



# CHAPTER 4

## Optical Cards

---

This chapter describes the Cisco ONS 15454 SDH optical, transponder, and muxponder card features and functions. It includes descriptions, hardware specifications, and block diagrams for each card. For installation and card turn-up procedures, refer to the *Cisco ONS 15454 SDH Procedure Guide*.

Chapter topics include:

- [4.1 Optical Card Overview, page 4-1](#)
- [4.2 OC3 IR 4/STM1 SH 1310 Card, page 4-5](#)
- [4.3 OC3 IR/STM1 SH 1310-8 Card, page 4-7](#)
- [4.4 OC12 IR/STM4 SH 1310 Card, page 4-9](#)
- [4.5 OC12 LR/STM4 LH 1310 Card, page 4-11](#)
- [4.6 OC12 LR/STM4 LH 1550 Card, page 4-13](#)
- [4.7 OC12 IR/STM4 SH 1310-4 Card, page 4-15](#)
- [4.8 OC48 IR/STM16 SH AS 1310 Card, page 4-17](#)
- [4.9 OC48 LR/STM16 LH AS 1550 Card, page 4-19](#)
- [4.10 OC48 ELR/STM16 EH 100 GHz Cards, page 4-21](#)
- [4.11 OC192 SR/STM64 IO 1310 Card, page 4-24](#)
- [4.12 OC192 IR/STM64 SH 1550 Card, page 4-25](#)
- [4.13 OC192 LR/STM64 LH 1550 Card, page 4-27](#)
- [4.14 OC192 LR/STM64 LH ITU 15xx.xx Card, page 4-31](#)
- [4.15 15454\\_MRC-12 Multirate Card, page 4-34](#)
- [4.16 MRC-2.5G-12 Multirate Card, page 4-39](#)
- [4.17 OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach Cards, page 4-42](#)
- [4.18 Optical Card SFPs and XFPs, page 4-44](#)

### 4.1 Optical Card Overview

The optical card overview section summarizes card functions and compatibility.

**Note**

Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 SDH shelf assembly. The cards are then installed into slots displaying the same symbols. See the “[1.13.1 Card Slot Requirements](#)” section on [page 1-25](#) for a list of slots and symbols.

## 4.1.1 Card Summary

[Table 4-1](#) lists the ONS 15454 SDH optical cards.

**Table 4-1** *Optical Cards for the ONS 15454 SDH*

Card	Description	For Additional Information...
<b>OC3 IR 4/STM1 SH 1310</b>	The OC3 IR 4/STM1 SH 1310 card provides four intermediate- or short-range STM-1 ports and operates at 1310 nm. It operates in Slots 1 to 6 and 12 to 17.	See the “ <a href="#">4.2 OC3 IR 4/STM1 SH 1310 Card</a> ” section on <a href="#">page 4-5</a> .
<b>OC3 IR/STM1 SH 1310-8</b>	The OC3 IR/STM1 SH 1310-8 card provides eight intermediate- or short-range STM-1 ports and operates at 1310 nm. It operates in Slots 1 to 4 and 14 to 17.	See the “ <a href="#">4.3 OC3 IR/STM1 SH 1310-8 Card</a> ” section on <a href="#">page 4-7</a> .
<b>OC12 IR/STM4 SH 1310</b>	The OC12 IR/STM4 SH 1310 card provides one intermediate- or short-range STM-4 port and operates at 1310 nm. It operates in Slots 1 to 6 and 12 to 17.	See the “ <a href="#">4.4 OC12 IR/STM4 SH 1310 Card</a> ” section on <a href="#">page 4-9</a> .
<b>OC12 LR/STM4 LH 1310</b>	The OC12 LR/STM4 LH 1310 card provides one long-range STM-4 port and operates at 1310 nm. It operates in Slots 1 to 6 and 12 to 17.	See the “ <a href="#">4.5 OC12 LR/STM4 LH 1310 Card</a> ” section on <a href="#">page 4-11</a> .
<b>OC12 LR/STM4 LH 1550</b>	The OC12 LR/STM4 LH 1550 card provides one long-range STM-4 port and operates at 1550 nm. It operates in Slots 1 to 6 and 12 to 17.	See the “ <a href="#">4.6 OC12 LR/STM4 LH 1550 Card</a> ” section on <a href="#">page 4-13</a> .
<b>OC12 IR/STM4 SH 1310-4</b>	The OC12 IR/STM4 SH 1310-4 card provides four intermediate- or short-range STM-4 ports and operates at 1310 nm. It operates in Slots 1 to 4 and 14 to 17.	See the “ <a href="#">4.7 OC12 IR/STM4 SH 1310-4 Card</a> ” section on <a href="#">page 4-15</a> .
<b>OC48 IR/STM16 SH AS 1310</b>	The OC48 IR/STM16 SH AS 1310 card provides one intermediate- or short-range STM-16 port at 1310 nm and operates in Slots 1 to 6 and 12 to 17.	See the <a href="#">4.8 OC48 IR/STM16 SH AS 1310 Card</a> , <a href="#">page 4-17</a> .
<b>OC48 LR/STM16 LH AS 1550</b>	The OC48 LR/STM16 LH AS 1550 card provides one long-range STM-16 port at 1550 nm and operates in Slots 1 to 6 and 12 to 17.	See the “ <a href="#">4.9 OC48 LR/STM16 LH AS 1550 Card</a> ” section on <a href="#">page 4-19</a> .
<b>OC48 ELR/STM16 EH 100 GHz</b>	The OC48 ELR/STM16 EH 100 GHz card provides one long-range (enhanced) STM-16 port and operates in Slots 5, 6, 12, or 13. This card is available in 18 different wavelengths (9 in the blue band and 9 in the red band) in the 1550-nm range, every second wavelength in the ITU grid for 100-GHz spacing dense wavelength division multiplexing (DWDM).	See the “ <a href="#">4.10 OC48 ELR/STM16 EH 100 GHz Cards</a> ” section on <a href="#">page 4-21</a> .
<b>OC192 SR/STM64 IO 1310</b>	The OC192 SR/STM64 IO 1310 card provides one intra-office-haul STM-64 port at 1310 nm and operates in Slots 5, 6, 12, or 13 with the XC-VXL-10G or XC-VXC-10G cross-connect card.	See the “ <a href="#">4.11 OC192 SR/STM64 IO 1310 Card</a> ” section on <a href="#">page 4-24</a> .

**Table 4-1** *Optical Cards for the ONS 15454 SDH (continued)*

Card	Description	For Additional Information...
<b>OC192 IR/STM64 SH 1550</b>	The OC192 IR/STM64 SH 1550 card provides one intermediate-range STM-64 port at 1550 nm and operates in Slots 5, 6, 12, or 13 with the XC-VXL-10G or XC-VXC-10G cross-connect card.	See the <a href="#">“4.12 OC192 IR/STM64 SH 1550 Card”</a> section on page 4-25.
<b>OC192 LR/STM64 LH 1550</b>	The OC192 LR/STM64 LH 1550 card provides one long-range STM-64 port at 1550 nm and operates in Slots 5, 6, 12, or 13 with the XC-VXL-10G or XC-VXC-10G cross-connect card.	See the <a href="#">“4.13 OC192 LR/STM64 LH 1550 Card”</a> section on page 4-27.
<b>OC192 LR/STM64 LH ITU 15xx.xx</b>	The OC192 LR/STM64 LH ITU 15xx.xx card provides one extended long-range STM-64 port and operates in Slots 5, 6, 12, or 13 with the XC-VXC-10G card. This card is available in multiple wavelengths in the 1550-nm range of the ITU grid for 100-GHz-spaced DWDM.	See the <a href="#">“4.14 OC192 LR/STM64 LH ITU 15xx.xx Card”</a> section on page 4-31.
<b>15454_MRC-12</b>	The 15454_MRC-12 card provides up to twelve STM-1 or STM-4 ports, or up to four STM-16 ports, using small form factor pluggables (SFPs). The card operates in Slots 1 to 6 and 12 to 17.	See the <a href="#">“4.15 15454_MRC-12 Multirate Card”</a> section on page 4-34.
<b>MRC-2.5G-12</b>	The 15454_MRC-12 card provides up to twelve OC-3/STM-1 ports, four OC-12/STM-4 ports, or one OC-48/STM-16 port, using small form factor pluggables (SFPs). The card operates in Slots 1 to 6 and 12 to 17.	See the <a href="#">“4.16 MRC-2.5G-12 Multirate Card”</a> section on page 4-39.
<b>OC192SR1/STM-64IO Short Reach/OC192/STM64IO Any Reach<sup>1</sup></b>	The OC192SR1/STM64 Short Reach and OC192/STM64 Any Reach cards provide a single OC-192/STM-64 interface capable of operating with SR-1, IR-2, and LR-2 XFP modules (depending on the card) at 1310 nm and 1550 nm. The cards operate in slots 5, 6, 12, or 13 with the XC-VXL-10G and XC-VXC-10G cards.	See the <a href="#">“4.17 OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach Cards”</a> section on page 4-42.

1. CTC refers to these cards as STM64-XFP

**Note**

The Cisco OC3 IR/STM1 SH 1310-8 and OC12 IR/STM4 SH 1310 interface optics, working at 1310 nm, are optimized for the most widely used SMF-28 fiber, available from many suppliers.

Corning MetroCor fiber is optimized for optical interfaces that transmit at 1550 nm or in the C and L DWDM windows, and targets interfaces with higher dispersion tolerances than those found in OC3 IR/STM1 SH 1310-8 and OC12 IR/STM4 SH 1310 interface optics. If you are using Corning MetroCor fiber, OC3 IR/STM1 SH 1310-8 and OC12 IR/STM4 SH 1310 interface optics become dispersion limited before they become attenuation limited. In this case, consider using OC12 LR/STM4 LH 1550 cards instead of OC12 IR/STM4 SH.

With all fiber types, network planners/engineers should review the relative fiber type and optics specifications to determine attenuation, dispersion, and other characteristics to ensure appropriate deployment.

## 4.1.2 Card Compatibility

Table 4-2 lists the CTC software compatibility for each optical card. See Table 2-5 on page 2-4 for a list of cross-connect cards that are compatible with each optical card.


**Note**

“Yes” indicates that this card is fully or partially supported by the indicated software release. Refer to the individual card reference section for more information about software limitations for this card.

**Table 4-2** Optical Card Software Release Compatibility

Optical Card	R3.1	R3.2	R3.3	R3.4	R4.0	R4.1	R4.5	R4.6	R4.7	R5.0	R6.0	R7.0	R7.2	R8.0	R8.5	R9.0
OC3 IR 4/STM1 SH 1310	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC3 IR/STM1 SH 1310-8	—	—	—	—	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC12 IR/STM4 SH 1310	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC12 LR/STM4 LH 1310	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC12 LR/STM4 LH 1550	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC12 IR/STM4 SH 1310-4	—	—	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC48 IR/STM16 SH AS 1310	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC48 LR/STM16 LH AS 1550	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC48 ELR/STM16 EH 100 GHz	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC48 ELR 200 GHz	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC192 SR/STM64 IO 1310	—	—	—	—	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC192 IR/STM64 SH 1550	—	—	—	—	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC192 LR/STM64 LH 1550 (15454-OC192LR1550)	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC192 LR/STM64 LH 1550 (15454-OC192-LR2)	—	—	—	—	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OC192 LR/STM64 LH ITU 15xx.xx	—	—	—	—	Yes	Yes	—	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15454_MRC-12	—	—	—	—	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes

Table 4-2 Optical Card Software Release Compatibility (continued)

Optical Card	R3.1	R3.2	R3.3	R3.4	R4.0	R4.1	R4.5	R4.6	R4.7	R5.0	R6.0	R7.0	R7.2	R8.0	R8.5	R9.0
MRC-2.5G-12	—	—	—	—	—	—	—	—	—	—	—	—	—	Yes	Yes	Yes
OC192SR1/STM6410 Short Reach/ OC192/STM64 Any Reach <sup>1</sup>	—	—	—	—	—	—	—	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes

1. These cards are designated as STM64-XFP in CTC

## 4.2 OC3 IR 4/STM1 SH 1310 Card



### Note

For specifications, see the [“A.6.1 OC3 IR 4/STM1 SH 1310 Card Specifications”](#) section on page A-27.

The OC3 IR 4/STM1 SH 1310 card provides four intermediate or short range SDH STM-1 ports compliant with ITU-T G.707 and ITU-T G.957. Each port operates at 155.52 Mbps over a single-mode fiber span. The card supports VC-4 and nonconcatenated or concatenated payloads at the STM-1 signal level.

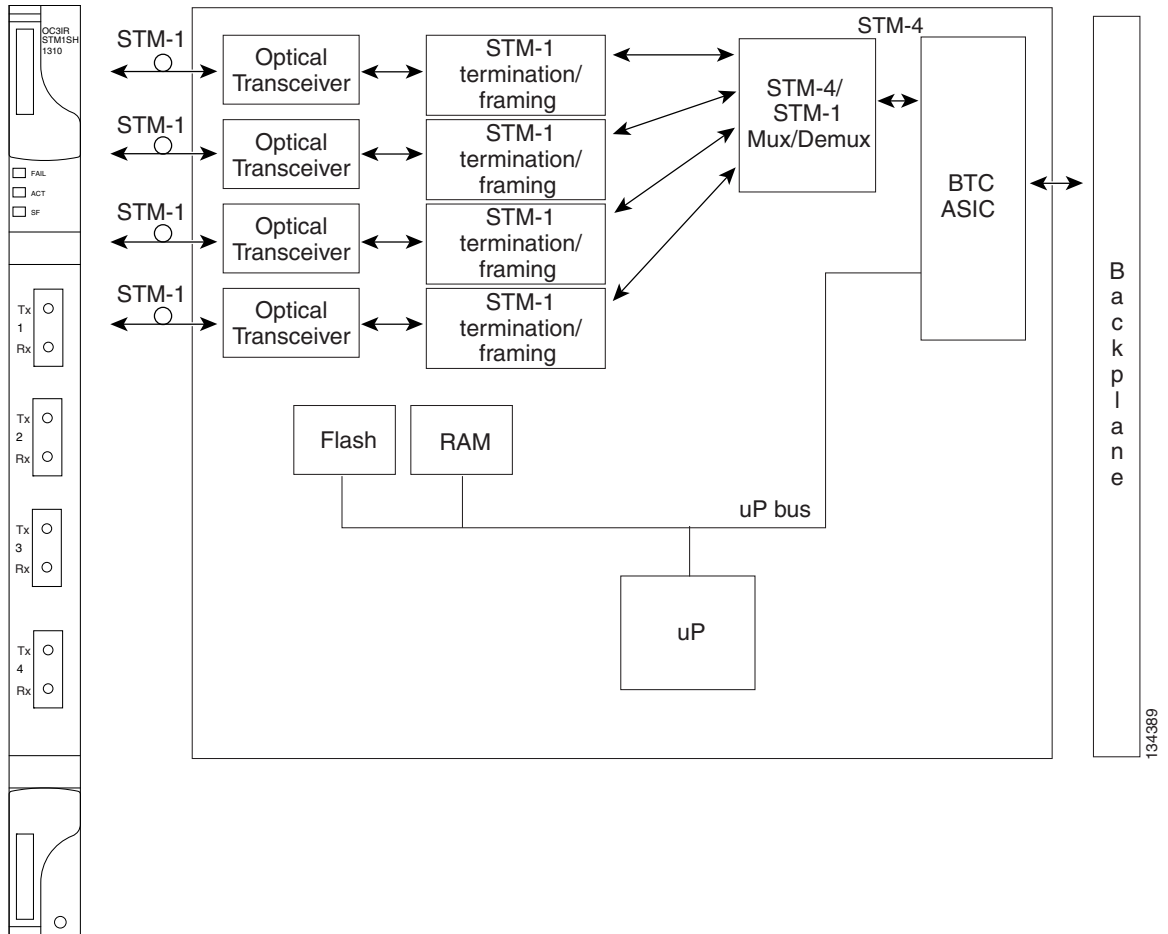


### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

[Figure 4-1](#) shows the OC3 IR 4/STM1 SH 1310 faceplate and block diagram.

Figure 4-1 OC3 IR 4/STM1 SH 1310 Faceplate and Block Diagram



## 4.2.1 OC3 IR 4/STM1 SH 1310 Functionality

You can install the OC3 IR 4/STM1 SH 1310 card in Slots 1 to 6 and 12 to 17. The card can be provisioned as part of a subnetwork connection protection (SNCP) ring or linear add-drop multiplexer (ADM) configuration. Each interface features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses SC connectors.

The OC3 IR 4/STM1 SH 1310 card supports 1+1 unidirectional and bidirectional protection switching. You can provision protection on a per port basis.

The OC3 IR 4/STM1 SH 1310 card detects loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), multiplex section alarm indication signal (MS-AIS), and multiplex section far-end receive failure (MS-FERF) conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line bit interleaved parity (BIP) errors.

To enable multiplex section protection (MSP), the OC3 IR 4/STM1 SH 1310 card extracts the K1 and K2 bytes from the SDH overhead to perform appropriate protection switches. The data communication channel/generic communication channel (GCC) bytes are forwarded to the TCC2 card, which terminates the GCC.

## 4.2.2 OC3 IR 4/STM1 SH 1310 Card-Level Indicators

Table 4-3 describes the three card-level LED indicators on the OC3 IR 4/STM1 SH 1310 card.

**Table 4-3 OC3 IR 4/STM1 SH 1310 Card-Level Indicators**

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, MS-AIS, or high BER on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the links are working, the light turns off.

## 4.2.3 OC3 IR 4/STM1 SH 1310 Port-Level Indicators

Eight bicolor LEDs show the status per port. The LEDs show green if the port is available to carry traffic, is provisioned as in-service, and is part of a protection group, in the active mode. You can find the status of the four card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.3 OC3 IR/STM1 SH 1310-8 Card



### Note

For specifications, see the [“A.6.2 OC3 IR/STM1 SH 1310-8 Card Specifications” section on page A-28](#).

The OC3 IR/STM1 SH 1310-8 card provides eight intermediate or short range SDH STM-1 ports compliant with ITU-T G.707, and ITU-T G.957. Each port operates at 155.52 Mbps over a single-mode fiber span. The card supports VC-4 and nonconcatenated or concatenated payloads at the STM-1 signal level.

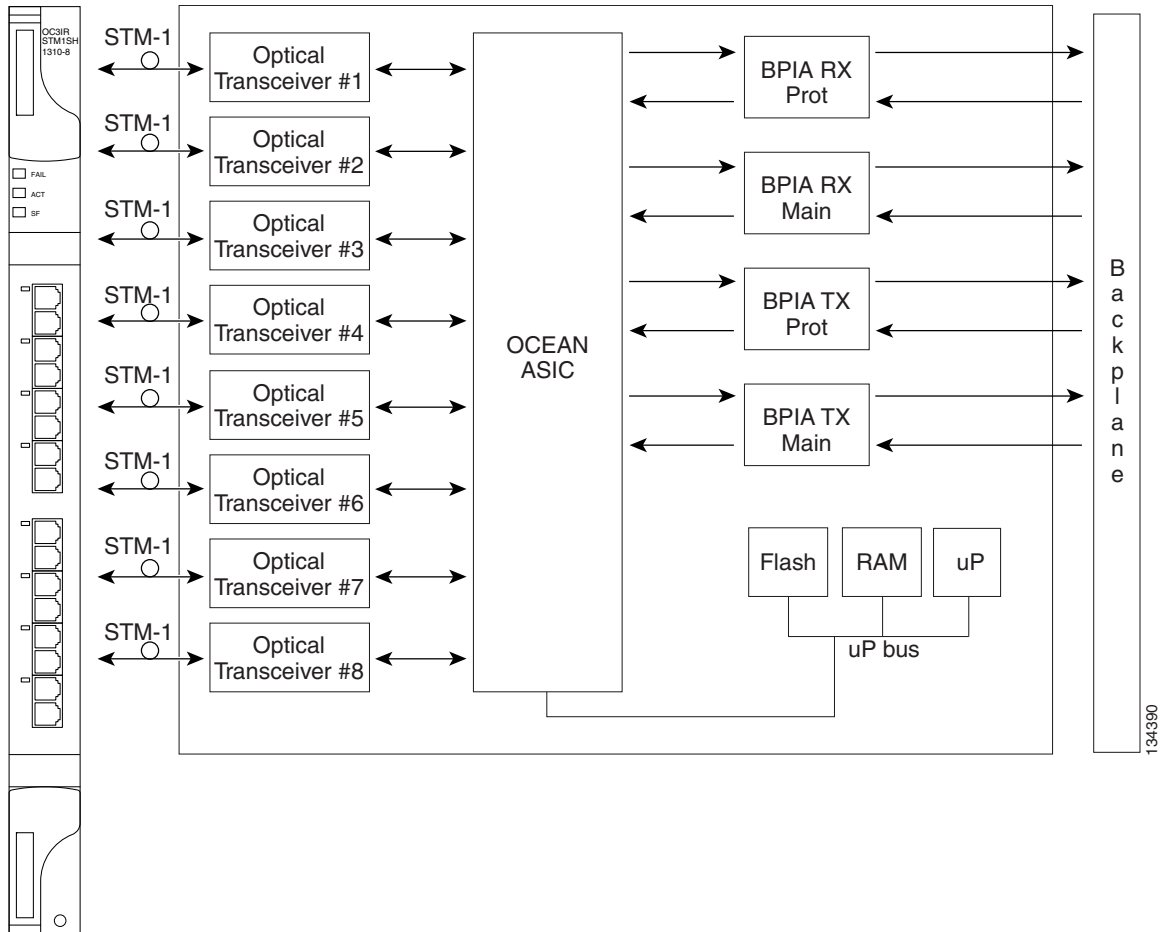


### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-2 shows the card faceplate and block diagram.

Figure 4-2 OC3 IR/STM1 SH 1310-8 Faceplate and Block Diagram



You can install the OC3IR/STM1 SH 1310-8 card in Slots 1 to 4 and 14 to 17. The card can be provisioned as part of an SNCP or in an (ADM) configuration. Each interface features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses LC connectors on the faceplate, angled downward 12.5 degrees.

The OC3IR/STM1 SH 1310-8 card supports 1+1 unidirectional and bidirectional protection switching. You can provision protection on a per port basis.

The OC3IR/STM1 SH 1310-8 card detects loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), multiplex section alarm indicator signal (MS-AIS), and multiplex section far-end receive failure (MS-FERF) conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

To enable an MS-SPRing, the OC3 IR/STM1 SH 1310-8 card extracts the K1 and K2 bytes from the SDH overhead to perform appropriate protection switches. The OC3IR/STM1 SH 1310-8 card supports full GCC connectivity for remote network management.



### 4.3.1 OC3 IR/STM1 SH 1310-8 Card-Level Indicators

Table 4-4 describes the three card-level LED indicators for the OC3IR/STM1 SH 1310-8 card.

**Table 4-4** OC3IR/STM1 SH 1310-8 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, MS-AIS, or high BER on one or more card ports. The amber signal fail (SF) LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the links are working, the light turns off.

### 4.3.2 OC3 IR/STM1 SH 1310-8 Port-Level Indicators

Eight bicolor LEDs show the status per port. The LEDs show green if the port is available to carry traffic, is provisioned as in-service, is part of a protection group, or in the active mode. You can also find the status of the eight card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.4 OC12 IR/STM4 SH 1310 Card



#### Note

For specifications, see the [“A.6.3 OC12 IR/STM4 SH 1310 Card Specifications” section on page A-29](#).

The OC12 IR/STM4 SH 1310 card provides one intermediate or short range SDH STM-4 port compliant with ITU-T G.707 and ITU-T G.957. The port operates at 622.08 Mbps over a single-mode fiber span. The card supports VC-4 and nonconcatenated or concatenated payloads at STM-1 and STM-4 signal levels.

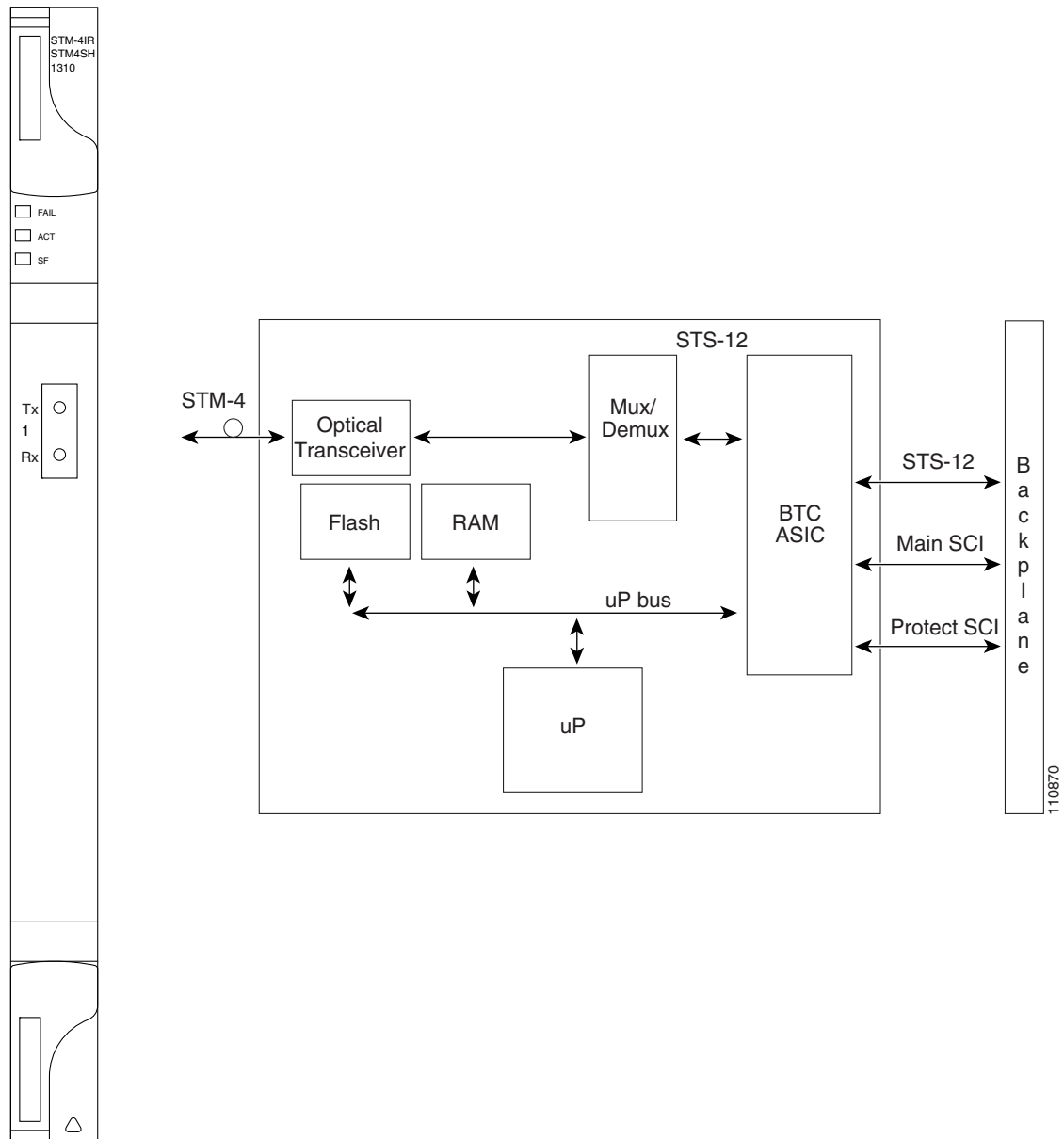


#### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-3 shows the OC12 IR/STM4 SH 1310 faceplate and a block diagram of the card.

**Figure 4-3** OC12 IR/STM4 SH 1310 Faceplate and Block Diagram



You can install the OC12 IR/STM4 SH 1310 card in Slots 1 to 6 and 12 to 17 and provision the card as part of an MS-SPRing or subnetwork connection protection (SNCP) ring. In ADM configurations, you can provision the card as either an access tributary or a transport span (trunk) side interface.

The OC12 IR/STM4 SH 1310 card interface features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The OC12 IR/STM4 SH 1310 card uses SC optical connections and supports 1+1 unidirectional and bidirectional protection.

The OC12 IR/STM4 SH 1310 detects LOS, LOF, LOP, MS-AIS, and MS-FERF conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

To enable an MS-SPRing, the OC12 IR/STM4 SH 1310 extracts the K1 and K2 bytes from the SDH overhead to perform appropriate protection switches. The GCC bytes are forwarded to the TCC2 card, which terminates the GCC.

## 4.4.1 OC12 IR/STM4 SH 1310 Card-Level Indicators

Table 4-5 describes the three card-level LED indicators on the OC12 IR/STM4 SH 1310 card.

**Table 4-5** OC12 IR/STM4 SH 1310 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green/Amber ACT LED	The green ACT LED indicates that the card is operational and is carrying traffic or is traffic-ready. The amber ACT LED indicates that the card is in standby mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, MS-AIS, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.4.2 OC12 IR/STM4 SH 1310 Port-Level Indicators

You can find the status of the OC12 IR/STM4 SH 1310 card port using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.5 OC12 LR/STM4 LH 1310 Card



### Note

For specifications, see the [“A.6.4 OC12 LR/STM4 LH 1310 Card Specifications”](#) section on page A-30.

The OC12 LR/STM4 LH 1310 card provides one long-range SDH STM-4 port per card compliant with ITU-T G.707, and ITU-T G.957. The port operates at 622.08 Mbps over a single-mode fiber span. The card supports VC-4 and nonconcatenated or concatenated payloads at STM-1 and STM-4 signal levels.

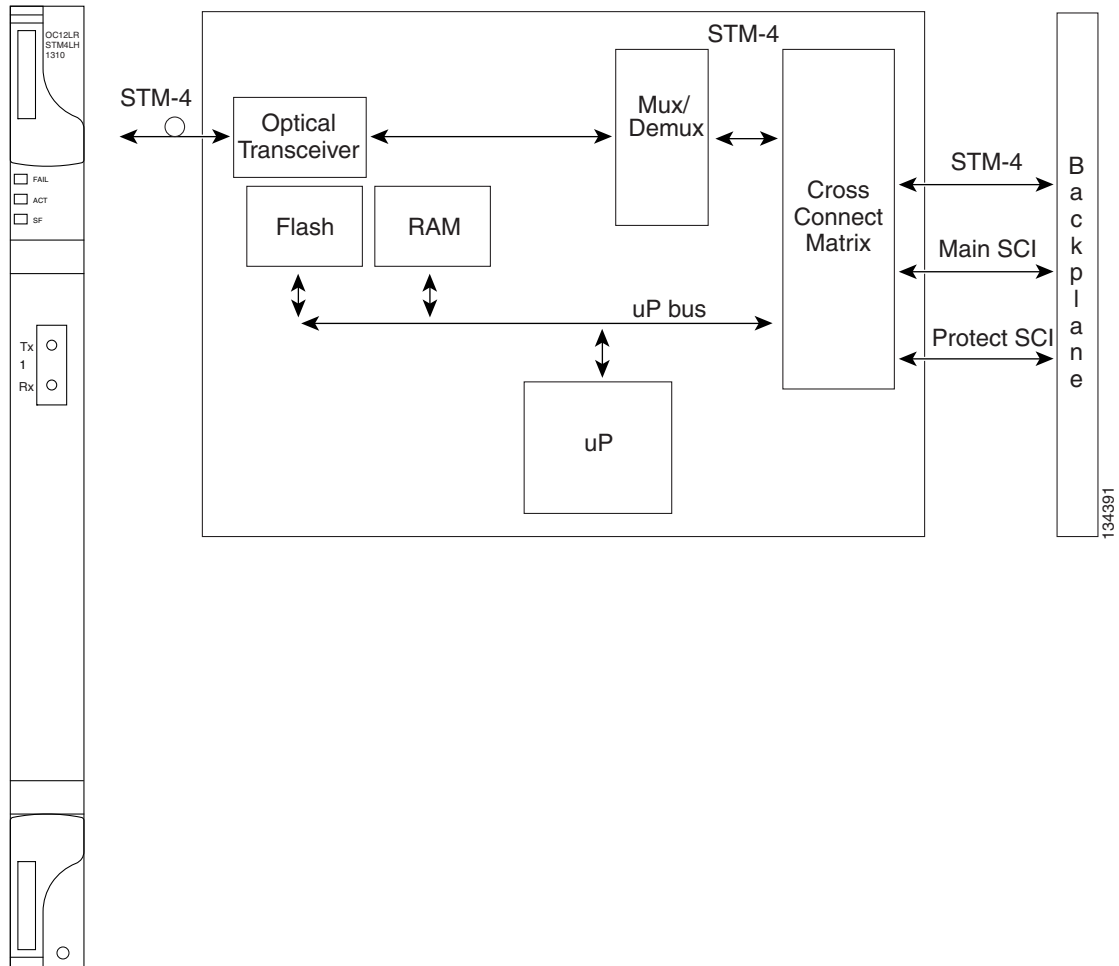


### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-4 shows the OC12 LR/STM4 LH 1310 faceplate and block diagram.

Figure 4-4 OC12 LR/STM4 LH 1310 Faceplate and Block Diagram



You can install the OC12 LR/STM4 LH 1310 card in Slots 1 to 6 and 12 to 17 and provision the card as part of an MS-SPRing or SNCP ring. In ADM configurations, you can provision the card as either an access tributary or a transport span-side interface.

The OC12 LR/STM4 LH 1310 card interface features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses SC optical connections and supports 1+1 unidirectional and bidirectional protection.

The OC12 LR/STM4 LH 1310 detects LOS, LOF, LOP, MS-AIS, and MS-FERF conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

To enable an MS-SPRing, the OC12 LR/STM4 LH 1310 extracts the K1 and K2 bytes from the SDH overhead to perform appropriate protection switches. The GCC bytes are forwarded to the TCC2 card, which terminates the GCC.

## 4.5.1 OC12 LR/STM4 LH 1310 Card-Level Indicators

Table 4-6 describes the three card-level LED indicators on the OC12 LR/STM4 LH 1310 card.

**Table 4-6 OC12 LR/STM4 LH 1310 Card-Level Indicators**

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green/Amber ACT LED	The green ACT LED indicates that the card is operational and is carrying traffic or is traffic-ready. The amber ACT LED indicates that the card is in standby mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, MS-AIS, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.5.2 OC12 LR/STM4 LH 1310 Port-Level Indicators

You can find the status of the OC12 LR/STM4 LH 1310 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.6 OC12 LR/STM4 LH 1550 Card



### Note

For specifications, see the [“A.6.5 OC12 LR/STM4 LH 1550 Card Specifications”](#) section on page A-31.

The OC12 LR/STM4 LH 1550 card provides one long-range, ITU-T G.707- and G.957-compliant, SDH STM-4 port per card. The interface operates at 622.08 Mbps over a single-mode fiber span. The card supports concatenated or nonconcatenated payloads on a per VC-4 basis.

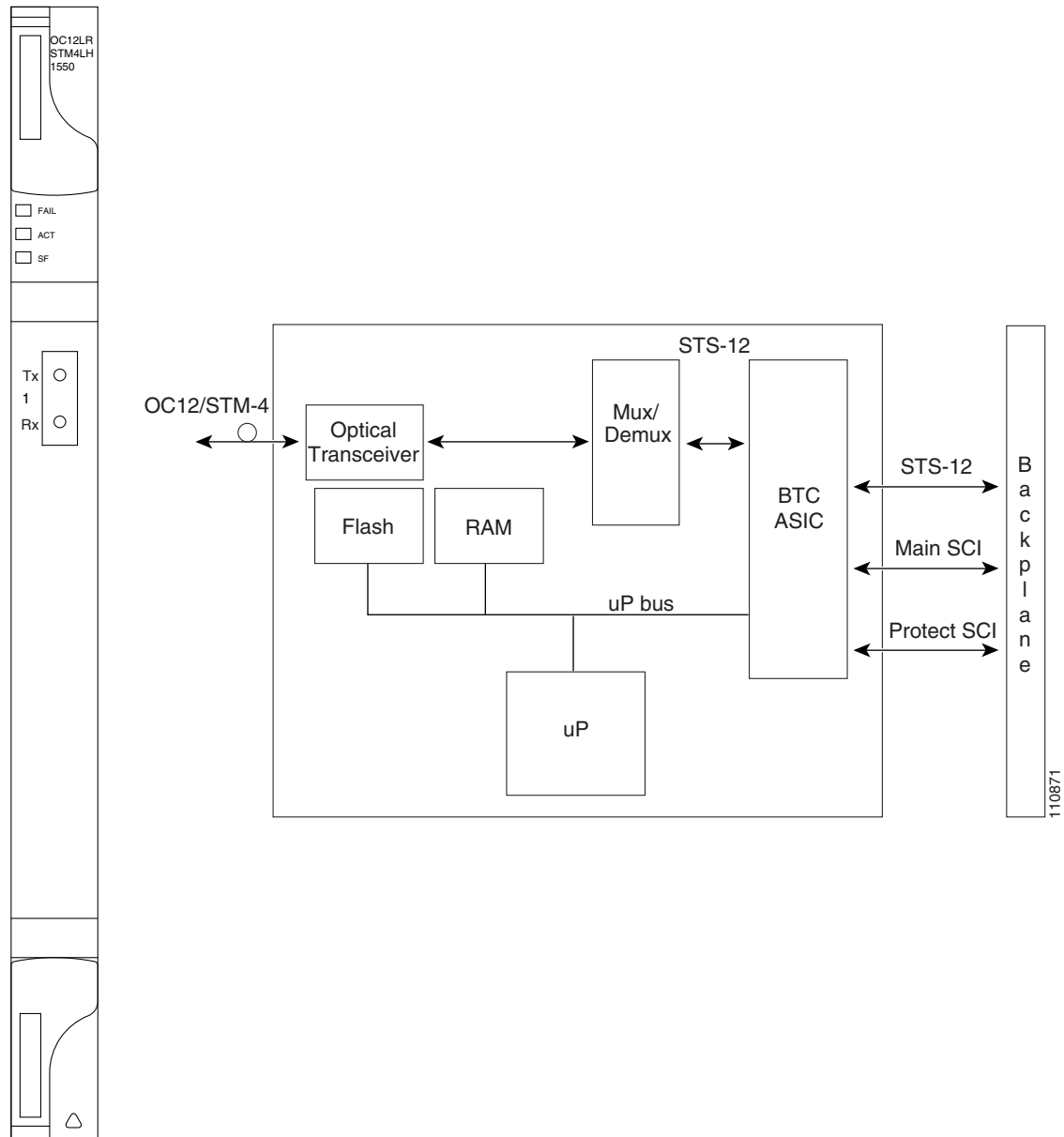


### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-5 shows the OC12 LR/STM4 LH 1550 faceplate and a block diagram of the card.

**Figure 4-5** OC12 LR/STM4 LH 1550 Faceplate and Block Diagram



### 4.6.1 OC12 LR/STM4 LH 1550 Card Functionality

You can install the OC12 LR/STM4 LH 1550 card in Slots 1 to 6 or 12 to 17. You can provision the card as part of an MS-SPRing or SNCP ring. In ADM configurations, you can provision the card as either an access tributary or a transport span-side interface.

The OC12 LR/STM4 LH 1550 card uses long-reach optics centered at 1550 nm and contains a transmit and receive connector (labeled) on the card faceplate. The OC12 LR/STM4 LH 1550 card uses SC optical connections and supports 1+1 bidirectional or unidirectional protection switching.

The OC12 LR/STM4 LH 1550 card detects LOS, LOF, LOP, MS-AIS, and MS-FERF conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

To enable an MS-SPRing, the OC12 LR/STM4 LH 1550 extracts the K1 and K2 bytes from the SDH overhead and processes them to switch accordingly. The GCC bytes are forwarded to the TCC2 card, which terminates the GCC.

## 4.6.2 OC12 LR/STM4 LH 1550 Card-Level Indicators

Table 4-7 describes the three card-level LED indicators on the OC12 LR/STM4 LH 1550 card.

**Table 4-7** OC12 LR/STM4 LH 1550 Card-Level Indicators

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

## 4.6.3 OC12 LR/STM4 LH 1550 Port-Level Indicators

You can find the status of the OC12 LR/STM4 LH 1550 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.7 OC12 IR/STM4 SH 1310-4 Card



### Note

For specifications, see the “[A.6.6 OC12 IR/STM4 SH 1310-4 Card Specifications](#)” section on [page A-32](#).

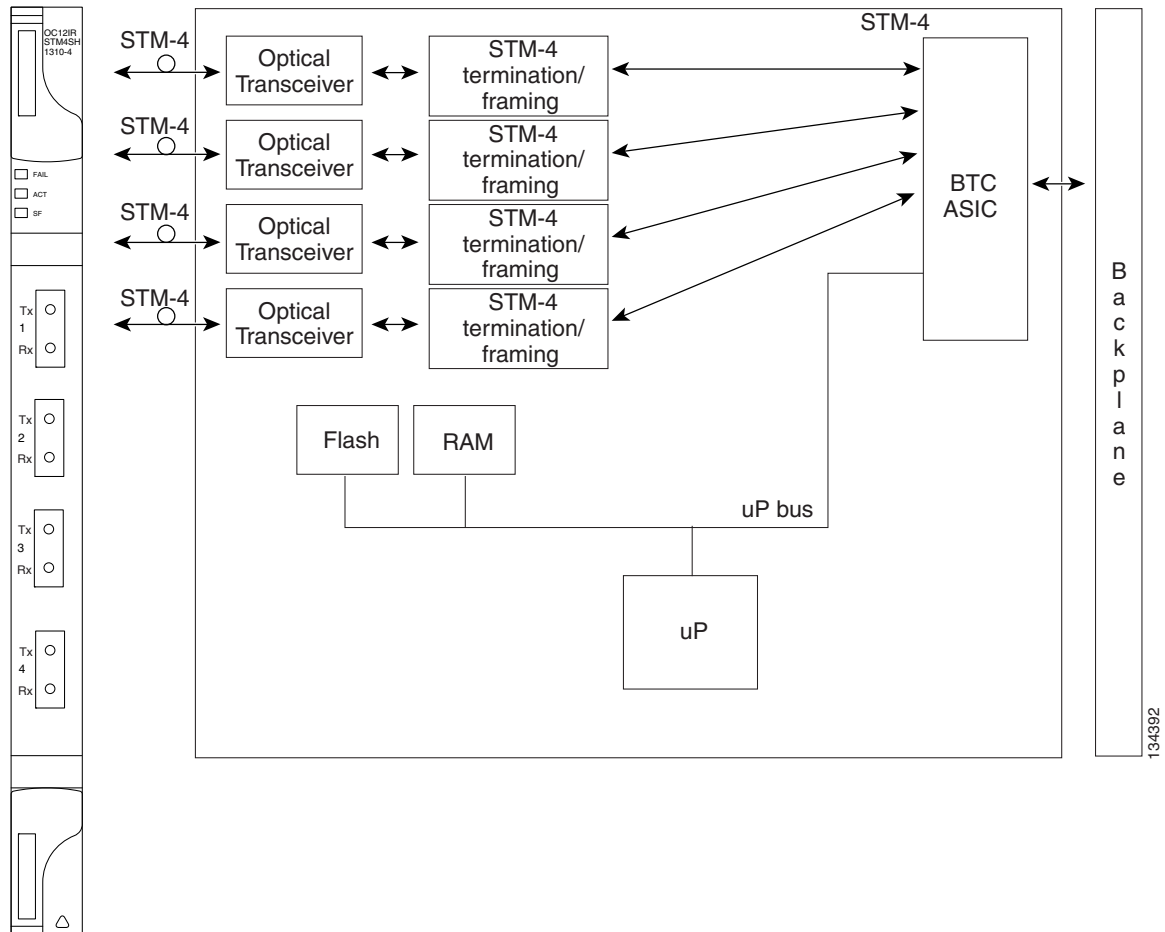
The OC12 IR/STM4 SH 1310-4 card provides four intermediate or short range SDH STM-4 ports compliant with ITU-T G.707, and ITU-T G.957. Each port operates at 622.08 Mbps over a single-mode fiber span. The card supports concatenated or nonconcatenated payloads on a per VC-4 basis.

**Warning**

The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on. Statement 293

Figure 4-6 shows the OC12 IR/STM4 SH 1310-4 faceplate and block diagram.

**Figure 4-6 OC12 IR/STM4 SH 1310-4 Faceplate and Block Diagram**



## 4.7.1 OC12 IR/STM4 SH 1310-4 Card Functionality

You can install the OC12 IR/STM4 SH 1310-4 card in Slots 1 to 4 and 14 to 17. The card can be provisioned as part of an SNCP, part of an MS-SPRing, or in an ADM/TM configuration. Each interface features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses SC connectors.

The OC12 IR/STM4 SH 1310-4 card supports 1+1 unidirectional and bidirectional protection switching. You can provision protection on a per port basis.

The OC12 IR/STM4 SH 1310-4 card detects LOS, LOF, LOP, MS-AIS, and MS-FERF conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.



Each port is configurable to support all ONS 15454 SDH configurations and can be provisioned as part of an MS-SPRing or SNCP configuration.

To enable an MS-SPRing, the OC12 IR/STM4 SH 1310-4 card extracts the K1 and K2 bytes from the SDH overhead and processes them to switch accordingly. The GCC bytes are forwarded to the TCC2 card, which terminates the GCC.

**Note**

If you ever expect to upgrade an OC-12/STM-4 ring to a higher bit rate, you should not put an OC12 IR/STM4 SH 1310-4 card in that ring. The four-port card is not upgradable to a single-port card. The reason is that four different spans, possibly going to four different nodes, cannot be merged to a single span.

## 4.7.2 OC12 IR/STM4 SH 1310-4 Card-Level Indicators

Table 4-8 describes the three card-level LED indicators on the OC12 IR/STM4 SH 1310-4 card.

**Table 4-8** OC12 IR/STM4 SH 1310-4 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, MS-AIS, or high BER on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the links are working, the light turns off.

## 4.7.3 OC12 IR/STM4 SH 1310-4 Port-Level Indicators

You can find the status of the four card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.8 OC48 IR/STM16 SH AS 1310 Card

**Note**

For specifications, see the “[A.6.7 OC48 IR/STM16 SH AS 1310 Card Specifications](#)” section on [page A-33](#).

**Note**

Any new features that are available as part of this software release are not enabled for this card.

The OC48 IR/STM16 SH AS 1310 card provides one intermediate-range, ITU-T G.707- and G.957-compliant, SDH STM-16 port per card. The interface operates at 2.488 Gbps over a single-mode fiber span. The card supports concatenated or nonconcatenated payloads at STM-1, STM-4, or STM-16 signal levels on a per VC-4 basis.

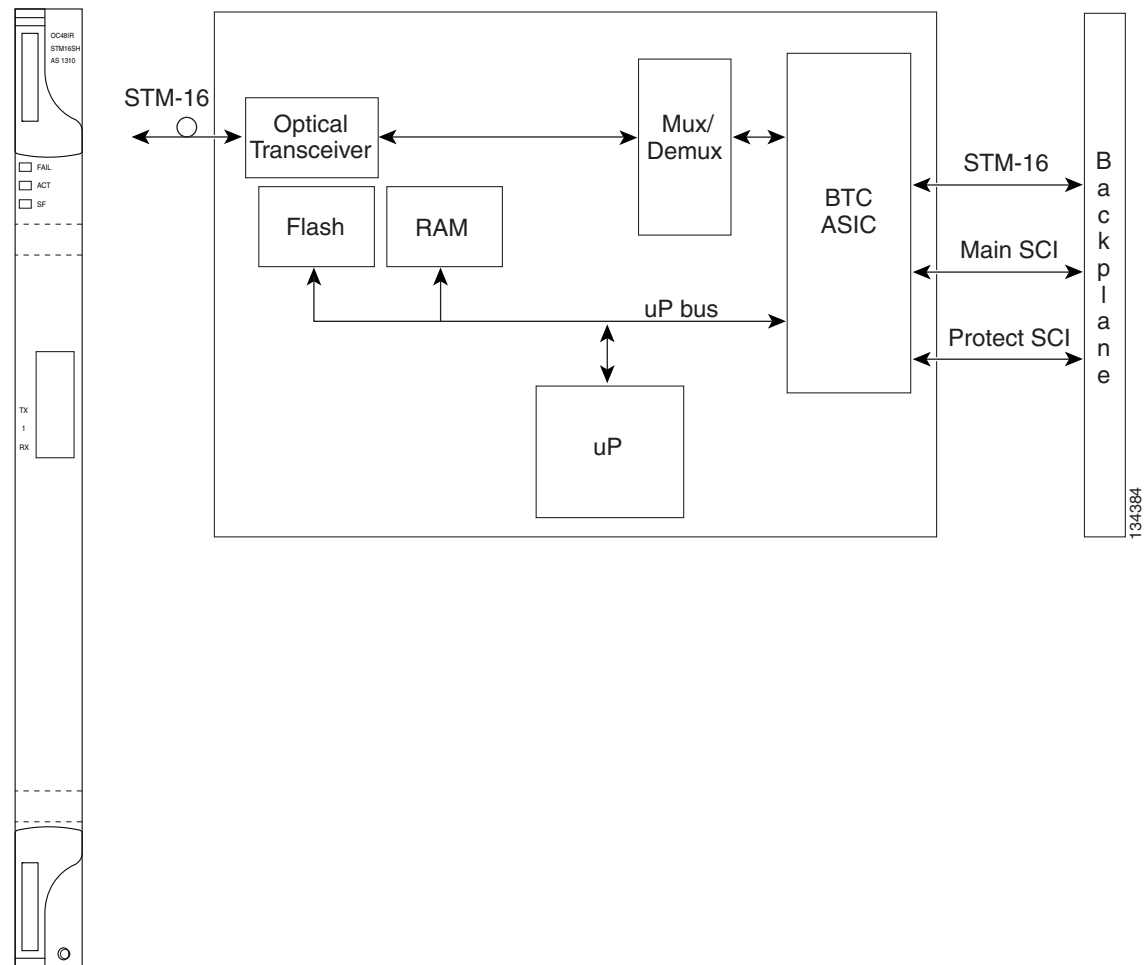


### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-7 shows the OC48 IR/STM16 SH AS 1310 faceplate and block diagram.

**Figure 4-7 OC48 IR/STM16 SH AS 1310 Faceplate and Block Diagram**



## 4.8.1 OC48 IR/STM16 SH AS 1310 Card Functionality

You can install the OC48 IR/STM16 SH AS 1310 card in Slots 1 to 6 and 12 to 17. You can provision the card as part of a MS-SPRing or SNCP. In an ADM configuration, you can provision the card as either an access tributary or a transport span interface.

The STM-16 port features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The OC48 IR/STM16 SH AS 1310 card uses SC connectors. The card supports 1+1 unidirectional protection and provisionable bidirectional switching.

The OC48 IR/STM16 SH AS 1310 card detects LOS, LOF, LOP, MS-AIS, and MS-RFI conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

## 4.8.2 OC48 IR/STM16 SH AS 1310 Card-Level Indicators

Table 4-9 describes the three card-level LED indicators on the OC48 IR/STM16 SH AS 1310 card.

**Table 4-9 OC48 IR/STM16 SH AS 1310 Card-Level Indicators**

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green/Amber ACT LED	The green ACT LED indicates that the card is carrying traffic or is traffic-ready. The amber ACT LED indicates that the card is in standby mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, MS-AIS, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.8.3 OC48 IR/STM16 SH AS 1310 Port-Level Indicators

You can find the status of the OC48 IR/STM16 SH AS 1310 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.9 OC48 LR/STM16 LH AS 1550 Card



**Note**

For specifications, see the “[A.6.8 OC48 LR/STM16 LH AS 1550 Card Specifications](#)” section on [page A-34](#).



**Note**

Any new features that are available as part of this software release are not enabled for this card.

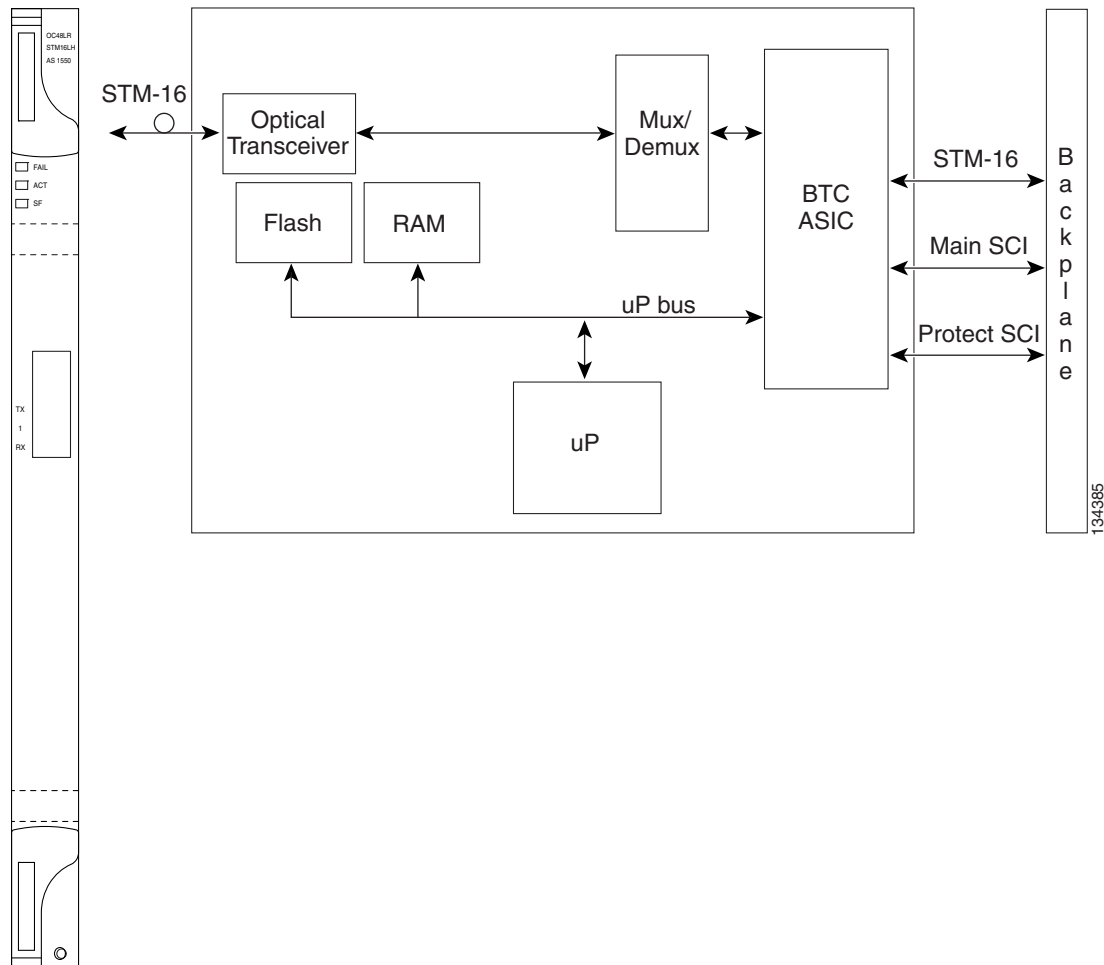
The OC48 LR/STM16 LH AS 1550 card provides one long-range, ITU-T G.707- and G.957-compliant, SDH STM-16 port per card. The interface operates at 2.488 Gbps over a single-mode fiber span. The card supports concatenated or nonconcatenated payloads at STM-1, STM-4, or STM-16 signal levels on a per VC-4 basis.

**Warning**

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-8 shows the OC48 LR/STM16 LH AS 1550 faceplate and block diagram.

**Figure 4-8 OC48 LR/STM16 LH AS 1550 Faceplate and Block Diagram**



## 4.9.1 OC48 LR/STM16 LH AS 1550 Card Functionality

You can install OC48 LR/STM16 LH AS 1550 cards in Slots 1 to 6 or 12 to 17. You can provision this card as part of a MS-SPRing or SNCP. In an LMSP configuration, you can provision the card as either an access tributary or a transport span interface.

The OC48 LR/STM16 LH AS 1550 port features a 1550-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses SC connectors, and it supports 1+1 unidirectional protection and provisionable bidirectional and unidirectional switching.

The OC48 LR/STM16 LH AS 1550 detects LOS, LOF, LOP, MS-AIS, and MS-FERF conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

## 4.9.2 OC48 LR/STM16 LH AS 1550 Card-Level Indicators

Table 4-10 describes the three card-level LED indicators on the OC48 LR/STM16 LH AS 1550 card.

**Table 4-10** OC48 LR/STM16 LH AS 1550 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green/Amber ACT LED	The green ACT LED indicates that the card is carrying traffic or is traffic-ready. The amber ACT LED indicates that the card is in standby mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.9.3 OC48 LR/STM16 LH AS 1550 Port-Level Indicators

You can find the status of the OC48 LR/STM16 LH AS 1550 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.10 OC48 ELR/STM16 EH 100 GHz Cards



### Note

For specifications, see the [“A.6.9 OC48 ELR/STM16 EH 100 GHz Card Specifications”](#) section on page A-35.

Eighteen distinct STM-16 ITU 100-GHz DWDM cards comprise the ONS 15454 SDH DWDM channel plan. This plan contains every second wavelength in the ITU grid for 100-GHz-spaced DWDM. Though the ONS 15454 SDH only uses 200-GHz spacing, the cards work in 100-GHz-spaced nodes, as well.

Each OC48 ELR/STM16 EH 100 GHz card provides one SDH STM-16 port compliant with ITU-T G.692, ITU-T G.707, ITU-T G.957, and ITU-T G.958. The interface operates at 2.488 Gbps over a single-mode fiber span. Each card supports concatenated or nonconcatenated payloads at STM-1, STM-4, or STM-16 signal levels on a per VC-4 basis.

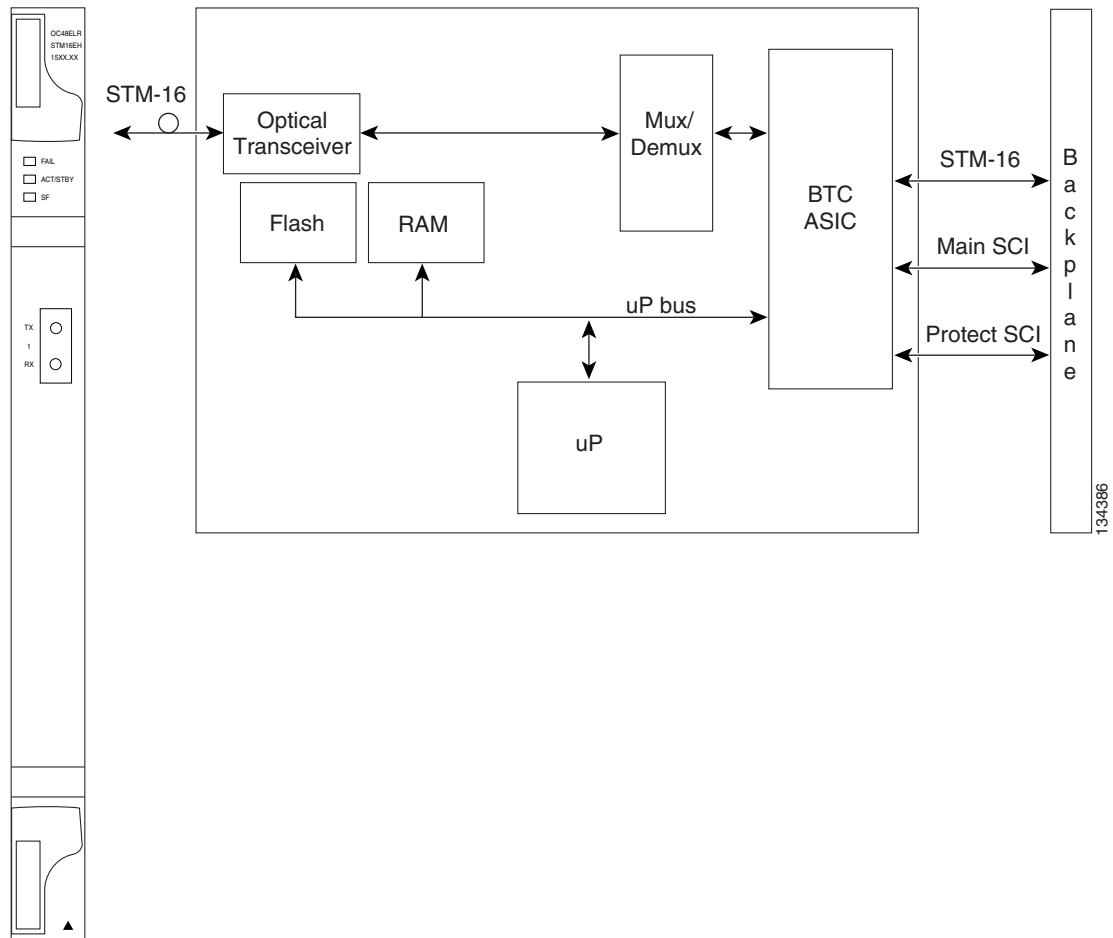


### Warning

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-9 shows the OC48 ELR/STM16 EH 100 GHz faceplate and block diagram.

**Figure 4-9 OC48 ELR/STM16 EH 100 GHz Faceplate and Block Diagram**



### 4.10.1 OC48 ELR/STM16 EH 100 GHz Card Functionality

You can install OC48 ELR/STM16 EH 100 GHz cards in Slot 5, 6, 12, and 13. You can provision this card as part of a MS-SPRing or SNCP. In an ADM/TM configuration, you can provision the card as either an access tributary or a transport span interface.

Nine of the 18 available cards operate in the blue band with a spacing of  $2 * 100$  GHz in the ITU grid (1530.33 nm, 1531.90 nm, 1533.47 nm, 1535.04 nm, 1536.61 nm, 1538.19 nm, 1539.77 nm, 1541.35 nm, and 1542.94 nm). The other nine cards operate in the red band with a spacing of  $2 * 100$  GHz in the ITU grid (1547.72 nm, 1549.32 nm, 1550.92 nm, 1552.52 nm, 1554.13 nm, 1555.75 nm, 1557.36 nm, 1558.98 nm, and 1560.61 nm).

Each OC48 ELR/STM16 EH 100 GHz card uses extended long-reach optics operating individually within the ITU 100-GHz grid. The OC48 ELR/STM16 EH 100 GHz cards are intended to be used in applications with long unregenerated spans of up to 200 km (with mid-span amplification). These

transmission distances are achieved through the use of inexpensive optical amplifiers (flat gain amplifiers) such as erbium-doped fiber amplifiers (EDFAs). Using collocated amplification, distances up to 200 km can be achieved for a single channel (160 km for 8 channels).

Maximum system reach in filterless applications is 24 dB, or approximately 80 km, without the use of optical amplifiers or regenerators. However, system reach also depends on the condition of the facilities, number of splices and connectors, and other performance-affecting factors. The OC48 ELR/STM16 EH 100 GHz cards feature wavelength stability of  $\pm 0.25$  nm. Each port contains a transmitter and a receiver.

The OC48 ELR/STM16 EH 100 GHz cards are the first in a family of cards meant to support extended long-reach applications in conjunction with optical amplification. Using DFB laser technology, the OC48 ELR/STM16 EH 100 GHz cards provide a solution at the lower extended long-reach distances.

The OC48 ELR/STM16 EH 100 GHz port features a 1550-nm range laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses SC connectors and supports 1+1 unidirectional and bidirectional protection switching.

The OC48 ELR/STM16 EH 100 GHz cards detect LOS, LOF, LOP, MS-AIS, and MS-FERF conditions. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The cards also count section and line BIP errors.

To enable an MS-SPRing, the OC48 ELR/STM16 EH 100 GHz cards extract the K1 and K2 bytes from the SDH overhead. The GCC bytes are forwarded to the TCC2/TCC2P card; the TCC2/TCC2P terminates the GCC.

## 4.10.2 OC48 ELR/STM16 EH 100 GHz Card-Level Indicators

Table 4-11 describes the three card-level LED indicators on the OC48 ELR/STM16 EH 100 GHz cards.

**Table 4-11** OC48 ELR Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card processor is not ready. The FAIL LED is on during reset and flashes during the boot process. Replace the card if the red FAIL LED persists.
Green/Amber ACT LED	The green ACT LED indicates that the card is carrying traffic or is traffic-ready. The amber ACT LED indicates that the card is in standby mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.10.3 OC48 ELR/STM16 EH 100 GHz Port-Level Indicators

You can find the status of the OC48 ELR/STM16 EH 100 GHz card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.11 OC192 SR/STM64 IO 1310 Card


**Note**

For specifications, see the “[A.6.10 OC192 SR/STM64 IO 1310 Card Specifications](#)” section on page A-36.

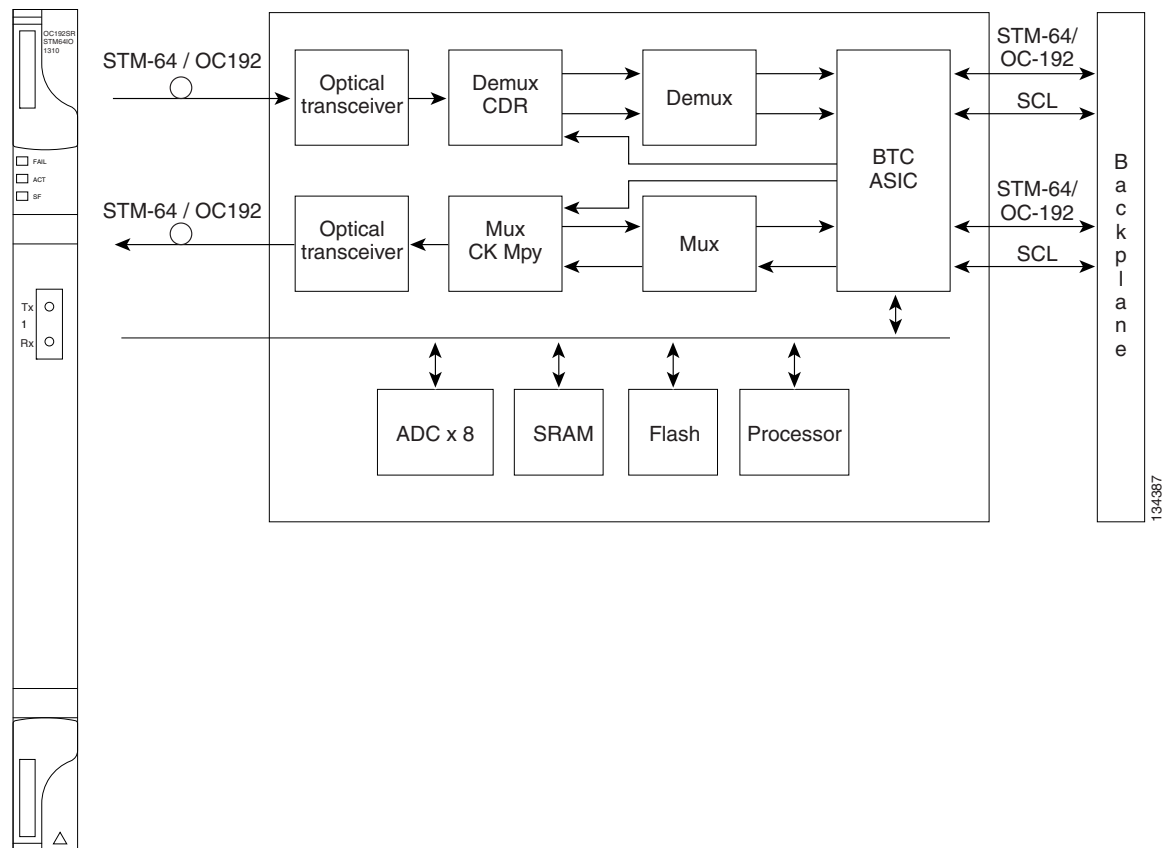
The OC192 SR/STM64 IO 1310 card provides one intra-office haul, ITU-T G.707- and G.957-compliant, SDH STM-64 port per card in the 1310-nm wavelength range. The port operates at 9.95328 Gbps over unamplified distances up to 2 km (1.24 miles). The card supports concatenated or nonconcatenated payloads on a VC-4 basis, as well as VC-4, VC-3, and VC-12 payloads.


**Warning**

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-10 shows the OC192 SR/STM64 IO 1310 faceplate and block diagram.

**Figure 4-10** OC192 SR/STM64 IO 1310 Faceplate and Block Diagram





## 4.11.1 OC192 SR/STM64 IO 1310 Card Functionality

You can install OC192 SR/STM64 IO 1310 cards in Slot 5, 6, 12, or 13. You can provision this card as part of an MS-SPRing, a SNCP, a linear configuration, or a regenerator for longer span reaches.

The OC192 SR/STM64 IO 1310 port features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses a dual SC connector for optical cable termination. The card supports 1+1 unidirectional and bidirectional facility protection. It also supports both span and ring switching in MS-SPRing protection scheme.

The OC192 SR/STM64 IO 1310 card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors from B1 and B2 byte registers in the section and line overhead.

## 4.11.2 OC192 SR/STM64 IO 1310 Card-Level Indicators

Table 4-12 describes the three card-level LED indicators on the OC192 SR/STM64 IO 1310 card.

**Table 4-12** OC192 SR/STM64 IO 1310 Card-Level Indicators

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

## 4.11.3 OC192 SR/STM64 IO 1310 Port-Level Indicators

You can find the status of the OC192 SR/STM64 IO 1310 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.12 OC192 IR/STM64 SH 1550 Card



### Note

For specifications, see the [“A.6.11 OC192 IR/STM64 SH 1550 Card Specifications”](#) section on [page A-37](#).

The OC192 IR/STM64 SH 1550 card provides one short-range, ITU-T G.707- and G.957-compliant, SDH STM-64 port per card. The port operates at 9.95328 Gbps over unamplified distances up to 40 km with SMF-28 fiber limited by loss and/or dispersion. The card supports concatenated or nonconcatenated payloads on a VC-4 basis, as well as VC-4, VC-3, and VC-12 payloads.

**Caution**

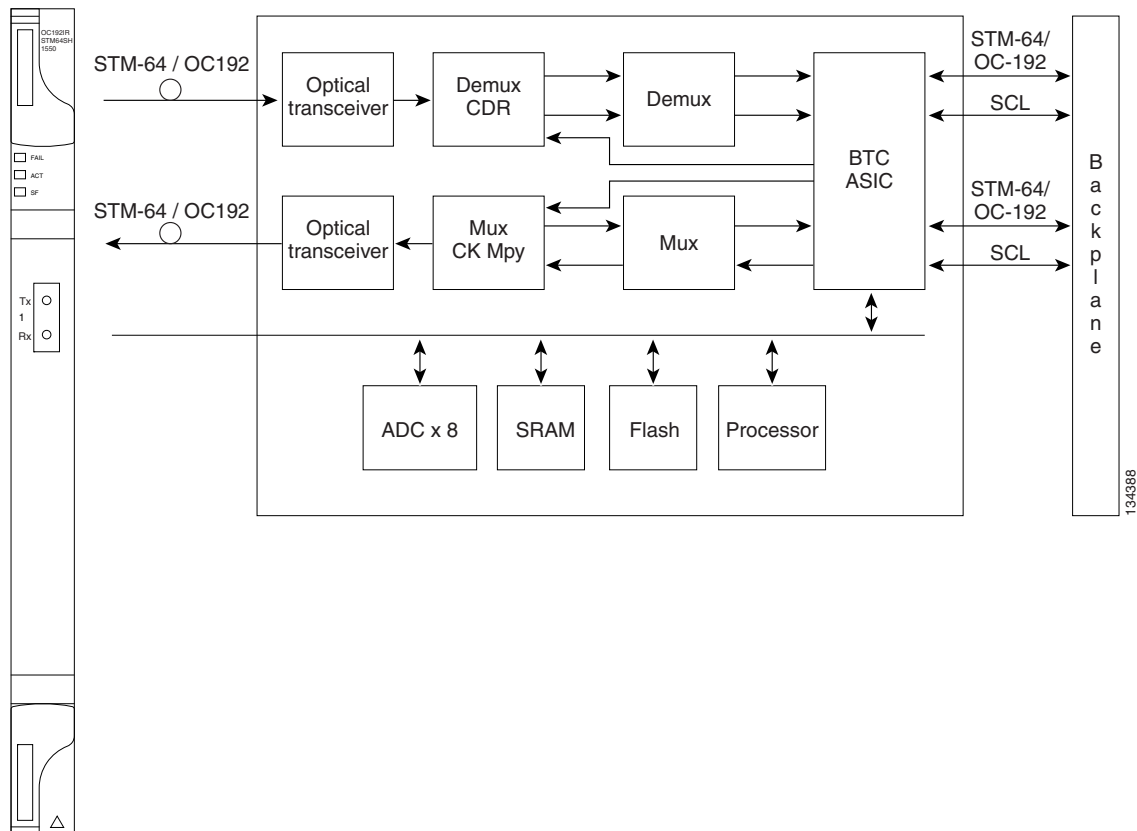
You must use a 3 to 15 dB fiber attenuator (5 dB recommended) when working with the OC192 IR/STM64 SH 1550 card in a loopback. Do not use fiber loopbacks with the OC192 IR/STM64 SH 1550 card. Using fiber loopbacks can cause irreparable damage to the OC192 IR/STM64 SH 1550 card.

**Warning**

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-11 shows the OC192 IR/STM64 SH 1550 faceplate and block diagram.

**Figure 4-11 OC192 IR/STM64 SH 1550 Faceplate and Block Diagram**



## 4.12.1 OC192 IR/STM64 SH 1550 Card Functionality

You can install OC192 IR/STM64 SH 1550 cards in Slot 5, 6, 12, or 13. You can provision this card as part of an MS-SPRing, SNCP, or linear configuration, or as a regenerator for longer span reaches.

The OC192 IR/STM64 SH 1550 port features a 1550-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses a dual SC connector for optical cable termination. The card supports 1+1 unidirectional and bidirectional facility protection. It also supports 1:1 protection in four-fiber bidirectional line switched ring applications where both span switching and ring switching might occur.

The OC192 IR/STM64 SH 1550 card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors from B1 and B2 byte registers in the section and line overhead.

## 4.12.2 OC192 IR/STM64 SH 1550 Card-Level Indicators

Table 4-13 describes the three card-level LED indicators on the OC192 IR/STM64 SH 1550 card.

**Table 4-13** OC192 IR/STM64 SH 1550 Card-Level Indicators

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

## 4.12.3 OC192 IR/STM64 SH 1550 Port-Level Indicators

You can find the status of the OC192 IR/STM64 SH 1550 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.13 OC192 LR/STM64 LH 1550 Card



**Note**

For specifications, see the “[A.6.12 OC192 LR/STM64 LH 1550 Card Specifications](#)” section on [page A-38](#).



**Note**

Any new features that are available as part of this software release are not enabled for this card.

The OC192 LR/STM64 LH 1550 card provides one long-range SDH STM-64 port per card, compliant with ITU-T G.707 and G.957, and Telcordia GR-253-CORE (except minimum and maximum transmit power, and minimum receive power). Also, the port is compliant to ITU-T G.691 (prepublished unedited version 10/2000) L-64.2, except for optical output power and receiver sensitivity.

**Note**

The optical output power of the OC192 LR/STM64 LH 1550 (+4 dBm to +7 dBm) is 6 dB lower than in L-64.2b of the 10/2000 prepublished unedited version of ITU-T G.691 (+10 dBm to +13 dBm). However, the total attenuation range of the optical path, 22 to 16 dB, is maintained by the optical receiver sensitivity range of the OC192 LR/STM64 LH 1550 (-7 dBm to -24 dBm). This sensitivity range outperforms the specification in L-64.2b of the 10/2000 prepublished unedited version of ITU-T G.691 as the resulting link budget of the card is 26 dBm.

The port operates at 9.95328 Gbps over unamplified distances up to 80 km with different types of fiber such as C-SMF or dispersion compensated fiber limited by loss and/or dispersion. The card supports concatenated or nonconcatenated payloads on a VC-4 basis, as well as VC-4, VC-3, and VC-12 payloads.

Figure 4-12 shows the OC192 LR/STM64 LH 1550 faceplate and a block diagram of the card. Figure 4-13 on page 4-30 shows an enlarged view of the faceplate warning.

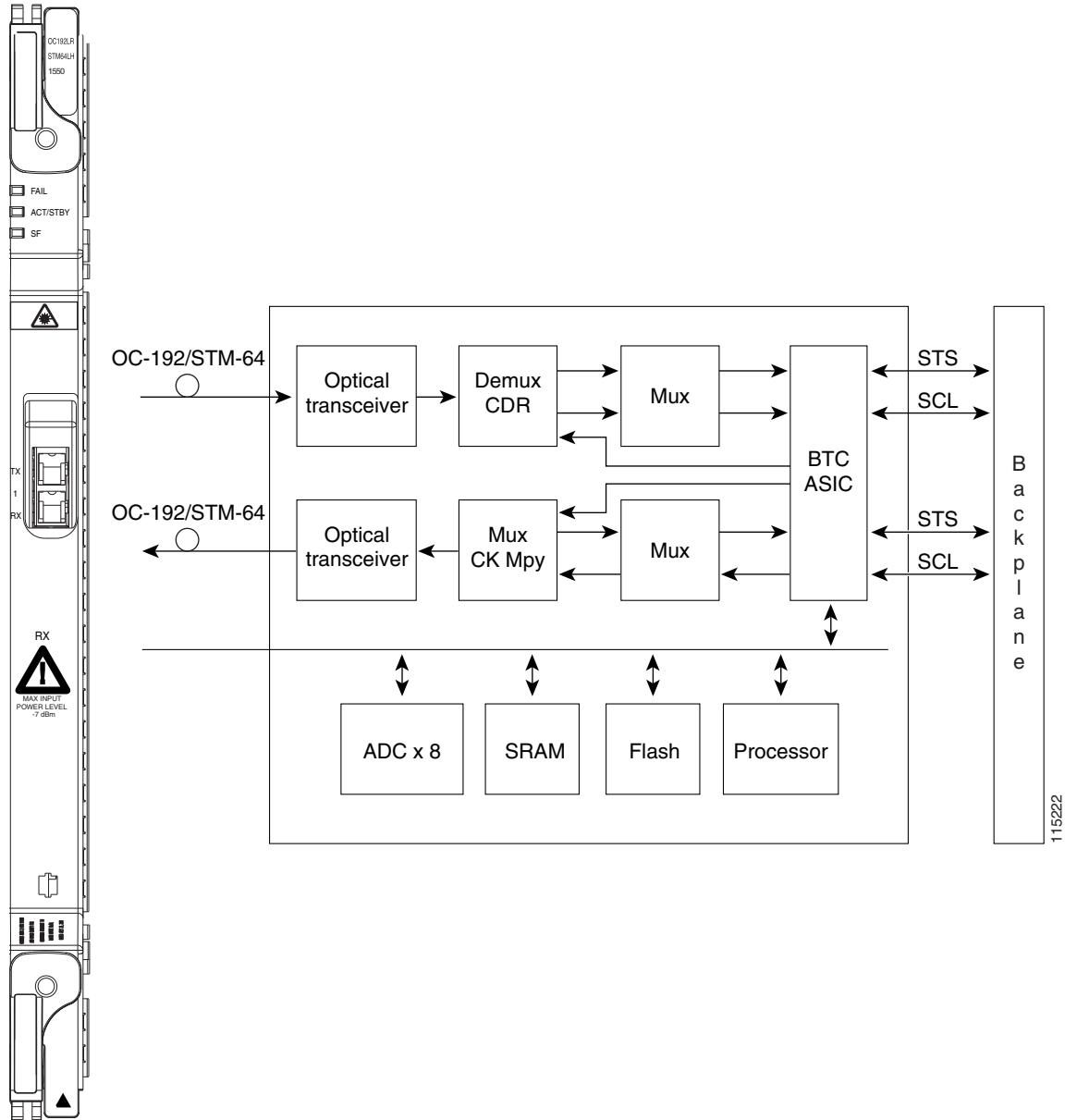
**Note**

You can differentiate this OC-192/STM-64 card (15454E-L64.2-1) from the OC-192/STM-64 card with the product ID 15454-OC192LR1550 by looking at the faceplate. This card does not have a laser on/off switch.

**Warning**

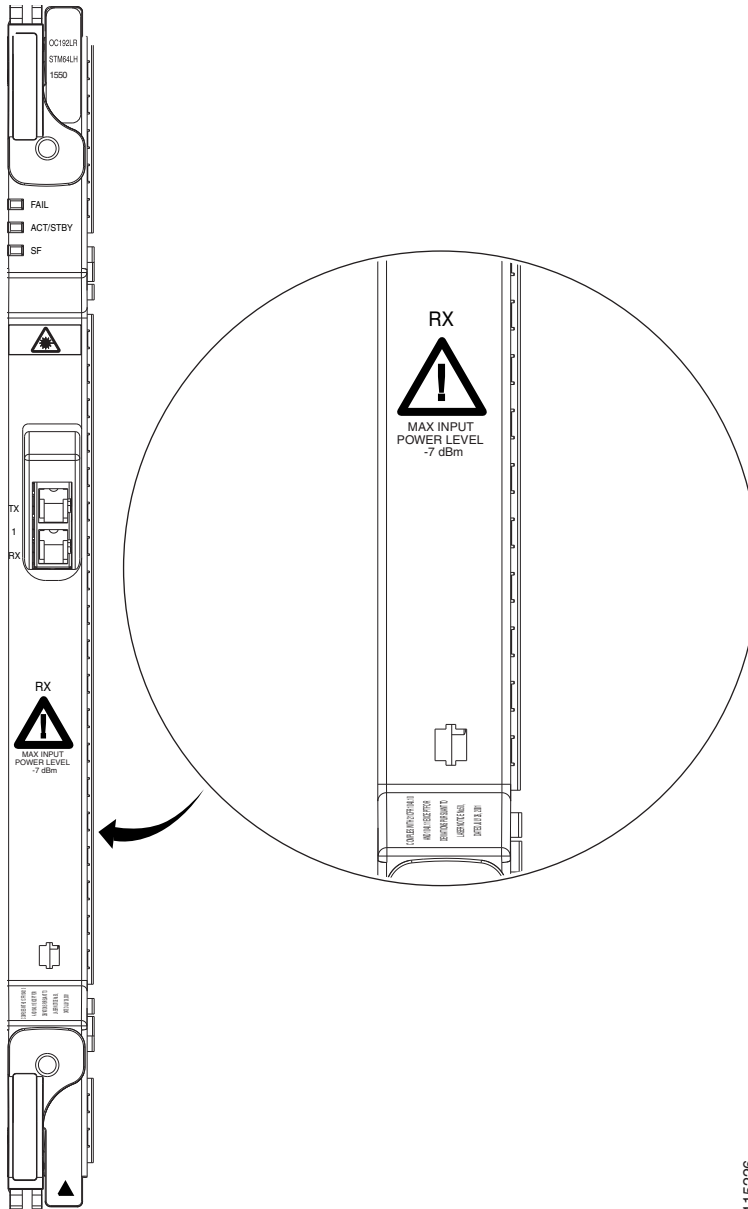
**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

Figure 4-12 OC192 LR/STM64 LH 1550 Faceplate and Block Diagram



115222

**Figure 4-13** Enlarged Section of the OC192 LR/STM64 LH 1550 Faceplate



### 4.13.1 OC192 LR/STM64 LH 1550 Card Functionality

You can install OC192 LR/STM64 LH 1550 cards in Slot 5, 6, 12, or 13. You can provision this card as part of an MS-SPRing, SNCP, or linear configuration, or also as a regenerator for longer span reaches.

The OC192 LR/STM64 LH 1550 port features a 1550-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses a dual SC connector for optical cable termination. The card supports 1+1 unidirectional and bidirectional facility protection. It also supports 1:1 protection in four-fiber bidirectional line switched ring applications where both span switching and ring switching might occur.

The OC192 LR/STM64 LH 1550 card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors from B1 and B2 byte registers in the section and line overhead.

**Caution**

You must use a 20-dB fiber attenuator (19 to 24 dB) when working with the OC192 LR/STM64 LH 1550 card in a loopback. Do not use fiber loopbacks with the OC192 LR/STM64 LH 1550 card. Using fiber loopbacks causes irreparable damage to the OC192 LR/STM64 LH 1550 card.

## 4.13.2 OC192 LR/STM64 LH 1550 Card-Level Indicators

Table 4-14 describes the three card-level LED indicators on the OC192 LR/STM64 LH 1550 card.

**Table 4-14** OC192 LR/STM64 LH 1550 Card-Level Indicators

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

## 4.13.3 OC192 LR/STM64 LH 1550 Port-Level Indicators

You can find the status of the OC192 LR/STM64 LH 1550 card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.14 OC192 LR/STM64 LH ITU 15xx.xx Card

**Note**

For specifications, see the [“A.6.13 OC192 LR/STM64 LH ITU 15xx.xx Card Specifications”](#) section on page A-39.

Sixteen distinct STM-64 ITU 100 GHz DWDM cards comprise the ONS 15454 SDH DWDM channel plan. The OC192 LR/STM64 LH ITU 15xx.xx card provides one long-range SDH STM-64 port per card, compliant with ITU-T G.707 and G.957, and Telcordia GR-253-CORE (except minimum and maximum transmit power, and minimum receive power). The port operates at 9.95328 Gbps over unamplified distances up to 60 km with different types of fiber such as C-SMF or dispersion compensated fiber limited by loss and/or dispersion.

**Note**

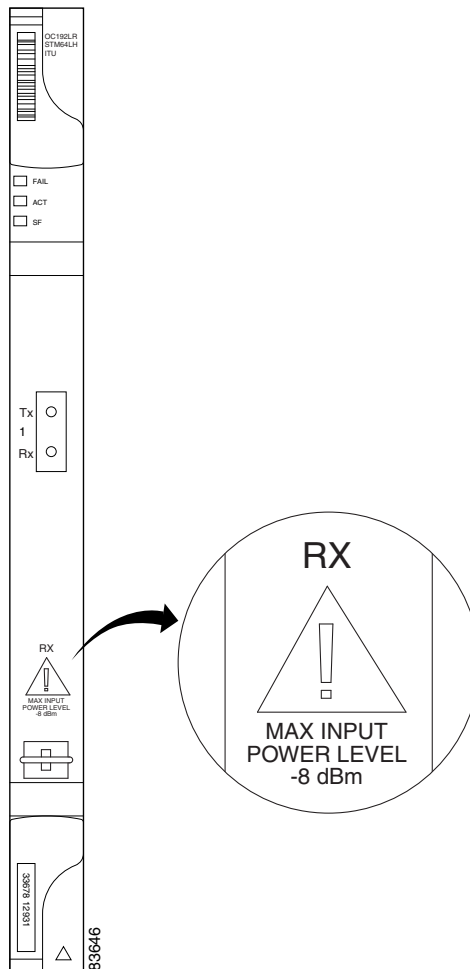
Longer distances are possible in an amplified system using dispersion compensation.

**Warning**

**The laser is on when the optical card is booted. The port does not have to be in service for the laser to be on.** Statement 293

The card supports concatenated or nonconcatenated payloads on a VC-4 basis, as well as VC-4, VC-3, and VC-12 payloads. [Figure 4-14](#) shows the OC192 LR/STM64 LH ITU 15xx.xx faceplate.

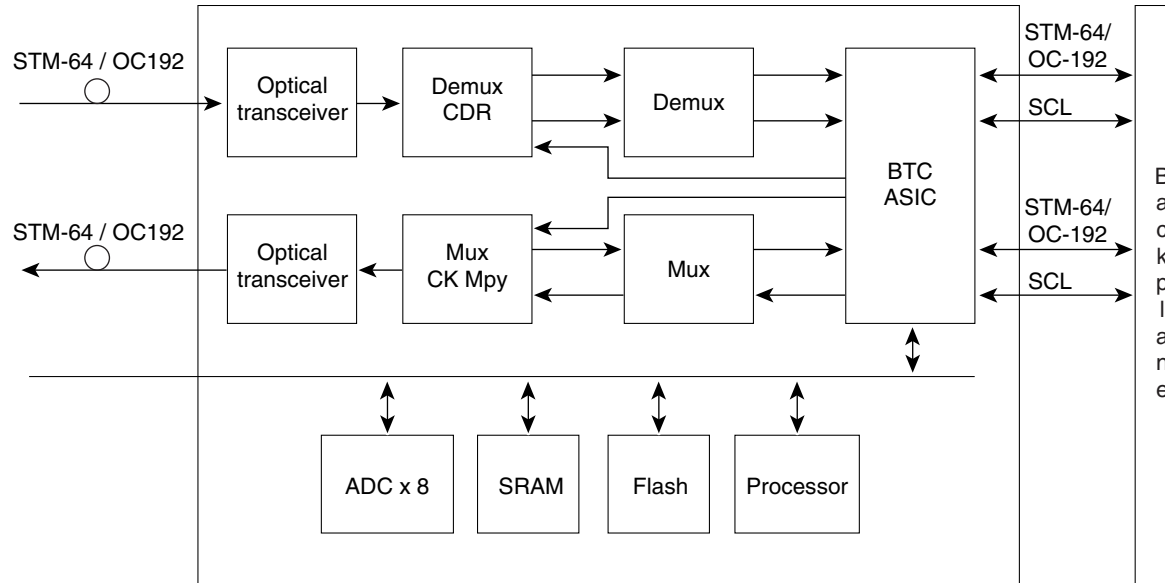
**Figure 4-14** OC192 LR/STM64 LH ITU 15xx.xx Faceplate



[Figure 4-15 on page 4-33](#) shows a block diagram of the card.



Figure 4-15 OC192 LR/STM64 LH ITU 15xx.xx Block Diagram



### 4.14.1 OC192 LR/STM64 LH ITU 15xx.xx Card Functionality

You can install OC192 LR/STM64 LH ITU 15xx.xx cards in Slot 5, 6, 12, or 13. You can provision this card as part of an MS-SPRing, SNCP, or linear configuration, or as a regenerator for longer span reaches.

Eight of the available 16 OC192 LR/STM64 LH ITU 15xx.xx cards operate in the blue band with a spacing of 100 GHz in the ITU grid (1534.25 nm, 1535.04 nm, 1535.82 nm, 1536.61 nm, 1538.19 nm, 1538.98 nm, 1539.77 nm, and 1540.56 nm). The other eight cards operate in the red band with a spacing of 100 GHz in the ITU grid (1550.12 nm, 1550.92 nm, 1551.72 nm, 1552.52 nm, 1554.13 nm, 1554.94 nm, 1555.75 nm, and 1556.55 nm).

The OC192 LR/STM64 LH ITU 15xx.xx port features a laser on a specific wavelength in the 1550-nm range and contains a transmit and receive connector (labeled) on the card faceplate. The card uses a dual SC connector for optical cable termination. The card supports 1+1 unidirectional and bidirectional facility protection. It also supports both span and ring switching in MS-SPRing protection scheme.

The OC192 LR/STM64 LH ITU 15xx.xx card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors from B1 and B2 byte registers in the section and line overhead.

## 4.14.2 OC192 LR/STM64 LH ITU 15xx.xx Card-Level Indicators

Table 4-15 describes the three card-level LED indicators on the OC192 LR/STM64 LH ITU 15xx.xx card.

**Table 4-15** OC192 LR/STM64 LH ITU 15xx.xx Card-Level Indicators

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

## 4.14.3 OC192 LR/STM64 LH ITU 15xx.xx Port-Level Indicators

You can find the status of the OC192 LR/STM64 LH ITU 15xx.xx card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.15 15454\_MRC-12 Multirate Card



### Note

For specifications, see the [“A.6.14 15454\\_MRC-12 Card Specifications”](#) section on page A-41.

The 15454\_MRC-12 multirate card provides up to twelve OC-3/STM-1 ports, twelve OC-12/STM-4 ports, or four OC-48/STM-16 ports using Small Form-factor Pluggables (SFPs), in any combination of line rates. All ports are Telcordia GR-253 compliant. The SFP optics can use SR, IR, LR, coarse wavelength division multiplexing (CWDM), and DWDM SFPs to support unrepeated spans. See the [“4.18 Optical Card SFPs and XFPs”](#) section on page 4-44 for more information about SFPs.

The ports operate at up to 2488.320 Mbps over a single-mode fiber. The 15454\_MRC-12 card has twelve physical connector adapters with two fibers per connector adapter (Tx and Rx). The card supports VT payloads, VC4 payloads, and concatenated payloads at VC4-1c, VC4-2c, VC4-3c, VC4-4c, VC4-8c, or VC4-16c signal levels. It is fully interoperable with the ONS 15454 SDH G-Series Ethernet cards.

Each 15454\_MRC-12 port contains a transmit and receive connector (labeled) on the card faceplate. The card supports unidirectional and bidirectional facility protection. It also supports both span and ring switching in MS-SPRing protection scheme. You can provision this card as part of an MS-SPRing, SNCP, or linear configuration.



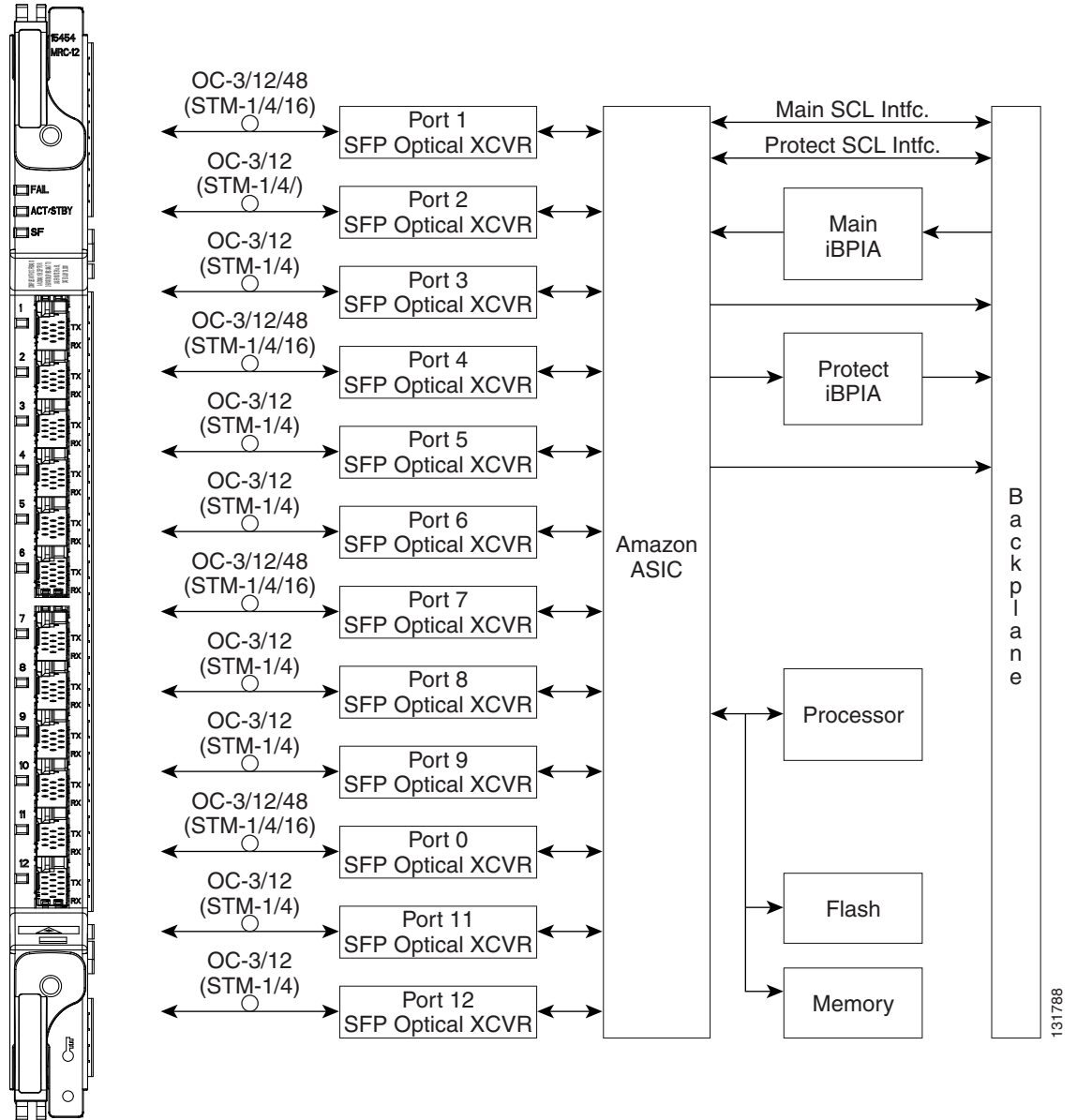
**Note** Longer distances are possible in an amplified system using dispersion compensation.



**Note** Refer to [Table 4-2 on page 4-4](#) for information on optical card compatibility.

Figure 4-16 shows the 15454\_MRC-12 faceplate and block diagram.

**Figure 4-16 15454\_MRC-12 Card Faceplate and Block Diagram**



## 4.15.1 Slot Compatibility by Cross-Connect Card

You can install 15454\_MRC-12 cards in Slots 1 through 6 and 12 through 17 with XC-VXL-2.5G, XC-VXL-10G, or XC-VXC-10G cards.



### Note

The 15454\_MRC-12 card supports an errorless software-initiated cross-connect card switch when used in a shelf equipped with XC-VXC-10G and TCC2/TCC2P cards.

The maximum bandwidth of the 15454\_MRC-12 card is determined by the cross-connect card, as shown in [Table 4-16](#).

**Table 4-16** Maximum Bandwidth by Shelf Slot for the 15454\_MRC-12 in Different Cross-Connect Configurations

XC Card Type	Maximum Bandwidth in Slots 1 through 4 and 12 through 17	Maximum Bandwidth in Slots 5, 6, 12, or 13
XC-VXL-2.5G	STM-16	STM-16
XC-VXC-10G/XC-VXL-10G	STM-16	STM-64

## 4.15.2 Ports and Line Rates

Each port on the 15454\_MRC-12 card can be configured as OC-3/STM-1, OC-12/STM-4, or OC-48/STM-16, depending on the available bandwidth and existing provisioned ports. Based on the cross-connect card and slot limitations shown in [Table 4-16](#), the following rules apply for various synchronous transport signal (STS) available bandwidths. ([Table 4-17](#) shows the same information in tabular format.)

- VC4-4
  - Port 1 is the only port that is usable as an STM-4. If Port 1 is used as an STM-4, all other ports are disabled.
  - Ports 1, 4, 7, and 10 are the only ports usable as STM-1. If any of these ports is used as an STM-1, Ports 2, 3, 5, 6, 8, 9, 11, and 12 are disabled.
- VC4-16
  - Port 1 is the only port usable as an STM-16. If Port 1 is used as an STM-16, all other ports are disabled.
  - Ports 1, 4, 7, and 10 are the only ports usable as STM-4.
  - If Port 4 is used as an STM-4, Ports 2 and 3 are disabled.
  - If Port 7 is used as an STM-4, Ports 5, 6, and 8 are disabled.
  - If Port 10 is used as an STM-4, Ports 9, 11, and 12 are disabled.
  - Any port can be used as an STM-1 as long as all of the above rules are followed.
- VC4-64
  - Ports 1, 4, 7, and 10 are the only ports usable as STM-16.
  - If Port 4 is used as an STM-16, Ports 2 and 3 are disabled.
  - If Port 7 is used as an STM-16, Ports 5, 6, and 8 are disabled.

- If Port 10 is used as an STM-16, Ports 9, 11, and 12 are disabled.
- If Port 4 is used as an STM-4, Ports 2 and 3 can be used as an STM-4 or STM-1.
- If Port 7 is used as an STM-4, Ports 5, 6, and 8 can be used as an STM-4 or STM-1.
- If Port 10 is used as an STM-4, Ports 9, 11, and 12 can be used as an STM-4 or STM-1.
- If Port 4 is used as an STM-1, Ports 2 and 3 can be used as an STM-1 or STM-4.
- If Port 7 is used as an STM-1, Ports 5, 6, and 8 can be used as an STM-1 or STM-4.
- If Port 10 is used as an STM-1, Ports 9, 11, and 12 can be used as an STM-1 or STM-4.
- Any port can be used as an STM-4 or STM-1, as long as all of the above rules are followed.

Table 4-17 shows the 15454\_MRC-12 port availability and line rate for each port, based on total available bandwidth. To use the table, go to the rows for the bandwidth that you have available, as determined in Table 4-16. Each row indicates what line rate can be provisioned for each port (identified in the MCR-12 Port Number row). The Ports Used column shows the total number of ports that can be used with each bandwidth scheme.

**Table 4-17** Line Rate Configurations Per 15454\_MRC-12 Port, Based on Available Bandwidth

MRC-12 Port Number	1	2	3	4	5	6	7	8	9	10	11	12	Ports Used	Total VC4s
Permitted Rate(s)	STM-1 STM-4 STM-16	STM-1 STM-4	STM-1 STM-4	STM-1 STM-4 STM-16	STM-1 STM-4	STM-1 STM-4	STM-1 STM-4 STM-16	STM-1 STM-4	STM-1 STM-4	STM-1 STM-4 STM-16	STM-1 STM-4	STM-1 STM-4	—	—
STM-4 Available Bandwidth	4	—	—	—	—	—	—	—	—	—	—	—	1	4
	1	—	—	1	—	—	1	—	—	1	—	—	4	4
STM-16 Available Bandwidth	1	1	1	1	1	1	1	1	1	1	1	1	4	12
	1	—	—	4	1	1	1	1	1	1	1	1	10	13
	1	—	—	4	—	—	4	—	1	1	1	1	7	13
	1	—	—	4	—	—	4	—	—	4	—	—	4	13
	4	1	1	1	1	1	1	1	1	1	1	1	12	15
	4	—	—	4	1	1	1	1	1	1	1	1	10	16
	4	—	—	4	—	—	4	—	1	1	1	1	7	16
	4	—	—	4	—	—	4	—	—	4	—	—	4	16
	4	1	1	1	—	—	4	—	1	1	1	1	9	15
	4	1	1	1	1	1	1	1	1	—	4	—	9	15
	1	1	1	1	1	1	1	1	1	—	4	—	9	12
	1	1	1	1	—	—	4	—	—	4	—	—	6	12
	16	—	—	—	—	—	—	—	—	—	—	—	—	1
16	1	1	—	4	4	4	4	4	1	1	1	1	11	38

**Table 4-17** Line Rate Configurations Per 15454\_MRC-12 Port, Based on Available Bandwidth (continued)

MRC-12 Port Number	1	2	3	4	5	6	7	8	9	10	11	12	Ports Used	Total VC4s	
STM-64 Available Bandwidth (when installing additional SFPs from the top port to the bottom port) <sup>1</sup>	16	1	1	1	1	1	1	1	1	1	1	1	12	27	
	16	12	12	12	1	1	1	1	1	1	1	1	12	36	
	16	12	12	12	12	12	12	12	1	1	1	1	12	48	
	16	12	12	12	12	12	12	12	12	12	12	12	12	12	60
	16	1	1	1	12	12	12	12	12	12	12	12	12	12	51
	16	1	1	1	1	1	1	1	1	12	12	12	12	12	39
	16	—	—	16	1	1	1	1	1	1	1	1	1	10	40
	16	—	—	16	12	12	12	12	1	1	1	1	1	10	52
	16	—	—	16	12	12	12	12	12	12	12	12	12	10	64
	16	—	—	16	—	—	16	—	1	1	1	1	1	7	52
	16	—	—	16	—	—	16	—	12	12	12	12	12	7	64
16	—	—	16	—	—	16	—	—	16	—	—	—	4	64	
STM-64 Available Bandwidth (when installing additional SFPs from the bottom port to the top port) <sup>1</sup>	1	1	1	1	1	1	1	1	—	16	—	—	9	24	
	1	1	1	1	12	12	12	12	—	16	—	—	9	36	
	1	12	12	12	12	12	12	12	—	16	—	—	9	45	
	12	12	12	12	12	12	12	12	—	16	—	—	9	48	
	12	12	12	12	1	1	1	1	—	16	—	—	9	36	
	12	1	1	1	1	1	1	1	—	16	—	—	9	27	
	1	1	1	1	—	—	16	—	—	16	—	—	6	36	
	1	12	12	12	—	—	16	—	—	16	—	—	6	45	
	12	12	12	12	—	—	16	—	—	16	—	—	6	48	
	12	1	1	1	—	—	16	—	—	16	—	—	6	39	
	1	—	—	16	—	—	16	—	—	16	—	—	4	49	
12	—	—	16	—	—	16	—	—	16	—	—	4	52		

1. If the MRC-12 card is initially populated with STM-1/STM-4 on all its 12 ports, you can later add STM-16 SFPs on that card from top port to bottom port or from bottom port to top port. The maximum available bandwidth usage is different for these two cases.

### 4.15.3 15454\_MRC-12 Card-Level Indicators

Table 4-18 describes the three card-level LEDs on the 15454\_MRC-12 card.

**Table 4-18 15454\_MRC-12 Card-Level Indicators**

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card 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)	If the ACT/STBY LED is green, the card is operational and ready to carry traffic. If the ACT/STBY LED is amber, the card is operational and in standby (protect) mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.15.4 15454\_MRC-12 Port-Level Indicators

Each port has an Rx indicator. The LED flashes green if the port is receiving a signal, and it flashes red if the port is not receiving a signal.

You can also find the status of the 15454\_MRC-12 card ports by using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.16 MRC-2.5G-12 Multirate Card



### Note

For specifications, see the [“A.6.14 15454\\_MRC-12 Card Specifications” section on page A-41](#).

The MRC-2.5G-12 multirate card provides up to twelve OC-3/STM-1 ports, four OC-12/STM-4 ports, or one OC-48/STM-16 ports using Small Form-factor Pluggables (SFPs), with total card bandwidth not exceeding OC-48/STM-16. Mixed OC-3 and OC-12 configurations are supported. OC-12/STM-4 SFPs can only be installed in Ports 1, 4, 7, and 10, and an OC-48/STM-16 SFP can only be installed in Port 1. All ports are Telcordia GR-253 compliant. The SFP optics can use SR, IR, LR, coarse wavelength division multiplexing (CWDM), and DWDM SFPs to support unrepeated spans. See the [“4.18 Optical Card SFPs and XFPs” section on page 4-44](#) for more information about SFPs.

The ports operate at up to 2488.320 Mbps over a single-mode fiber. The MRC-2.5G-12 card has twelve physical connector adapters with two fibers per connector adapter (Tx and Rx). The card supports VT payloads, VC4 payloads, and concatenated payloads at VC4-1c, VC4-2c, VC4-3c, VC4-4c, VC4-8c, VC4-12c, or VC4-16c signal levels. It is fully interoperable with the ONS 15454 SDH G-Series Ethernet cards.

Each port contains a transmit and receive connector (labeled) on the card faceplate. The card supports unidirectional and bidirectional facility protection. It also supports both span and ring switching in MS-SPRing protection scheme. You can provision this card as part of an MS-SPRing, SNCP, or linear configuration.



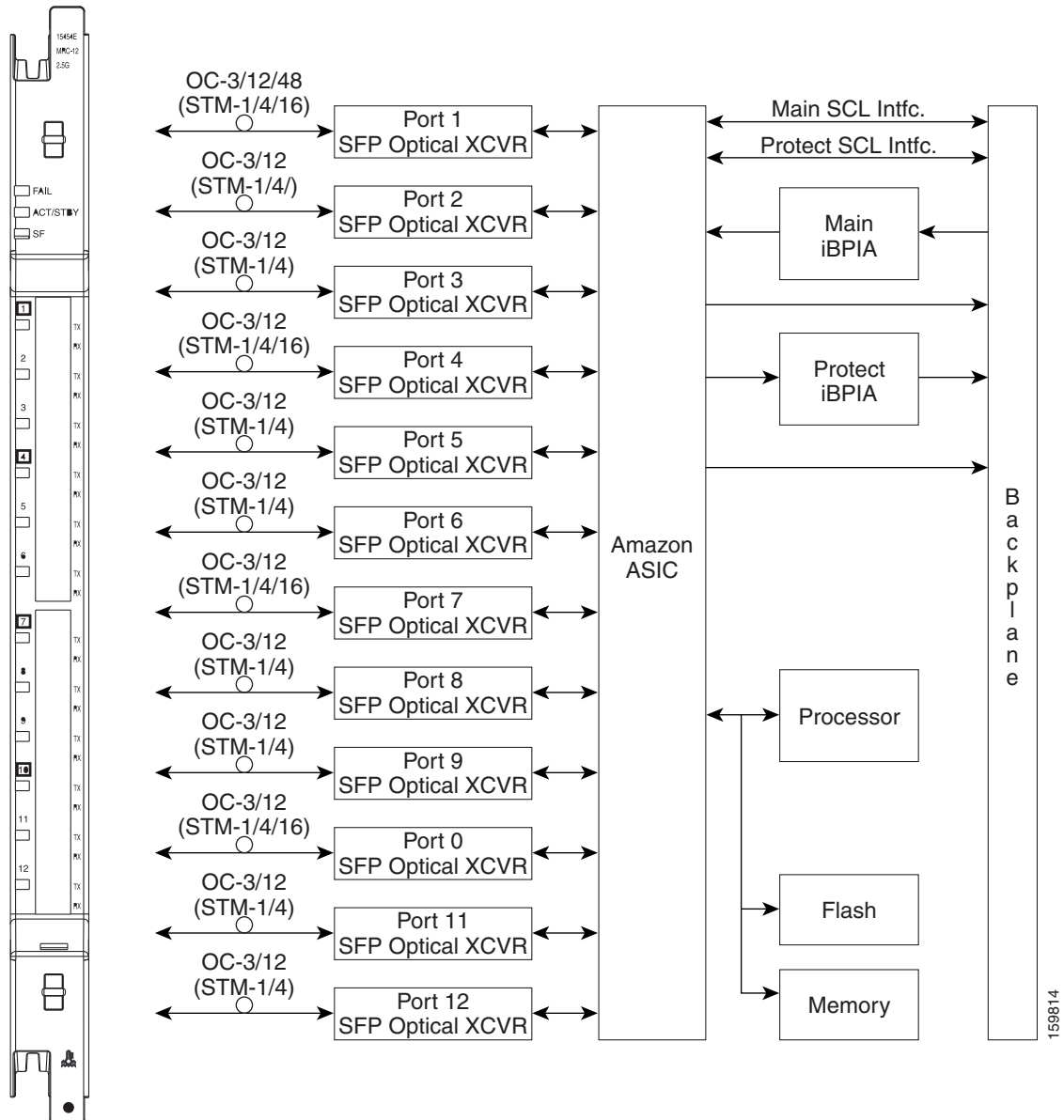
**Note** Longer distances are possible in an amplified system using dispersion compensation.



**Note** Refer to [Table 4-2 on page 4-4](#) for information on optical card compatibility.

Figure 4-17 shows the MRC-2.5G-12 faceplate and block diagram.

**Figure 4-17 MRC-2.5G-12 Card Faceplate and Block Diagram**





## 4.16.1 Slot Compatibility by Cross-Connect Card

You can install MRC-2.5G-12 cards in Slots 1 through 6 and 12 through 17 with XC10G, XC-VXL-2.5G, XC-VXL-10G, or XC-VXC-10G cards, with a maximum total bandwidth of STM-16.



**Note**

The MRC-2.5G-12 card supports an errorless software-initiated cross-connect card switch when used in a shelf equipped with XC-VXC-10G and TCC2/TCC2P cards.

## 4.16.2 Ports and Line Rates

Total MRC-2.5G-12 card bandwidth cannot exceed OC-48/STM-16, so there are some limitations on which SFP ports can be used as OC-3/STM-1, OC-12/STM-4, and OC-48/STM-16.

The following rules apply for port bandwidth allocation:

- Port 1 is the only port that is usable as an STM-16. If Port 1 is used as an STM-16, all other ports are disabled.
- Ports 1, 4, 7, and 10 are the only ports usable as STM-4.

All twelve ports are divided into the following four groups:

- Port Group 1: Port 1 only
- Port Group 2: Ports 2, 3, and 4
- Port Group 3: Ports 5, 6, 7 and 8
- Port Group 4: Ports 9, 10, 11 and 12

Each port group has a master port, which may take the whole bandwidth allocated to its group, and there are zero to 3 slave ports whose bandwidth cannot exceed that of the master port. Ports 1, 4, 7 and 10 are the master ports in their port group and all the other ports are slave ports.



**Note**

Mixed OC-3 and OC-12 configurations are supported within Port Groups 2 through 4. All possible permutations are not covered in this reference section.

## 4.16.3 MRC-2.5G-12 Card-Level Indicators

[Table 4-19](#) describes the three card-level LEDs on the MRC-2.5G-12 card.

**Table 4-19** MRC-2.5G-12 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card 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.

**Table 4-19 MRC-2.5G-12 Card-Level Indicators (continued)**

Card-Level LED	Description
ACT/STBY LED Green (Active) Amber (Standby)	If the ACT/STBY LED is green, the card is operational and ready to carry traffic. If the ACT/STBY LED is amber, the card is operational and in standby (protect) mode or is part of an active ring switch (MS-SPRing).
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more card ports. The amber SF LED is also on if the transmit and receive fibers are incorrectly connected. If the fibers are properly connected and the link is working, the light turns off.

## 4.16.4 MRC-2.5G-12Port-Level Indicators

Each port has an Rx indicator. The LED flashes green if the port is receiving a signal, and it flashes red if the port is not receiving a signal.

You can also find the status of the MRC-2.5G-12 card ports by using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for a complete description of the alarm messages.

## 4.17 OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach Cards



### Note

For specifications, see the [“A.6.16 OC192SR1/STM64IO Short Reach Card Specifications”](#) section on page A-43.

The OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach cards (also known in CTC as STM64-XFP) each provide a single OC-192/STM-64 interface, as follows:

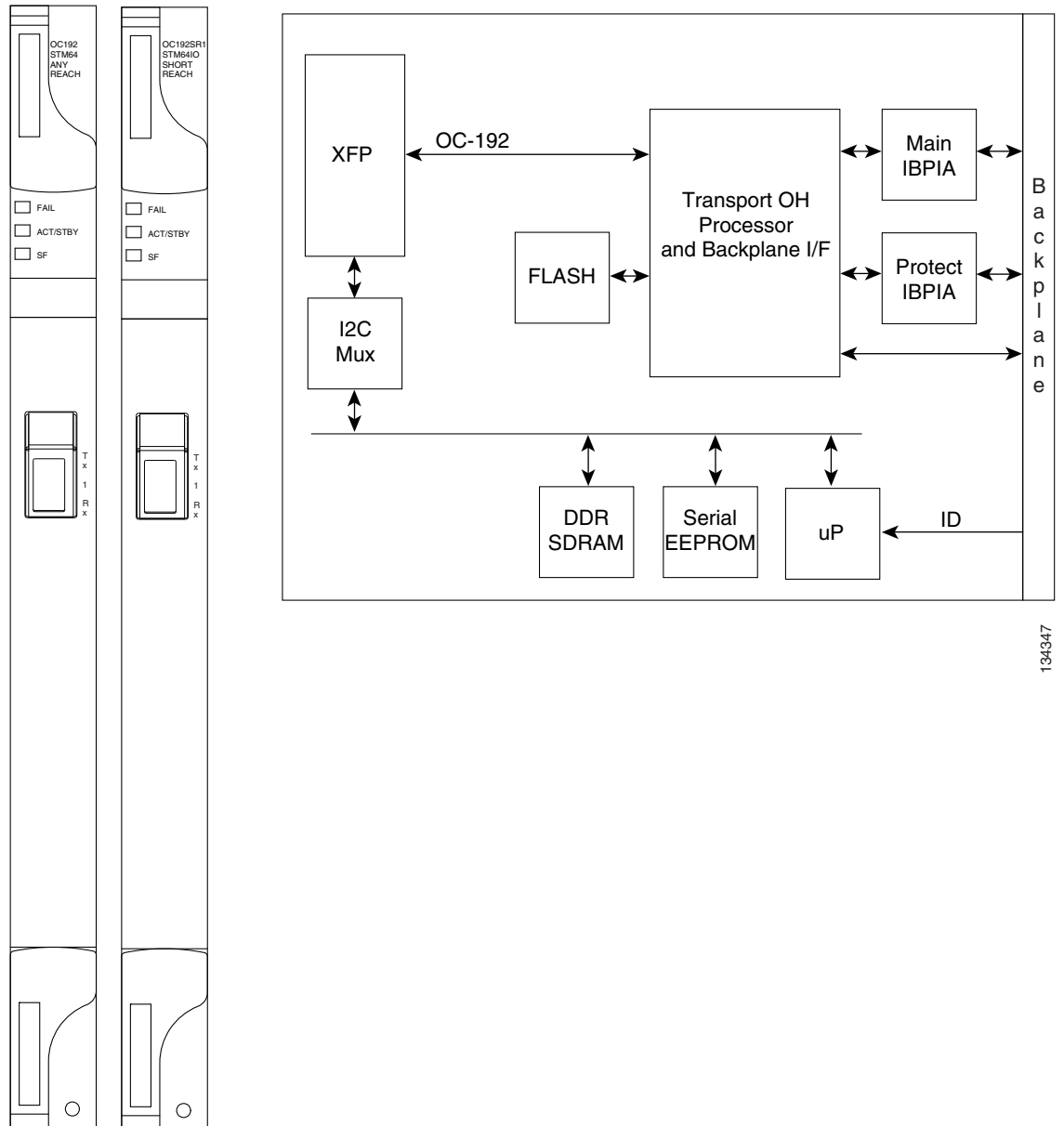
- OC192SR1/STM64IO Short Reach card (SR-1)
- OC192/STM64 Any Reach card (SR-1, IR-2, and LR-2)

The interface operates at 9.952 Gbps over single-mode fiber spans and may be provisioned for both concatenated and non-concatenated payloads on a per VC-4/STS-1 basis. Specifications references can be found for the OC-192/STM-64 interface in ITU-T G.691, G.693, and G.959.1 as well as Telcordia GR-253.

The optical interface uses a 10 Gbps Form Factor Pluggable (XFP) optical transceiver that plugs into a receptacle on the front of the card. The OC192/STM-64 SR-1 Short Reach card is used only with an SR-1 XFP, while the OC192/STM-64 Any Reach card can be provisioned for use with an SR-1, IR-2, LR-2, or DWDM XFP module. The XFP SR, IR, and LR interfaces each provide one bidirectional OC192/STM64 interface compliant with the recommendations defined by ITU-T G6.91.SR-1 is compliant with I-64.1, IR-2 is compliant with S-64.2b, and LR-2 is compliant with P1L1-2D2.

The cards are used in Slots 5, 6, 12, and 13 and only with 10 Gbps cross-connect cards, such as the XC-VXL-10G and XC-VXC-10G. The cards also must be supported with the TCC2 or TCC2P cards. [Figure 4-18](#) shows the faceplates and block diagram for the two cards.

**Figure 4-18** OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach Card Faceplates and Block Diagram



The cards have spans according to the XFP module used:

- A card using the SR-1 XFP is intended to be used in applications requiring 10 Gbps transport with unregenerated spans of up to 2.0 km.
- A card using the IR-2 XFP is intended to be used in applications requiring 10 Gbps transport with unregenerated spans of up to 40 km.
- A card using the LR-2 XFP is intended to be used in applications requiring 10 Gbps transport with unregenerated spans of up to 80 km.

## 4.17.1 OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach Card-Level Indicators

Table 4-20 describes the three card-level LEDs on the OC-192/STM-64 cards.

**Table 4-20** OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card 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)	If the ACT/STBY LED is green, the card is operational and ready to carry traffic. If the ACT/STBY LED is amber, the card is operational and in standby (protect) mode or is part of an active ring switch (MS-SPRing).

## 4.17.2 OC192SR1/STM 64IO Short Reach and OC192/STM64 Any Reach Port-Level Indicators

You can find the status of the OC192SR1/STM64IO Short Reach and OC192/STM64 Any Reach card ports using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the Cisco ONS 15454 Troubleshooting Guide for a complete description of the alarm messages.

## 4.18 Optical Card SFPs and XFPs



### Note

For specifications, see the “A.2 SFP and XFP Specifications” section on page A-4.

The ONS 15454 optical cards use industry standard small form-factor pluggable connectors (SFPs) and 10 Gbps (XFP) modular receptacles. This section describes SFPs and XFPs used with optical cards. Currently, the only optical cards that use SFPs and XFPs are the 15454\_MRC-12, OC192SR1/STM64IO Short Reach, and OC192/STM64 Any Reach cards.

The type of SFP or XFP plugged into the card appears in CTC and TL1. Cisco offers SFPs as separate orderable products.

### 4.18.1 Compatibility by Card

Table 4-21 lists Cisco ONS 15454 optical cards with their compatible SFPs and XFPs.



### Caution

Only use SFPs certified for use in Cisco Optical Networking Systems. The qualified Cisco SFP and XFP pluggable module’s top assembly numbers (TANs) are provided in Table 4-21.

**Table 4-21 SFP and XFP Card Compatibility**

<b>Card</b>	<b>Compatible SFPs and XFPs (Cisco Product ID)</b>	<b>Cisco Top Assembly Number (TAN)<sup>1</sup></b>
15454_MRC-12 and MRC-2.5G-12 (ONS 15454 SONET/SDH)	ONS-SC-2G-28.7= <sup>2</sup> through ONS-SC-2G-60.6= ONS-SE-155-1470= through ONS-SE-155-1610= ONS-SE-622-1470= through ONS-SE-622-1610= ONS-SI-155-I1= ONS-SI-155-L1= ONS-SI-155-L2= ONS-SI-2G-S1= ONS-SI-2G-I1= ONS-SI-2G-L1= ONS-SI-2G-L2= ONS-SI-622-I1= ONS-SI-622-L1= ONS-SI-622-L2= ONS-SI-155-I1-MM= ONS-SI-622-I1-MM= ONS-SC-Z3-1470= ONS-SC-Z3-1490= ONS-SC-Z3-1510= ONS-SC-Z3-1530= ONS-SC-Z3-1550= ONS-SC-Z3-1570= ONS-SC-Z3-1590= ONS-SC-Z3-1610= ONS-SE-Z1= ONS-SC-155-EL=	10-2307-02, 10-2155-02 through 10-2186-02 10-1996-02 through 10-2003-02 10-2004-02 through 10-2011-02 10-1938-02 10-1957-02 10-1937-02 10-1992-02 10-1993-02 10-2102-02 10-1990-02 10-1956-02 10-1958-02 10-1936-02 10-2279-01 10-2280-01 10-2285-01 10-2286-01 10-2287-01 10-2288-01 10-2289-01 10-2290-01 10-2291-01 10-2292-01 10-1971-02 10-2363-01
MRC-2.5G-12 only	ONS-SE-155-I1-MM= ONS-SE-622-I1-MM= ONS-SC-Z3-1470= through ONS-SC-Z3-1610	10-2279-01 10-2280-01 10-2285-01 through 10-2292-01
OC192SR1/STM64IO Short Reach (ONS 15454 SONET/SDH) <sup>3</sup>	ONS-XC-10G-S1	10-2012-01
OC192/STM64 Any Reach (ONS 15454 SONET/SDH) <sup>3</sup>	ONS-XC-10G-S1 ONS-XC-10G-I2 ONS-XC-10G-L2 ONS-XC-10G-30.3= through ONS-XC-10G-61.4=	10-2012-01 10-2193-01 10-2194-01 10-2347-01 through 10-2309-01

1. The TAN indicated for the pluggables are backward compatible. For example, TAN 10-2307-02 is compatible with 10-2307-01.
2. ONS-SC-2G-28.7, ONS-SC-2G-33.4, ONS-SC-2G-41.3, ONS-SC-2G-49.3, and ONS-SC-2G-57.3 are supported from Release 8.5 and later.

- CTC refers to this card as STM64-XFP.

SFPs that are LED based do not support the optical power transmitted (OPT) and laser bias current (LBC) optical parameters. [Table 4-22](#) lists the LED based SFPs.

**Table 4-22 LED Based SFPs**

SFPs (Cisco Product ID)	Cisco Top Assembly Number (TAN)
ONS-SI-155-SR-MM SFP	10-2279-01
ONS-SI-622-SR-MM SFP	10-2280-01
ONS-SE-100-FX	10-2212-01
ONS-SI-100-FX	10-2350-01

## 4.18.2 SFP Description

SFPs are integrated fiber optic transceivers that provide high speed serial links from a port or slot to the network. Various latching mechanisms are used on the modules. There is no correlation between the type of latch to the model type (such as SX or LX/LH) and the technology type (such as Gigabit Ethernet). See the label on the SFP for technology type and model. One type of latch available is a mylar tab ([Figure 4-19](#)), a second type of latch available is an actuator/button ([Figure 4-20](#)), and a third type of latch is a bail clasp ([Figure 4-21](#)).

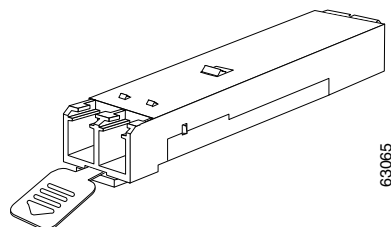
SFP dimensions are:

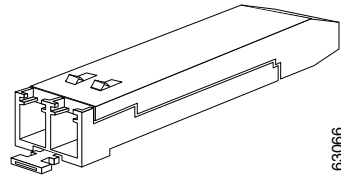
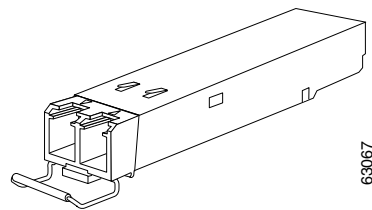
- Height 0.03 in. (8.5 mm)
- Width 0.53 in. (13.4 mm)
- Depth 2.22 in. (56.5 mm)

SFP and XFP temperature ranges for are:

- COM—commercial operating temperature range -5°C to 70°C
- EXT—extended operating temperature range -5°C to 85°C
- IND—industrial operating temperature range -40°C to 85°C

**Figure 4-19 Mylar Tab SFP**



**Figure 4-20 Actuator/Button SFP****Figure 4-21 Bail Clasp SFP**

### 4.18.3 XFP Description

The 10 Gbps 1310 nm and 1550 nm XFP transceivers are integrated fiber optic transceivers that provide high-speed serial links at the following signaling rates: 9.95 Gbps, 10.31 Gbps, and 10.51 Gbps. The XFP integrates the receiver and transmit path. The transmit side recovers and retimes the 10 Gbps serial data and passes it to a laser driver. The laser driver biases and modulates a 1310 nm or 1550 nm distributed feedback (DFB), enabling data transmission over SMF through an LC connector. The receive side recovers and retimes the 10 Gbps optical data stream from a PIN photo detector, transimpedance amplifier and passes it to an output driver.

The XFP module uses the bail clasp latching mechanism as shown unlatched in [Figure 4-22](#) and latched in [Figure 4-23](#). See the label on the XFP for technology type and model.

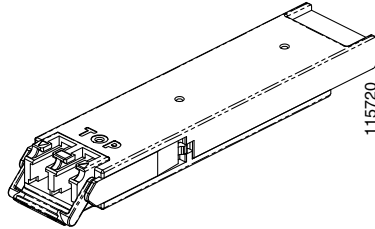
XFP dimensions are:

- Height 0.33 in. (8.5 mm)
- Width 0.72 in. (18.3 mm)
- Depth 3.1 in. (78 mm)

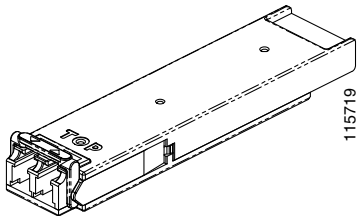
XFP temperature ranges are:

- COM—commercial operating temperature range –5 degrees C to 70 degrees C
- EXT—extended operating temperature range –5 degrees C to 85 degrees C
- IND—industrial operating temperature range –40 degrees C to 85 degrees C

**Figure 4-22** *Bail Clasp XFP (Unlatched)*



**Figure 4-23** *Bail Clasp XFP (Latched)*



## 4.18.4 PPM Provisioning

SFPs and XFPs are known as pluggable-port modules (PPMs) in the ONS 15454 SDH graphical user interface (GUI), CTC. Multirate PPMs for the 15454\_MRC-12 card can be provisioned for different line rates in CTC. For more information about provisioning PPMs, refer to the *Cisco ONS 15454 SDH Procedure Guide*.