



# Installing MXP\_MR\_2.5G and MXPP\_MR\_2.5G Cards in the Cisco ONS 15454 SONET/SDH

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**Product Names:** 15454-Datamux2.5GDM and 15454-Datamux2.5GDMP

This document provides a card description, specifications, and installation procedure for the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards. These cards are compatible with the ONS 15454 SONET (ANSI) and the ONS 15454 SDH (ETSI) shelf assemblies. As appropriate use this document in conjunction with the *Cisco ONS 15454 DWDM Procedure Guide*, the *Cisco ONS 15454 DWDM Reference Manual*, and the *Cisco ONS 15454 DWDM Troubleshooting Guide*.

This document contains the following sections:

- [MXP\\_MR\\_2.5G and MXPP\\_MR\\_2.5G Card Description, page 1](#)
- [MXP\\_MR\\_2.5G and MXPP\\_MR\\_2.5G Card Specifications, page 7](#)
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## MXP\_MR\_2.5G and MXPP\_MR\_2.5G Card Description

The MXP\_MR\_2.5G card aggregates a mix and match of client Storage Area Network (SAN) service client inputs (GE, FICON, Fibre Channel, and ESCON) into one 2.5 Gbps STM-16/OC-48 DWDM signal on the trunk side. It provides one long-reach STM-16/OC-48 port per card and is compliant with Telcordia GR-253-CORE.



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**Note**

In Release 7.0, two additional operating modes have been made available to the user: pure ESCON (all 8 ports running ESCON), and mixed mode (port 1 running FC/GE/FICON, and ports 5 through 8 running ESCON). When the card is part of a system running Release 6.0 or earlier, only one operating mode, FC/GE, is available for use.

The MXPP\_MR\_2.5G (2.5-Gbps Multirate Muxponder–Protected–100 GHz–Tunable 15xx.xx-15yy.yy) card aggregates various client SAN service client inputs (GE, FICON, Fibre Channel, and ESCON) into one 2.5 Gbps STM-16/OC-48 DWDM signal on the trunk side. It provides two long-reach STM-16/OC-48 ports per card and is compliant with ITU-T G.957 and Telcordia GR-253-CORE.

Because the cards are tunable to one of four adjacent grid channels on a 100-GHz spacing, each card is available in eight versions, with 15xx.xx representing the first wavelength and 15yy.yy representing the last wavelength of the four available on the card. In total, 32 DWDM wavelengths are covered in accordance with the ITU-T 100-GHz grid standard, G.692, and Telcordia GR-2918-CORE, Issue 2. The card versions along with their corresponding wavelengths are shown in [Table 1](#).

**Table 1**      **Card Versions**

Card Version	Frequency Channels at 100 GHz (0.8 nm) Spacing			
1530.33–1532.68	1530.33 nm	1531.12 nm	1531.90 nm	1532.68 nm
1534.25–1536.61	1534.25 nm	1535.04 nm	1535.82 nm	1536.61 nm
1538.19–1540.56	1538.19 nm	1538.98 nm	1539.77 nm	1540.56 nm
1542.14–1544.53	1542.14 nm	1542.94 nm	1543.73 nm	1544.53 nm
1546.12–1548.51	1546.12 nm	1546.92 nm	1547.72 nm	1548.51 nm
1550.12–1552.52	1550.12 nm	1550.92 nm	1551.72 nm	1552.52 nm
1554.13–1556.55	1554.13 nm	1554.94 nm	1555.75 nm	1556.55 nm
1558.17–1560.61	1558.17 nm	1558.98 nm	1559.79 nm	1560.61 nm

## Signal Types

The client interface supports the following payload types:

- 2G FC
- 1G FC
- 2G FICON
- 1G FICON
- GE
- ESCON



**Note**

Because the client payload cannot oversubscribe the trunk, a mix of client signals can be accepted, up to a maximum limit of 2.5 Gbps.

## Data Rates

Table 2 shows the input data rate for each client interface, and the encapsulation method. The current version of the ITU-T Transparent Generic Framing Procedure (GFP-T) G.7041 supports transparent mapping of 8B/10B block-coded protocols, including Gigabit Ethernet, Fibre Channel, and FICON.

In addition to the GFP mapping, 1-Gbps traffic on Port 1 or 2 of the high-speed serializer/deserializer (SERDES) is mapped to an STS-24c channel. If two 1-Gbps client signals are present at Port 1 and Port 2 of the SERDES, the Port 1 signal is mapped into the first STS-24c channel and the Port 2 signal into the second STS-24c channel. The two channels are then mapped into an OC-48 trunk channel.

**Table 2** *MXP\_MR\_2.5G and MXPP\_MR\_2.5G Client Interface Data Rates and Encapsulation*

Client Interface	Input Data Rate	ITU-T GFP-T G.7041 Encapsulation
2G FC	2.125 Gbps	Yes
1G FC	1.06 Gbps	Yes
2G FICON	2.125 Gbps	Yes
1G FICON	1.06 Gbps	Yes
GE	1.25 Gbps	Yes
ESCON	0.2 Gbps	Yes

Table 3 shows some of the mix and match possibilities on the various client ports. The table is intended to show the full client payload configurations for the card.

**Table 3** *Client Data Rates and Ports*

Mode	Port(s)	Aggregate Data Rate
2G FC	1	2.125 Gbps
1G FC	1, 2	2.125 Gbps
2G FICON	1	2.125 Gbps
1G FICON	1, 2	2.125 Gbps
GE	1, 2	2.5 Gbps
1G FC ESCON (mixed mode)	1 5, 6, 7, 8	1.06 Gbps 0.8 Gbps 1.86 Gbps total
1G FICON ESCON (mixed mode)	1 5, 6, 7, 8	1.06 Gbps 0.8 Gbps 1.86 Gbps total
GE ESCON (mixed mode)	1 5, 6, 7, 8	1.25 Gbps 0.8 Gbps Total 2.05 Gbps
ESCON	1, 2, 3, 4, 5, 6, 7, 8	1.6 Gbps

## Client and Trunk Ports

The MXP\_MR\_2.5G card features a 1550-nm laser for the trunk/line port and a 1310-nm or 850-nm laser for the client ports depending on the small form-factor pluggable (SFP). The card contains SFP modules for the client interfaces. For optical termination, each SFP uses two LC connectors, which are labeled TX and RX on the faceplate. The trunk port is a dual-LC connector.

The MXPP\_MR\_2.5G card features a 1550-nm laser for the trunk/line port and a 1310-nm or 850-nm laser (depending on the SFP) for the client port. The card contains eight SFP modules for the client interfaces. For optical termination, each SFP uses two LC connectors, which are labeled TX and RX on the faceplate. There are two trunk port connectors (one for working and one for protect). Each is a dual-LC connector.

## Card Protection

The MXP\_MR\_2.5G card supports Y-cable protection. Two MXP\_MR\_2.5G cards can be joined in a Y-cable protection group, which provides protection against failures on the fiber and in the muxponders.

The MXPP\_MR\_2.5G card supports splitter protection, which provides protection against failures due to fiber cuts or unacceptable signal degradation on the trunk side. See the *Cisco ONS 15454 DWDM Reference Manual* for more detailed information.



**Note**

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Protection switching occurs only if the protect line is error free.

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## Performance Monitoring

GFP-T performance monitoring (GFP-T PM) is available via remote monitoring (RMON), and trunk PM is managed according to Telcordia GR-253-CORE and ITU G.783/826. Client PM is achieved through RMON for FC and GE.

## Distance Extension

A buffer-to-buffer credit management scheme provides FC flow control. With this feature enabled, a port indicates the number of frames that can be sent to it (its buffer credit), before the sender is required to stop transmitting and wait for the receipt of a “ready” indication. The MXP\_MR\_2.5G and MXPP\_MR\_2.5 cards support FC credit-based flow control with a buffer-to-buffer credit extension of up to 1600 km (994.2 miles) for 1G FC and up to 800 km (497.1 miles) for 2G FC. The feature can be enabled or disabled.

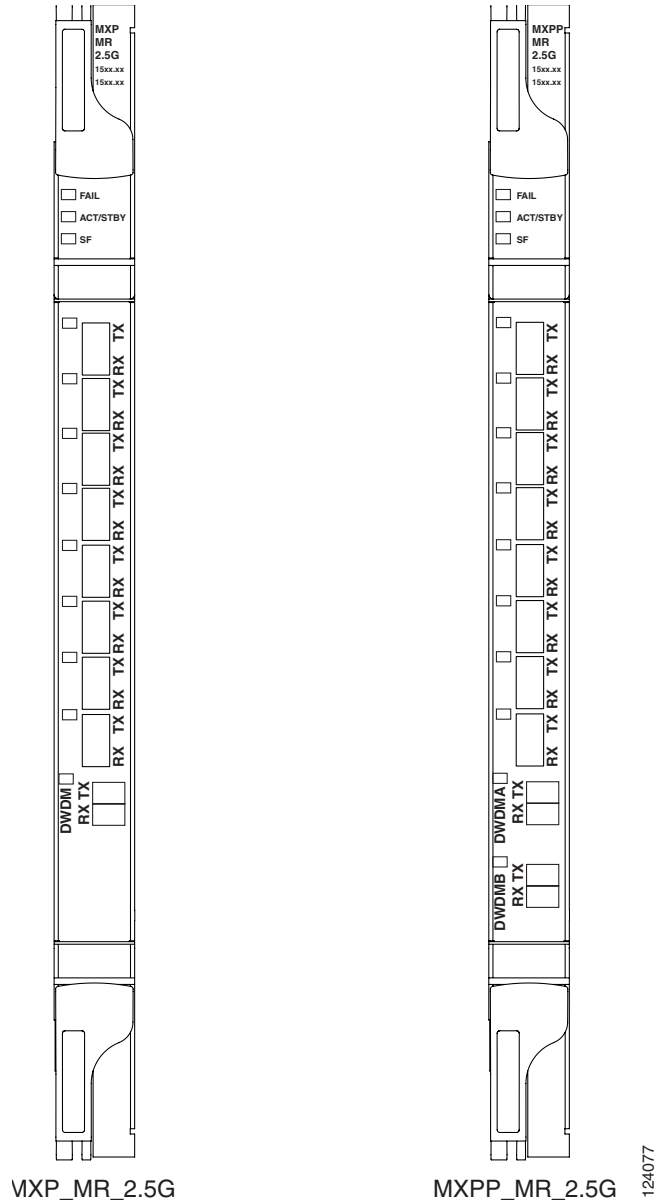
## Slot Compatibility

You can install MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards in Slots 1 to 6 and 12 to 17. The cards cannot operate without a TCC2 or TCC2P card installed in the node. Cross-connect cards do not affect the operation of the muxponder cards.

# Faceplates

Figure 1 shows the MXP\_MR\_2.5G and MXPP\_MR\_2.5G faceplates.

**Figure 1** MXP\_MR\_2.5G and MXPP\_MR\_2.5G Faceplates



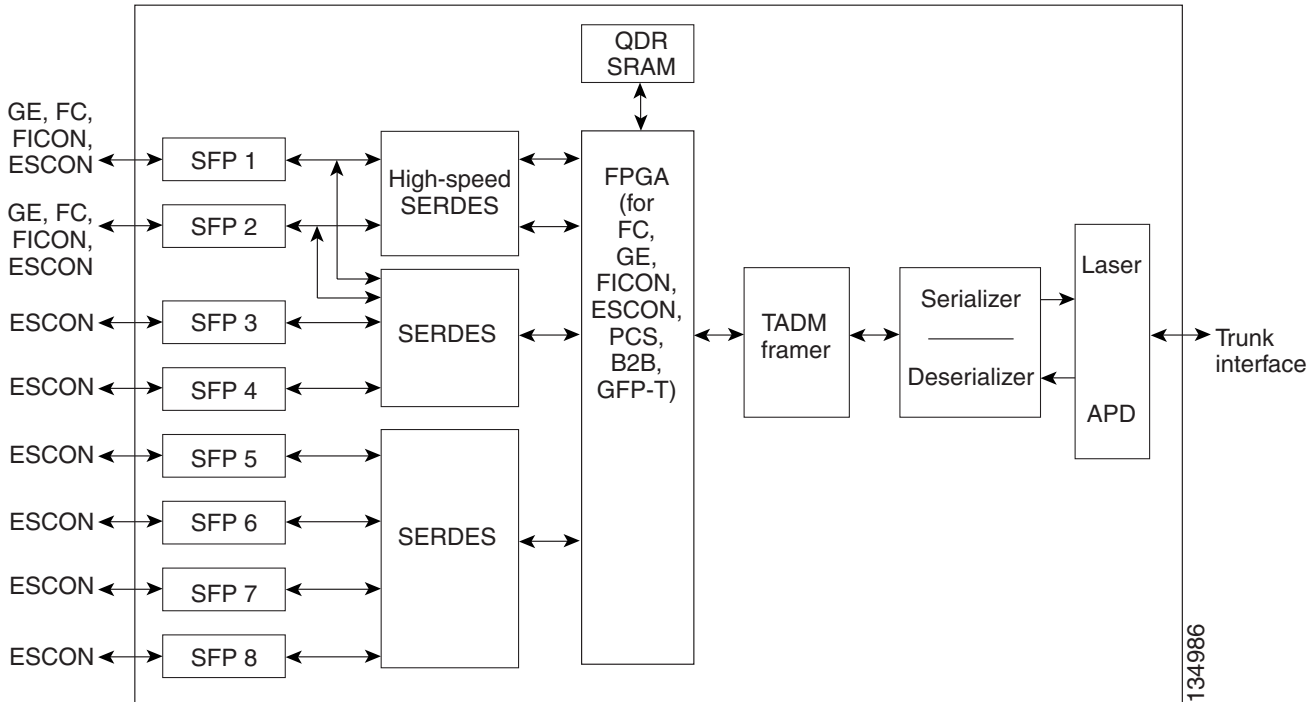
# Block Diagram

Figure 2 shows a block diagram of the MXP\_MR\_2.5G card. The card has eight SFP client interfaces. Ports 1 and 2 can be used for GE, FC, FICON, or ESCON (ESCON is available for Software R7.0 and later). In Software R7.0 and later, Ports 3 through 8 are used for ESCON client interfaces. There are two SERDES blocks dedicated to the high-speed interfaces (GE, FC, FICON, and ESCON) and two SERDES

blocks for the ESCON interfaces. A FPGA is provided to support different configurations for different modes of operation. This FPGA has a Universal Test and Operations Physical Interface for ATM (UTOPIA) interface.

The MXPP\_MR\_2.5G is the same, except a 50/50 splitter divides the power at the trunk interface. In the receive direction, there are two APDs, two SERDES blocks, and two TADM framers. This is necessary to monitor both the working and protect paths. A switch selects one of the two paths to connect to the client interface.

**Figure 2 MXP\_MR\_2.5G and MXPP\_MR\_2.5G Block Diagram**



## Automatic Laser Shutdown

Automatic laser shutdown (ALS) is a safety mechanism used in the event of a fiber cut. The ALS procedure is supported on both client and trunk interfaces. On the client interface, ALS is compliant with ITU-T G.664 (6/99). On the data application and trunk interface, the switch on and off pulse duration is greater than 60 seconds. The on and off pulse duration is user-configurable. For details regarding ALS provisioning for the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards, see the *Cisco ONS 15454 DWDM Procedure Guide*.

## Card-Level Indicators

Table 4 lists the four card-level LEDs on the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards.

**Table 4** MXP\_MR\_2.5G and MXPP\_MR\_2.5G Card-Level Indicators

Card-Level LED	Description
FAIL LED (Red)	Red indicates that the card's processor is not ready. This LED is on during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Amber (Standby)	Green indicates that the card is operational (one or both ports active) and ready to carry traffic. Amber indicates that the card is operational and in standby (protect) mode.
SF LED (Amber)	Amber indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more of the card's ports. The amber SF LED is also illuminated if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the LED turns off.

## Port-Level Indicators

Table 5 lists the eight port-level LEDs on the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards.

**Table 5** MXP\_MR\_2.5G and MXPP\_MR\_2.5G Port-Level Indicators

Port-Level LED	Description
Client LEDs (eight LEDs)	Green indicates that the port is carrying traffic (active) on the interface. Amber indicates that the port is carrying protect traffic (MXPP_MR_2.5G). Red indicates that the port has detected a loss of signal.
DWDM LED (MXP_MR_2.5G) Green (Active) Red (LOS)	Green indicates that the card is carrying traffic (active) on the interface. A red LED indicates that the interface has detected an LOS or LOC.
DWDMA and DWDMB LEDs (MXPP_MR_2.5G) Green (Active) Amber (Protect Traffic) Red (LOS)	Green indicates that the card is carrying traffic (active) on the interface. When the LED is amber, it indicates that the interface is carrying protect traffic in a splitter protection card (MXPP_MR_2.5G). A red LED indicates that the interface has detected an LOS or LOC.

## MXP\_MR\_2.5G and MXPP\_MR\_2.5G Card Specifications

The MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards have the following specifications:

- Payload configuration
  - FC1G—Fibre Channel 1.06 Gbps
  - FC2G—Fibre Channel 2.125 Gbps
  - FICON1G—Fiber connectivity 1.06 Gbps (IBM signal)

- FICON2G—Fiber connectivity 2.125 Gbps (IBM signal)
- ESCON—Enterprise System Connection 200 Mbps
- ONE\_GE—One Gigabit Ethernet 1.125 Gbps
- Mixed configurations up to maximum line rate of 2.5 Gbps (for example, if you have a port configured for FRC2G, you cannot use another port at the same time).
- Client ports: 8x SFP
- Performance monitoring (PM) for all interfaces
- Buffer-to-buffer credit management for distance extension
- Line (trunk side)
  - Bit rate: 2.488 Gbps for OC-48/STM-16
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: 6000 ps/nm
  - Loopback modes: Terminal and facility



**Caution**

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You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards. Using direct fiber loopbacks causes irreparable damage to the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards.

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- Connectors: LC
- Compliance: Telcordia GR-253-CORE, Telcordia GR-2918-CORE, Issue 2, ITU-T G.957, and ITU-T 100-GHz grid standard G.692
- Transmitter (trunk side)
  - Transmit power: +3 +/- 1 dBm with MXP\_MR\_2.5G card, and +/- 1 dBm with MXPP\_MR\_2.5G card
  - 50-GHz DWDM migration ready (the wavelength deviation is less than +/- 0.040 nm through wavelocker deployment)
  - Four-channel wavelength tunability at 100-GHz spacing
  - Transmitter maximum return reflectance: -27 dB
  - Chromatic dispersion allowance: 5400 ps/nm, giving an optical power penalty < 2.0 dB
  - Minimum side mode suppression ratio: 30 dB
  - Transmitter is a direct modulated laser
  - Wavelength stability (drift): +/- 25 picometers (pm)



**Note**

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An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

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- Currently available wavelengths of the TXP\_MR\_2.5G and TXPP\_MR\_2.5G cards (eight card versions):
  - ITU grid blue band: 1530.334 to 1544.526 nm (four card versions, four wavelengths each)

- ITU grid red band: 1546.119 to 1560.606 nm (four card versions, four wavelengths each)
- Receiver (trunk side)

**Table 6** MXP\_MR\_2.5G/MXPP\_MR\_2.5G Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	Chromatic Dispersion Tolerance
17 dB	N/A	< 10 exp – 12	N/A	– 9 to – 23 dBm	—
17 dB	N/A	< 10 exp – 12	N/A	– 9 to – 22 dBm	+/- 1800 ps/nm
17 dB	N/A	< 10 exp – 12	N/A	– 9 to – 21 dBm	+/- 5400 ps/nm
18 dB	N/A	< 10 exp – 12	N/A	– 9 to – 23 dBm	+/- 1800 ps/nm
19 dB	N/A	< 10 exp – 12	N/A	– 9 to – 23 dBm	+/- 5400 ps/nm
21 dB	N/A	< 10 exp – 12	N/A	– 9 to – 30 dBm	—
21 dB	N/A	< 10 exp – 12	N/A	– 9 to – 29 dBm	+/- 1800 ps/nm
21 dB	N/A	< 10 exp – 12	N/A	– 9 to – 28 dBm	+/- 5400 ps/nm
22 dB	N/A	< 10 exp – 12	N/A	– 9 to – 30 dBm	+/- 1800 ps/nm
23 dB	N/A	< 10 exp – 12	N/A	– 9 to – 30 dBm	+/- 5400 ps/nm

1. OSNR defined with 0.1 nm RBW

- Receiver sensitivity –28 dBm, BER 1 \* 10 exp – 12
- Receiver overload is equal to or exceeds –8 dBm
- Receiver maximum reflectance of –27 dB
- Line (client side)
  - Bit rate: 1.06 Gbps to 2.125 Gbps per client
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode or 850-nm multimode
  - Maximum chromatic dispersion allowance: 1600 ps/nm
  - Loopback modes: Terminal and facility
  - Connectors: LC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: 1290 to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: DFB laser
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER 1 \* 10 exp – 12
  - Minimum receiver level: –14 dBm at BER 1 \* 10 exp – 12
  - Receiver: APD

- Link loss budget: 8 dB minimum, at BER =  $1 * 10 \text{ exp} - 12$
- Receiver input wavelength range: 1290 to 1605 nm
- Environmental
  - Operating temperature: +23 to +104 degrees Fahrenheit (-5 to +40 degrees Celsius)
  - Operating humidity: 5 to 85 percent, noncondensing
  - Power consumption (maximum): 60 W, 1.25 A at -48 V, 204 BTU/hr
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.716 in. (18.2 mm)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 2.25 lb (1.02 kg)

## Install the MXP\_MR\_2.5G and MXPP\_MR\_2.5G Cards



**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.** Statement 94



**Warning**

**Class I (CDRH) and Class 1M (IEC) laser products.** Statement 1055



**Warning**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 272



**Note**

If protective clips are installed on the card connectors, remove the clips before installing the cards.

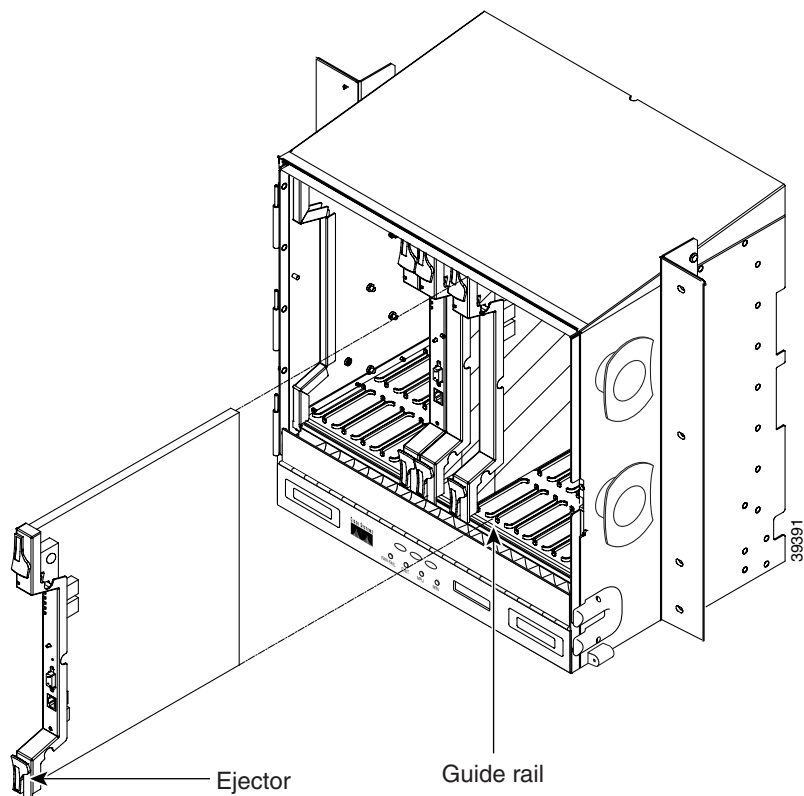


**Note**

If you install a card incorrectly, the FAIL LED flashes continuously.

Figure 3 shows general card installation.

**Figure 3** Installing a Card in the Cisco ONS 15454 (ANSI) Shelf Assembly



- Step 1** Display the card installation plan for the node using one of the following sources:
- The Cisco MetroPlanner Site Dialog window for the node you are provisioning.
  - CTC node view with slots preprovisioned based on the Cisco MetroPlanner Site Dialog window.
  - Written slot plan. The plan must be based on the Cisco MetroPlanner Site Dialog window for your installation.
- Step 2** Remove the card from its packaging, then remove the protective clips from the backplane connectors.
- Step 3** Open the card latches/ejectors.
- Step 4** Use the latches/ejectors to firmly slide the card along the guide rails until the card plugs into the receptacle at the back of the slot.
- Step 5** Verify that the card is inserted correctly and close the latches/ejectors on the card.



**Note** It is possible to close the latches and ejectors when the card is not completely plugged into the chassis. Ensure that you cannot insert the card any further.

- Step 6** Verify the LED activity:
- The red FAIL LED turns on for 20 to 30 seconds.
  - The red FAIL LED blinks for 35 to 45 seconds.
  - All LEDs blink once and turn off for 5 to 10 seconds.

- The ACT or ACT/STBY LED turns on. The SF LED can persist until all card ports connect to their far-end counterparts and a signal is present.

**Step 7** If the card does not boot up properly, or the LED activity does not occur as described in [Step 6](#), check the following:

- When a physical card type does not match the type of card provisioned for that slot in CTC, the card might not boot. If a card does not boot, open CTC and ensure that the slot is not provisioned for a different card type before assuming that the card is faulty.
- If the red FAIL LED does not turn on, check the power.
- If you insert a card into a slot provisioned for a different card, all LEDs turn off.
- If the red FAIL LED is on continuously or the LEDs behave erratically, the card is not installed properly. Remove the card and repeat Steps [3](#) to [6](#).

**Stop. You have completed this procedure.**

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## Related Documentation

- *Cisco ONS 15454 DWDM Reference Manual*
- *Cisco ONS 15454 DWDM Procedure Guide*
- *Cisco ONS 15454 DWDM Troubleshooting Guide*
- *Cisco MetroPlanner DWDM Operations Guide*

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- Nonemergencies—[psirt@cisco.com](mailto:psirt@cisco.com)

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- 1 408 525-6532



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[http://www.cisco.com/en/US/products/products\\_security\\_vulnerability\\_policy.html](http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html)

The link on this page has the current PGP key ID in use.

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### Note

Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

## Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

<http://www.cisco.com/techsupport/servicerequest>

For S1 or S2 service requests or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request 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 list of Cisco TAC contacts, go to this URL:

<http://www.cisco.com/techsupport/contacts>

## Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—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.

Severity 2 (S2)—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.

Severity 3 (S3)—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.

Severity 4 (S4)—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, documentation, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

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

- *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 at this URL:

<http://www.ciscopress.com>

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

<http://www.cisco.com/packet>

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

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

or view the digital edition at this URL:

<http://ciscoiq.texterity.com/ciscoiq/sample/>

- *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>
- Networking products offered by Cisco Systems, as well as customer support services, can be obtained at this URL:  
<http://www.cisco.com/en/US/products/index.html>
- Networking Professionals Connection is an interactive website for networking professionals to share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:  
<http://www.cisco.com/discuss/networking>
- World-class networking training is available from Cisco. You can view current offerings at this URL:  
<http://www.cisco.com/en/US/learning/index.html>


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This document is to be used in conjunction with the documents listed in the “[Related Documentation](#)” section

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