interfaces" task on page 4-18.

Figure 5-1 Example Setup for 2.5-Gbps Transponder Modules



Step 3 Clear all errors on the BER test set.

Step 4 Start the traffic with the BER test set.

Step 5 Verify that the test runs error free for 15 minutes.

Step 6 If the 2.5-Gbps transponder module has splitter protection, perform the following steps:

- **a.** Issue **shutdown** commands on the active wavepatch interfaces on both nodes.
- **b.** Issue **no shutdown** commands on the standby wavepatch interfaces on both nodes.
- **c.** Perform Step 3 through Step 5 on the client interface.

Step 7 Verify that the test runs error free for 15 minutes.

Step 8 Repeat Step 1 through Step 7 for all client interfaces on every node in the network.

DLP-73 Test 10-GE Transponder Module Transmission Quality

Purpose	This task tests optical transmission quality of 10-GE transponder modules between the nodes that add and drop the same channel.
Tools/Equipment	Native 10-GE traffic analyzer
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-19 Verify the Optical Power and Frequency, page 4-15
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

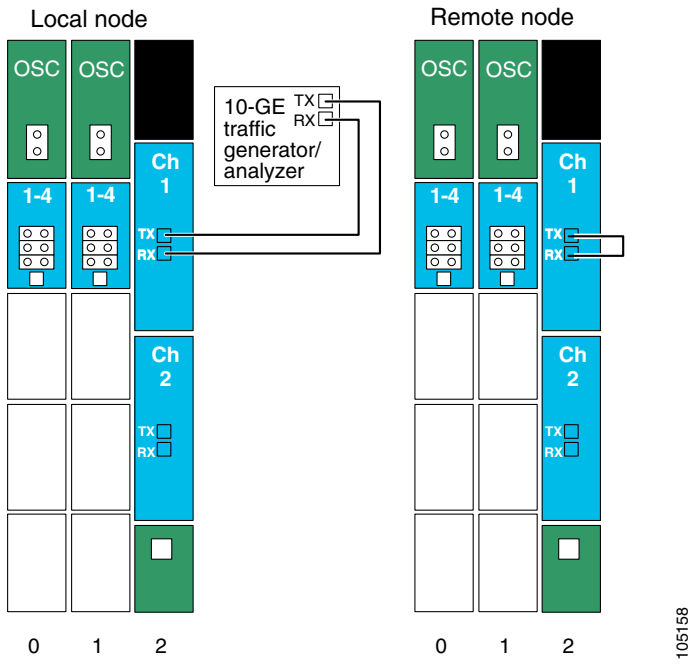
Step 1 Connect the traffic generator transmit port to the 10-GE transponder module client RX port on the local node.

Step 2 Connect the traffic analyzer receive port to the 10-GE transponder module client TX port on the local node.

Step 3 Loop back the client TX port to the client RX port on the 10-GE transponder module supporting the same channel on the remote node with appropriate attenuation. See the example setup in Figure 5-2.

Note Determine the attenuation using the power values recorded in the "DLP-67 Verify the Power Levels on the 10-GE Transponder Module Client Interfaces" task on page 4-22.

Figure 5-2 Example Setup for 10-GE Transponder Modules



Step 4 Clear all errors on the traffic analyzer.

Step 5 Start the traffic generator.

Step 6 Verify that the test runs error free for 15 minutes.

Step 7 If the 10-GE transponder module has splitter protection, perform the following steps:

a. Issue **shutdown** commands on the active wavepatch interfaces on both nodes.

b. Issue **no shutdown** commands on the standby wavepatch interfaces on both nodes.

c. Perform Step 3 through Step 5 on the client interface.

Step 8 Verify that the test runs error free for 15 minutes.

Step 9 Repeat Step 1 through Step 7 for all client interfaces on every node in the network.

NTP-28 Verify the Optical Signal Protection Configuration

Purpose	This procedure describes how to verify that APS configuration is correctly configured and that it is operating properly.
Tools/Equipment	SONET analyzer
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Complete the "DLP-74 Verify the APS Configuration" task on page 5-8.

Step 2 As needed, complete the "DLP-75 Verify the Splitter Protection Operation" task on page 5-9.

Step 3 As needed, complete the "DLP-76 Verify the Y-Cable Protection Operation" task on page 5-10.

Step 4 As needed, complete the "DLP-77 Verify the Trunk Fiber Based Protection Operation" task on page 5-11.

DLP-74 Verify the APS Configuration

Purpose	This task verifies the APS configuration on the system.
Tools/Equipment	None
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Step 1 Issue a **show aps group** command for each APS group on both nodes in the topology.

```
Switch# show aps group sonet-group

APS Group sonet-group :

  architecture.: 1+1, remote prov: 1+1
  span.........: end-to-end
  prot. mode...: client side y-cable
  direction....: prov: bi, current: bi, remote prov: bi
  revertive....: no
  aps state....: enabled (associated)
  request timer: holddown: 5000 ms, max: 15000 ms, count 2
  msg-channel..: auto (up on osc)
  created......: 17 hours, 10 minutes
  auto-failover: enabled
  transmit k1k2: reverse-request, 1, 1, 1+1, bi
  receive  k1k2: forced-switch, 1, 1, 1+1, bi
  switched chan: 1
  protection(0): Transparent2/0/0 (ACTIVE - UP), Wave2/0 (UP)
               : channel  request: no-request
               : switchover count: 2
               : last  switchover: 15 hours, 14 minutes
  working...(1): Transparent4/0/0 (STANDBY - UP), Wave4/0 (UP)
               : channel  request: no-request
               : switchover count: 3
               : last  switchover: 14 hours, 41 minutes
```

Step 2 Check the prot. mode field for the state of the protection switching. For each APS group, both nodes should be configured with the same type of protection switch, either unidirectional (uni) or bidirectional (bi).

Step 3 Check the aps state field for the status of each APS group. The state should be enabled and associated. If it is not enabled, perform an **aps enable** command on the APS group.

Step 4 Check the protection and working fields for the state of the interfaces. Both should be UP. If they are not up, perform **no shutdown** commands on the interfaces on both nodes.

Step 5 Check the msg-channel field for the state of the message channel for the APS channel messages. The state should be up. If the message channel is not up, check the status of the OSC and OSCP, and the configuration of the patch connections for the OSC modules and OADM modules on both nodes.

DLP-75 Verify the Splitter Protection Operation

Purpose	This task verifies the operation of the splitter protection configuration on your network.
Tools/Equipment	SONET analyzer or Ethernet analyzer (for 2.5-Gbps traffic) 10-GE traffic analyzer (for 10-GE traffic)
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-26 Verify the Power Levels, page 5-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Note To perform these measurements with a SONET analyzer, you must have SM transponder modules or MM transponder modules configured to SONET OC-3 or OC-12 protocol encapsulation. Otherwise, use an Ethernet analyzer, measure how many frames are lost, and divide by the frame rate to determine the restoration time.

Step 1 To verify restoration time after a fiber break on the trunk, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Disconnect the active trunk fiber.

c. Verify that the restoration time is less than 50 ms.

Step 2 To verify protection switching from the working path to the protection path, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Perform a manual switch command through the CLI to verify manual protection switch functionality. Enter the following command:

aps switch *group-name* **manual working-to-protection**

c. Verify that the restoration time is less than 50 ms.

Step 3 To verify protection switching from the protection path to the working path, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Perform a manual switch command through the CLI to verify manual protection switch functionality. Enter the following command:

aps switch *group-name* **manual protection-to-working**

c. Verify that the restoration time is less than 50 ms.

Step 4 Enter an **aps clear** *group-name* to remove all APS switchover requests.

Step 5 For bidirectional switching configurations, repeat Step 1 through Step 4 on the remote node.

DLP-76 Verify the Y-Cable Protection Operation

Purpose	This task verifies the operation of the y-cable protection configuration on your network.
Tools/Equipment	SONET analyzer or Ethernet analyzer (for 2.5-Gbps traffic) 10-GE traffic analyzer (for 10-GE traffic)
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-26 Verify the Power Levels, page 5-4
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Privileged

Note To perform these measurements with a SONET analyzer, you must have SM transponder modules or MM transponder modules configured to SONET OC-3 or OC-12 protocol encapsulation. Otherwise, use an Ethernet analyzer, measure how many frames are lost, and divide by the frame rate to determine the restoration time.

Step 1 To verify restoration time after removing an active transponder module, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Remove the active transponder module.

c. Verify that the restoration time is less than 50 ms.

Step 2 To verify restoration time after a fiber break on the trunk, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Disconnect the active trunk fiber.

c. Verify that the restoration time is less than 50 ms.

Step 3 To verify protection switching from the working path to the protection path, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Perform a manual switch command through the CLI to verify manual protection switch functionality. Enter the following command:

aps switch *group-name* **manual working-to-protection**

c. Verify that the restoration time is less than 50 ms.

Step 4 To verify protection switching from the protection path to the working path, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Perform a manual switch command through the CLI to verify manual protection switch functionality. Enter the following command:

aps switch *group-name* **manual protection-to-working**

c. Verify that the restoration time is less than 50 ms.

Step 5 Enter an **aps clear** *group-name* to remove all APS switchover requests.

Step 6 For bidirectional switching configurations, repeat Step 1 through Step 5 on the remote node.

DLP-77 Verify the Trunk Fiber Based Protection Operation

Purpose	This task verifies the operation of the trunk fiber based protection configuration on your network.
Tools/Equipment	SONET analyzer or Ethernet analyzer
Prerequisite Procedures	NTP-14 Verify the System Configuration, page 3-31 NTP-26 Verify the Power Levels, page 5-4
Required/As Needed	As needed

Onsite/Remote	Onsite or remote
Security Level	Privileged

Note To perform these measurements with a SONET analyzer, you must have 2.5-Gbps transponder modules configured to SONET OC-3 or OC-12 protocol encapsulation. Otherwise, use an Ethernet analyzer, measure how many frames are lost, and divide by the frame rate to determine the restoration time.

Step 1 To verify restoration time after a fiber break on the trunk, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Disconnect the trunk fiber the active PSM.

c. Verify that the restoration time is less than 50 ms.

Step 2 To verify protection switching from the working path to the protection path, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Perform a manual switch command through the CLI to verify manual protection switch functionality. Enter the following command:

aps switch *group-name* **manual working-to-protection**

c. Verify that the restoration time is less than 50 ms.

Step 3 To verify protection switching from the protection path to the working path, perform these steps:

a. Connect a SONET analyzer (with service time disruption measurement) to the client side.

b. Perform a manual switch command through the CLI to verify manual protection switch functionality. Enter the following command:

aps switch *group-name* **manual protection-to-working**

c. Verify that the restoration time is less than 50 ms.

Step 4 Enter an **aps clear** *group-name* to remove all APS switchover requests.

Step 5 For bidirectional switching configurations, repeat Step 1 through Step 4 on the remote node.

Node Data Record

The tables in this appendix are used to keep track of data for each node. Make copies of these tables to record information for additional nodes.

Table A-1 tracks essential node data, such as IP address, host name, and ID.

Table A-1 Node Data Checklist

Node data	Value
Node IP address	
Node IP subnet mask	
Node host name	
Node ID	

Table A-2 tracks customer site information, such as customer name, site name, location of the equipment, and system configuration (network topology, number of processor cards).

Table A-2 Customer Information

Customer data	Value
Customer name	
Site name	
Location	
System Configuration	

Table A-3 records contact information for the engineers responsible for installation and verification of the node.

Table A-3 Team Information

Team data	Value
Lead Engineer	
Test Engineer	
Test Engineer	
Date	

Table A-4 records the expected power from the network design, and the power measured by the OSA during system span testing.

See the "NTP-23 Verify the Optical Power Budget Between Nodes" procedure on page 5-2.

Table A-4 Expected and Measured Power for Channels in the Network

Channel	Expected Power	OSA Measured Power

Test Results Tables

This appendix contains tables and checklists to use during the turn-up and test of a Cisco ONS 15540 ESPx.

Table B-1 Test Results for the Cisco ONS 15540 ESPx

Test or Procedure Section	Expected Result (After Powerup)	Notes
"Fiber Plant Characterization" section on page 1-8	Tested fiber meets the specifications listed in that section.	
"DLP-13 Install the 2.5-Gbps Line Card Motherboard" section on page 2-19	All LEDs on the modules are off (default).	
"DLP-40 Verify the Powerup" task on page 2-66	The Status LED is green. The Active LED on the primary processor and the Standby LED on the standby processor are both green. The alarm LEDs are off.	
"NTP-8 Verify Installation of Hardware" procedure on page 2-66	All modules in the chassis are reported in the proper slot by Cisco IOS software. The modules have the correct hardware version and software version.	
"NTP-15 Verify the Interface Status" procedure on page 4-2	The interfaces are administratively up.	
"NTP-16 Verify the Optical Patch Configuration" procedure on page 4-11	The patch connections are correctly configured.	
"DLP-65 Verify the Power Levels at the DWDM Trunk Signal" task on page 4-15	Tx optical power and wavelengths are in line with figures in the power specification tables.	
"DLP-65 Verify the Power Levels at the DWDM Trunk Signal" task on page 4-15	Measured power matches the specifications provided.	
"DLP-64 Verify the 2.5-Gbps Transponder Module Laser Frequency" procedure on page 4-13	The laser frequency (channel number) is configured to the proper wavelength.	
"NTP-20 Verify the Optical Transmission Quality" procedure on page 4-23	The test runs error free for 15 minutes.	

Table B-1 Test Results for the Cisco ONS 15540 ESPx (continued)

Test or Procedure Section	Expected Result (After Powerup)	Notes
"NTP-21 Verify the Alarm Status" procedure on page 4-27	Alarms are generated for the listed fault conditions.	
"NTP-23 Verify the Optical Power Budget Between Nodes" procedure on page 5-2	Expected results (from network design), measured results, and results as seen by Cisco IOS software match.	
"NTP-24 Verify the Connectivity Between OSC Modules" procedure on page 5-3	Active is displayed under the Status field. 2way is displayed under the OSCP St. field.	
"NTP-26 Verify the Power Levels" procedure on page 5-4	Channel count, power, power equalization, and OSNR meet the network design requirements.	
"NTP-27 Test the Optical Transmission Quality" procedure on page 5-5	The test runs error free for 15 minutes.	

Numerics

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