Optical Cards

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Note The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This chapter describes Cisco ONS 15454 card features and functions. For installation and card turn-up procedures, see the *Cisco ONS 15454 Procedure Guide*.

Chapter topics include:

4.1 Card Overview

The optical card overview section summarizes card functions, power consumption, and temperature ranges. For compatibility, see the "1.15 Software and Hardware Compatibility" section on page 1-41.

Note   Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 shelf assembly. The cards are then installed into slots displaying the same symbols. See the "1.13.1 Card Slot Requirements" section on page 1-38 for a list of slots and symbols.

4.1.1 Optical Cards

Table 4-1 lists the Cisco ONS 15454 optical cards.

Table 4-1   Optical Cards for the ONS 15454

Card	Port Description	For Additional Information...
OC3 IR 4 SH 1310	The OC3 IR 4 1310 card provides four intermediate or short-range OC-3 ports. **Note** The OC3 IR 4 SH 1310 and OC3 IR 4/STM1 SH 1310 cards are functionally the same.	See the "4.2 OC3 IR 4/STM1 SH 1310 Card" section on page 4-9.
OC3 IR 4/ STM1 SH 1310	The OC3 IR 4/STM1 SH 1310 card provides four intermediate or short-range OC-3 ports.	See the "4.2 OC3 IR 4/STM1 SH 1310 Card" section on page 4-9.
OC3 IR/ STM1 SH 1310-8	The OC3 IR/STM1 SH 1310-8 card provides eight intermediate or short-range OC-3 ports.	See the "4.3 OC3IR/STM1SH 1310-8 Card" section on page 4-12.
OC12 IR 1310	The OC12 IR 1310 card provides one intermediate or short-range OC-12 port. **Note** The OC12 IR 1310 and OC12/STM4 SH 1310 cards are functionally the same.	See the "4.4 OC12 IR/STM4 SH 1310 Card" section on page 4-16.
OC12 IR/ STM4 SH 1310	The OC12 IR/STM4 SH 1310 card provides one intermediate or short-range OC-12 port.	See the "4.4 OC12 IR/STM4 SH 1310 Card" section on page 4-16.
OC12 LR 1310	The OC12 LR 1310 card provides one long-range OC-12 port and operates at 1310 nm. **Note** The OC12 LR 1310 and OC12 LR/STM4 LH 1310 cards are functionally the same.	See the "4.5 OC12 LR/STM4 LH 1310 Card" section on page 4-19.
OC12 LR/ STM4 LH 1310	The OC12 LR/STM4 LH 1310 card provides one long-range OC-12 port and operates at 1310 nm.	See the "4.5 OC12 LR/STM4 LH 1310 Card" section on page 4-19.
OC12 LR 1550	The OC12 LR 1550 card provides one long-range OC-12 port and operates at 1550 nm. **Note** The OC12 LR 1550 and OC12 LR/STM4 LH 1550 cards are functionally the same.	See the "4.6 OC12 LR/STM4 LH 1550 Card" section on page 4-22.

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

Card	Port Description	For Additional Information...
OC12 LR/ STM4 LH 1550	The OC12 LR/STM4 LH 1550 card provides one long-range OC-12 port and operates at 1550 nm.	See the "4.6 OC12 LR/STM4 LH 1550 Card" section on page 4-22.
OC12 IR/STM4 SH 1310-4	The OC12 IR/STM4 SH 1310-4 card provides four intermediate or short-range OC-12/STM-4 ports.	See the "4.7 OC12 IR/STM4 SH 1310-4 Card" section on page 4-25.
OC48 IR 1310	The OC48 IR 1310 card provides one intermediate-range OC-48 port and operates at 1310 nm. This card functions in Slots 5, 6, 12, or 13 (high-speed slots) only.	See the "4.8 OC48 IR 1310 Card" section on page 4-28.
OC48 LR 1550	The OC48 LR 1550 card provides one long-range OC-48 port and operates at 1550 nm. This card functions in Slots 5, 6, 12, or 13 only.	See the "4.9 OC48 LR 1550 Card" section on page 4-31.
OC48 IR/ STM16 SH AS 1310	The OC48 IR/STM16 SH AS 1310 card provides one intermediate-range OC-48 port and operates in Slots 1 to 6 and 12 to 17 (any multispeed or high-speed card slot).	See the "4.10 OC48 IR/STM16 SH AS 1310 Card" section on page 4-34.
OC48 LR/ STM16 LH AS 1550	The OC48 LR/STM16 LH AS 1550 card provides one long-range OC-48 port and operates in Slots 1 to 6 and 12 to 17.	See the "4.11 OC48 LR/STM16 LH AS 1550 Card" section on page 4-37.
OC48 ELR/ STM16 EH 100 GHz	Thirty-seven distinct OC48 ITU 100-GHz dense wavelength division multiplexing (DWDM) cards provide the ONS 15454 DWDM channel plan.	See the "4.12 OC48 ELR/STM16 EH 100 GHz Cards" section on page 4-40.
OC48 ELR 200 GHz	Eighteen distinct OC48 ITU 20-GHz DWDM cards provide the ONS 15454 DWDM channel plan.	See the "4.13 OC48 ELR 200 GHz Cards" section on page 4-44.
OC192 SR/ STM64 IO 1310	The OC192 SR/STM64 IO 1310 card provides one intra-office haul OC-192 port at 1310 nm and operates in Slot 5, 6, 12, or 13 with the 10 Gigabit Cross-Connect (XC10G) card.	See the "4.14 OC192 SR/STM64 IO 1310 Card" section on page 4-47.
OC192 IR/ STM64 SH 1550	The OC192 IR/STM64 SH 1550 card provides one intermediate reach OC-192 port at 1550 nm and operates in Slot 5, 6, 12, or 13 with the XC10G.	See the "4.15 OC192 IR/STM64 SH 1550 Card" section on page 4-51.
OC192 LR/ STM64 LH 1550	The OC192 LR/STM64 LH 1550 card provides one long-range OC-192 port at 1550 nm and operates in Slot 5, 6, 12, or 13 with the XC10G.	See the "4.16 OC192 LR/STM64 LH 1550 Card" section on page 4-55.
OC192 LR/ STM64 LH ITU 15xx.xx	The OC192 LR/STM64 LH ITU 15xx.xx card provides one long-reach OC-192 port and operates in Slot 5, 6, 12, or 13 with the XC10G. This card is available in multiple wavelengths in the 1550-nm range of the ITU grid for 100-GHz spaced DWDM.	See the "4.17 OC192 LR/STM64 LH ITU 15xx.xx Card" section on page 4-60.

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

Card	Port Description	For Additional Information...
TXP_MR_10G	The TXP_MR_10G (10-Gbps Transponder–100-Ghz–Tunable xx.xx-xx.xx) card provides one extended long-range OC-192 port (trunk side) and one short-range OC-192 port (client side). It can process one standard OC-192 interface for use in a 100-GHz DWDM system. On the trunk side, it can provide forward error correction (FEC). The TXP_MR_10G card operates in Slots 1 to 6 and 12 to 17. The TXP_MR_10G card is tunable over two neighboring wavelengths in the 1550-nm, ITU 100-GHz range. It is available in four different versions, covering eight different wavelengths in the 1550-nm range. For the individual card, "xx.xx" is replaced with the wavelength intended to be used. **Note** The trunk side is also known as the span side.	See the "4.18 TXP_MR_10G Card" section on page 4-65
MXP_2.5G_10G	The MXP_2.5G_10G (2.5-Gbps–10-Gbps Muxponder–100 Ghz–Tunable xx.xx-xx.xx) card provides one extended long-range OC-192 port (trunk side) and four short-range OC-48 ports (client side). It can multiplex four standard OC-48 interfaces into one OC-192 interface for usage in a 100-GHz DWDM system. On the trunk side, it can provide FEC. The MXP_2.5G_10G card operates in Slots 1 to 6 and 12 to 17. The MXP_2.5G_10G card is tunable over two neighboring wavelengths in the 1550-nm, ITU 100-GHz range. It is available in four different versions, covering eight different wavelengths in the 1550-nm range. For the individual card, "xx.xx" is replaced with the wavelength intended to be used.	See the "4.19 MXP_2.5G_10G Card" section on page 4-70

Note   The Cisco OC3 IR/STM1 SH, OC12 IR/STM4 SH, and OC48 IR/STM16 SH interface optics, all 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, OC12 IR/STM4 SH, and OC48 IR/STM16 SH interface optics. If you are using Corning MetroCor fiber, OC3 IR/STM1 SH, OC12 IR/STM4 SH, and OC48 IR/STM16 SH interface optics become dispersion limited before they become attenuation limited. In this case, consider using OC3 LR/STM1 LH, OC12 LR/STM4 LH, and OC48 LR/STM16 LH cards instead of OC3 IR/STM1 SH, OC12 IR/STM4 SH, and OC48 IR/STM16 SH cards.

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 Power Requirements

Table 4-2 lists power requirements for individual cards.

Note   Asterisks (*) next to card or fan tray names mean the power specifications shown in Table 4-2 is based on a calculation because an actual measurement was not available at the time of publication.

Table 4-2   Individual Card Power Requirements

Card Name	Watts	Amperes	BTU/Hr
OC3 IR 4 SH 1310	19.20	0.40	65.56
OC3 IR 4/ STM1 SH 1310	19.20	0.40	65.56
OC3 IR/STM1 SH 1310-8	23.00	0.48	78.5
OC12 IR 1310	10.90	0.23	37.22
OC12 LR 1310	9.28	0.19	31.68
OC12 LR 1550	9.28	0.19	31.68
OC12 IR/ STM4 SH 1310	9.28	0.19	31.68
OC12 LR/ STM4 LH 1310	9.28	0.19	31.68
OC12 LR/ STM4 LH 1550	9.28	0.19	31.68
OC12 IR/STM4 SH 1310-4	35.60	0.74	121.6
OC48 IR 1310	32.20	0.67	109.94
OC48 LR 1550	26.80	0.56	91.50
OC48 IR/ STM16 SH AS 1310	37.20	0.77	127.01
OC48 LR/ STM16 LH AS 1550	37.20	0.77	127.01
OC48 ELR/ STM16 EH 100 GHz	31.20	0.65	106.53
OC48 ELR 200 GHz	31.20	0.65	106.53
OC192 SR/STM64 IO 1310	42.00	0.88	143.4
OC192 IR/STM64 SH 1550	44.00	0.92	150.2
OC192 LR/STM64 LH 1550	72.20	1.50	246.5
OC192 LR/STM64 LH ITU 15xx.xx	46.00	0.96	157.1
TXP_MR_10G *	35.00	0.73	119.5
MXP_2.5G_10G *	50.00	1.04	170.7

4.1.3 Card Temperature Ranges

Table 4-3 shows C-Temp and I-Temp compliant cards and their product names.

Note   The I-Temp symbol is displayed on the faceplate of an I-Temp compliant card. A card without this symbol is C-Temp compliant.

Table 4-3   Optical Card Temperature Ranges and Product Names for the ONS 15454

Card	C-Temp Product Name (+23 to +131 degrees Fahrenheit, –5 to +55 degrees Celsius)	I-Temp Product Name (–40 to +149 degrees Fahrenheit, –40 to +65 degrees Celsius)
OC3 IR 4/STM1 SH 1310	15454-OC34IR1310	15454-OC34I13-T
OC3 IR/STM1 SH 1310-8	15454-OC3I8-1310	—
OC12 IR/STM4 SH 1310	15454-OC121IR1310	15454-OC121I13-T
OC12 LR/STM4 LH 1310	15454-OC121LR1310	15454-OC121L13-T
OC12 LR/STM4 LH 1550	15454-OC121LR1550	15454-OC121L15-T
OC12 IR/STM4 SH 1310-4	15454-OC12I4-1310	—
OC48 IR 1310	15454-OC481IR1310	—
OC48 LR 1550	15454-OC481LR1550	—
OC48 IR/STM16 SH AS 1310	15454-OC481IR1310A	—
OC48 LR/STM16 LH AS 1550	15454-OC481LR1550A	—

Table 4-3   Optical Card Temperature Ranges and Product Names for the ONS 15454 (continued)

Card	C-Temp Product Name (+23 to +131 degrees Fahrenheit, –5 to +55 degrees Celsius)	I-Temp Product Name (–40 to +149 degrees Fahrenheit, –40 to +65 degrees Celsius)
OC48 ELR/STM16 EH 100 GHz	15454-OC48E-1-28.7	—
	15454-OC48E-1-30.3	
	15454-OC48E-1-31.1	
	15454-OC48E-1-31.9	
	15454-OC48E-1-32.6	
	15454-OC48E-1-33.4	
	15454-OC48E-1-34.2	
	15454-OC48E-1-35.0	
	15454-OC48E-1-35.8	
	15454-OC48E-1-36.6	
	15454-OC48E-1-38.1	
	15454-OC48E-1-38.9	
	15454-OC48E-1-39.7	
	15454-OC48E-1-40.5	
	15454-OC48E-1-41.3	
	15454-OC48E-1-42.1	
	15454-OC48E-1-42.9	
	15454-OC48E-1-43.7	
	15454-OC48E-1-44.5	
	15454-OC48E-1-46.1	
	15454-OC48E-1-46.9	
	15454-OC48E-1-47.7	
	15454-OC48E-1-48.5	
	15454-OC48E-1-49.3	
	15454-OC48E-1-50.1	

Table 4-3   Optical Card Temperature Ranges and Product Names for the ONS 15454 (continued)

Card	C-Temp Product Name (+23 to +131 degrees Fahrenheit, –5 to +55 degrees Celsius)	I-Temp Product Name (–40 to +149 degrees Fahrenheit, –40 to +65 degrees Celsius)
OC48 ELR/STM16 EH 100 GHz (continued)	15454-OC48E-1-50.9	—
	15454-OC48E-1-51.7	
	15454-OC48E-1-52.5	
	15454-OC48E-1-54.1	
	15454-OC48E-1-54.9	
	15454-OC48E-1-55.7	
	15454-OC48E-1-56.5	
	15454-OC48E-1-57.3	
	15454-OC48E-1-58.1	
	15454-OC48E-1-58.9	
	15454-OC48E-1-59.7	
	15454-OC48E-1-60.6	
OC48 ELR/STM16 EH 200 GHz	15454-OC48E-30.33	—
	15454-OC48E-31.90	
	15454-OC48E-33.47	
	15454-OC48E-35.04	
	15454-OC48E-36.61	
	15454-OC48E-38.19	
	15454-OC48E-39.77	
	15454-OC48E-31.35	
	15454-OC48E-42.94	
	15454-OC48E-47.72	
	15454-OC48E-49.32	
	15454-OC48E-50.92	
	15454-OC48E-52.52	
	15454-OC48E-54.13	
	15454-OC48E-55.75	
	15454-OC48E-57.36	
	15454-OC48E-58.98	
	15454-OC48E-60.61	
OC192 SR/STM64 IO 1310	15454-OC192SR1310	—
OC192 IR/STM64 SH 1550	15454-OC192IR1550	—
OC192 LR/STM64 LH 1550	15454-OC192LR1550	—

Table 4-3   Optical Card Temperature Ranges and Product Names for the ONS 15454 (continued)

| Card	C-Temp Product Name (+23 to +131 degrees Fahrenheit, –5 to +55 degrees Celsius)	I-Temp Product Name (–40 to +149 degrees Fahrenheit, –40 to +65 degrees Celsius)
OC192 LR/STM64 LH ITU 15xx.xx	15454-192L-1-34.2	—
	15454-192L-1-35.0	
	15454-192L-1-35.8	
	15454-192L-1-36.6	
	15454-192L-1-50.1	
	15454-192L-1-50.9	
	15454-192L-1-51.7	
	15454-192L-1-52.5	
TXP_MR_10G	15454-10T-L1-38.1	—
	15454-10T-L1-39.7	
	15454-10T-L1-54.1	
	15454-10T-L1-55.7	
MXP_2.5G_10G	15454-10M-L1-42.1	—
	15454-10M-L1-43.7	
	15454-10M-L1-58.1	
	15454-10M-L1-59.7	

4.2 OC3 IR 4/STM1 SH 1310 Card

The OC3 IR 4/STM1 SH 1310 card provides four intermediate or short range SONET/SDH OC-3 ports compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. Each port operates at 155.52 Mbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at the STS-1 or STS-3c signal levels. Figure 4-1 on page 4-10 shows the OC3 IR 4/STM1 SH 1310 faceplate and a diagram of the card.

Note   The OC3 IR 4 SH 1310 and OC3 IR 4/STM1 SH 1310 cards are functionally the same.

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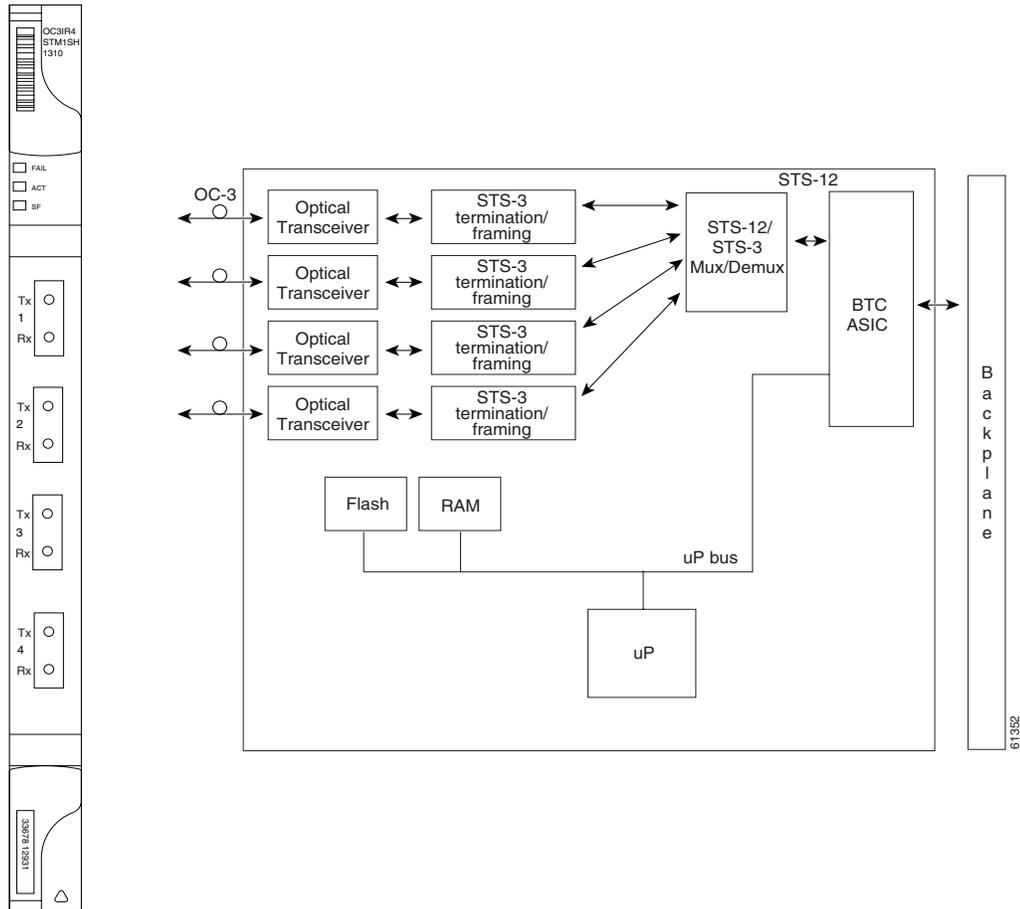
You can install the OC3 IR 4/STM1 SH 1310 card in Slots 1 to 6 and 12 to 17. The card can be provisioned as part of a path protection configuration or in a linear add-drop multiplexer (ADM) configuration. Each port features a 1310-nm laser and contains a transmit and receive connector (labeled) on the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

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

The OC3 IR 4/STM1 SH 1310 detects loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), line-layer alarm indication signal (AIS-L), and line-layer remote defect indication (RDI-L) conditions. See the Alarm Troubleshooting chapter in the *Cisco ONS 15454 Troubleshooting Guide* for a description of these conditions. The card also counts section and line bit interleaved parity (BIP) errors.

4.2.1 OC3 IR 4/STM1 SH 1310 Card-Level Indicators

The OC3 IR 4/STM1 SH 1310 card has three card-level LED indicators, described in Table 4-4.

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

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC3 IR 4/STM1 SH 1310 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, AIS-L or high BER on one or more of the card's ports. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.2.2 OC3 IR 4/STM1 SH 1310 Port-Level Indicators

You can find the status of the four 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.2.3 OC3 IR 4/STM1 SH 1310 Card Specifications

The OC3 IR 4/STM1 SH 1310 card has the following specifications:

- Line
    - Bit rate:155.52 Mbps
    - Code: Scrambled non-return to zero (NRZ)
    - Fiber: 1310-nm single-mode
    - Loopback modes: Terminal and Facility
    - Connector: SC
    - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
    - Maximum transmitter output power: –8 dBm
    - Minimum transmitter output power: –15 dBm
    - Center wavelength: 1274 nm to 1356 nm
    - Nominal wavelength: 1310 nm

- – Transmitter: Fabry Perot laser
- • Receiver
  - – Maximum receiver level: –8 dBm
  - – Minimum receiver level: –28 dBm
  - – Receiver: InGaAs/InP photodetector
  - – Link loss budget: 13 dB
  - – Receiver input wavelength range: 1274 nm to 1356 nm
- • Environmental
  - – Operating temperature:

    C-Temp (15454-OC34IR1310): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

    I-Temp (15454-OC34I13-T): –40 to +65 degrees Celsius (–40 to +149 degrees Fahrenheit)
  - – Operating humidity: 5 to 95%, noncondensing
  - – Power consumption: 19.20 W, 0.40 A, 65.56 BTU/hr
- • Dimensions
  - – Height: 12.650 in. (321.3 mm)
  - – Width: 0.716 in. (18.2 mm)
  - – Depth: 9.000 in. (228.6 mm)
  - – Weight not including clam shell: 1.0 lb (0.4 kg)
- • Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:
  - – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
  - – Eye safety compliance: Class I

4.3 OC3IR/STM1SH 1310-8 Card

The OC3IR/STM1SH 1310-8 card provides eight intermediate or short range SONET/SDH OC-3 ports compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. Each port operates at 155.52 Mbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at the STS-1 or STS-3c signal levels. Figure 4-2 on page 4-13 shows the OC3IR/STM1SH 1310-8 faceplate and Figure 4-3 on page 4-14 shows a block diagram of the card.

Warning   **Class 1 laser product.**
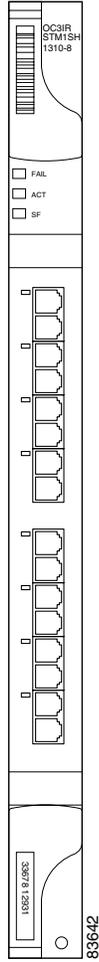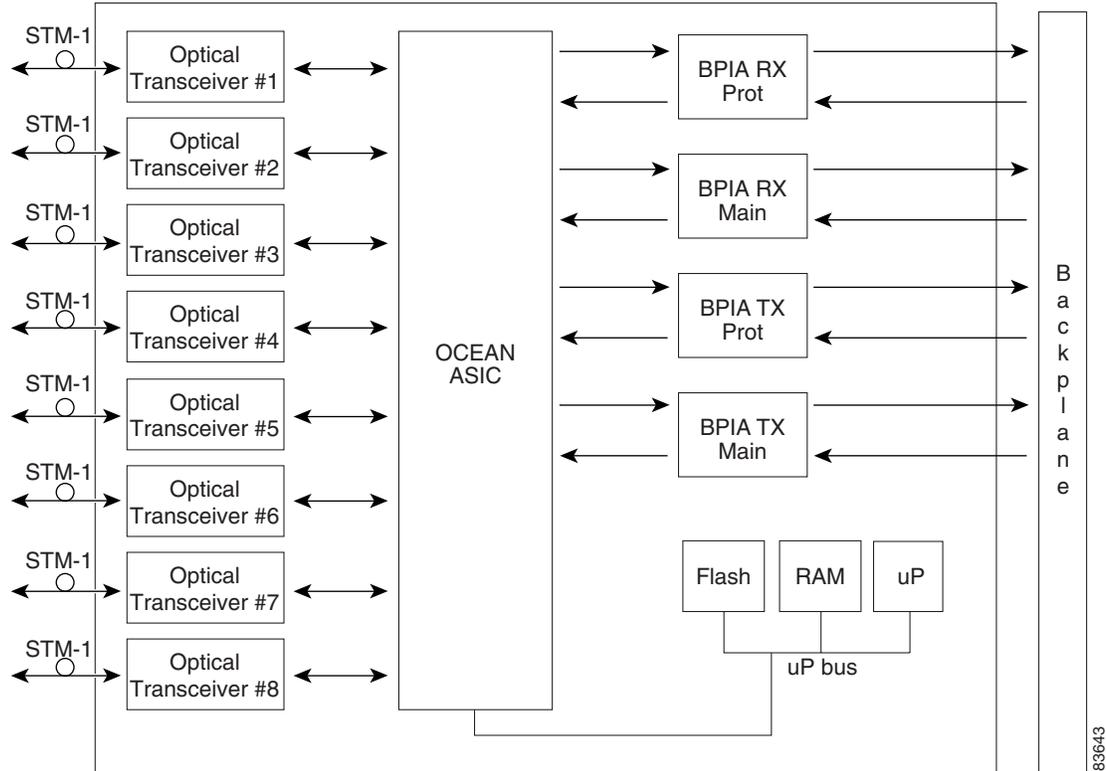
Figure 4-2   OC3IR/STM1SH 1310-8 Faceplate

Figure 4-3   OC3IR/STM1SH 1310-8 Block Diagram

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

You can install the OC3IR/STM1SH 1310-8 card in Slots 1 to 4 and 14 to 17 (multispeed slots). The card can be provisioned as part of an path protection configuration or in an add-drop multiplexer/terminal monitor (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 LC connectors on the faceplate, angled downward 12.5 degrees.

The OC3IR/STM1SH 1310-8 card supports 1+1 unidirectional and bidirectional protection switching. You can provision protection on a per port basis.

The OC3IR/STM1SH 1310-8 card detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. Refer to the *Cisco ONS 15454 Troubleshooting Guide* for a description of these conditions. The card also counts section and line BIP errors.

To enable APS, the OC3IR/STM1SH 1310-8 card extracts the K1 and K2 bytes from the SONET overhead to perform appropriate protection switches. The OC3IR/STM1SH 1310-8 card supports full data communications channel/general communication channel (DCC/GCC) connectivity for remote network management.

4.3.1 OC3IR/STM1SH 1310-8 Card-Level Indicators

The OC3IR/STM1SH 1310-8 card has three card-level LED indicators, described in Table 4-5 on page 4-15.

Table 4-5   OC3IR/STM1SH 1310-8 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. This LED is lit during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC3IR/STM1SH 1310-8 card is carrying traffic or is traffic-ready.
Yellow SF LED	The yellow SF LED indicates a signal failure or condition such as LOS, LOF, AIS-L or high BER on one or more of the card's ports. The yellow SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected and the links are working, the light turns off.

4.3.2 OC3IR/STM1SH 1310-8 Port-Level Indicators

Eight bi-color LEDs show the status per port. The LEDs shows 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 also find the status of the eight card ports using 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.

4.3.3 OC3IR/STM1SH 1310-8 Card Specifications

The OC3IR/STM1SH 1310-8 card has the following specifications:

- Line
  - Bit rate: 155.52 Mbps
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connector: LC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
  - Maximum transmitter output power: –8 dBm
  - Minimum transmitter output power: –15 dBm
  - Center wavelength: 1261 nm to 1360 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: Fabry Perot laser
- Receiver
  - Maximum receiver level: –8 dBm at BER 1 * 10 exp – 12
  - Minimum receiver level: –28 dBm at BER 1 * 10 exp – 12

- Receiver: InGaAs/InP photodetector

- Link loss budget: 13 dB

- Receiver input wavelength range: 1261 nm to 1360 nm

- Environmental

  - Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

  - Operating humidity: 5 to 95%, noncondensing

  - Power consumption: 23.00 W, 0.48 A at –48 V, 78.5 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: 1.0 lb (0.4 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - Eye safety compliance: Class I

4.4 OC12 IR/STM4 SH 1310 Card

The OC12 IR/STM4 SH 1310 card provides one intermediate or short range SONET/SDH OC-12 port compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The port operates at 622.08 Mbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at STS-1, STS-3c, STS-6c or STS-12c signal levels. Figure 4-4 on page 4-17 shows the OC12 IR/STM4 SH 1310 faceplate and a block diagram of the card.
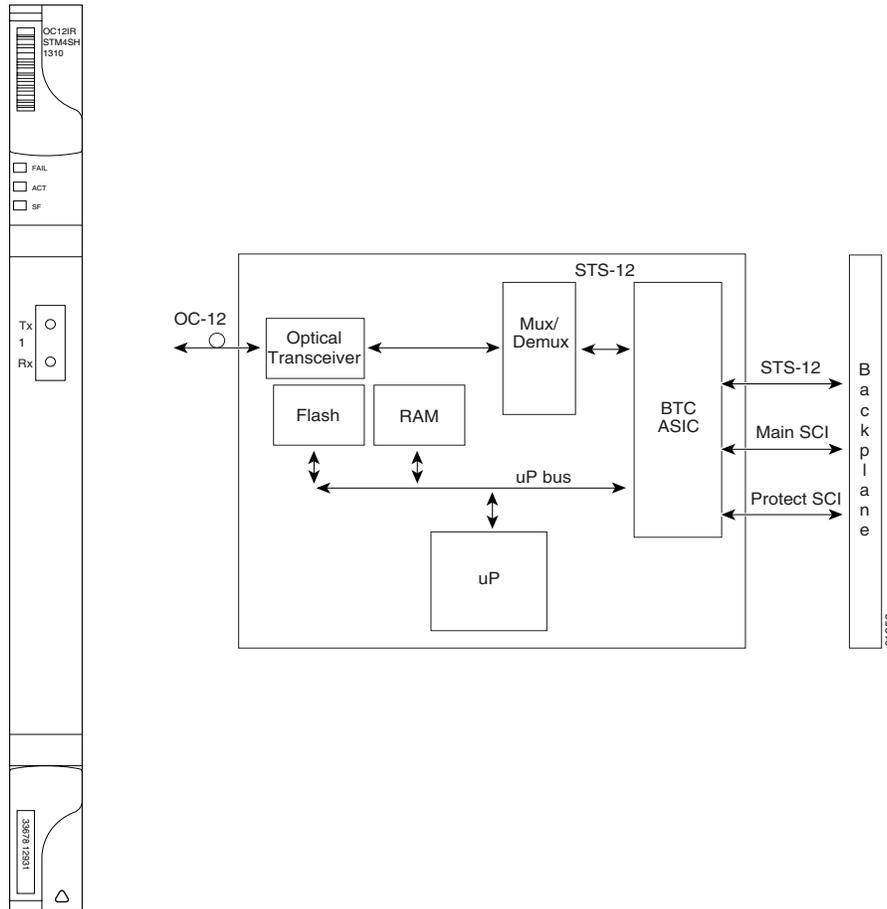
Note   The OC12 IR 1310 and OC12/STM4 SH 1310 cards are functionally the same.

Figure 4-4   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 a drop card or span card in a two-fiber BLSR, path protection configuration, or in ADM (linear) configurations.

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

The OC12 IR/STM4 SH 1310 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. See the *Cisco ONS 15454 Troubleshooting Guide* for a description of these conditions. The card counts section and line BIT errors.

4.4.1 OC12 IR/STM4 SH 1310 Card-Level Indicators

The OC12 IR/STM4 SH 1310 card has three card-level LED indicators, described in .

Table 4-6   OC12 IR/STM4 SH 1310 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC12 IR/STM4 SH 1310 card is operational and is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, AIS-L or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.4.2 OC12 IR/STM4 SH 1310 Port-Level Indicators

You can find the status of the OC-12 card port 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.4.3 OC12 IR/STM4 SH 1310 Card Specifications

The OC12 IR/STM4 SH 1310 card has the following specifications:

- Line
  - Bit rate: 622.08 Mbps
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
  - Maximum transmitter output power: –8 dBm
  - Minimum transmitter output power: –15 dBm
  - Center wavelength: 1274 nm to 1356 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: Fabry Perot laser

- Receiver

  - Maximum receiver level: –8 dBm at BER 1 * 10 exp – 12

  - Minimum receiver level: –28 dBm at BER 1 * 10 exp – 12

  - Receiver: InGa As/InP photodetector

  - Link loss budget: 13 dB

  - Receiver input wavelength range: 1274 nm to 1356 nm

- Environmental

  - Operating temperature:

    C-Temp (15454-OC121IR1310): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

    I-Temp (15454-OC121I13-T): –40 to +65 degrees Celsius (–40 to +149 degrees Fahrenheit)

  - Operating humidity: 5 to 95%, noncondensing

  - Power consumption: 10.90 W, 0.23 A, 37.22 BTU/hr

- Dimensions

  - Height: 12.650 in. (321.3 mm)

  - Width: 0.716 in. (18.2 mm)

  - Depth: 9.000 in. (228.6 mm)

  - Weight not including clam shell: 1.4 lb (0.6 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - Eye safety compliance: Class I

4.5 OC12 LR/STM4 LH 1310 Card

The OC12 LR/STM4 LH 1310 card provides one long-range SONET OC-12 port per card compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The port operates at 622.08 Mbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at STS-1, STS-3c, STS-6c or STS-12c signal levels. shows the OC12 LR/STM4 LH 1310 faceplate and a block diagram of the card.
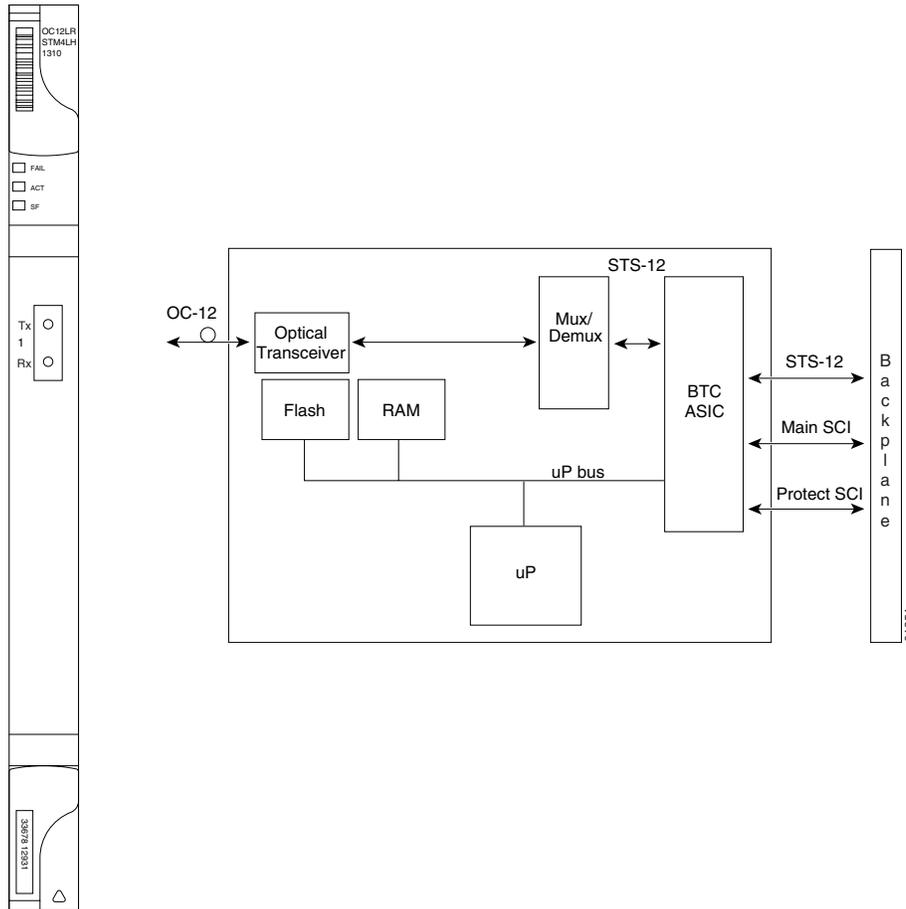
Note   The OC12 LR 1310 and OC12 LR/STM4 LH 1310 cards are functionally the same.

Figure 4-5   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 a drop card or span card in a two-fiber BLSR (Bidirectional line switched ring), path protection configuration, or ADM (linear) configuration.

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

The OC12 LR/STM4 LH 1310 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIT errors.

4.5.1 OC12 LR/STM4 LH 1310 Card-Level Indicators

The OC12 LR/STM4 LH 1310 card has three card-level LED indicators, described in Table 4-7.

Table 4-7   OC12 LR/STM4 LH 1310 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC12 LR/STM4 LH 1310 card is operational and is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, AIS-L or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, 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 port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to quickly view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.5.3 OC12 LR/STM4 LH 1310 Card Specifications

The OC12 LR/STM4 LH 1310 card has the following specifications:

- Line
  - Bit rate: 622.08 Mbps
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia SONET, GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
  - Maximum transmitter output power: +2 dBm
  - Minimum transmitter output power: –3 dBm
  - Center wavelength: 1280 nm to 1335 nm
  - Nominal wavelength: 1310 nm

- Transmitter: Distributed feedback (DFB) laser
- Receiver
  - Maximum receiver level: –8 dBm at BER 1 * 10 exp – 12
  - Minimum receiver level: –28 dBm at BER 1 * 10 exp – 12
  - Receiver: InGaAs/InP photodetector
  - Link loss budget: 25 dB
  - Receiver input wavelength range: 1280 nm to 1335 nm
- Environmental
  - Operating temperature:

    C-Temp (15454-OC121LR1310): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

    I-Temp (15454-OC121L13-T): –40 to +65 degrees Celsius (–40 to +149 degrees Fahrenheit)
  - Operating humidity: 5 to 95%, noncondensing
  - Power consumption: 9.28 W, 0.25 A, 41BTU/hr
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.716 in. (18.2 mm)
  - Depth: 9.000 in. (228.6 mm)
  - Weight not including clam shell: 1.4 lb (0.6 kg)
- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:
  - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
  - Eye safety compliance: Class I

4.6 OC12 LR/STM4 LH 1550 Card

The OC12 LR/STM4 LH 1550 card provides one long-range SONET/SDH OC-12 port compliant with the ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The port operates at 622.08 Mbps over a single-mode fiber span. The card supports VT and nonconcatenated, or concatenated payloads at STS-1, STS-3c, STS-6c, or STS-12c signal levels. Figure 4-6 on page 4-23 shows the OC12 LR/STM4 LH 1550 faceplate and a block diagram of the card.
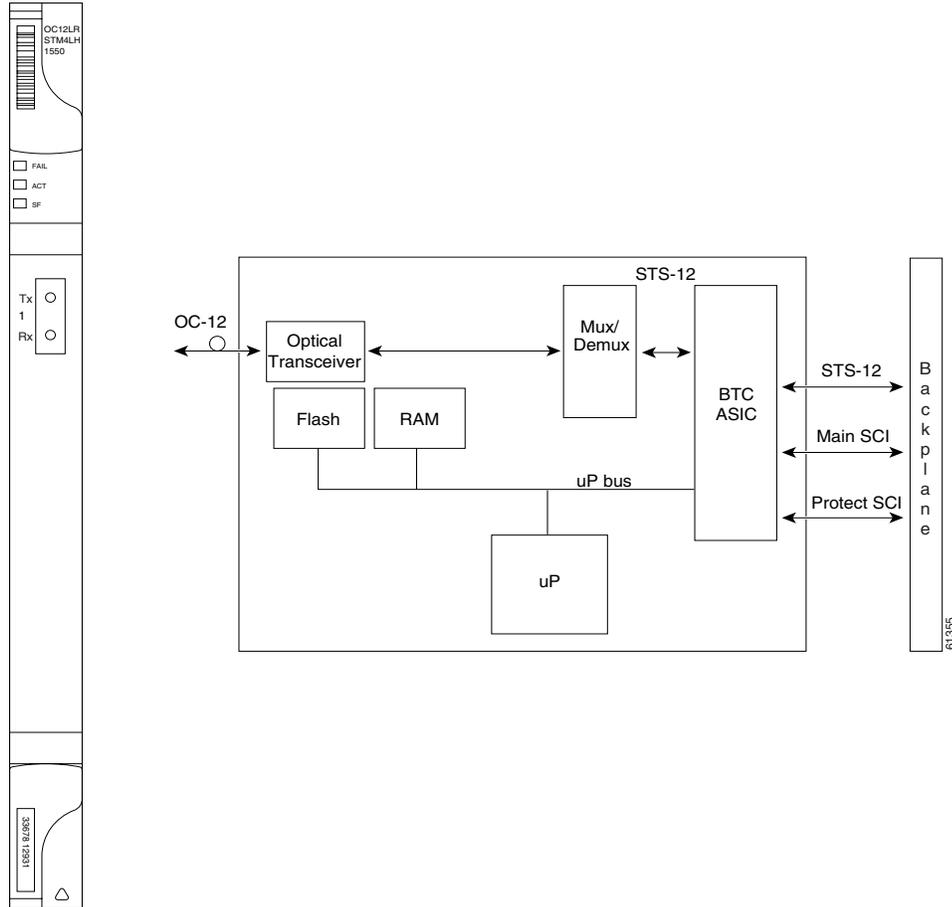
Note   The OC12 LR 1550 and OC12 LR/STM4 LH 1550 cards are functionally the same.

Figure 4-6   OC12 LR/STM4 LH 1550 Faceplate and Block Diagram

You can install the OC12 LR/STM4 LH 1550 card in Slots 1 to 4 and 14 to 17. The OC12 LR/STM4 LH 1550 can be provisioned as part of a two-fiber BLSR, path protection configuration or linear ADM.

The OC12 LR/STM4 LH 1550 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 uses SC optical connections and supports 1+1 bidirectional or unidirectional protection switching.

The OC12 LR/STM4 LH 1550 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIT errors.

4.6.1 OC12 LR/STM4 LH 1550 Card-Level Indicators

The OC12 LR/STM4 LH 1550 card has three card-level LED indicators, described in Table 4-8.

Table 4-8   OC12 LR/STM4 LH 1550 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC12 LR/STM4 LH 1550 card is operational and ready to carry traffic.
Amber SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF, AIS-L or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.6.2 OC12 LR/STM4 LH 1550 Port-Level Indicators

You can find the status of the OC12 LR/STM4 LH 1550 card port 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.6.3 OC12 LR/STM4 LH 1550 Card Specifications

The OC12 LR/STM4 LH 1550 card has the following specifications:

- Line
  - Bit rate: 622.08 Mbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia SONET, GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
  - Maximum transmitter output power: +2 dBm
  - Minimum transmitter output power: –3 dBm
  - Center wavelength: 1480 nm to 1580 nm
  - Nominal wavelength: 1550 nm

- Transmitter: DFB laser

- Receiver

  - Maximum receiver level: –8 dBm at BER 1 * 10 exp – 12

  - Minimum receiver level: –28 dBm at BER 1 * 10 exp – 12

  - Receiver: InGaAs/InP photodetector

  - Link loss budget: 25 dB

  - Receiver input wavelength range: 1480 nm to 1580 nm

- Environmental

  - Operating temperature:

    C-Temp (15454-OC121LR1550): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

    I-Temp (15454-OC121L15-T): –40 to +65 degrees Celsius (–40 to +149 degrees Fahrenheit)

  - Operating humidity: 5 to 95%, noncondensing

  - Power consumption: 9.28 W, 0.19 A, 31.68 BTU/hr

- Dimensions

  - Height: 12.650 in. (321.3 mm)

  - Width: 0.716 in. (18.2 mm)

  - Depth: 9.000 in. (228.6 mm)

  - Weight not including clam shell: 1.4 lb (0.6 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - Eye safety compliance: Class I

4.7 OC12 IR/STM4 SH 1310-4 Card

The OC12 IR/STM4 SH 1310-4 card provides four intermediate or short range SONET/SDH OC-12/STM-4 ports compliant with the ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. Each port operates at 622.08 Mbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at the STS-1, STS-3c, STS-6c, or STS-12c signal levels.

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

The OC12 IR/STM4 SH 1310-4 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIP errors.

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 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.

4.7.1 OC12 IR/STM4 SH 1310-4 Slots and Connectors

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 a path protection configuration or in an ADM configuration. Each port features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The card uses SC connectors.

4.7.2 OC12 IR/STM4 SH 1310-4 Faceplate and Block Diagram

Figure 4-7 shows the OC12 IR/STM4 SH 1310-4 faceplate and a diagram of the card.

Figure 4-7   OC12 IR/STM4 SH 1310-4 Faceplate and Block Diagram
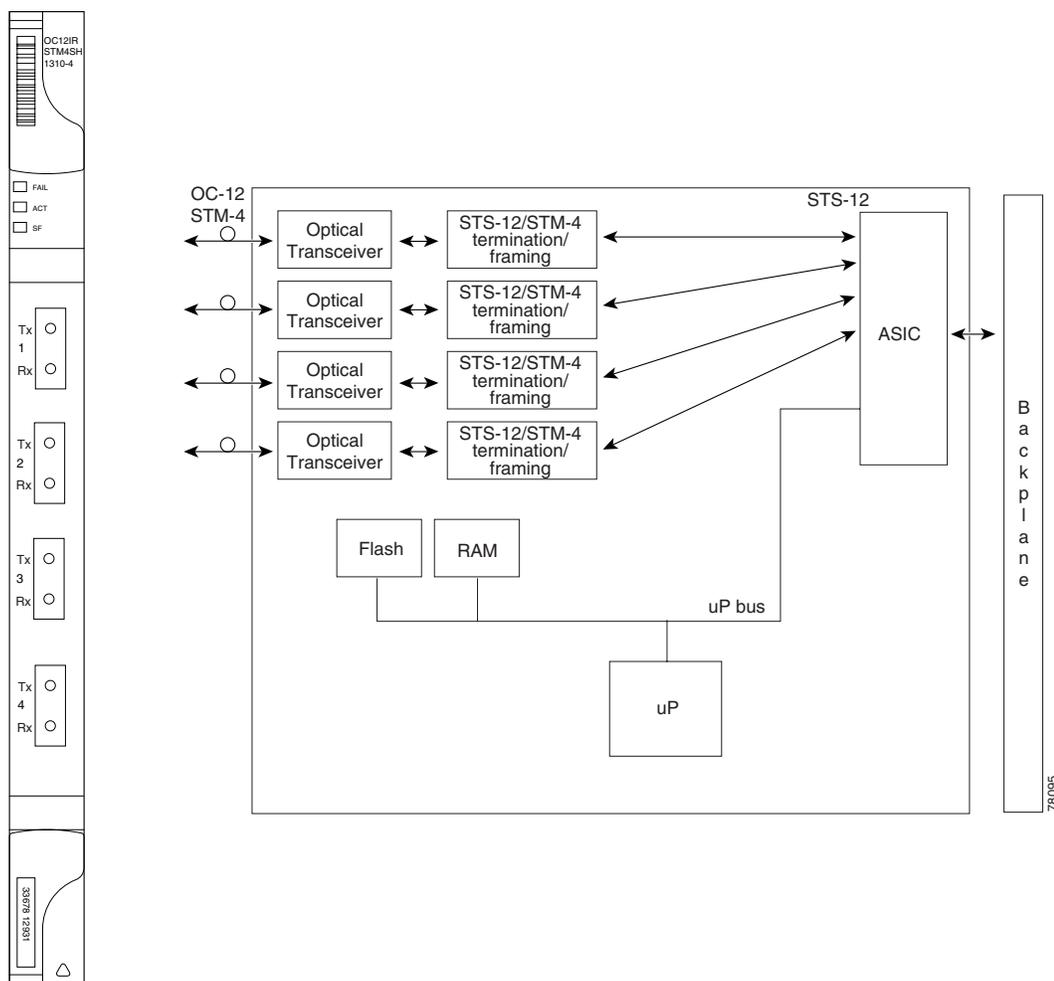
4.7.3 OC12 IR/STM4 SH 1310-4 Card-Level Indicators

The OC12 IR/STM4 SH 1310-4 card has three card-level LED indicators, described in Table 4-9.

Table 4-9   OC12 IR/STM4 SH 1310-4 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC12 IR/STM4 SH 1310-4 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, AIS-L or high BER on one or more of the card's ports. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.7.4 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 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.7.5 OC12 IR/STM4 SH 1310-4 Specifications

The OC12 IR/STM4 SH 1310-4 card has the following specifications:

- Line
  - Bit rate: 622.08 Mbps
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connector: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
  - Maximum transmitter output power: –8 dBm
  - Minimum transmitter output power: –15 dBm
  - Center wavelength: 1274 nm to 1356 nm
  - Nominal wavelength: 1310 nm

- – Transmitter: Fabry Perot laser
- • Receiver
  - – Maximum receiver level: –8 dBm
  - – Minimum receiver level: –30 dBm
  - – Receiver: InGaAs/InP photodetector
  - – Link loss budget: 15 dB
  - – Receiver input wavelength range: 1274 nm to 1356 nm
- • Operating temperature
  - – C-Temp: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
- • Operating humidity
  - – 5 to 95%, noncondensing
- • Power consumption
  - – 28 W, 0.58 A, 100 BTU/hr
- • Dimensions
  - – Height: 12.650 in. (321.3 mm)
  - – Width: 0.716 in. (18.2 mm)
  - – Depth: 9.000 in. (228.6 mm)
  - – Weight not including clam shell: 1.0 lb (0.4 kg)
- • Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:
  - – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
 - – Eye safety compliance: Class I

Note   Minimum transmit power, Minimum receive power, and link loss budget might exceed standard specifications.

4.8 OC48 IR 1310 Card

The OC48 IR 1310 card provides one intermediate-range, SONET OC-48 port per card, compliant with Telcordia GR-253-CORE. Each port operates at 2.49 Gbps over a single-mode fiber span. The card supports VT and nonconcatenated, or concatenated payloads at STS-1, STS-3c, STS-6c, STS-12c, or STS-48c signal levels. Figure 4-8 on page 4-29 shows the OC48 IR 1310 faceplate and a block diagram of the card.

Figure 4-8   OC48 IR 1310 Faceplate and Block Diagram
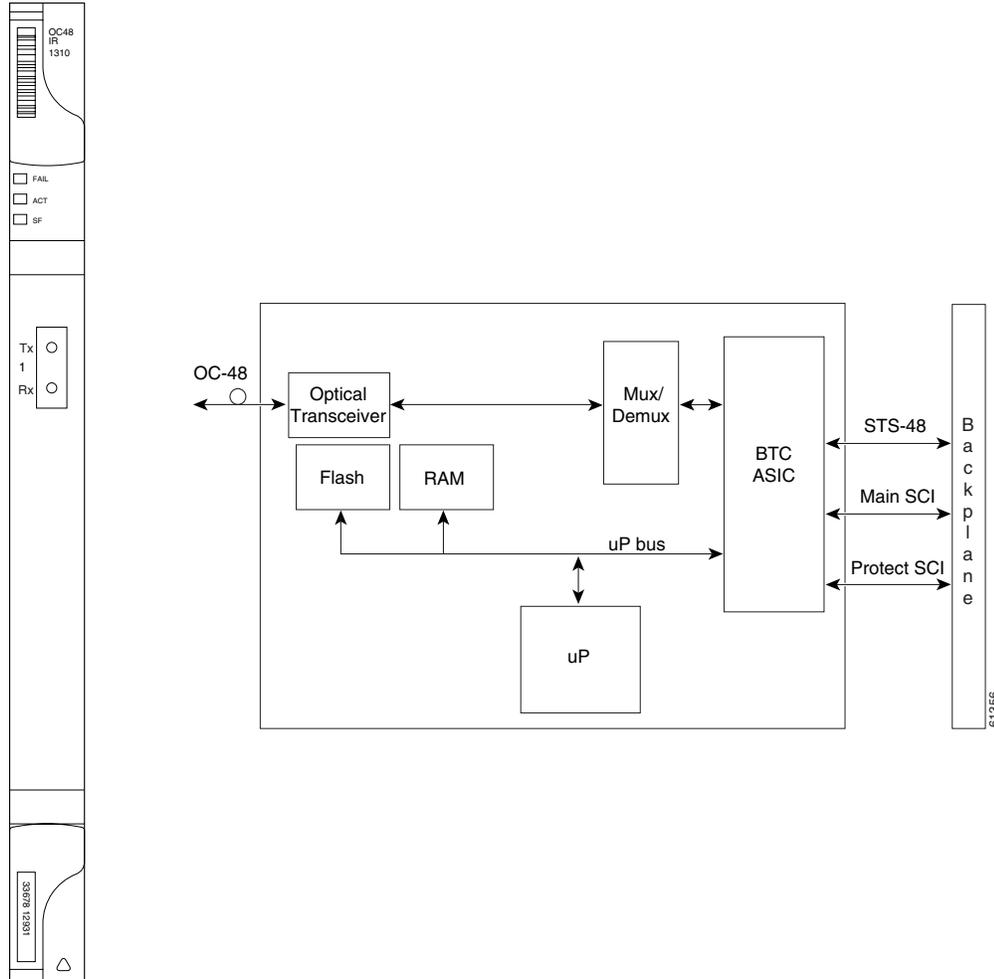
You can install the OC48 IR 1310 card in Slots 5, 6, 12, and 13, and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration.

The OC-48 port features a 1310-nm laser and contains a transmit and receive connector (labeled) on the card faceplate. The OC48 IR 1310 uses SC connectors. The card supports 1+1 unidirectional and bidirectional protection switching.

The OC48 IR 1310 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIT errors.

4.8.1 OC48 IR 1310 Card-Level Indicators

The OC48 IR 1310 card has three card-level LED indicators, described in Table 4-10.

Table 4-10   OC48 IR 1310 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC48 IR 1310 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, AIS-L or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.8.2 OC48 IR 1310 Port-Level Indicators

You can find the status of the OC48 IR 1310 card port 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.8.3 OC48 IR 1310 Card Specifications

The OC48 IR 1310 card has the following specifications:

- Line

  - Bit rate: 2.49 Gbps

  - Code: Scrambled NRZ

  - Fiber: 1310-nm single-mode

  - Loopback modes: Terminal and Facility

  - Connectors: SC

  - Compliance: Telcordia GR-253-CORE

- Transmitter

  - Maximum transmitter output power: 0 dBm

  - Minimum transmitter output power: –5 dBm

  - Center wavelength: 1280 nm to 1350 nm

  - Nominal wavelength: 1310 nm

Transmitter: Uncooled direct modulated DFB

• Receiver

  – Maximum receiver level: 0 dBm

  – Minimum receiver level: –18 dBm

  – Receiver: InGaAs InP photodetector

  – Link loss budget: 13 dB minimum

  – Receiver input wavelength range: 1280 nm to 1350 nm

• Environmental

  – Operating temperature:

    C-Temp (15454-OC481IR1310): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

  – Operating humidity: 5 to 95%, noncondensing

  – Power consumption: 32.20 W, 0.67 A, 109.94 BTU/hr

• Dimensions

  – Height: 12.650 in. (321.3 mm)

  – Width: 0.716 in. (18.2 mm)

  – Depth: 9.000 in. (228.6 mm)

  – Weight not including clam shell: 1.8 lb (0.8 kg)

• Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  – Eye safety compliance: Class I

4.9 OC48 LR 1550 Card

The OC48 LR 1550 card provides one long-range, SONET OC-48 port per card, compliant with
Telcordia GR-253-CORE. Each port operates at 2.49 Gbps over a single-mode fiber span. The card
supports VT, nonconcatenated or concatenated payloads at STS-1, STS-3c, STS-6c STS-12c or STS-48c
signal levels. Figure 4-9 on page 4-32 shows the OC48 LR 1550 faceplate and a block diagram of the
card.

Figure 4-9   OC48 LR 1550 Faceplate and Block Diagram
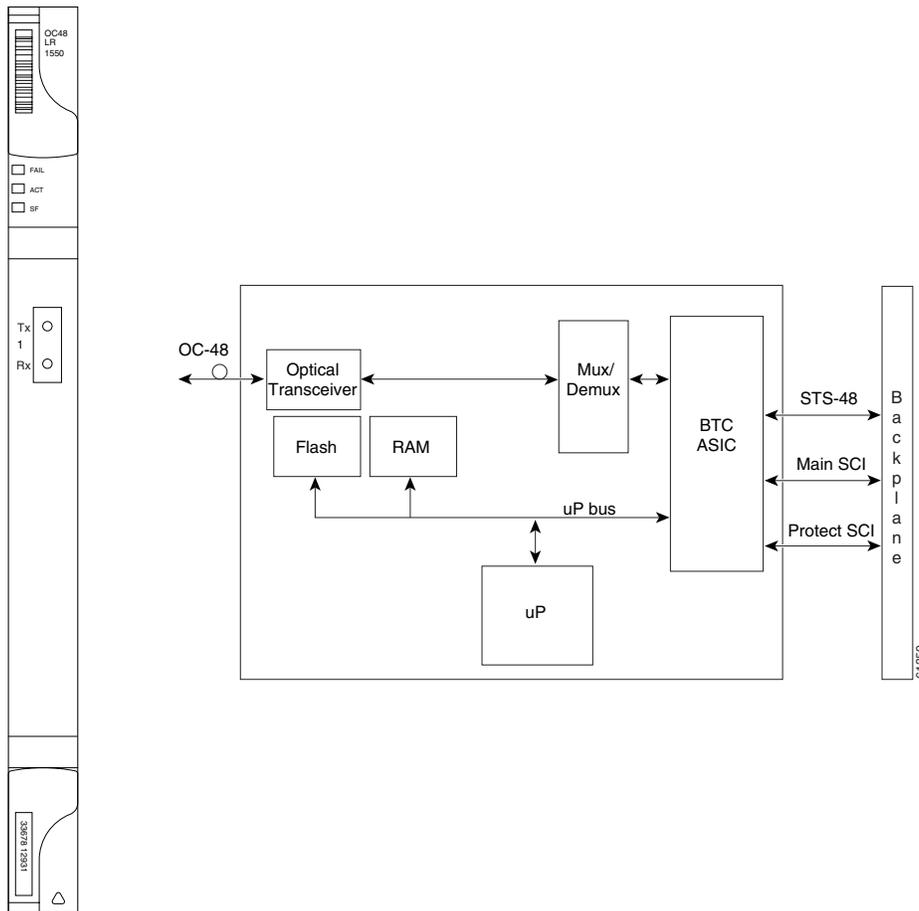
You can install OC48 LR 1550 cards in Slots 5, 6, 12, and 13 and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration.

The OC48 LR 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 and bidirectional protection switching.

The OC48 LR 1550 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIT errors.

4.9.1 OC48 LR 1550 Card-Level Indicators

The OC48 LR 1550 card has three card-level LED indicators, described in Table 4-11.

Table 4-11   OC48 LR 1550 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC48 LR 1550 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 or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.9.2 OC48 LR 1550 Port-Level Indicators

You can find the status of the OC48 LR 1550 card port 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.9.3 OC48 LR 1550 Card Specifications

The OC48 LR 1550 card has the following specifications:

- Line
  - Bit rate: 2.49 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE
- Transmitter
  - Maximum transmitter output power: +3 dBm
  - Minimum transmitter output power: –2 dBm
  - Center wavelength: 1520 nm to 1580 nm
  - Nominal wavelength: 1550 nm

- – Transmitter: DFB laser
- Receiver
    - – Maximum receiver level: –8 dBm
    - – Minimum receiver level: –28 dBm
    - – Receiver: InGaAs avalanche photo diode (APD) photodetector
    - – Link loss budget: 26 dB minimum, with 1 dB dispersion penalty
    - – Receiver input wavelength range: 1520 nm to 1580 nm
- Environmental
    - – Operating temperature:

        C-Temp (15454-OC481LR1550): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
    - – Operating humidity: 5 to 95%, noncondensing
    - – Power consumption: 26.80 W, 0.56 A, 91.50 BTU/hr
- Dimensions
    - – Height:12.650 in. (321.3 mm)
    - – Width: 0.716 in. (18.2 mm)
    - – Depth: 9.000 in. (228.6 mm)
    - – Weight not including clam shell: 1.8 lb (0.8 kg)
- Compliance

    ONS 15454 optical cards, when installed in a system, comply with these standards:
    - – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
    - – Eye safety compliance: Class I

4.10 OC48 IR/STM16 SH AS 1310 Card

The OC48 IR/STM16 SH AS 1310 card provides one intermediate-range SONET/SDH OC-48 port compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The port operates at 2.49 Gbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at STS-1, STS-3c, STS-6c, STS-12c, or STS-48c signal levels. Figure 4-10 on page 4-35 shows the OC48 IR/STM16 SH AS 1310 faceplate and a block diagram of the card.

Figure 4-10   OC48 IR/STM16 SH AS 1310 Faceplate and Block Diagram
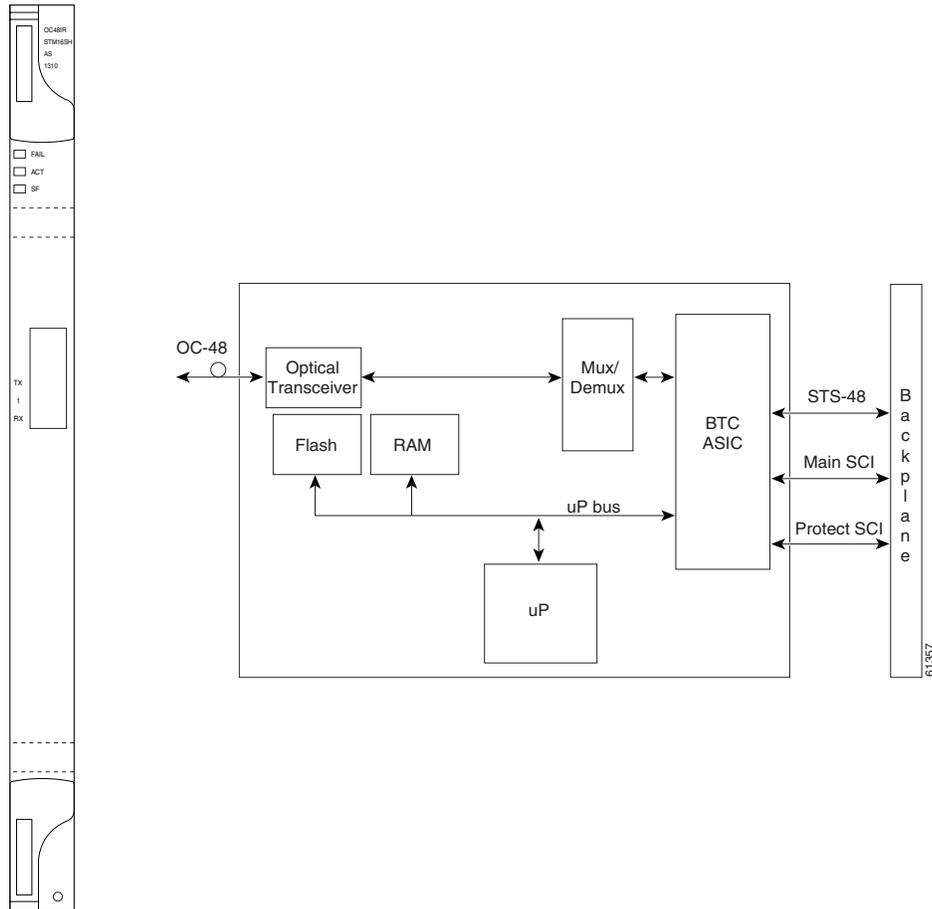
You can install the OC48 IR/STM16 SH AS 1310 card in Slots 1 to 6 and 12 to 17 and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration.

The OC-48 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 uses SC connectors. The card supports 1+1 unidirectional and bidirectional protection switching.

The OC48 IR/STM16 SH AS 1310 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIT errors.

4.10.1 OC48 IR/STM16 SH AS 1310 Card-Level Indicators

The OC48 IR/STM16 SH AS 1310 card has three card-level LED indicators, described in Table 4-12.

Table 4-12   OC48 IR/STM16 SH AS 1310 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC48 IR/STM16 SH AS 1310 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, AIS-L or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.10.2 OC48 IR/STM16 SH AS 1310 Port-Level Indicators

You can find the status of the OC48 IR/STM16 SH AS 1310 card port 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.10.3 OC48 IR/STM16 SH AS 1310 Compatibility

Use the XC10G card, the TCC+/TCC2 card, the 15454-SA-ANSI shelf assembly, and Software R3.1 or later to enable the OC48 IR/STM16 SH AS 1310 card. The OC48 IR/STM16 SH AS 1310 card uses the BTC backplane interface to provide recognition in Slots 1 to 6 and 12 to 17.

4.10.4 OC48 IR/STM16 SH AS 1310 Card Specifications

The OC48 IR/STM16 SH AS 1310 card has the following specifications:

- Line
  - Bit rate: 2.49 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957

- Transmitter

    - Maximum transmitter output power: 0 dBm

    - Minimum transmitter output power: –5 dBm

    - Center wavelength: 1280 nm to 1350 nm

    - Nominal wavelength: 1310nm

    - Transmitter: DFB laser

- Receiver

    - Maximum receiver level: 0 dBm

    - Minimum receiver level: –18 dBm

    - Receiver: InGaAs InP photodetector

    - Link loss budget: 13 dB minimum

    - Receiver input wavelength range: 1280 nm to 1350 nm

- Environmental

    - Operating temperature:

      C-Temp (15454-OC481IR1310A): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

    - Operating humidity: 5 to 95%, noncondensing

    - Power consumption: 37.20 W, 0.77 A, 127.01 BTU/hr

- Dimensions

    - Height: 12.650 in. (321.3 mm)

    - Width: 0.716 in. (18.2 mm)

    - Depth: 9.000 in. (228.6 mm)

    - Weight not including clam shell: 2.2 lb (0.9 kg)

- Compliance

    ONS 15454 optical cards, when installed in a system, comply with these standards:

    - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

    - Eye safety compliance: Class I

4.11 OC48 LR/STM16 LH AS 1550 Card

The OC48 LR/STM16 LH AS 1550 card provides one long-range SONET/SDH OC-48 port compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. Each port operates at 2.49 Gbps over a single-mode fiber span. The card supports VT and nonconcatenated or concatenated payloads at STS-1, STS-3c, STS-6c, STS-12c, or STS-48c signal levels. Figure 4-11 on page 4-38 shows a block diagram and the faceplate of the OC48 LR/STM16 LH AS 1550 card.

Figure 4-11   OC48 LR/STM16 LH AS 1550 Faceplate and Block Diagram
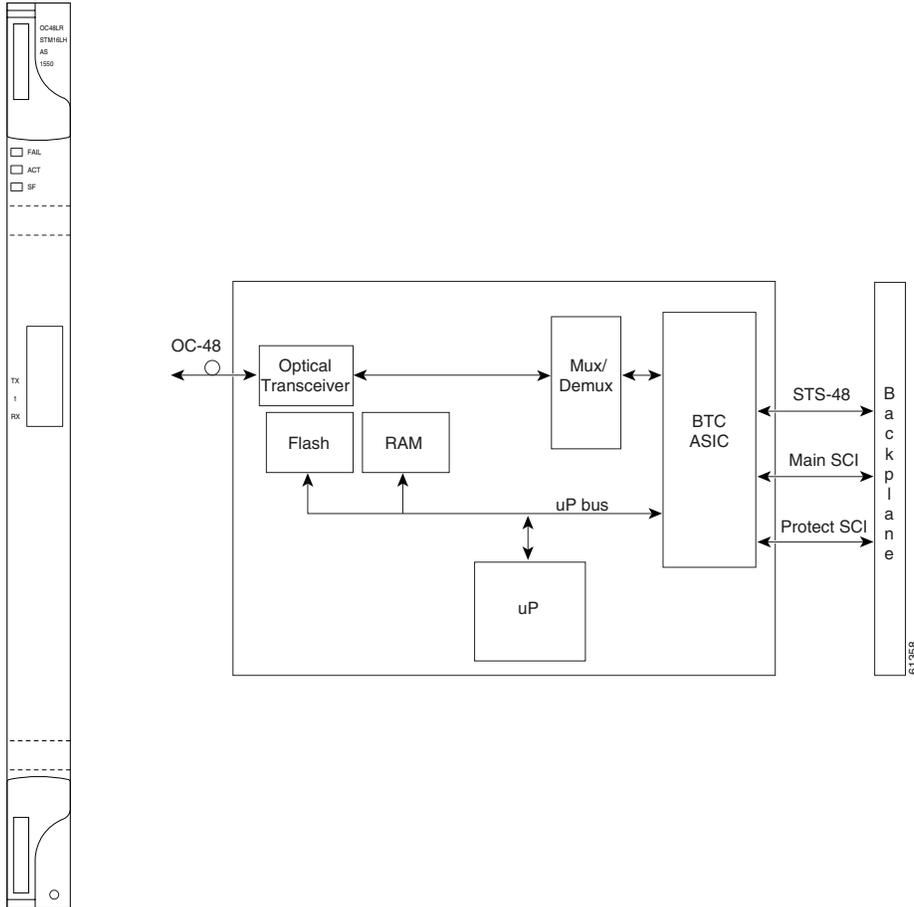
You can install OC48 LR/STM16 LH AS 1550 cards in Slots 1 to 6 and 12 to 17 and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration.

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 and bidirectional protection switching.

The OC48 LR/STM16 LH AS 1550 detects LOS, LOF, LOP, AIS-L, and RDI-L conditions. The card also counts section and line BIT errors.

4.11.1 OC48 LR/STM16 LH AS 1550 Card-Level Indicators

The OC48 LR/STM16 LH AS 1550 card has three card-level LED indicators, described in Table 4-13.

Table 4-13   OC48 LR/STM16 LH AS 1550 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC48 LR/STM16 LH AS 1550 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, or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.11.2 OC48 LR/STM16 LH AS 1550 Port-Level Indicators

You can find the status of the OC48 LR/STM16 LH AS 1550 card port 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.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.11.3 OC48 LR/STM16 LH AS 1550 Compatibility

Use the XC10G card, the TCC+/TCC2 card, the 15454-SA-ANSI shelf assembly, and Software R3.1 or later to enable the OC48 LR/STM16 LH AS 1550 card. The OC48 LR/STM16 LH AS 1550 card uses the BTC backplane interface to provide recognition in Slots 1 to 6 and 12 to 17.

4.11.4 OC48 LR/STM16 LH AS 1550 Card Specifications

The OC48 LR/STM16 LH AS 1550 card has the following specifications:

- Line
  - Bit rate: 2.49 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957

- Transmitter
  - Maximum transmitter output power: +3 dBm
  - Minimum transmitter output power: –2 dBm
  - Center wavelength: 1520 nm to 1580 nm
  - Nominal wavelength: 1550 nm
  - Transmitter: DFB laser
- Receiver
  - Maximum receiver level: –8 dBm
  - Minimum receiver level: –28 dBm
  - Receiver: InGaAs APD photodetector
  - Link loss budget: 26 dB minimum, with 1 dB dispersion penalty
  - Receiver input wavelength range: 1520 nm to 1580 nm
- Environmental
  - Operating temperature:

    C-Temp (15454-OC481LR1550A): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
  - Operating humidity: 5 to 95%, noncondensing
  - Power consumption: 37.20 W, 0.77 A, 127.01 BTU/hr
- Dimensions
  - Height:12.650 in. (321.3 mm)
  - Width: 0.716 in. (18.2 mm)
  - Depth: 9.000 in. (228.6 mm)
  - Weight not including clam shell: 2.2 lb (0.9 kg)
- Compliance

 ONS 15454 optical cards, when installed in a system, comply with these standards:
  - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950
  - Eye safety compliance: Class I

4.12 OC48 ELR/STM16 EH 100 GHz Cards

Thirty-seven distinct OC48 ELR/STM16 EH 100 GHz cards provide the ONS 15454 DWDM channel plan. Each OC48 ELR/STM16 EH 100 GHz card has one SONET OC-48/SDH STM-16 port that complies with Telcordia GR-253-CORE, ITU-T G.692, and ITU-T G.958.

The port operates at 2.49 Gbps over a single-mode fiber span. The card carries VT, concatenated, and nonconcatenated payloads at STS-1, STS-3c, STS-6c, STS-12c, or STS-48c signal levels. Figure 4-12 on page 4-41 shows the OC48 ELR/STM16 EH 100 GHz faceplate and a block diagram of the card.

Figure 4-12   OC48 ELR/STM16 EH 100 GHz Faceplate and Block Diagram
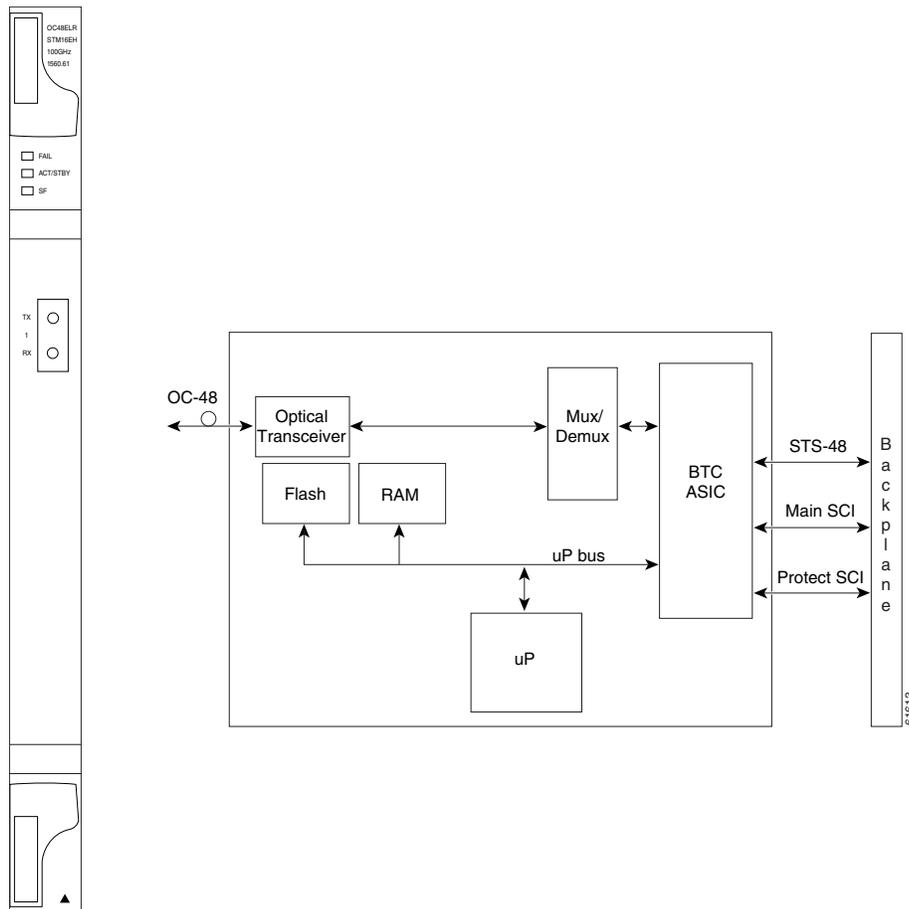
Nineteen of the cards operate in the blue band with spacing of 100 GHz on the ITU grid (1528.77 nm, 1530.33 nm, 1531.12 nm, 1531.90 nm, 1532.68 nm, 1533.47 nm, 1534.25 nm, 1535.04 nm, 1535.82 nm, 1536.61 nm, 1538.19 nm, 1538.98 nm, 1539.77 nm, 1540.56 nm, 1541.35 nm, 1542.14 nm, 1542.94 nm, 1543.73 nm, 1544.53 nm). ITU spacing conforms to ITU-T G.692 and Telcordia GR-2918-CORE, issue 2.

The other eighteen cards operate in the red band with spacing of 100 GHz on the ITU grid (1546.12 nm, 1546.92 nm, 1547.72 nm, 1548.51 nm,1549.32 nm, 1550.12 nm, 1550.92 nm, 1551.72 nm, 1552.52 nm, 1554.13 nm, 1554.94 nm, 1555.75 nm, 1556.55 nm, 1557.36 nm, 1558.17 nm, 1558.98 nm, 1559.79 nm, 1560.61 nm). These cards are also designed to interoperate with the Cisco ONS 15216 DWDM solution.

You can install the OC48 ELR/STM16 EH 100 GHz cards in Slots 5, 6, 12, and 13, and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration. Each OC48 ELR/STM16 EH 100 GHz card uses extended long-reach optics operating individually within the ITU-T 100 GHz grid. The OC-48 DWDM cards are intended to be used in applications with long unregenerated spans of up to 186 miles (300 km) (with mid-span amplification). These transmission distances are achieved through the use of inexpensive optical amplifiers (flat gain amplifiers) such as Cisco ONS 15216 erbium-doped fiber amplifiers (EDFAs).

Maximum system reach in filterless applications is 26 dB 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. When used in combination with ONS 15216 100-GHz filters, the link budget is reduced by the insertion loss of the filters plus an additional 2-dB

power penalty. The wavelength stability of the OC48 ELR/STM16 EH 100 GHz cards is +/- 0.12 nm for the life of the product and over the full range of operating temperatures. Each interface contains a transmitter and receiver.

The OC48 ELR/STM16 EH 100 GHz cards detect LOS, LOF, LOP, and AIS-L conditions. The cards also count section and line BIT errors.

4.12.1 OC48 ELR 100 GHz Card-Level Indicators

The OC48 ELR/STM16 EH 100 GHz cards have three card-level LED indicators, listed in Table 4-14.

Table 4-14   OC48 ELR/STM16 EH 100 GHz Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC48 ELR/STM16 EH 100 GHz 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 or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.12.2 OC48 ELR 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 fan-tray assembly. Use the LCD to quickly view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.12.3 OC48 ELR 100 GHz Compatibility

The OC48 ELR/STM16 EH 100 GHz card requires a Cross Connect (XC) card, a Cross Connect Virtual Tributary (XCVT) card, or an XC10G for proper operation.

4.12.4 OC48 ELR 100 GHz Card Specifications

The OC48 ELR 100 GHz card has the following specifications:

*   Line
    *   Bit rate: 2.49 Gbps

- – Code: Scrambled NRZ

- – Fiber: 1550-nm single-mode

- – Loopback modes: Terminal and Facility

- – Connectors: SC

- – Compliance: Telcordia GR-253-CORE, ITU-T G.692, ITU-T G.958

- Transmitter

  - – Maximum transmitter output power: 0 dBm

  - – Minimum transmitter output power: –2 dBm

  - – Center wavelength: ±.12 nm

  - – Transmitter: Electro-absorption laser

- Receiver

  - – Maximum receiver level: –9 dBm

  - – Minimum receiver level: –27 dBm at 1E–12 BER

  - – Receiver: InGaAs APD photodetector

  - – Link loss budget: 25 dB minimum at 1E–12 BER, (not including the power dispersion penalty)

  - – Dispersion Penalty: 2 dB for a dispersion of up to 5400 ps/nm

  - – Receiver input wavelength range: 1520 nm to 1580 nm

- Environmental

  - – Operating temperature:

    C-Temp: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
    (For product names, see 4.1.3 Card Temperature Ranges, page 4-6)

  - – Operating humidity: 5 to 95%, noncondensing

  - – Power consumption: 31.20 W, 0.65 A, 106.53 BTU/hr

- Dimensions

  - – Height:12.650 in. (321.3 mm)

  - – Width: 0.716 in. (18.2 mm)

  - – Depth: 9.000 in. (228.6 mm)

  - – Weight not including clam shell: 2.4 lb (1.1 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - – Eye safety compliance: Class I

4.13 OC48 ELR 200 GHz Cards

Eighteen distinct OC48 ELR 200 GHz cards provide the ONS 15454 DWDM channel plan. Each OC48 ELR 200 GHz card provides one SONET OC-48 port that is compliant with Telcordia GR-253-CORE. The port operates at 2.49 Gbps over a single-mode fiber span. The card carries VT, concatenated, and nonconcatenated payloads at STS-1, STS-3c, STS-6c, STS-12c, or STS-48c signal levels. Figure 4-13 shows the OC48 ELR 200 GHz faceplate and a block diagram of the card.

Figure 4-13   OC48 ELR 200 GHz Faceplate and Block Diagram
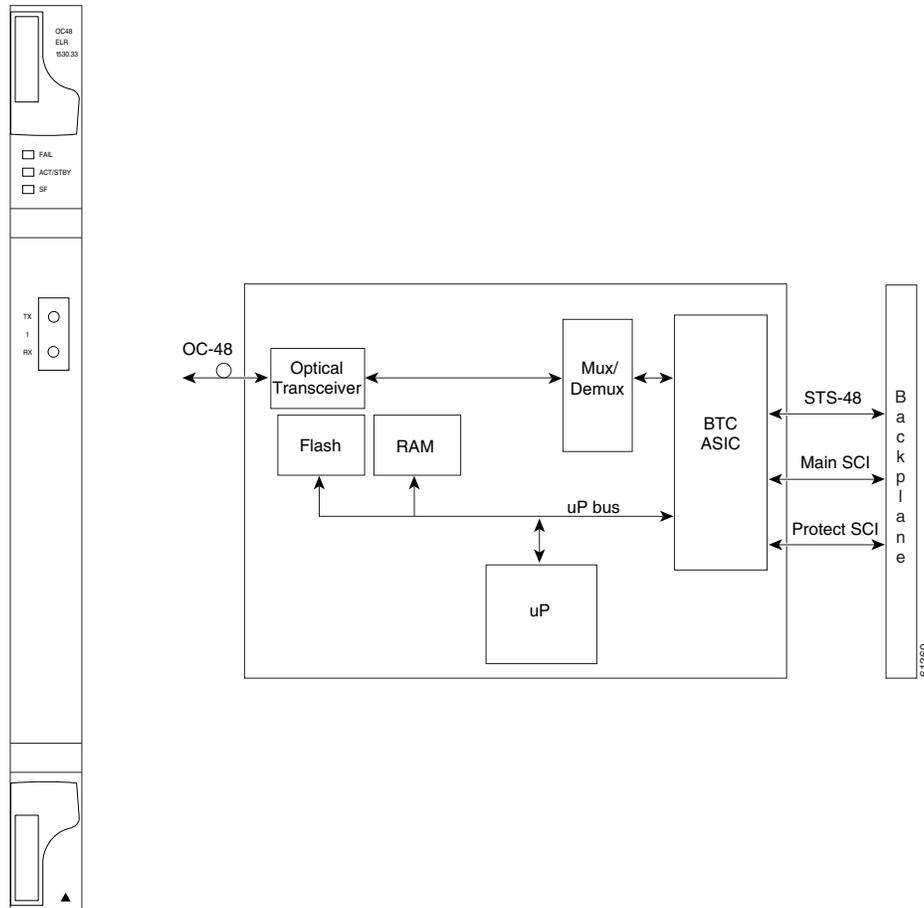
Nine of the cards operate in the blue band with spacing of 200 GHz on the ITU grid (1530.33 nm, 1531.90 nm, 1533.47 nm, 1535.04 nm, 1536.61 nm, 1538.19 nm, 1539.77 nm, 1541.35 nm, 1542.94 nm).

The other nine cards operate in the red band with spacing of 200 GHz on 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, 1560.61 nm). These cards are also designed to interoperate with the Cisco ONS 15216 DWDM solution.

You can install the OC48 ELR 200 GHz cards in Slots 5, 6, 12, and 13, and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration. Each OC48 ELR 200 GHz card uses extended long-reach optics operating individually within the ITU-T 200-GHz grid. The OC48 ELR 200 GHz cards are intended to be used in applications with long unregenerated spans of up to 124 miles (200 km) (with mid-span amplification). These

transmission distances are achieved through the use of inexpensive optical amplifiers (flat gain amplifiers) such as EDFAs. Using collocated amplification, distances up to 124 miles (200 km) can be achieved for a single channel, 99 miles (160 km) for 8 channels.

Maximum system reach in filterless applications is 24 dB or approximately 50 miles (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 or other performance-affecting factors. The OC48 ELR DWDM cards feature wavelength stability of +/- 0.25 nm. Each interface contains a transmitter and receiver.

The OC48 ELR 200 GHz cards are the first in a family of cards meant to support extended long-reach applications in conjunction with optical amplification. Using electro-absorption technology, the OC48 DWDM cards provide a solution at the lower extended long-reach distances.

The OC48 ELR 200 GHz interface features a 1550-nm 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 200 GHz cards detect LOS, LOF, LOP, AIS-L, and RDI-L conditions. The cards also count section and line BIT errors. To enable APS, the OC48 ELR 200 GHz cards extract the K1 and K2 bytes from the SONET overhead. The DCC bytes are forwarded to the TCC+/TCC2 card; the TCC+/TCC2 terminates the DCC/GCC.

4.13.1 OC48 ELR 200 GHz Card-Level Indicators

The OC48 ELR 200 GHz cards have three card-level LED indicators, described in Table 4-15.

Table 4-15   OC48 ELR 200 GHz Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the OC48 ELR 200 GHz 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 or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.13.2 OC48 ELR 200 GHz Port-Level Indicators

You can find the status of the OC48 ELR 200 GHz card ports using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to quickly view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.13.3 OC48 ELR 200 GHz Compatibility

The OC48 ELR 200 GHz card requires an XC card, XCVT card, or XC10G card for proper operation.

4.13.4 OC48 ELR 200 GHz Card Specifications

The OC48 ELR 200 GHz card has the following specifications:

- Line
  - Bit rate: 2.49 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G692, ITU-T G958
- Transmitter
  - Maximum transmitter output power: 0 dBm
  - Minimum transmitter output power: –2 dBm
  - Center wavelength: ±.25 nm
  - Transmitter: Electro-absorption laser
- Receiver
  - Maximum receiver level: –8 dBm
  - Minimum receiver level: –28 dBm
  - Receiver: InGaAs APD photodetector
  - Link loss budget: 26 dB minimum, with 1 dB dispersion penalty
  - Receiver input wavelength range: 1520 nm to 1580 nm
- Environmental
  - Operating temperature:

    C-Temp: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
  - Operating humidity: 5 to 95%, noncondensing
  - Power consumption: 31.20 W, 0.65 A, 106.53 BTU/hr
- Dimensions
  - Height:12.650 in. (321.3 mm)
  - Width: 0.716 in. (18.2 mm)
  - Depth: 9.000 in. (228.6 mm)
  - Weight not including clam shell: 2.9 lb (1.3 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  – Eye safety compliance: Class I

4.14 OC192 SR/STM64 IO 1310 Card

Warning   **Class 1 (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products. Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments, or performance of procedures other than those specified may result in hazardous radiation exposure.**

The OC192 SR/STM64 IO 1310 card provides one intra-office haul SONET/SDH OC-192 port in the 1310-nm wavelength range, compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The port operates at 9.95328 Gbps over unamplified distances up to 1.24 miles (2 km). The card supports VT and nonconcatenated or concatenated payloads. Figure 4-14 on page 4-48 shows the OC192 SR/STM64 IO 1310 faceplate and Figure 4-15 on page 4-49 shows a block diagram of the card.

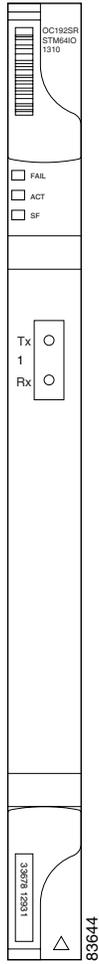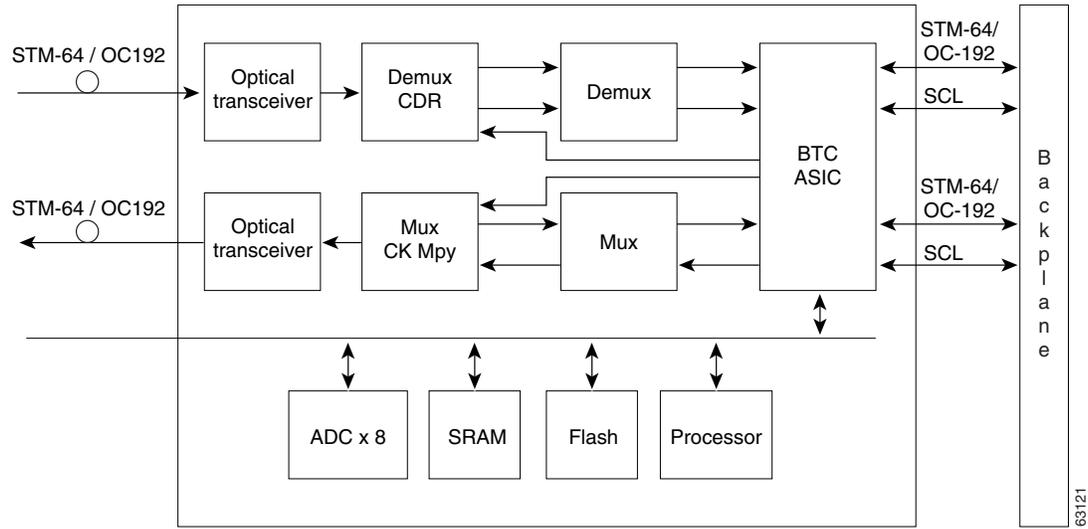*Figure 4-14   OC192 SR/STM64 IO 1310 Faceplate*

Figure 4-15 OC192 SR/STM64 IO 1310 Block Diagram

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 BLSR, a path protection configuration, a linear configuration, or as 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 1:1 protection in four-fiber bidirectional line switched ring applications where both span switching and ring switching might occur.

The OC192 SR/STM64 IO 1310 card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 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.

4.14.1 OC192 SR/STM64 IO 1310 Card-Level Indicators

The OC192 SR/STM64 IO 1310 card has three card-level LED indicators, listed in Table 4-16.

Table 4-16   OC192 SR/STM64 IO 1310 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. This LED is lit during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.

Table 4-16   OC192 SR/STM64 IO 1310 Card-Level Indicators (continued)

Card-Level LED	Description
ACT/STBY LED Green (Active) Yellow (Standby)	When the ACTV/STBY LED is green, the OC192 SR/STM64 IO 1310 card is operational and ready to carry traffic. When the ACTV/STBY LED is yellow, the OC192 SR/STM64 IO 1310 card is operational and in standby (protect) mode.
Yellow SF LED	The yellow SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more of the card's ports. The yellow SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected and the link is working, the light turns off.

4.14.2 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 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.

4.14.3 OC192 SR/STM64 IO 1310 Card Specifications

The OC 192 SR/STM64 IO 1310 card has the following specifications:

- Line
  - Bit rate: 9.95328 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 6.6 ps/nm
  - Loopback modes: Terminal and Facility
  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957, ITU-T G.691
- Transmitter
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: 1290 nm to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: Directly modulated laser
- Receiver
  - Maximum receiver level: –1 dBm at BER 1 * 10 exp – 12
  - Minimum receiver level: –11 dBm at BER 1 * 10 exp – 12
  - Receiver: PIN diode

- – Link loss budget: 5 dB minimum, plus 1 dB dispersion penalty
at BER = 1 * 10 exp – 12 including dispersion

- – Receiver input wavelength range: 1290 nm to 1330 nm

- Environmental

  - – Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

  - – Operating humidity: 5 to 95%, noncondensing

  - – Power consumption: 47.00 W, 0.98 A at –48 V, 160.5 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: 3.1 lb (1.3 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - – Eye safety compliance: Class I

4.15 OC192 IR/STM64 SH 1550 Card

⚠ Warning   **Class 1 (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products. Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments, or performance of procedures other than those specified may result in hazardous radiation exposure.**

The OC192 IR/STM64 SH 1550 card provides one intermediate reach SONET/SDH OC-192 port in the 1550-nm wavelength range, compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The port operates at 9.95328 Gbps over unamplified distances up to 25 miles (40 km) with SMF-28 fiber limited by loss and/or dispersion. The card supports VT and nonconcatenated or concatenated payloads. Figure 4-16 on page 4-52 shows the OC192 IR/STM64 SH 1550 faceplate and Figure 4-17 on page 4-53 shows a block diagram of the card.

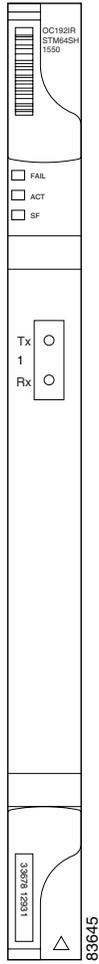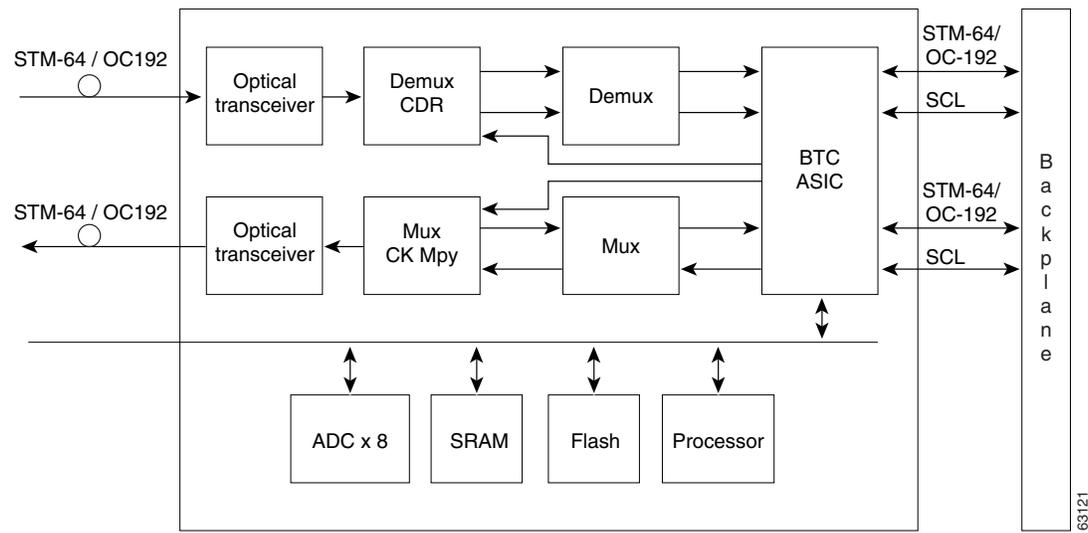*Figure 4-16   OC192 IR/STM64 SH 1550 Faceplate*

Figure 4-17   OC192 IR/STM64 SH 1550 Block Diagram

Note   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 card.

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 BLSR, path protection configuration, or linear configuration, or also 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 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.

4.15.1 OC192 IR/STM64 SH 1550 Card-Level Indicators

The OC192 IR/STM64 SH 1550 card has three card-level LED indicators, listed in Table 4-17.

Table 4-17   OC192 IR/STM64 SH 1550 Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. This LED is lit during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Yellow (Standby)	When the ACTV/STBY LED is green, the OC192 IR/STM64 SH 1550 card is operational and ready to carry traffic. When the ACTV/STBY LED is yellow, the OC192 IR/STM64 SH 1550 card is operational and in standby (protect) mode.
Yellow SF LED	The yellow SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more of the card's ports. The yellow SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected and the link is working, the light turns off.

4.15.2 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 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.

4.15.3 OC192 IR/STM64 SH 1550 Card Specifications

The OC192 IR/STM64 SH 1550 card has the following specifications:

- Line
  - Bit rate: 9.95328 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: 800 ps/nm
  - Loopback modes: Terminal and Facility

Note 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.

  - Connectors: SC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
  - Maximum transmitter output power: +2 dBm
  - Minimum transmitter output power: –1 dBm

- Center wavelength: 1530 nm to 1565 nm

- Nominal wavelength: 1550 nm

- Transmitter: Cooled EA modulated laser

- Receiver

  - Maximum receiver level: –1 dBm at BER 1 * 10 exp – 12

  - Minimum receiver level: –14 dBm at BER 1 * 10 exp – 12

  - Receiver: PIN diode

  - Link loss budget: 13 dB minimum, plus 2 dB dispersion penalty at BER = 1 * 10 exp – 12 including dispersion

  - Receiver input wavelength range: 1530 nm to 1565 nm

- Environmental

  - Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

  - Operating humidity: 5 to 95%, noncondensing

  - Power consumption: 50.00 W, 1.04 A at –48 V, 170.7 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: 3.1 lb (1.3 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - Eye safety compliance: Class I

4.16 OC192 LR/STM64 LH 1550 Card

The OC192 LR/STM64 LH 1550 card provides one long-range SONET/SDH OC-192 port compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE. The card port operates at 9.96 Gbps over unamplified distances up to 50 miles (80 km) with different types of fiber such as C-SMF or dispersion compensated fiber limited by loss and/or dispersion. The card supports VT and nonconcatenated or concatenated payloads.

Figure 4-18 on page 4-56 shows the OC192 LR/STM64 LH 1550 faceplate and a block diagram of the card. Figure 4-19 on page 4-57 shows an enlarged view of the faceplate warning.

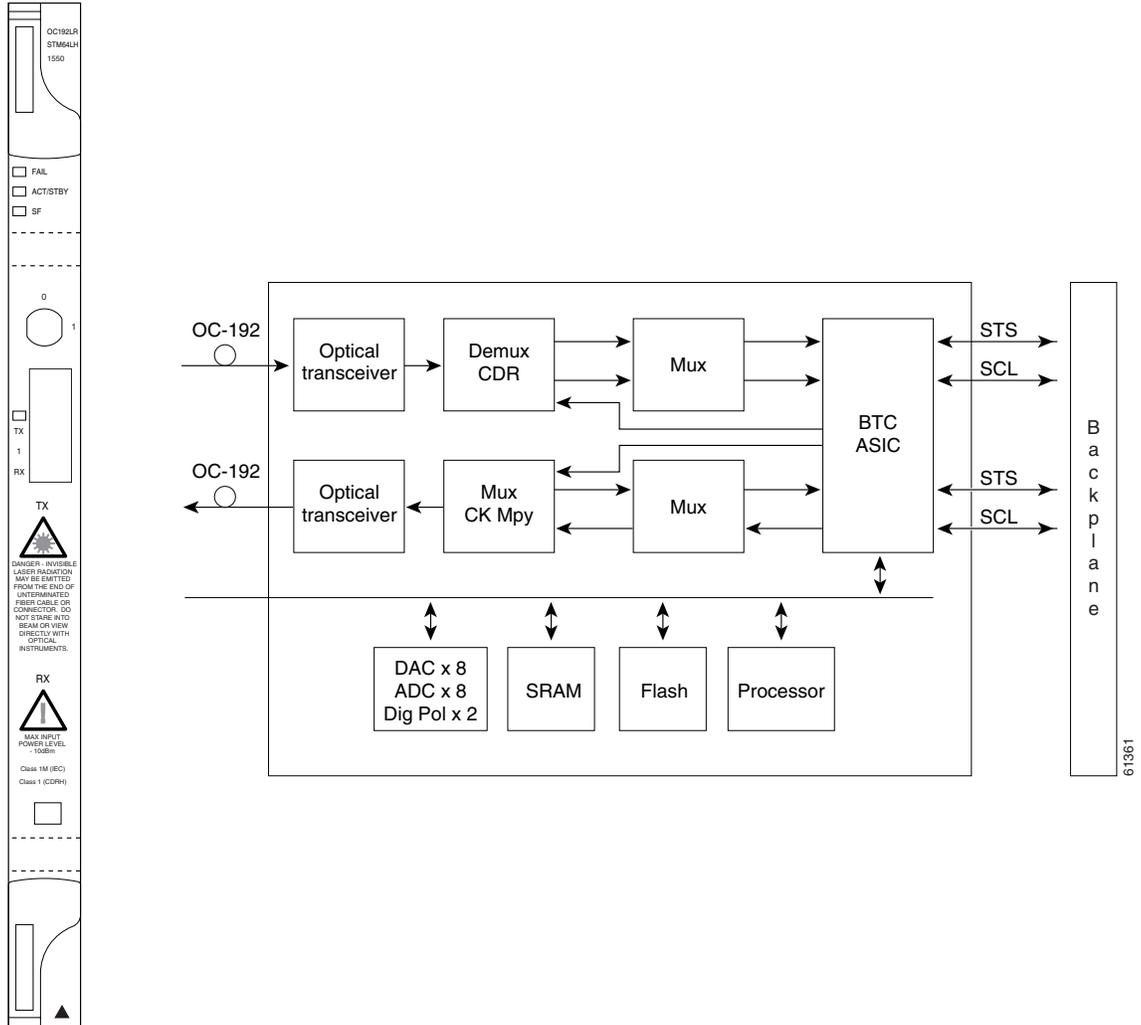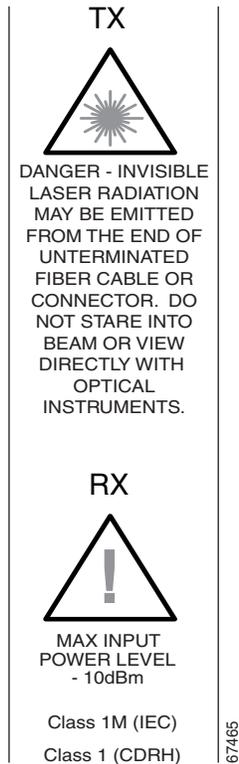**Figure 4-18   OC192 LR/STM64 LH 1550 Faceplate and Block Diagram**

Figure 4-19   Enlarged Section of the OC192 LR/STM64 LH 1550 Faceplate

TX

DANGER - INVISIBLE
LASER RADIATION
MAY BE EMITTED
FROM THE END OF
UNTERMINATED
FIBER CABLE OR
CONNECTOR. DO
NOT STARE INTO
BEAM OR VIEW
DIRECTLY WITH
OPTICAL
INSTRUMENTS.

RX

MAX INPUT
POWER LEVEL
- 10dBm

Class 1M (IEC)

Class 1 (CDRH)

67465

⚠
Caution   You must use a 19 to 24 dB (20 recommended) fiber attenuator when connecting a fiber loopback to an OC192 LR/STM64 LH 1550 card. Never connect a direct fiber loopback. Using fiber loopbacks causes irreparable damage to the card. A transmit-to-receive (Tx-to-Rx) connection that is not attenuated damages the receiver.

You can install OC192 LR/STM64 LH 1550 cards in Slots 5, 6, 12, and 13 and provision the card as a drop or span card in a two-fiber or four-fiber BLSR, path protection configuration, or in an ADM (linear) configuration.

The OC-192 card port features a 1550-nm laser and contains a transmit and receive connector (labeled) on the card faceplate.

⚠
Warning   **On the OC192 LR/STM64 LH 1550 card, the laser is on when the card is booted and the safety key is in the on position (labeled 1). The port does not have to be in service for the laser to be on. The laser is off when the safety key is off (labeled 0).**

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. The card also counts section and line BIT errors from B1 and B2 byte registers in the section and line overhead.

4.16.1 OC192 LR/STM64 LH 1550 Card-Level Indicators

The OC192 LR/STM64 LH 1550 card has three card-level LED indicators, described in Table 4-18.

Table 4-18   OC192 LR/STM64 LH 1550 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
ACT/STBY LED **Green (Active)** **Yellow (Standby)**	When the ACTV/STBY LED is green, the OC-192 card is operational and ready to carry traffic. When the ACTV/STBY LED is amber, the OC-192 card is operational and in standby (protect) mode.
Yellow SF LED	The amber SF LED indicates a signal failure or condition such as LOS, LOF or high BERs on the card's port. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

4.16.2 OC192 LR/STM64 LH 1550 Port-Level Indicators

You can find the status of the OC192 LR/STM64 LH 1550 card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of the port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Warning   **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.**

4.16.3 OC192 LR/STM64 LH 1550 Compatibility

Use the XC10G card, the TCC+/TCC2 card, the new 15454-SA-ANSI shelf assembly, and Software R3.1 or later to enable the OC192 LR/STM64 LH 1550 card.

4.16.4 OC192 LR/STM64 LH 1550 Card Specifications

The OC192 LR/STM64 LH 1550 card has the following specifications:

* Line
    - Bit rate: 9.96 Gbps
    - Code: Scrambled NRZ
    - Fiber: 1550-nm single-mode
    - Loopback modes: Terminal and Facility

Note   You must use a 19 to 24 dB (20 dB recommended) fiber attenuator when connecting a fiber loopback to an OC192 LR/STM64 LH 1550 card. Never connect a direct fiber loopback.

- – Connectors: SC

- – Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957

- Transmitter

  - – Maximum transmitter output power: +10 dBm

  - – Minimum transmitter output power: +7 dBm

  - – Center wavelength: 1530 nm to 1565 nm

  - – Nominal wavelength: 1550 nm

  - – Transmitter: LN (Lithium Niobate) external modulator transmitter

- Receiver

  - – Maximum receiver level: –10 dBm

  - – Minimum receiver level: –19 dBm

  - – Receiver: APD/TIA

  - – Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = 1 – exp (–12) including dispersion

  - – Receiver input wavelength range: 1530 nm to 1565 nm

- Environmental

  - – Operating temperature:

    C-Temp (15454-OC192LR1550): –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)

  - – Operating humidity: 5 to 95%, noncondensing

  - – Power consumption: 72.20 W, 1.50 A, 246.52 BTU/hr

- Dimensions

  - – Height:12.650 in. (321.3 mm)

  - – Width: 0.716 in. (18.2 mm)

  - – Depth: 9.000 in. (228.6 mm)

  - – Weight not including clam shell: 3.1 lb (1.3 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - – Safety: UL 1950, CSA C22.2 No. 950, EN 60950, IEC 60950

  - – Eye safety compliance: Class I (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-12001-01) laser products

4.17 OC192 LR/STM64 LH ITU 15xx.xx Card

Warning **Class 1 (21 CFR 1040.10, 1040.11 and IEC 60825-1 2001-01) laser products. Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments, or performance of procedures other than those specified may result in hazardous radiation exposure.**

Sixteen distinct OC-192/STM-64 ITU 100 GHz DWDM cards comprise the ONS 15454 DWDM channel plan. The OC192 LR/STM64 LH ITU 15xx.xx card provides one long-reach STM-64/OC-192 port per card, compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE . The port operates at 9.95328 Gbps over unamplified distances up to 37 miles (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.

The card supports VT and nonconcatenated or concatenated payloads. Figure 4-20 on page 4-61 shows the OC192 LR/STM64 LH ITU 15xx.xx faceplate and Figure 4-21 on page 4-62 shows a block diagram of the card.

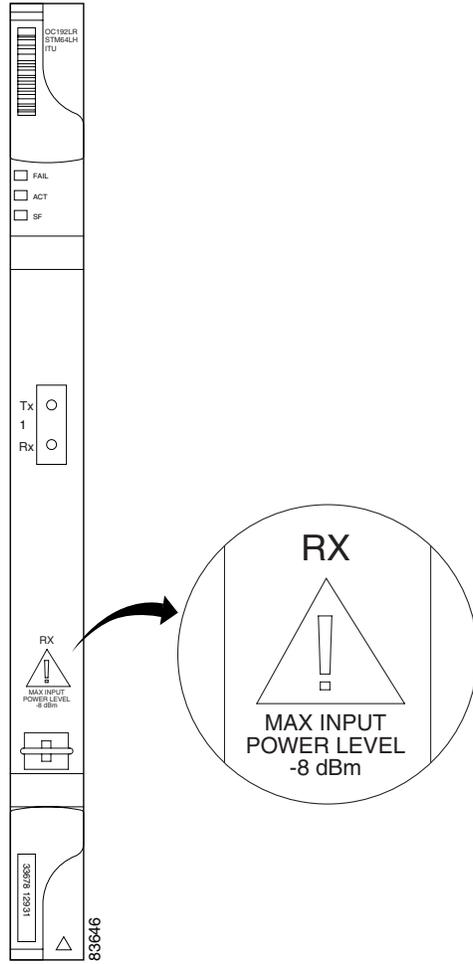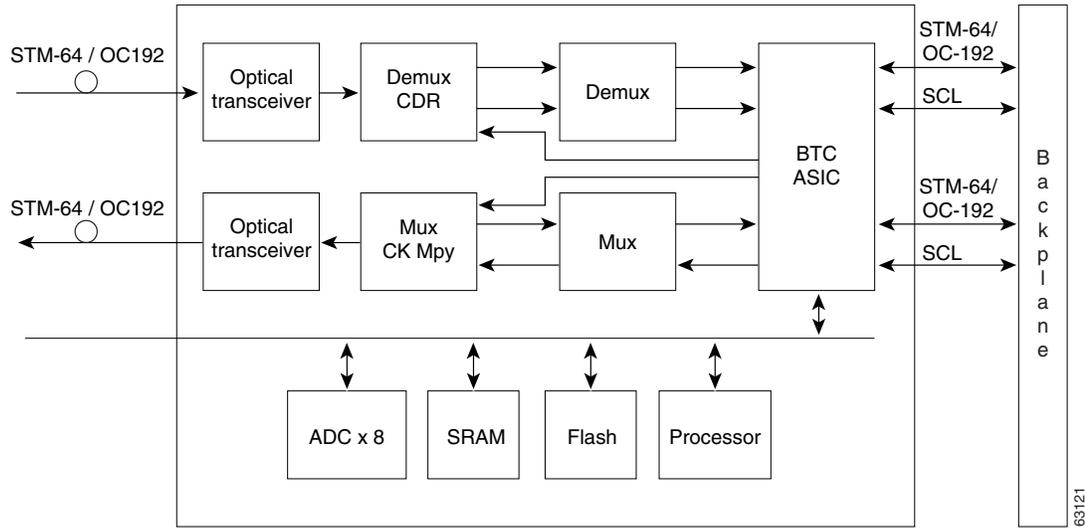*Figure 4-20   OC192 LR/STM64 LH ITU 15xx.xx Faceplate*

Figure 4-21   OC192 LR/STM64 LH ITU 15xx.xx Block Diagram

Note   You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the
OC192 LR/STM64 LH 15xx.xx card in a loopback. Do not use fiber loopbacks with the
OC192 LR/STM64 LH 15xx.xx card. Using fiber loopbacks causes irreparable damage to this card.

Eight of the 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).

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 BLSR, path protection configuration, or linear configuration or also as a regenerator for longer span reaches.

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 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 ITU 15xx.xx card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 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.

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

The OC192 LR/STM64 LH ITU 15xx.xx card has three card-level LED indicators, listed in Table 4-19.

Table 4-19   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's processor is not ready. This LED is lit during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Yellow (Standby)	When the ACTV/STBY LED is green, the OC192 LR/STM64 LH ITU 15xx.xx card is operational and ready to carry traffic. When the ACTV/STBY LED is yellow, the OC192 LR/STM64 LH ITU 15xx.xx card is operational and in standby (protect) mode.
Yellow SF LED	The yellow SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more of the card's ports. The yellow SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected and the link is working, the light turns off.

4.17.2 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 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.

4.17.3 OC192 LR/STM64 LH ITU 15xx.xx Card Specifications

The OC192 LR/STM64 LH ITU 15xx.xx card has the following specifications:

- Line
    - Bit rate: 9.95328 Gbps
    - Code: Scrambled NRZ
    - Fiber: 1550-nm single-mode
    - Maximum chromatic dispersion allowance:
      in deployments with DCU: +/- 1000 ps/nm, with ONSR of 19 dB (0.5 nm RBW)
      in deployments without DCU: +/- 1200 ps/nm, with ONSR of 23 dB (0.5 nm RBW)
    - Loopback modes: Terminal and Facility

Note You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the OC192 LR/STM64 LH 15xx.xx card in a loopback. Do not use fiber loopbacks with the OC192 LR/STM64 LH 15xx.xx card. Using fiber loopbacks causes irreparable damage to this card.

    - Connectors: SC

- – Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- Transmitter
    - – Maximum transmitter output power: +6 dBm
    - – Minimum transmitter output power: +3 dBm
    - – Center wavelength: See wavelength plan
    - – Center wavelength accuracy: +/– 0.040 nm
    - – Transmitter: LN external modulator transmitter
- Receiver
    - – Maximum receiver level: –9 dBm at BER 1 * 10 exp – 12
    - – Minimum receiver level: –22 dBm at BER 1 * 10 exp – 12
    - – Receiver: APD
    - – Link loss budget: 25 dB minimum, plus 2 dB dispersion penalty
      at BER = 1 * 10 exp – 12 including dispersion
    - – Receiver input wavelength range: 1529 nm to 1565 nm
- Environmental
    - – Operating temperature: –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit)
    - – Operating humidity: 5 to 95%, noncondensing
    - – Power consumption: 52.00 W, 1.08 A at –48 V, 177.6 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: 3.1 lb (1.3 kg)
- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:
    - – Safety: IEC 60950, EN 60950, UL 60950, CSA C22.2 No. 60950, TS 001, AS/NZS 3260, IEC 60825-1, IEC 60825-2, 21 CFR 1040-10, and 21 CFR 1040.11
    - – Class 1 (IEC 60825-1 2001.01, 21 CFR 1040.10 and 1040.11) laser product
- Currently available wavelengths and versions of OC192 LR/STM64 LH ITU 15xx.xx card:

  ITU grid blue band:
    - – 1534.25 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1534.25
    - – 1535.04 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1535.04
    - – 1535.82 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1535.82
    - – 1536.61 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1536.61
    - – 1538.19 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1538.19
    - – 1538.98 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1538.98
    - – 1539.77 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1539.77

- 1540.56 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1540.56

ITU grid red band:

- 1550.12 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1550.12

- 1550.92 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1550.92

- 1551.72 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1551.72

- 1552.52 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1552.52

- 1554.13 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1554.13

- 1554.94 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1554.94

- 1555.75 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1555.75

- 1556.55 +/– 0.040 nm, OC192 LR/STM64 LH ITU 1556.55

4.18 TXP_MR_10G Card

Warning   **Class 1 (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products. Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments, or performance of procedures other than those specified may result in hazardous radiation exposure.**

The TXP_MR_10G card (Transponder multirate 10G) processes one 10-Gbps signal (client side) into one 10-Gbps, 100-GHz DWDM signal (trunk side). It provides one extended long-range STM-64/OC-192 port per card, compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE.

The TXP_MR_10G card is tunable over two neighboring wavelengths in the 1550-nm, ITU 100-GHz range. It is available in four different versions, covering eight different wavelengths in the 1550-nm range.

Note   ITU-T G.709 specifies a form of FEC that uses a "wrapper" approach. The digital wrapper lets you transparently take in a signal on the client side, wrap a frame around it and restore it to its original form. FEC enables longer fiber links because errors caused by the optical signal degrading with distance are corrected.

The port operates at 9.95328 Gbps (or 10.70923 Gbps with ITU-T G.709 Digital Wrapper/FEC) over unamplified distances up to 50 miles (80 km) with different types of fiber such as C-SMF or dispersion compensated fiber limited by loss and/or dispersion. Figure 4-22 on page 4-66 shows the TXP_MR_10G faceplate and Figure 4-23 on page 4-67 shows a block diagram of the card.

Caution   Because the software has no capability to look into the payload and detect circuits, a TXP_MR_10G card does not display circuits under card view.

For cards such as the TXP_MR_10G or the MXP_2.5G_10G card, protection is done using the Y-cable protection. Two TXP_MR_10G cards can be joined in a Y-cable protection group. In Y-cable protection, the client ports of the two cards are joined by Y-cables. A single client signal is injected into the receive (RX) Y-cable and is split between the two TXP_MR_10G cards. The two transmit (TX) client signals from the TXP_MR_10G cards are summed in the TX Y-cable into a single client signal.

Note If you create a GCC on either card of the protect group, the trunk (span) port stays permanently active, regardless of the switch state. When you provision a GCC, you are provisioning unprotected overhead bytes. The GCC is not protected by the protect group.
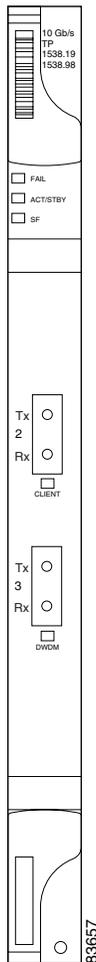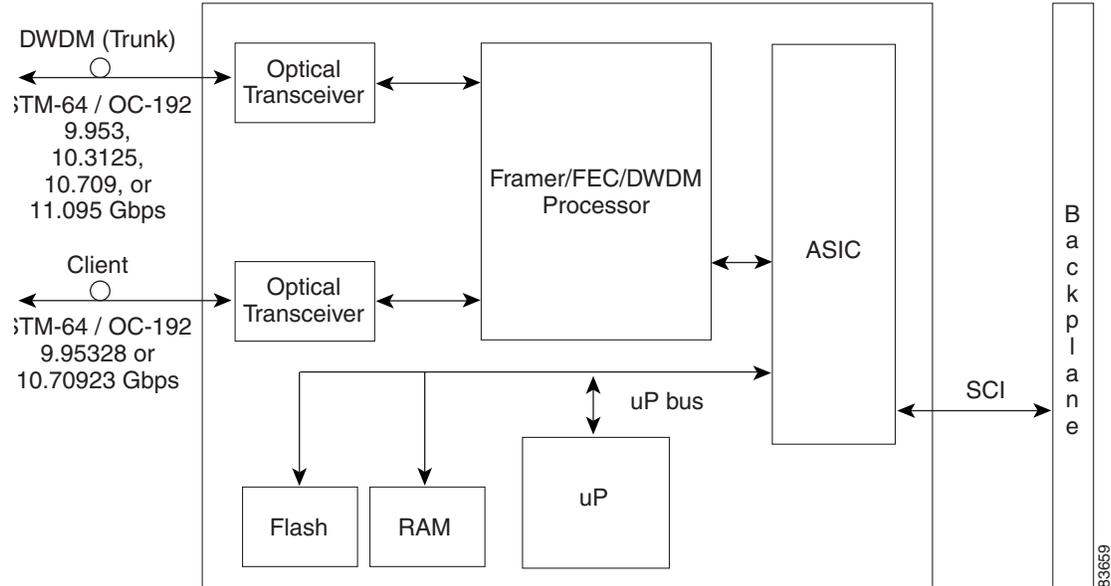
Figure 4-22   TXP_MR_10G Faceplate

Figure 4-23   TXP_MR_10G Block Diagram

Note You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the TXP_MR_10G card in a loopback on the trunk port. Do not use fiber loopbacks with the TXP_MR_10G card. Using fiber loopbacks causes irreparable damage to the TXP_MR_10G card.

You can install TXP_MR_10G cards in Slots 1 to 6 and 12 to 17. You can provision this card in a linear configuration. TXP_MR_10G cards cannot be provisioned as BLSR, path protection configuration, or as a regenerator. They can be used in the middle of BLSR or path protection configuration spans.

The TXP_MR_10G port features a 1550-nm laser for the trunk port and a 1310-nm laser for the client port and contains two transmit and receive connector pairs (labeled) on the card faceplate. The card uses dual LC connectors for optical cable termination.

The TXP_MR_10G card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 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.

4.18.1 TXP_MR_10G Card-Level Indicators

The TXP_MR_10G card has three card-level LED indicators, listed in Table 4-20.

Table 4-20   TXP_MR_10G Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. This LED is lit during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Yellow (Standby)	When the ACTV/STBY LED is green, the TXP_MR_10G card is operational (one or both ports active) and ready to carry traffic. When the ACTV/STBY LED is yellow, the TXP_MR_10G card is operational and in standby (protect) mode.
Yellow SF LED	The yellow SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more of the card's ports. The yellow SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected and the link is working, the light turns off.

4.18.2 TXP_MR_10G Port-Level Indicators

The TXP_MR_10G card has four port-level LED indicators, listed in Table 4-21.

Table 4-21   TXP_MR_10G Port-Level Indicators

Port-Level LED	Description
Green Client LED	The green Client LED indicates that the client port is in service and that it is receiving a recognized signal.
Green DWDM LED	The green DWDM LED indicates that the DWDM port is in service and that it is receiving a recognized signal.
Green Wavelength 1 LED	Each port supports two wavelengths on the DWDM side. Each wavelength LED matches one of the wavelengths. This LED indicates that the board is configured for wavelength 1.
Green Wavelength 2 LED	Each port supports two wavelengths on the DWDM side. Each wavelength LED matches one of the wavelengths. This LED indicates that the board is configured for wavelength 2.

4.18.3 TXP_MR_10G Card Specifications

The TXP_MR_10G card has the following specifications:

- Line (trunk side)
  - Bit rate: 9.95328 Gbps for OC-192/STM-64 or 10.70923 Gbps with ITU-T G.709 Digital Wrapper/FEC
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode

- Maximum chromatic dispersion allowance: 6000 ps/nm

- Loopback modes: Terminal and Facility

⚠

Caution You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the TXP_MR_10G card in a loopback on the trunk port. Do not use fiber loopbacks with the TXP_MR_10G card. Using fiber loopbacks causes irreparable damage to the TXP_MR_10G card.

- Connectors: LC

- Compliance Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957

• Transmitter (trunk side)

- Maximum transmitter output power: +3 dBm

- Minimum transmitter output power: –16 dBm
(The optical output power on the trunk side is configurable from –16 to +3 dBm with an accuracy of +/–0.5 dB.)

- Transmitter: Lithium niobate (LN) external modulator transmitter

• Currently available wavelengths and versions of TXP_MR_10G:

ITU grid blue band:

- 1538.19 to 1538.98 nm, 10T-L1-38.1

- 1539.77 to 1540.56 nm, 10T-L1-39.7

ITU grid red band:

- 1554.13 to 1554.94 nm, 10T-L1-54.1

- 1555.75 to 1556.55 nm, 10T-L1-55.7

• Receiver (trunk side)

- Receiver input power (no FEC, unamplified, BER $1 * 10 exp - 12$): –8 to –24 dBm

- Receiver input power (FEC, unamplified, BER $1 * 10 exp - 6$): –8 to –26 dBm

- Receiver input power (no FEC, amplified, BER $1 * 10 exp - 12$): –8 to –22 dBm

- Receiver input power (FEC, amplified, BER $1 * 10 exp - 6$): –8 to –18 dBm

- Receiver: APD

- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = $1 * 10 exp - 12$ including dispersion

- Receiver input wavelength range: 1290 nm to 1605 nm

• Line (client side)

- Bit rate: 9.95328 Gbps

- Code: Scrambled NRZ

- Fiber: 1550-nm single-mode

- 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 nm 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 exp – 12

  - Receiver input wavelength range: 1290 nm to 1605 nm

- Environmental

  - Operating temperature: –5 to +55 degrees Celsius (+23 to +113 degrees Fahrenheit)

  - Operating humidity: 5 to 95%, noncondensing

  - Power consumption: 35.00 W, 0.73 A at –48 V, 119.5 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: 3.1 lb (1.3 kg)

- Compliance

  ONS 15454 optical cards, when installed in a system, comply with these standards:

  - Safety: IEC 60950, EN 60950, UL 60950, CSA C22.2 No. 60950, TS 001, AS/NZS 3260, IEC 60825-1, IEC 60825-2, 21 CFR 1040-10, and 21 CFR 1040.11

  - Class 1M (IEC 60825-1 2001.01) and class I (21 CFR 1040.10 and 1040.11) laser product

4.19 MXP_2.5G_10G Card

Warning   **Class 1 (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products. Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not stare into the beam or view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Use of controls or adjustments, or performance of procedures other than those specified may result in hazardous radiation exposure.**

The MXP_2.5G_10G card (Muxponder 2.5G/10G) multiplexes/demultiplexes four 2.5-Gbps signals (client side) into one 10-Gbps, 100-GHz DWDM signal (trunk side). It provides one extended long-range STM-64/OC-192 port per card on the trunk side (compliant with ITU-T G.707, ITU-T G.957, and

Telcordia GR-253-CORE) and four intermediate or short-range OC-48/STM-16 ports per card on the client side. The port operates at 9.95328 Gbps over unamplified distances up to 50 miles (80 km) with different types of fiber such as C-SMF or dispersion compensated fiber limited by loss and/or dispersion.

The MXP_2.5G_10G card is tunable over two neighboring wavelengths in the 1550-nm, ITU 100-GHz range. It is available in four different versions, covering eight different wavelengths in the 1550-nm range.

Note   ITU-T G.709 specifies a form of FEC that uses a "wrapper" approach. The digital wrapper lets you transparently take in a signal on the client side, wrap a frame around it and restore it to its original form. FEC enables longer fiber links because errors caused by the optical signal degrading with distance are corrected.

The port can also operate at 10.70923 Gbps in ITU-T G.709 Digital Wrapper/FEC mode. Figure 4-24 on page 4-72 shows the MXP_2.5G_10G faceplate and Figure 4-25 on page 4-73 shows a block diagram of the card.

Caution   Because the software has no capability to look into the payload and detect circuits, an MXP_2.5G_10G card does not display circuits under card view.

For cards such as the TXP_MR_10G or the MXP_2.5G_10G card, protection is done using the Y-cable protection. Two TXP_MR_10G cards can be joined in a Y-cable protection group. In Y-cable protection, the client ports of the two cards are joined by Y-cables. A single client signal is injected into the RX Y-cable and is split between the two TXP_MR_10G cards. The two TX client signals from the TXP_MR_10G cards are summed in the TX Y-cable into a single client signal.

Note   If you create a GCC on either card of the protect group, the trunk port stays permanently active, regardless of the switch state. When you provision a GCC, you are provisioning unprotected overhead bytes. The GCC is not protected by the protect group.
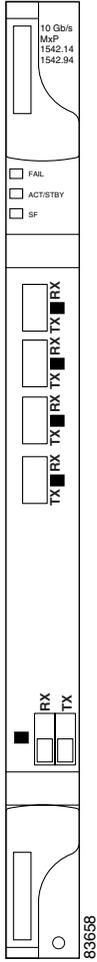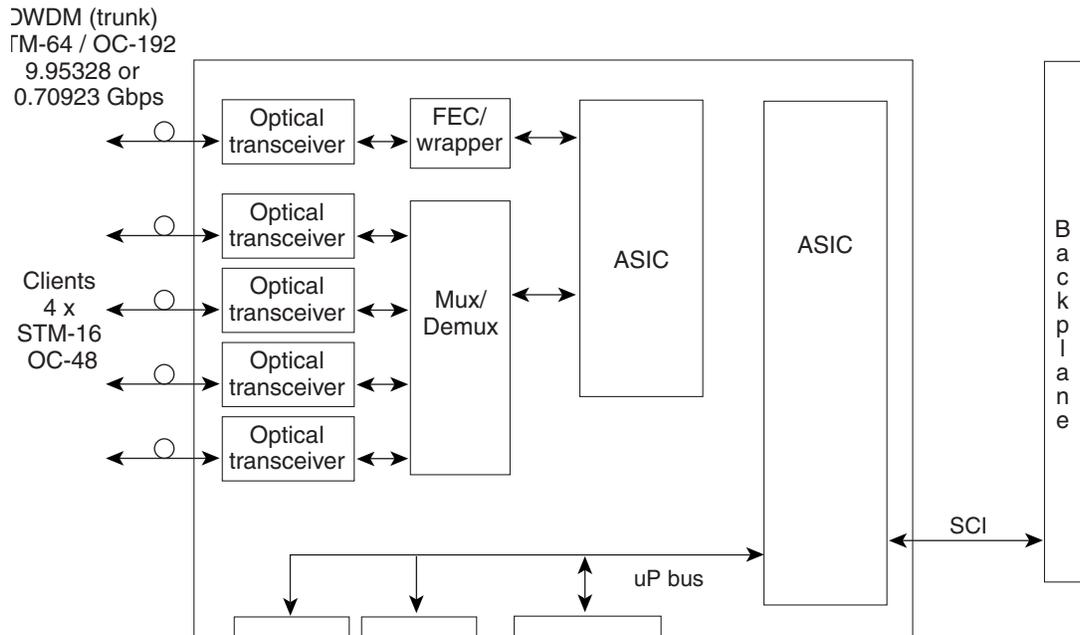
Figure 4-24   MXP_2.5G_10G Faceplate

Figure 4-25   MXP_2.5G_10G Block Diagram

Note You must use a 20-dB fiber attenuator (19 to 24 dB) when working with the MXP_2.5G_10G card in a loopback on the trunk port. Do not use fiber loopbacks with the MXP_2.5G_10G card. Using fiber loopbacks causes irreparable damage to the MXP_2.5G_10G card.

You can install MXP_2.5G_10G cards in Slots 1 to 6 and 12 to 17. You can provision this card in a linear configuration. MXP_2.5G_10G cards cannot be provisioned as BLSR, path protection configuration, or as a regenerator. They can be used in the middle of BLSR or path protection configuration spans.

The MXP_2.5G_10G port features a 1550-nm laser on the trunk port and four 1310-nm lasers on the client ports and contains five transmit and receive connector pairs (labeled) on the card faceplate. The card uses a dual LC connector on the trunk side and small form factor pluggable (SFP) connectors on the client side for optical cable termination.

The MXP_2.5G_10G card detects SF, LOS, or LOF conditions on the optical facility. Refer to the *Cisco ONS 15454 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.

4.19.1 MXP_2.5G_10G Card-Level Indicators

The MXP_2.5G_10G card has three card-level LED indicators, listed in Table 4-22.

Table 4-22   MXP_2.5G_10G Card-Level Indicators

Card-Level LED	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. This LED is lit during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists.
ACT/STBY LED Green (Active) Yellow (Standby)	When the ACTV/STBY LED is green, the MXP_2.5G_10G card is operational (one or more ports active) and ready to carry traffic. When the ACTV/STBY LED is yellow, the MXP_2.5G_10G card is operational and in standby (protect) mode.
Yellow SF LED	The yellow SF LED indicates a signal failure or condition such as LOS, LOF, or high BERs on one or more of the card's ports. The yellow SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected and the link is working, the light turns off.

4.19.2 MXP_2.5G_10G Port-Level Indicators

The MXP_2.5G_10G card has seven port-level LED indicators, listed in Table 4-22.

Table 4-23   MXP_2.5G_10G Port-Level Indicators

Port-Level LED	Description
Green Client LED (four LEDs)	The green Client LED indicates that the client port is in service and that it is receiving a recognized signal. The card has four client ports, and so has four Client LEDs.
Green DWDM LED	The green DWDM LED indicates that the DWDM port is in service and that it is receiving a recognized signal.
Green Wavelength 1 LED	Each port supports two wavelengths on the DWDM side. Each wavelength LED matches one of the wavelengths. This LED indicates that the board is configured for wavelength 1.
Green Wavelength 2 LED	Each port supports two wavelengths on the DWDM side. Each wavelength LED matches one of the wavelengths. This LED indicates that the board is configured for wavelength 2.

4.19.3 MXP_2.5G_10G Card Specifications

The MXP_2.5G_10G card has the following specifications:

- Line (trunk side)

    - Bit rate: 9.95328 Gbps for OC-192/STM-64 or
      10.70923 Gbps with ITU-T G.709 Digital Wrapper/FEC

    - Code: Scrambled NRZ

- – Fiber: 1550-nm single-mode

- – Maximum chromatic dispersion allowance: 6000 ps/nm

- – Loopback modes: Terminal and Facility

⚠️
Caution   You must use a 20 dB fiber attenuator (19 to 24dB) when working with the MXP_2.5G_10G card in a loopback on the trunk port. Do not use fiber loopbacks with these cards.

- – Connectors: LC

- – Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957

- • Transmitter (trunk side)

  - – Maximum transmitter output power: +3 dBm

  - – Minimum transmitter output power: –16 dBm
    (The optical output power on the trunk side is configurable from –16 to +3 dBm with an accuracy of +/–0.5 dB.)

  - – Transmitter: LN (Lithium Niobate) external modulator transmitter

- • Currently available wavelengths and versions of MXP_2.5G_10G:

  ITU grid blue band:

  - – 1542.14 to 1542.94 nm, 10M-L1-42.1

  - – 1543.73 to 1544.53 nm, 10M-L1-43.7

  ITU grid red band:

  - – 1558.17 to 1558.98 nm, 10M-L1-58.1

  - – 1559.79 to 1560.61 nm, 10M-L1-59.7

- • Receiver (trunk side)

  - – Receiver input power (no FEC, unamplified, BER 1 * 10 exp – 12): –8 to –24 dBm

  - – Receiver input power (FEC, unamplified, BER 1 * 10 exp – 6): –8 to –26 dBm

  - – Receiver input power (no FEC, amplified, BER 1 * 10 exp – 12): –8 to –22 dBm

  - – Receiver input power (FEC, amplified, BER 1 * 10 exp – 6): –8 to –18 dBm

  - – Receiver: APD

  - – Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = 1 * 10 exp – 12 including dispersion

  - – Receiver input wavelength range: 1290 nm to 1605 nm

- • Line (client side)

  - – Bit rate: 2.48832 Gbps

  - – Code: Scrambled NRZ

  - – Fiber: 1550-nm single-mode

  - – Maximum chromatic dispersion allowance: 1600 ps/nm

  - – Loopback modes: Terminal and Facility

  - – Connectors: SFF

  - – Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957

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- Transmitter (client side)
    - Depends on SFP that is used
- Receiver (client side)
    - Depends on SFP that is used
- Environmental
    - Operating temperature: –5 to +55 degrees Celsius (+23 to +113 degrees Fahrenheit)
    - Operating humidity: 5 to 95%, noncondensing
    - Power consumption: 50.00 W, 1.04 A at –48 V, 170.7 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: 3.1 lb (1.3 kg)
- Compliance

    ONS 15454 optical cards, when installed in a system, comply with these standards:
    - Safety: IEC 60950, EN 60950, UL 60950, CSA C22.2 No. 60950, TS 001, AS/NZS 3260, IEC 60825-1, IEC 60825-2, 21 CFR 1040-10, and 21 CFR 1040.11
    - Class 1M (IEC 60825-1 2001.01) and class I (21 CFR 1040.10 and 1040.11) laser product