



# Cisco ONS 15530 Overview

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The Cisco ONS 15530 is a modular and scalable optical switching and aggregation platform designed to supplement the Cisco ONS 15540 ESP. With the Cisco ONS 15530, users can take advantage of the availability of dark fiber to build a common infrastructure that supports data, storage area network (SAN), and time-division multiplexing(TDM) traffic. For more information about DWDM technology and applications, refer to the *Introduction to DWDM Technology* publication and the *Cisco ONS 15530 Planning Guide*.

The Cisco ONS 15530 is designed to meet or exceed stringent ISP (Internet service provider) requirements for product availability and reliability.



**Note**

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

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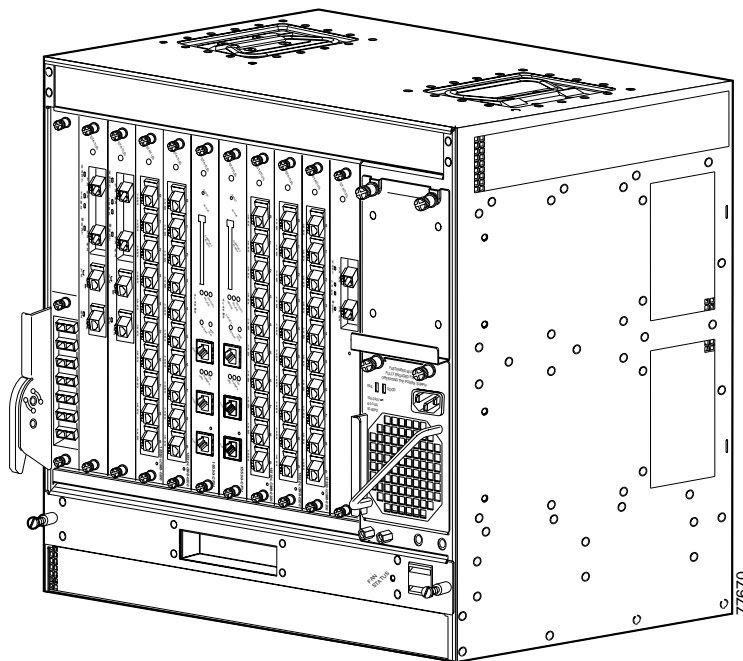
This chapter includes the following sections:

- [Cisco ONS 15530 Chassis, page 1-2](#)
- [Cisco ONS 15530 Components, page 1-10](#)

# Cisco ONS 15530 Chassis

The Cisco ONS 15530 is available in two configurations. Both have two vertically stacked half-height slots specifically for the optical OADM (optical add/drop multiplexing) modules, and 10 vertically oriented slots that hold the CPU switch modules, line cards, and 2.5-G transponder trunk line cards. Slot 0 holds two half height optical OADM modules. Slots 1 through 4 and slots 7 through 10 hold the line cards and transponder cards. Slots 5 and 6 hold the CPU switch modules. Power supplies are located on the right side of the chassis next to slot 10. Air inlet and fan tray assembly are located beneath the slots. Cable management is located beneath the slots. The system has an electrical backplane for system control. All optical connections are located on the front of the cards. [Figure 1-1](#) shows a fully populated chassis.

*Figure 1-1 Cisco ONS 15530 Shelf*

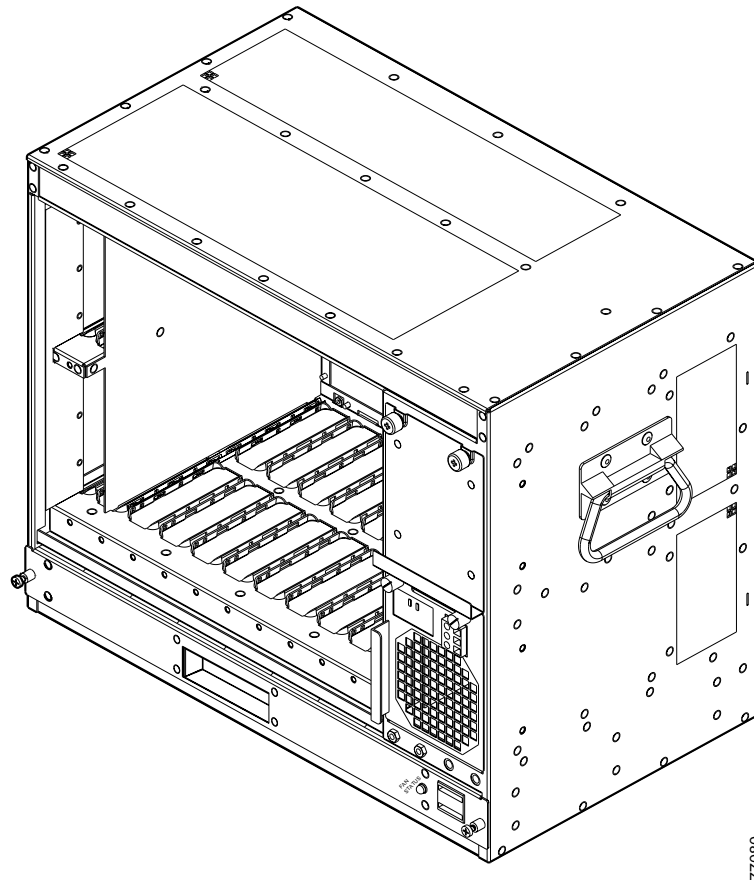


The chassis configurations differ in how cooling air is routed through the chassis and where the lifting handles are placed.

## Cisco ONS 15530-CHAS-E Chassis

The dimensions of the Cisco ONS 15530 CHAS-E chassis are 14.4 x 17.3 x 10.1 inches (H x W x D) See [Figure 1-2](#). Handles for lifting the chassis are located on the sides.

*Figure 1-2 Cisco ONS 15530 CHAS-E Chassis*



The fan assembly draws in cooling air through the air ramp baffle (see [Figure 1-3](#)) on the bottom of the chassis, pushing the air across the internal components and out the exhaust baffles on the top of the chassis.

The air ramp baffle for the Cisco ONS 15530 CHAS-E chassis redirects the cooling air intake as shown in [Figure 1-4](#). The air ramp baffle must be installed when installing the Cisco ONS 15530 CHAS-E type chassis.

Figure 1-3 Cisco ONS 15530 CHAS-E (with Air Ramp Baffle)

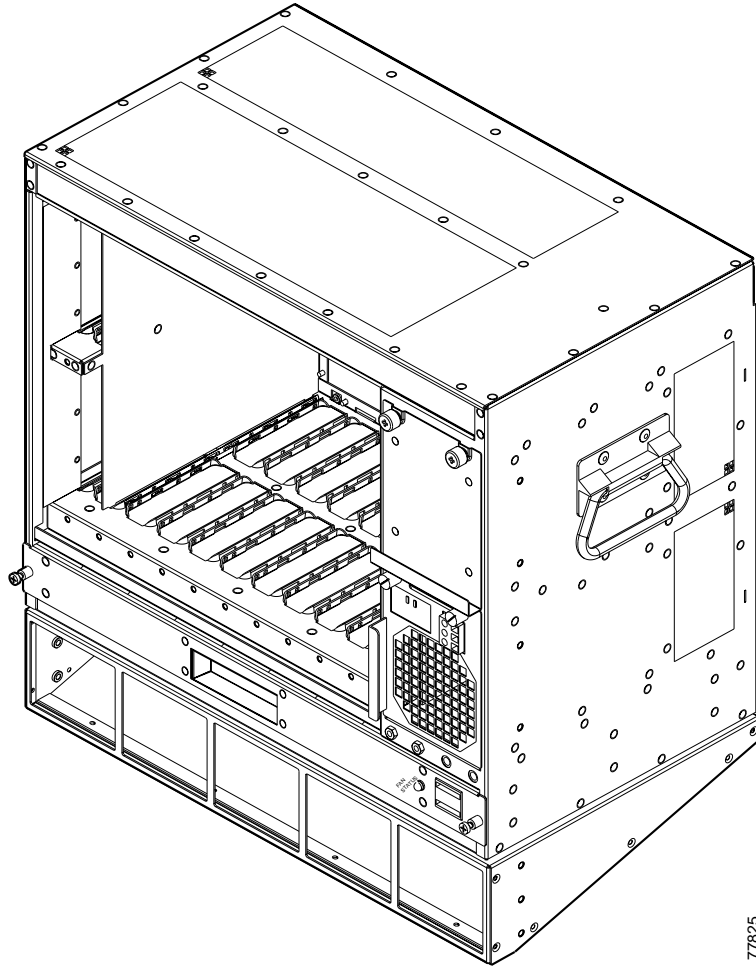
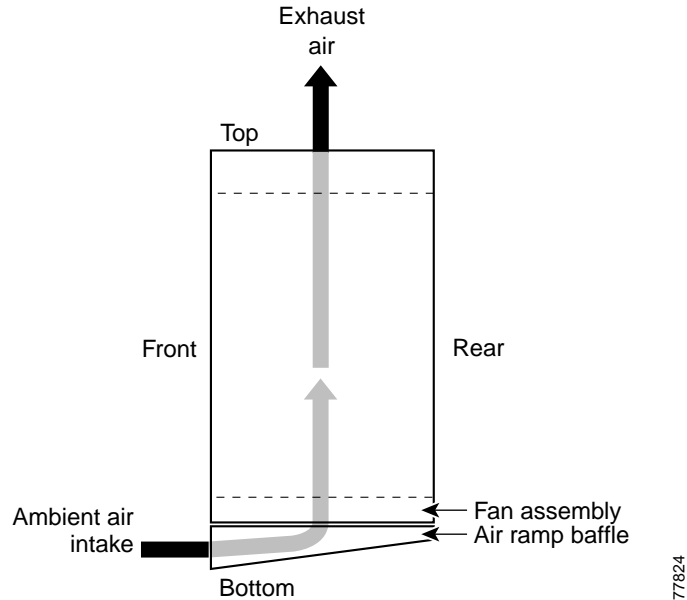


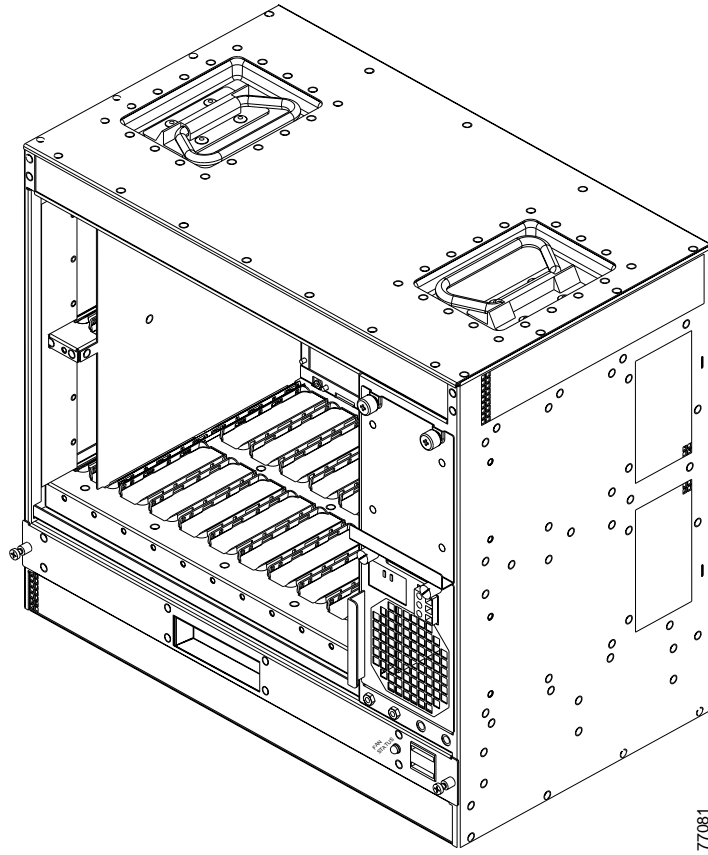
Figure 1-4 Cisco ONS 15530 CHAS-E Chassis Airflow (with Air Ramp Baffle Installed)



## Cisco ONS 15530 CHAS-N Chassis

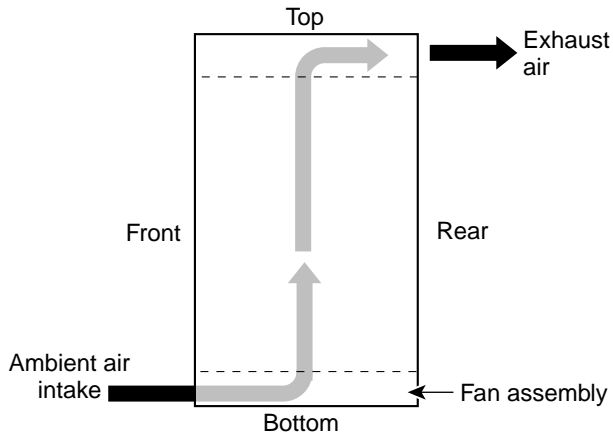
The dimensions of the Cisco ONS 15530 CHAS-N chassis are 14.4 x 15.7 x 10.1 inches (H x W x D). (See [Figure 1-5](#).) Handles for lifting the chassis are located on the top. The fan assembly draws in cooling air through the intake baffles on the front of the chassis, below the fan assembly, pushing the air over the internal components and out the exhaust on the top rear and sides of the chassis (see [Figure 1-6](#)).

Figure 1-5 Cisco ONS 15530 CHAS-N Chassis



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Figure 1-6 Cisco ONS 15530 CHAS-N Chassis Airflow

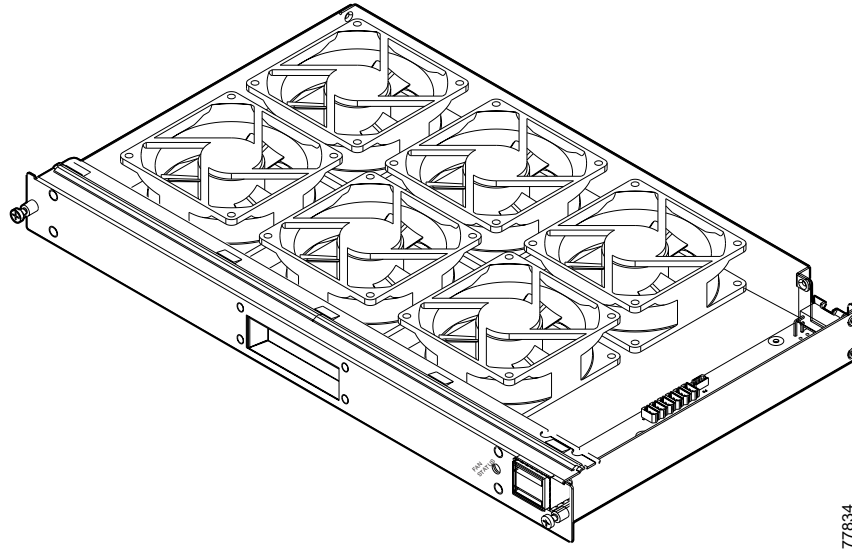


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## Fan Assembly

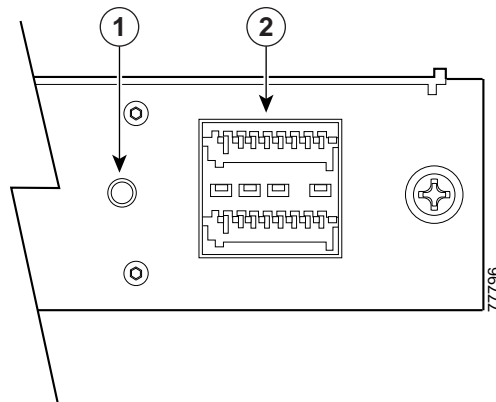
The Cisco ONS 15530 fan assembly is located at the bottom of the chassis. The assembly contains six individual fans and a fan controller board (see [Figure 1-7](#)).

**Figure 1-7** Fan Assembly



The controller board monitors the status of each fan and reports the status to the CPU switch modules. If a single fan fails, a minor alarm is reported to the CPU and the fan assembly LED changes from green to yellow (see [Figure 1-8](#)). If two or more fans fail, a major alarm is reported to the CPU and the fan LED changes to red.

**Figure 1-8** Fan Assembly LED



1	Fan assembly LED	2	Alarm connector
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Table 1-1 lists the fan assembly LED status describing the alarm reports for the fan assembly. The fan assembly is hot-swappable.

**Table 1-1 Fan Assembly Status**

Fan Failure	LED	Status
None	Green	Normal
One	Yellow	Minor
Two or more	Red	Major

## Audible and Visible Alarms

The Cisco ONS 15530 provides audible and visible alarm status to the Telco central office alarm equipment through hardware located on the fan assembly (see Figure 1-8). Software determines the alarm condition and sets the appropriate relays for critical, major, or minor alarms. Table 1-2 lists the terminal block pinouts.

**Table 1-2 Terminal Block Pinouts**

Connector	Alarm Type	Level	Pin	Contact	Notes
P1	Visible	Critical	1	C <sup>1</sup>	Each type and level of alarm is signaled by a contact closure of C to NO and an open from C to NC. Voltage at contacts is limited to 48 VDC. Switched current / load is limited to 1-A resistive. Alarms are signaled when the chassis is unpowered.
			2	NC <sup>2</sup>	
			3	NO <sup>3</sup>	
		Major	4	C	
			5	NC	
			6	NO	
		Minor	7	C	
			8	NC	
			9	NO	
P2	Audible	Critical	1	C	
			2	NC	
			3	NO	
		Major	4	C	
			5	NC	
			6	NO	
		Minor	7	C	
			8	NC	
			9	NO	

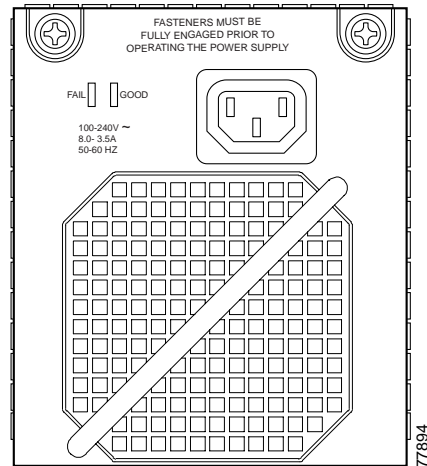
1. C = center
2. NC = normally closed
3. NO = normally open



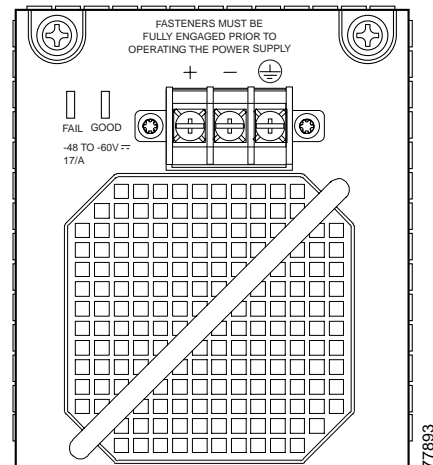
## Power Supplies

The Cisco ONS 15530 chassis supports redundant 120–240 VAC (see [Figure 1-9](#)) or –48 VDC (see [Figure 1-10](#)) power. The power supplies are located at the right of the chassis, next to the card slots (see [Figure 1-1](#)). Up to two power supplies can be installed for redundancy.

**Figure 1-9** 120–240 VAC Power Supply



**Figure 1-10** –48 VDC Power Supply



See the “[Powering Up the Shelf](#)” section on page 2-31 for more information about the power supplies.

## Backplane

The Cisco ONS 15530 backplane implements all board-to-board signal interconnects and provides power distribution within the chassis. Connections are present for two power supplies and the fan assembly. The backplane contains a total of 12 slots; two half-height slots for the OADM modules, two full height slots for the CPU switch modules, and eight full height slots for line cards and transponder cards.

## Cable Storage Drawer

The cable storage drawer is mounted directly below the fan assembly. It provides storage for the excess cable length. Sliding radius limiters move to release the excess fiber cable slack when the drawer is pulled out, allowing the user to raise the fiber routing tray and access the fan assembly.

## Version Identification Labels

The version identifier on a 4-port 1-Gbps/2-Gbps FC aggregation card is located on the inside of the card. We recommend that you record the version ID in a safe place before installing the card. You can also use the **show hardware** and **show inventory** commands to verify the version ID of the card.

## Cisco ONS 15530 Components

The following hardware components can be installed in the Cisco ONS 15530:

- [CPU Switch Modules, page 1-10](#)
- [OSC Modules and Carrier Motherboards, page 1-13](#)
- [PSMs, page 1-14](#)
- [Transponder Line Cards, page 1-15](#)
- [OADM Modules, page 1-18](#)
- [Wide-Band Variable Optical Attenuator and Per-Band Optical Equalizer Modules, page 1-19](#)
- [ESCON Aggregation Cards, page 1-23](#)
- [4-Port 1-Gbps/2-Gbps FC Aggregation Cards, page 1-25](#)
- [8-Port FC/GE Aggregation Cards, page 1-28](#)
- [8-Port Multi-Service Muxponders, page 1-31](#)
- [2.5-Gbps ITU Trunk Cards, page 1-34](#)
- [10-Gbps ITU Trunk Cards, page 1-37](#)
- [10-Gbps ITU Tunable Trunk Cards, page 1-40](#)
- [10-Gbps Uplink Cards, page 1-43](#)



### Note

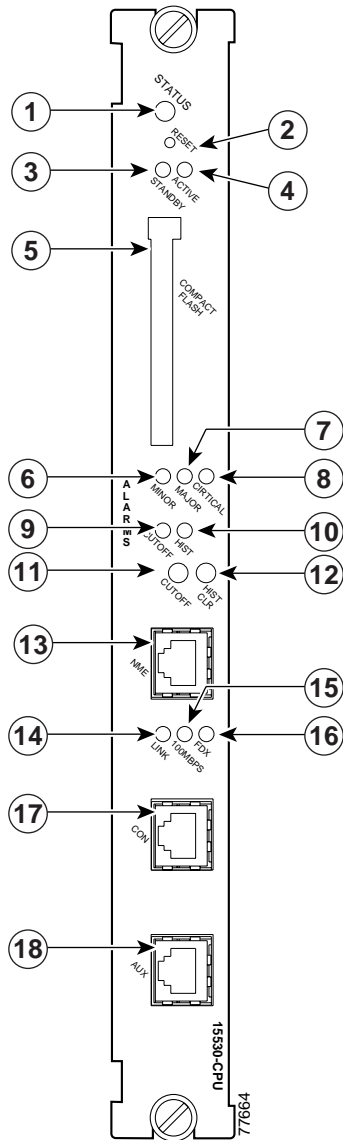
To ensure that your release of Cisco IOS software supports your hardware, see the [“New and Changed Information” section on page vii](#). Also refer to the “Hardware Supported” section of the latest release notes for the Cisco ONS 15530.

## CPU Switch Modules

The Cisco ONS 15530 supports two CPU switch modules for redundancy, one in active mode and the other in hot-standby mode. CPU switch modules are installed in slot 5 and slot 6. Each CPU switch module has a processor, a switch fabric, a clock, an Ethernet switch for communication between processors and with the LRC (line card redundancy controller) on the OADM modules and line cards, and an SRC (switch card redundancy controller). The active processor controls the system. All LRCs in the system use the system clock and synchronization signals from the active processor. Interfaces on the CPU switch modules permit access by 10/100 Ethernet, console terminal, or modem connections.

Figure 1-11 shows the front panel of the CPU switch module.

Figure 1-11 Cisco ONS 15530 CPU Switch Module



1	Card status LED	7	Major alarm LED	13	NME port
2	Reset button	8	Critical alarm LED	14	Link LED
3	Standby LED	9	Cutoff LED	15	100 Mbps LED
4	Active LED	10	HIST LED	16	Full-duplex LED
5	CompactFlash card slot	11	Cutoff LED	17	Console port
6	Minor alarm LED	12	HIST CLR LED	18	Auxiliary port

## CPU Switch Module Ports, LEDs, and Switches

Table 1-3 lists the LEDs on the CPU switch module faceplate with a description of the status indication.

*Table 1-3 CPU Switch Module LEDs*

LED	Status	Description
STATUS	Green	IOS is loaded and running.
	Yellow	Card is in the process of booting.
ACTIVE	Green	Module is the primary CPU switch module, otherwise the LED is off.
STANDBY	Green	Module is in standby mode, otherwise the LED is off.
<b>ALARM LEDs</b>		
CRITICAL	Red	A system wide critical alarm exists.
MAJOR	Yellow	A system wide major alarm exists.
MINOR	Yellow	A system wide minor alarm exists.
HIST	Yellow	A system wide major or minor alarm has occurred.
HIST CLR	Yellow	A system wide major or minor alarm has occurred.
CUTOFF	Red	A major or minor alarm exists and the cutoff button has been pushed.
FDX	Green	Module is running full-duplex.
	Off	Module is running half-duplex.
100MBPS	Green	Module is running at 100 Mbps.
	Off	Module is running at 10 Mbps.
LINK	Green	Link is up.
	Off	Link is down.

## Connector Ports

The front panel on the CPU switch module contains three ports with RJ-45 connectors (see [Figure 1-11](#)):

- Network Management Ethernet port (NME)—This Ethernet port connects the CPU switch module to a 10/100BASE-T network management LAN.
- Console port (CON)—This asynchronous EIA/TIA-232 serial port connects a terminal to the CPU switch module for local administrative access.
- Auxiliary port (AUX)—This asynchronous EIA/TIA-232 serial port connects a modem to the CPU switch module for remote administrative access.

The RJ-45 connectors on the front panel of the CPU switch module have an extra EMI shield and the signals going to them are filtered.

Table 1-4 shows the pinouts of the console and auxiliary ports.

**Table 1-4 Console and Auxiliary Port RJ-45 Pinout**

Pin No.	Console			Auxiliary		
	Direction	Function		Direction	Function	
1	Output	RTS	Request To Send	Output	RTS	Request To Send
2	Output	DTR	Data terminal ready	Output	DTR	Data terminal ready
3	Output	TxD	Transmit data	Output	TxD	Transmit data
4	N/A	GND	Ground	N/A	GND	Ground
5	N/A	GND	Ground	N/A	GND	Ground
6	Input	RxD	Receive data	Input	RxD	Receive data
7	Input	DSR	Data set ready	Input	CD	Carrier Detect
8	Input	CTS	Clear To Send	Input	CTS	Clear To Send

## CompactFlash Card Slot

A CompactFlash card slot (see [Figure 1-11](#)) can store the Cisco IOS image or a system configuration file on a CompactFlash memory card. The system can also boot from the software stored on the CompactFlash memory card.

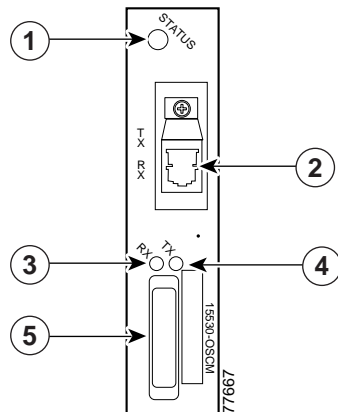
## OSC Modules and Carrier Motherboards

The OSC (optical supervisory channel) module supports an optional out-of-band management channel for communicating between systems on the network. Using a 33rd wavelength (channel 0), the OSC allows control and management traffic to be carried without requiring a separate Ethernet connection to each Cisco ONS 15530 in the network. Up to two OSC modules can be installed in the carrier motherboard, one module for the west direction and one for the east direction.

The OSC always terminates on a neighboring node. By contrast, data channels may or may not be terminated on a given node, depending on whether the channels on the OADM modules are treated as either express (pass-through) or add/drop channels.

[Figure 1-12](#) shows the front panel of the OSC module.

Figure 1-12 OSC Module



1	Card status LED	4	Transmit LED
2	OADM port	5	Card handle
3	Receive LED		

## OSC Module LEDs

Table 1-5 lists the LEDs on the OSC module faceplate, their default conditions, and what the conditions indicate.

Table 1-5 OSC Module LEDs

LED	Status	Description
STATUS	Green	OSC module initialization process is complete.
	Yellow	OSC module is in initialization process.
TX	Green	Transmit laser is enabled.
RX	Green	Light reception exists at wave OSC interface.

## PSMs

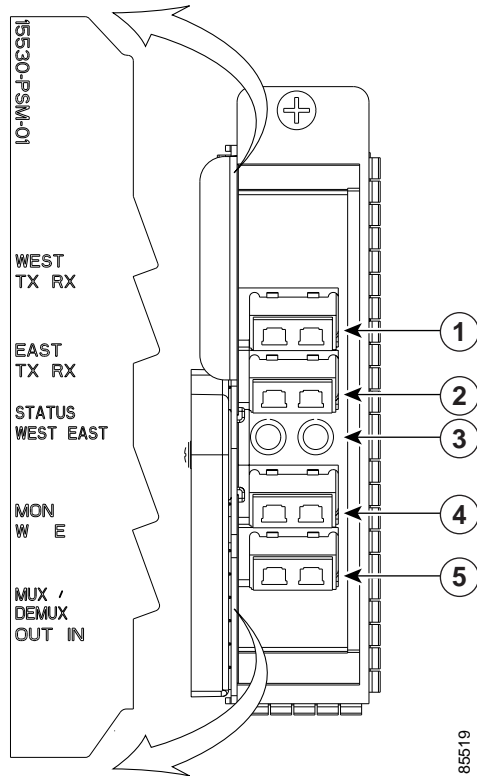
The PSM (protection switch module) provides trunk fiber protection for Cisco ONS 15530 systems configured in point-to-point topologies. The PSM sends the signal from an OADM module, an ITU trunk card, or a transponder line card to both the west and east directions. It receives both the west and east signals and sends to the OADM module, ITU trunk card, or transponder line card. Both nodes in the network topology must have the same shelf configuration. When a trunk fiber cut occurs on the active path, the PSM switches the received signal to the standby path. Because the PSM occupies one of the OADM subslots in the shelf, it protects a maximum of four channels and the OSC in a single shelf configuration.

The PSM also has an optical monitor port for testing the west and east receive signals. This port samples one percent of these signals, which can be monitored with an optical power meter or an optical spectrum analyzer.

A PSM can be installed in subslots 0/0 and 0/1 of the Cisco ONS 15530 chassis.

The PSM for the Cisco ONS 15530 has a front panel with four MU connector pairs, as shown in Figure 1-13.

Figure 1-13 PSM



1	Rx/Tx West ports	4	East and West optical monitor ports
2	Rx/Tx East ports	5	Common IN/OUT ports
3	East and West status LEDs		

## PSM LEDs

Table 1-6 lists the LEDs on the PSM faceplate, their default conditions, and what the conditions indicate.

Table 1-6 PSM LEDs

LED	Status	Description
Status	Green	Software initialization is successful.
	Off	Board failure.

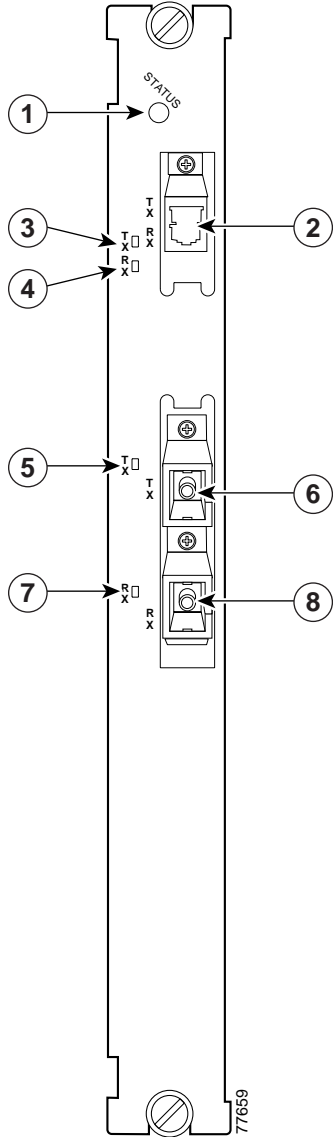


## Transponder Line Cards

The protocol-transparent and bit-rate transparent transponder line card converts a single client signal into an ITU wavelength, or channel. The transponder line cards have tunable lasers and you can configure the line cards to work in two different wavelengths. The Cisco ONS 15530 holds up to four transponder line cards, one for each wavelength supported by the OADM modules.

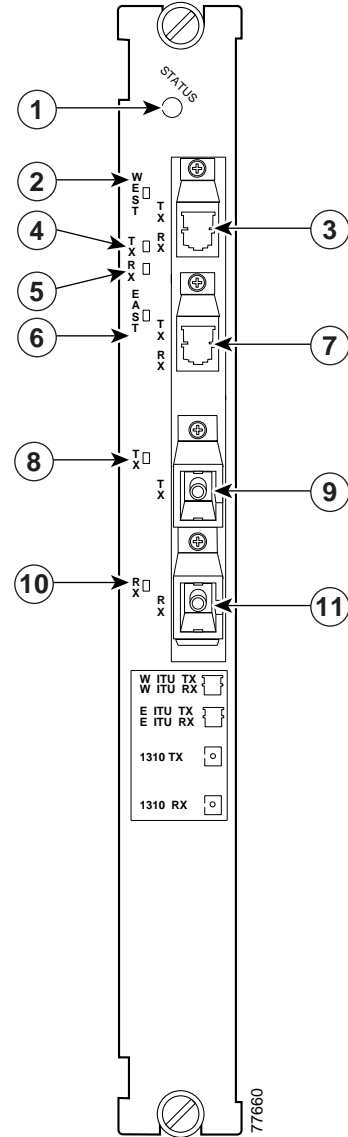
The Cisco ONS 15530 supports four types of single client interface transponder line cards: SM (single mode) unprotected, SM splitter protected, MM (multimode) unprotected, and MM splitter protected. Both types of SM transponder line cards accept SM client signals on the 1310-nm wavelength through an SC connector and support client signal clock rates ranging from 16 Mbps to 2.5 Gbps. Both types of MM transponder line cards accept SM and MM client signals on the 1310-nm wavelength through an SC connector and support client signal clock rates ranging from 16 Mbps to 622 Mbps (see [Figure 1-14](#) and [Figure 1-15](#)).

Figure 1-14 Transponder Line Card LEDs (Nonsplitter)



1	Card status LED	5	Client side transmit LED
2	ITU side port	6	Client side transmit port
3	ITU transmit LED	7	Client side receive LED
4	ITU receive LED	8	Client side receive port

Figure 1-15 Transponder Line Card LEDs (Splitter)



1	Card status LED	7	East side ITU port
2	West side ITU LED	8	Client side transmit LED
3	West side ITU port	9	Client side transmit port
4	ITU side transmit LED	10	Client side receive LED
5	ITU side receive LED	11	Client side receive port
6	East side ITU LED		

The transponder line cards are hot swappable, permitting in-service upgrades and replacement. All client signals on the transponders are supported in 3R (reshape, retune, retransmit) mode, regardless of protocol encapsulation type. The client interfaces also support the OFC (open fiber control) safety protocol for Fibre Channel, ISC compatibility mode, and FICON. The client side ports use SC-type connectors.

On the trunk side, the transponder line card output laser power ranges from 5 to 10 dBm and the receive detector has a sensitivity of -32 dBm. The ports on the trunk side use MU-type connectors.

## Transponder Line Card LEDs

Table 1-7 lists the LEDs on the transponder line card faceplate, their default conditions, and what the conditions indicate.

*Table 1-7 Transponder Line Card LEDs*

LED	Status	Description
STATUS	Green	Card is properly initialized.
	Blinking green	Good system clock is present and card is out of reset state.
	Yellow	System clock is not present.
EAST <sup>1</sup>	Green	Card is listening to the east side signal.
TX (Trunk port)	Green	Port is up and transmit laser is enabled.
RX (Trunk port)	Green	Light reception exists at the port.
WEST <sup>1</sup>	Green	Card is listening to the west side signal.
TX (Client port)	Green	Port is up and transmit laser is enabled.
RX (Client port)	Green	Light reception exists at the port.

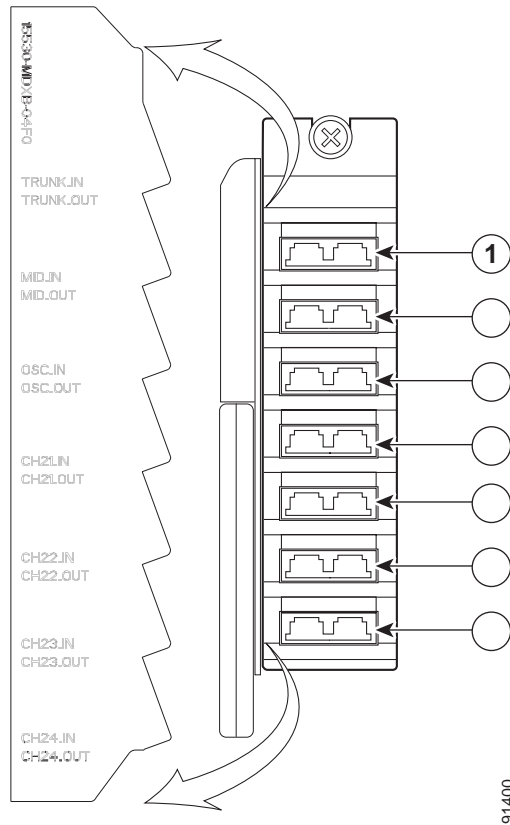
1. This LED is only present on transponder line cards with splitter.

## OADM Modules

The OADM modules are passive devices that optically multiplex and demultiplex a specific band of four ITU wavelengths. The OADM modules supported by the Cisco ONS 15530 each add and drop a specified band of four channels at a node and pass the other bands through. To support the 32-channel spectrum, there are eight different 4-channel cards (see Figure 1-16).

In the transmit direction, the OADM modules multiplex signals transmitted by the transponder line cards and 10-Gbps ITU trunk cards over optical cross connections and provide the interfaces to connect the multiplexed signal to the DWDM trunk side. In the receive direction, the OADM modules demultiplex the signals from the trunk side before passing them over optical cross connections to the transponder line cards and 10-Gbps ITU trunk cards.

Figure 1-16 OADM Module



1	Trunk IN/OUT ports	5	Data channel IN/OUT ports
2	Thru IN/OUT ports	6	Data channel IN/OUT ports
3	OSC IN/OUT ports <sup>1</sup>	7	Data channel IN/OUT ports
4	Data channel IN/OUT ports		

1. Only on OADM modules with OSC. These ports are not used on other modules.

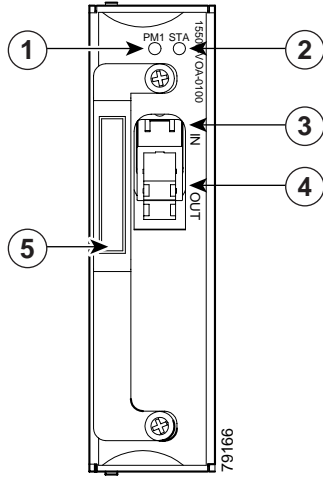
## Wide-Band Variable Optical Attenuator and Per-Band Optical Equalizer Modules

The WB-VOA (wide-band variable optical attenuator) and PB-OE (per-band power equalizer) modules are half-width modules that allow the ONS 15530 to extend the internodal and ring circumference distances and number of nodes supported for point-to-point, hub ring, and mesh ring networks by equalizing power levels.

The WB-VOA module and the PB-OE module are available in single and dual band versions. These modules are installed into a carrier motherboard. This motherboard is installed into and operates on the Cisco ONS 15530 chassis. The carrier motherboard can be installed in slots 1 to 4 or 7 to 10. All optical connectors are located on the front panel and the connectors are angled.

Figure 1-17 and Figure 1-18 show the single and dual versions of the WB-VOA module. Figure 1-19 and Figure 1-20 show the single-band and dual-band versions of the PB-OE module.

Figure 1-17 Single WB-VOA Module



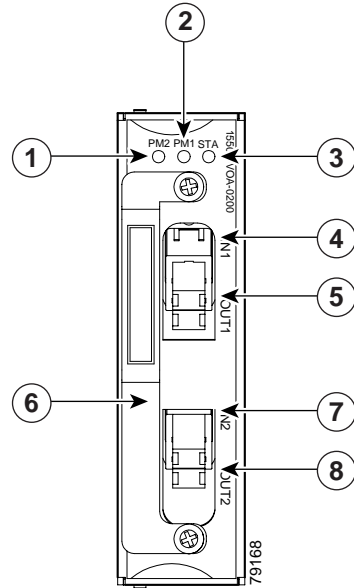
1	PM1 LED	4	OUT port
2	Card status LED	5	Handle
3	IN port		

Table 1-8 lists the LEDs on the single WB-VOA module faceplate, their default conditions, and what the conditions indicate.

Table 1-8 Single WB-VOA Module LEDs

LED	Status	Description
PM1	Green	Light reception exists at the port.
STA	Green	Card is properly initialized.

Figure 1-18 Dual WB-VOA Module



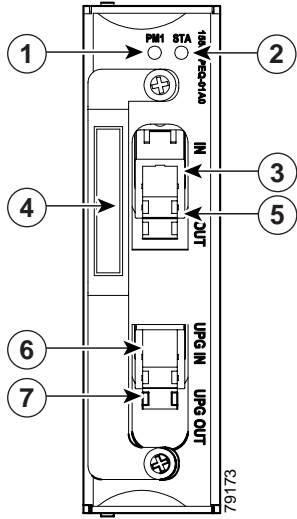
1	PM2 LED	5	OUT1 port
2	PM1 LED	6	Handle
3	Card status LED	7	IN2 port
4	IN1 port	8	OUT2 port

Table 1-9 lists the LEDs on the dual WB-VOA module faceplate, their default conditions, and what the conditions indicate.

Table 1-9 Dual WB-VOA Module LEDs

LED	Status	Description
PM2	Green	Light reception exists at the port.
PM1	Green	Light reception exists at the port.
STATUS	Green	Card is properly initialized.

Figure 1-19 Single-Band PB-OE Module



1	PM1 LED	5	OUT port
2	Card status LED	6	UPG IN port
3	IN port	7	UPG OUT port
4	Handle		

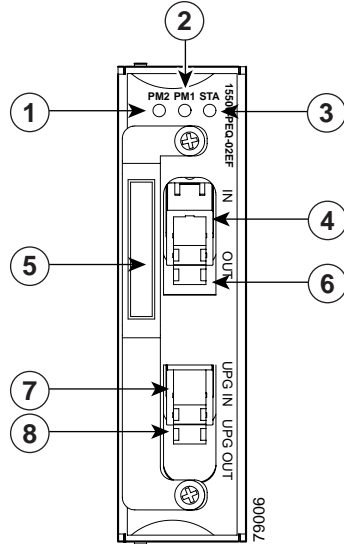
Table 1-10 lists the LEDs on the single-band PB-OE module faceplate, their default conditions, and what the conditions indicate.

Table 1-10 Single-Band PB-OE Module

LED	Status	Description
PM1	Green	Light reception exists at the port.
STA	Green	Card is properly initialized.



Figure 1-20 Dual-Band PB-OE Module



1	PM2 LED	5	Handle
2	PM1 LED	6	OUT port
3	Card status LED	7	UPG IN port
4	IN port	8	UPG OUT port

Table 1-11 lists the LEDs on the dual-band PB-OE module faceplate, their default conditions, and what the conditions indicate.

Table 1-11 Dual-Band PB-OE LEDs

LED	Status	Description
PM2	Green	Light reception exists at the port.
PM1	Green	Light reception exists at the port.
STATUS	Green	Card is properly initialized.

## ESCON Aggregation Cards

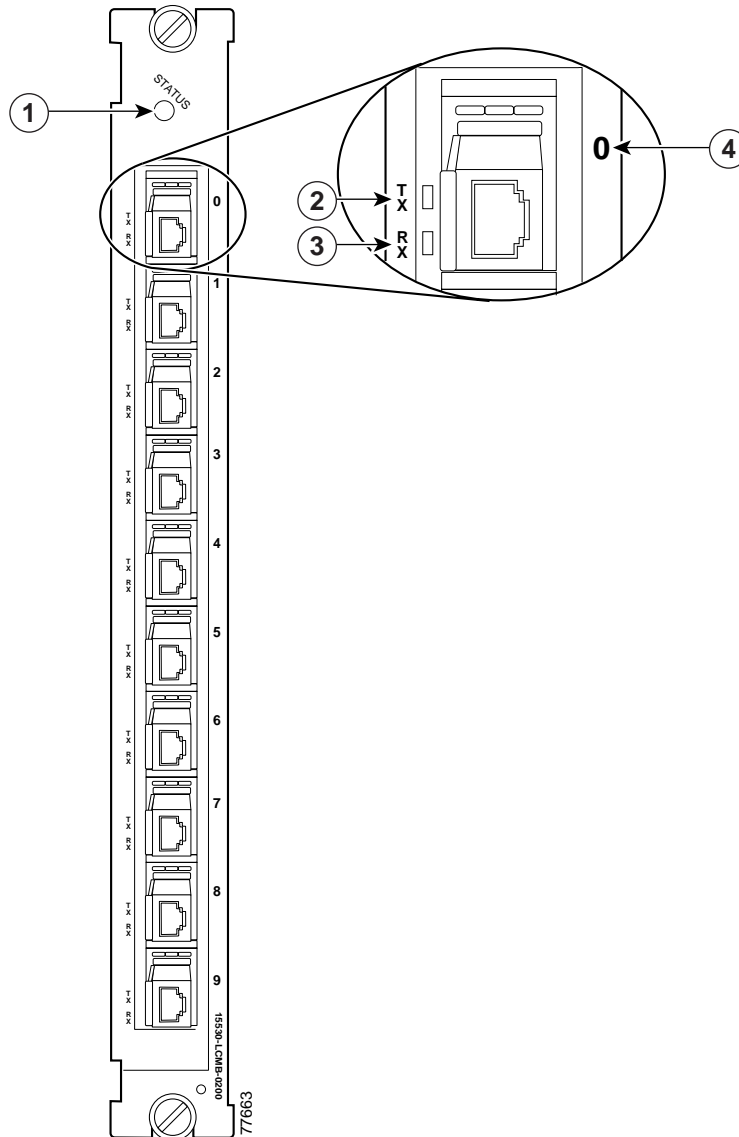
The ESCON aggregation card is a 10-port card for ESCON (Enterprise Systems Connection) traffic. The ESCON card converts the 10 client signals from optical to electrical and then aggregates them into a single 2.5-Gbps signal. This aggregated signal is sent through the backplane and the active switch fabric to either a 10-Gbps ITU trunk card or a 10-Gbps uplink card. The cross connection between the two cards is configured using the CLI (command-line interface). The ESCON aggregation card has a redundant backplane connection.

The ESCON aggregation card uses multimode 62.5/125 m optical cable with SFPs (small form factor pluggables) and MT-RJ connectors for the client signals. (See Figure 1-21.)

**Note**

A patch cable to adapt MT-RJ connectors to standard ESCON connectors directly or intermediately to SC-type connectors may be required.

**Figure 1-21** ESCON Aggregation Card



1	Card status LED	3	Port receive LED
2	Port transmit LED	4	Port number

This signal is sent through the switch fabric to a 10-Gbps ITU trunk card or a 10-Gbps uplink card. The 10-Gbps ITU trunk card converts the aggregated signal to an ITU-compliant wavelength, or channel. The 10-Gbps uplink card converts the aggregated signal to transmit to another shelf.

Table 1-12 describes the ESCON aggregation card LED status.

**Table 1-12** *ESCON Aggregation Card LEDs*

LED	Status	Description
STATUS	Green	Card is properly initialized.
	Blinking green	Good system clock is present and card is out of reset state.
	Yellow	System clock is not present.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.

The ESCON aggregation card uses single-mode and multimode SFP optics for the client signals. There are no restrictions on populating the line card with SFPs. For example, you can mix a single-mode SFP optics with a multimode SFP optics on the same ESCON aggregation card. Table 1-13 lists the characteristics for the SFP optics supported by the ESCON aggregation card.

**Table 1-13** *ESCON Aggregation Card SFP Optics Characteristics*

Model Number	Clock Rate Range	Fiber Type	Wavelength	Connector Type
15500-XVRA-01A2	ESCON, OC-3/ STM-1 SR	MM 50/125 m MM 62.5/125 m	1310 nm	MT-RJ
15500-XVRA-10A1	Low-band 8 Mbps to 200 Mbps	MM 50/125 m MM 62.5/125 m	1310 nm	LC
15500-XVRA-10B1	Low-band 8 Mbps to 200 Mbps	SM 9/125 m	1310 nm	LC
15500-XVRA-11A1	Mid-band 200 Mbps to 622 Mbps	MM 62.5/125 m	1310 nm	LC
15500-XVRA-11B1	Mid-band 200 Mbps to 1.25 Gbps	SM 9/125 m	1310 nm	LC
15500-XVRA-12B1	High-band 1.062 Gbps to 2.488 Gbps	SM 9/125 m	1310 nm	LC



**Note**

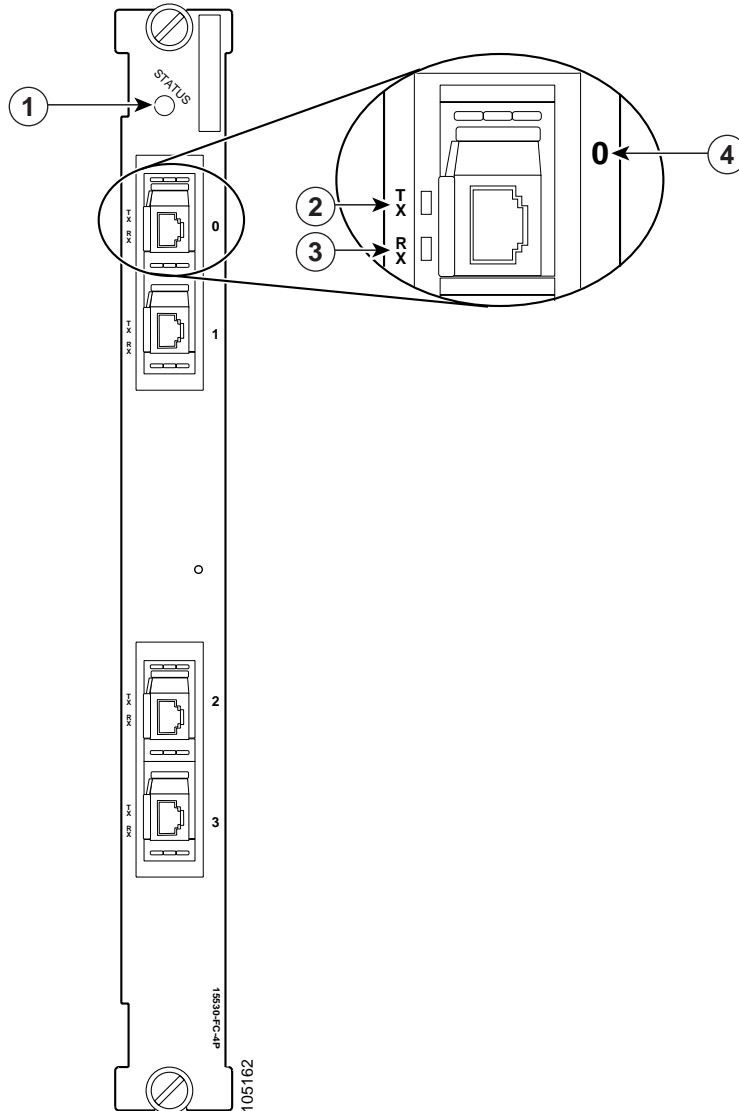
The SFP optics must be purchased separately. Protocol monitoring is the same as for single mode transponder modules and multimode transponder modules.

## 4-Port 1-Gbps/2-Gbps FC Aggregation Cards

The Cisco ONS 15530 supports a line card for FC (Fibre Channel), FICON, and ISC traffic. The 4-port 1-Gbps/2-Gbps FC aggregation card accepts up to four SFP (small form-factor pluggable) optics for client traffic. Each SFP optic supports either FC, FICON, or ISC, depending on how it is configured in the CLI. The 4-port 1-Gbps/2-Gbps FC aggregation card connects four 2.5-Gbps electric signals, or portgroup interfaces, to the switch fabric. The client port data streams must be mapped to one of these portgroup interfaces, using the CLI. Only two 1-Gbps client interfaces or one 2-Gbps client interface can

be mapped into a single portgroup interface. The signal on the portgroup interfaces connects through the backplane and the switch fabric on the active CPU switch module to a 2.5-Gbps ITU trunk card, a 10-Gbps ITU trunk card, or a 10-Gbps uplink card, where the signal is converted to, and from, an ITU channel. The cross connections between the two cards through the backplane and switch fabrics are configured using the CLI. The 4-port 1-Gbps/2-Gbps FC aggregation card has redundant connections over the backplane to the switch fabric on the active and standby CPU switch modules. (See [Figure 1-22](#)).

**Figure 1-22 4-Port 1-Gbps/2-Gbps FC Aggregation Card**



1	Status LED	3	Rx LED
2	Tx LED	4	Port number

Table 1-14 lists the LEDs on the 4-port 1-Gbps/2-Gbps FC aggregation card, their default conditions, and what the conditions indicate.

**Table 1-14 4-Port 1-Gbps/2-Gbps FC Aggregation Card LEDs**

LED	Status	Description
STATUS	Off	No power to the board.
	Red	Card is in reset or the LRC is not configured.
	Yellow	Card is out of reset.
	Green	Card is properly initialized.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.

The 4-port 1-Gbps/2-Gbps FC aggregation card uses single-mode and multimode SFP optics for the client signals. There are no restrictions on populating the line card with SFPs. Table 1-15 lists the characteristics for the SFP optics supported by the 4-port 1-Gbps/2-Gbps FC aggregation card.

**Table 1-15 4-port 1-Gbps/2-Gbps FC Aggregation Card SFP Optics Characteristics**

Part Number	Protocols or Clock Rate Range Supported	Fiber Type	Wavelength	Connector Type
15500-XVRA-02C1	Gigabit Ethernet <sup>1</sup> , Fibre Channel (1 Gbps) <sup>2</sup> , FICON (1 Gbps), ISC-1 (1-Gbps)	MM 50/125 m MM 62.5/125 m	850 nm	LC
15500-XVRA-03B1	Gigabit Ethernet <sup>3</sup> , Fibre Channel (1 Gbps) <sup>4</sup> , FICON (1 Gbps), ISC-3 links compatibility mode	SM 9/125 m	1310 nm	LC
15500-XVRA-03B2	Fibre Channel (1-Gbps and 2-Gbps), FICON (1-Gbps and 2 Gbps)	SM 9/125 m	1310 nm	LC
15500-XVRA-11B1	Mid-band variable rate 200-Mbps to 1.25-Gbps, ISC-1	SM 9/125 m	1310 nm	LC
15500-XVRA-12B1	High-band variable rate 1.062-Gbps to 2.488-Gbps, ISC-1, ISC-3	SM 9/125 m	1310 nm	LC
15454-SFP-GEFC-SX	Fibre Channel (2-Gbps), Fibre Channel (1-Gbps), FICON (1-Gbps and 2 Gbps) ISC-3 (1-Gbps and 2 Gbps)	MM 50/125 m MM 62.5/125 m	850 nm	LC
ONS-SE-GEFC-SX	Fibre Channel (2-Gbps), Fibre Channel (1-Gbps), FICON (1-Gbps and 2 Gbps) ISC-3 (1-Gbps and 2 Gbps)	MM 50/125 m MM 62.5/125 m	850 nm	LC

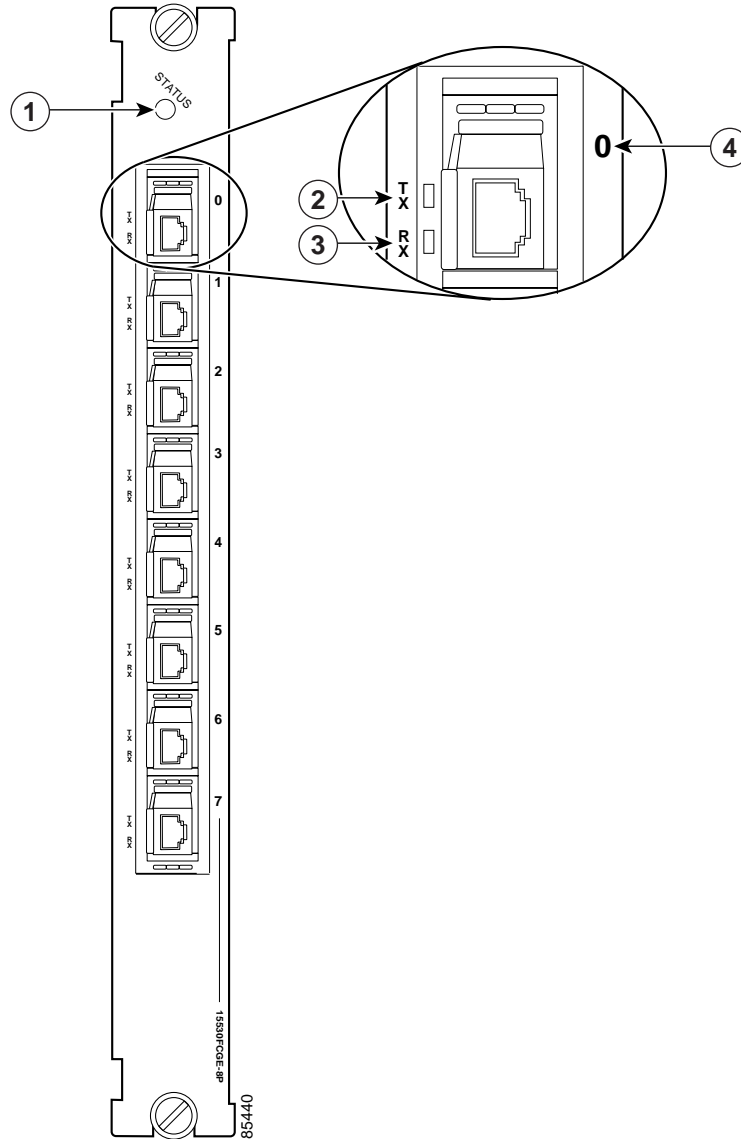
- 1000BASE-SX
- FC-0-100-M5-SN-S and FC-0-100-M6-SN-S standards

3. 1000BASE-LX
4. FC-0-100-SM-LC-S standard

## 8-Port FC/GE Aggregation Cards

The Cisco ONS 15530 supports a line card specifically for ISC (compatibility and peer mode), FICON, FC (Fibre Channel) and GE (Gigabit Ethernet) traffic. The 8-port Fibre Channel/Gigabit Ethernet aggregation card accepts up to eight SFP (small form-factor pluggable) optics for client traffic. Each SFP optic supports either FC or GE, depending on how it is configured in the CLI. The 8-port FC/GE aggregation card converts client signals from two adjacent port pairs (0–1, 2–3, 4–5, or 6–7) from optical form to electrical form, and then aggregates them into four 2.5-Gbps signals. These aggregated signals pass through the backplane and the switch fabric on the active CPU switch module to a 2.5-Gbps ITU trunk card, a 10-Gbps ITU trunk card, or a 10-Gbps uplink card. The cross connections between the two cards through the backplane and switch fabric are configured using the CLI. The 8-port FC/GE aggregation card has redundant connections over the backplane to the switch fabric on the active and standby CPU switch modules. (See [Figure 1-23](#)).

Figure 1-23 8-Port FC/GE Aggregation Card



1	Card status LED	3	Receive Port status
2	Transmit Port status	4	Port number



**Note** The 8-port FC/GE aggregation card also supports FICON traffic at 1 Gbps.



**Note** We strongly recommend configuring port pairs as ISC, FICON, FC only or GE only. Mixing FC, FICON, and ISC with GE in a port pair increases the signal latency between nodes.

The Cisco ONS 15530 supports up to four 8-port FC/GE aggregation cards for a total of 32 client signals.

Table 1-16 describes the LEDs on the 8-port FC/GE aggregation card.

**Table 1-16** 8-Port FC/GE Aggregation Card LEDs

LED	Status	Description
STATUS	Off	No power to the board.
	Red	Card is in reset or the LRC is not configured.
	Yellow	Card is out of reset.
	Green	Card is properly initialized.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.

The 8-port FC/GE aggregation card uses single-mode and multimode SFP optics for the client signals. There are no restrictions on populating the line card with SFPs. For example, you can mix a single-mode SFP optics with a multimode SFP optics on the same port pair. Table 1-17 lists the characteristics for the SFP optics supported by the 8-port FC/GE aggregation card.

**Table 1-17** 8-port FC/GE Aggregation Card SFP Optics Characteristics

Part Number	Protocols or Clock Rate Range Supported	Fiber Type	Wavelength	Connector Type
15500-XVRA-02C1	Gigabit Ethernet <sup>1</sup> , Fibre Channel (1 Gbps) <sup>2</sup> , FICON (1 Gbps)	MM 50/125 m MM 62.5/125 m	850 nm	LC
15500-XVRA-03B1	Gigabit Ethernet <sup>3</sup> , Fibre Channel (1 Gbps) <sup>4</sup> , FICON (1 Gbps), ISC-3 links compatibility mode, ISC peer mode	SM 9/125 m	1310 nm	LC
15500-XVRA-11B1	Mid-band variable rate 200 Mbps to 1.25 Gbps	SM 9/125 m	1310 nm	LC
15500-XVRA-11B2	Mid-band variable rate 200 Mbps to 1.25 Gbps	SM 9/125 m	1310 nm	LC
15500-XVRA-12B1	High-band variable rate 1.062 Gbps to 2.488 Gbps	SM 9/125 m	1310 nm	LC

1. 1000BASE-SX
2. FC-0-100-M5-SN-S and FC-0-100-M6-SN-S standards
3. 1000BASE-LX
4. FC-0-100-SM-LC-S standard



**Note** The SFP optics must be purchased separately.

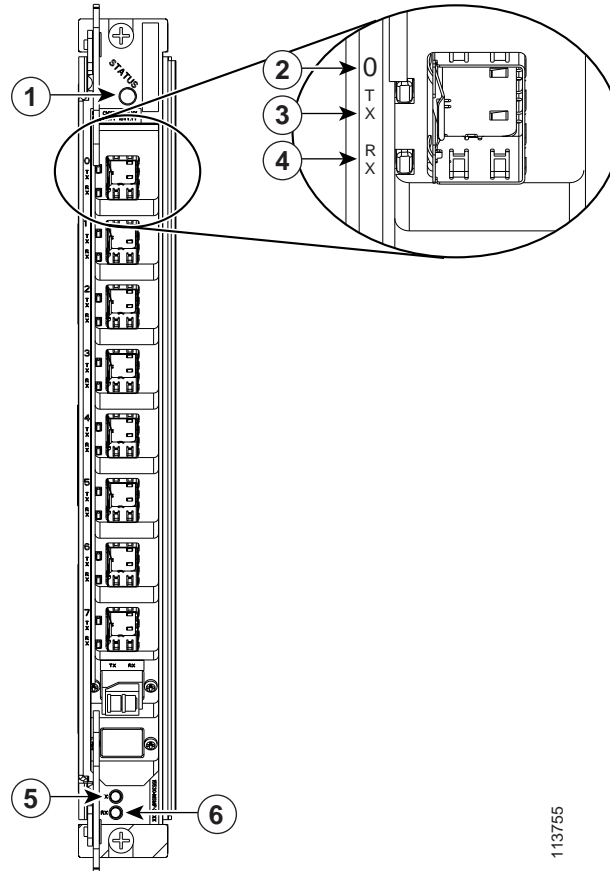
Protocol monitoring is the same as for single mode transponder modules and multimode transponder modules.



## 8-Port Multi-Service Muxponders

The 8-port multi-service muxponder aggregates up to eight ports of client traffic into 2.5-Gbps DWDM traffic to the trunk. The muxponder transports a mix of different protocols between sites in a metro DWDM network. The protocols that can be aggregated and transported range from high-speed services such as Fibre Channel and Gigabit Ethernet to low-speed services such as OC-3, Fast Ethernet, or even T1 or E1. [Figure 1-24](#) shows a nonsplitter protected 8-port multi-service muxponder.

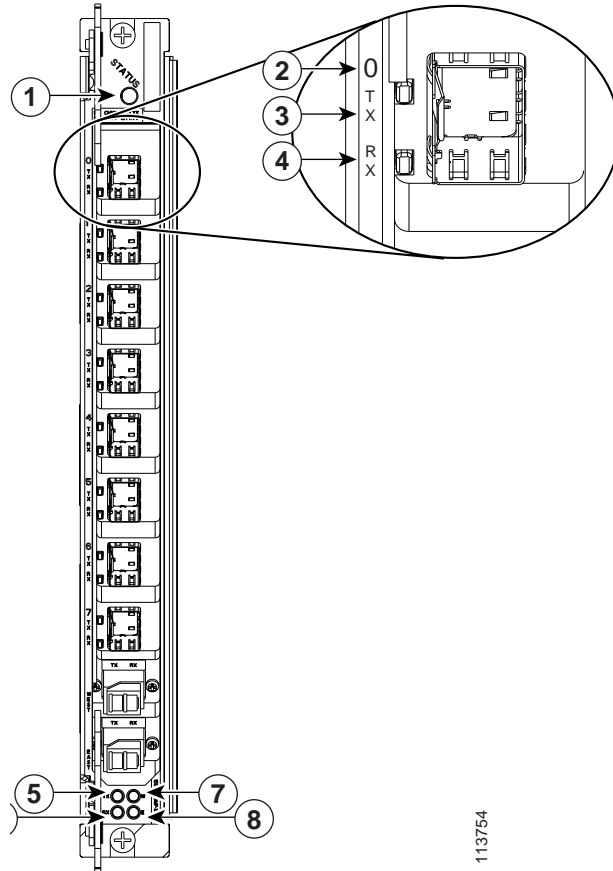
**Figure 1-24** 8-Port Multi-Service Muxponder (Nonsplitter)



1	Status LED	4	Port Rx (receive) LED
2	Port number	5	Trunk Tx (transmit) LED
3	Port Tx (transmit)	6	Trunk Rx (receive) LED

Figure 1-25 shows a splitter protected 8-port multi-service muxponder.

Figure 1-25 8-Port Multi-Service Muxponder (Splitter)



113754

1	Status LED	5	Trunk Tx (transmit) LED
2	Port number	6	Trunk Rx (receive) LED
3	Port Tx (transmit)	7	Trunk east LED
4	Port Rx (receive)	8	Trunk west LED

Table 1-18 lists the LEDs on the 8-port multi-service muxponder faceplate, their default conditions, and what the conditions indicate.

**Table 1-18 8-Port Multi-Service Muxponder LEDs**

LED	Status	Description
Status	Off	No power to the muxponder.
	Red	The functional image on the trunk is not configured.
	Yellow	The system clock is not present.
	Blinking green	The muxponder is out of reset, and the system clock is good and waiting for software initialization.
	Green	The muxponder is initialized and operational.
Client port status	Rx green	Port is operational.
	Rx off	Rx link is down.
	Tx green	Transmit enabled.
	Tx off	Transmit disabled.
Trunk status	East green	The muxponder is communicating with the West signal.
	West green	The muxponder is communicating with the East signal.
	Rx green	Light reception exists at the port.
	Txgreen	Transmit enabled.

The 8-port multi-service muxponder uses SFPs for the client signals. There are no restrictions on populating the line card with SFPs. For example, you can mix a single-mode SFP with a multimode SFP on the same card. [Table 1-19](#) lists the characteristics for the SFPs supported by the 8-port multi-service muxponder.

**Table 1-19 8-Port Multi-Service Muxponder SFP Characteristics**

Part Number	Protocols or Clock Rate Range Supported	Fiber Type	Wavelength	Connector Type
15500-XVRA-10A2	Low band 8 Mbps to 200 Mbps	MM 50/125 m MM 62.5/125 m	1310 nm	LC
15500-XVRA-10B2	Low band 8 Mbps to 200 Mbps	SM 9/125 m	1310 nm	LC
15500-XVRA-11A2	Mid-band 200 Mbps to 622 Mbps	MM 62.5/125 m	1310 nm	LC
15500-XVRA-11B2	Mid-band 200 Mbps to 1.25 Gbps	SM 9/125 m	1310 nm	LC
15500-XVRA-12B1	High-band 1.062 Gbps to 2.488 Gbps	SM 9/125 m	1310 nm	LC
15454-SFP-GEFC-SX	Fibre Channel (2.125 Gbps), Fibre Channel (1 Gbps), Gigabit Ethernet	MM 50/125 m MM 62.5/125 m	850 nm	LC
15500-XVRA-08D1	T1 <sup>1</sup> 1.544 Mbps	Copper T1	–	RJ-45
15500-XVRA-09D1	E1 2.044 Mbps	Copper E1	–	RJ-45

**Table 1-19 8-Port Multi-Service Muxponder SFP Characteristics (continued)**

Part Number	Protocols or Clock Rate Range Supported	Fiber Type	Wavelength	Connector Type
15500-XVRA-10E1 <sup>2</sup>	SDI and DVB-ASI <sup>3</sup> Video	Copper Digital Video	–	Mini SMB Coax
15500-XVRA-11D1 <sup>4</sup>	GE 1.25 Gbps, FE 1.25 Mbps	Copper GE/FE	–	RJ-45

1. DSX-1 interface
2. In a normal operating environment, the maximum digital video application connection length using a Belden 1694A cable is 200 m (218 yd). If the chassis ambient operating temperature is above 45°C (113° F) and ports 0 and 1 are used for video applications with this SFP, the maximum cable connection length supported may be less than the specified 200 m (218 yd), depending on the operating environment.
3. Data Video Broadcast Asynchronous Serial Interface
4. To ensure proper operation of the 15500-XVRA-11D1 SFP, the ambient operating temperature should not exceed 45°C (113°F).

The following warning applies to the copper SFPs listed in [Table 1-19](#).

**Warning**

For connections outside the building where the equipment is installed, the following ports must be connected through an approved network termination unit with integral circuit protection. 15500-XVRA-08D1, 15500-XVRA-09D1, 15500-XVRA-10E1 and 15500-XVRA-11D1. Statement 1044

**Note**

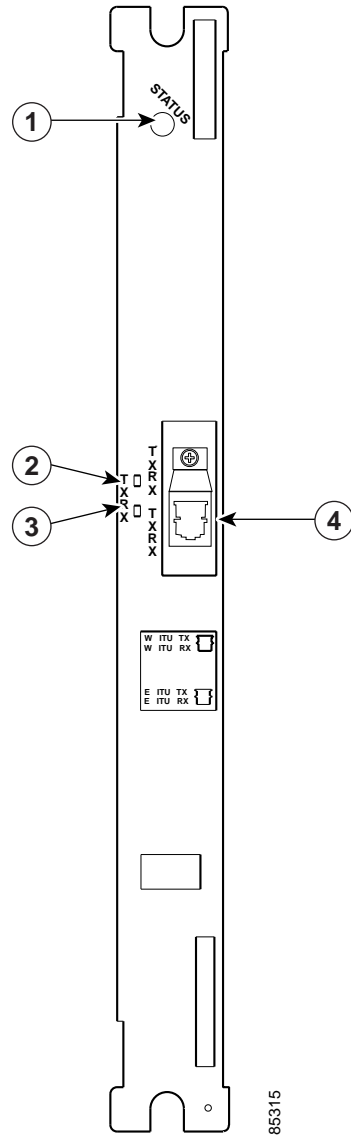
The SFPs must be purchased separately.

## 2.5-Gbps ITU Trunk Cards

The 2.5-Gbps ITU trunk card sends and receives the ITU grid wavelength signal to and from an OADM module. This card accepts a 2.5-Gbps (3.125-Gbps line rate) electrical signal from either a 10-port ESCON aggregation card or an 8-port FC/GE aggregation card, which is converted to the ITU grid wavelength, or channel. The 2.5-Gbps ITU trunk card has redundant interfaces to the backplane, connecting to the switch fabrics on the active and standby CPU switch modules. The ITU laser is tunable to one of two channel frequencies. There are 16 different 2.5-Gbps ITU trunk cards (for channels 1–2, 3–4, ..., 31–32) to support the 32 channels.

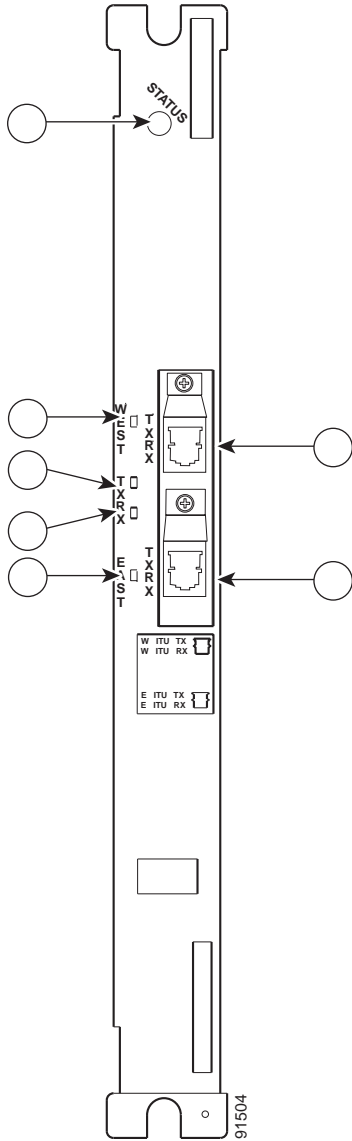
The 2.5-Gbps ITU trunk card has two versions: nonsplitter (shown in [Figure 1-26](#)) and splitter (shown in [Figure 1-27](#)). The nonsplitter version has only one pair of optical connectors on the front panel, which connects to either the east or the west OADM module, and can be used for unprotected, line card protected, or switch fabric protected applications. The card supports 32 channels as shown in [Table A-2 on page A-3](#).

Figure 1-26 2.5-Gbps ITU Trunk Card (Nonsplitter)



1	Card status LED	3	Receive LED
2	Transmit LED	4	Transmit/Receive port

Figure 1-27 2.5-Gbps ITU Trunk Card (Splitter)



1	Card status LED	5	Receive LED
2	West side port LED	6	East side port LED
3	West side port	7	East side port
4	Transmit LED		

Table 1-20 lists and describes the 2.5-Gbps ITU Trunk Card LEDs.

*Table 1-20 2.5-Gbps ITU Trunk Card LEDs*

LED	Status	Description
STATUS	Green	Card is properly initialized.
WEST	Green	Card is listening to the west side signal.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.
EAST	Green	Card is listening to the east side signal.

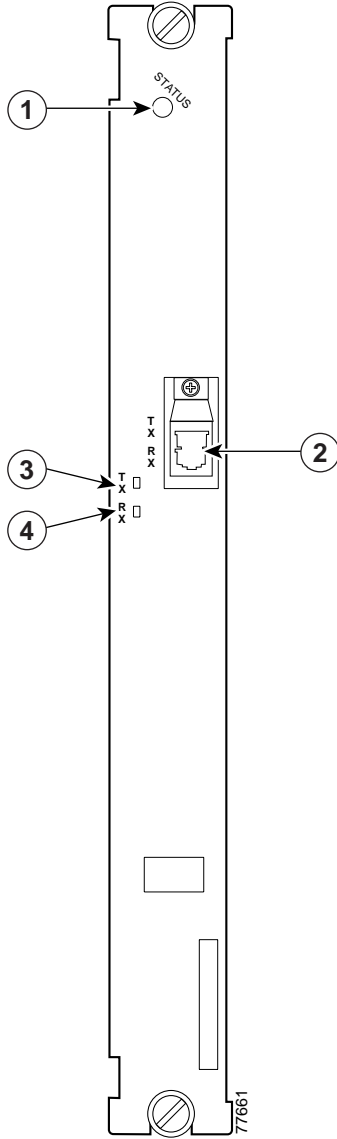
## 10-Gbps ITU Trunk Cards

The 10-Gbps ITU trunk card sends and receives the ITU grid wavelength signal to and from an OADM module. This card accepts up to four 2.5-Gbps (3.125-Gbps line rate) electrical signals from the 10-port ESCON aggregation cards and 8-port FC/GE aggregation cards, and combines them into one 10-Gbps signal, which is converted to the ITU grid wavelength, or channel. The 10-Gbps ITU trunk card has four separate redundant interfaces to the backplane, each connecting to the switch fabrics on the active and standby CPU switch modules.

The 10-Gbps ITU trunk card has two versions: nonsplitter and splitter. The nonsplitter version has only one pair of optical connectors on the front panel, which connects to either the east or the west OADM module, and can be used for unprotected, line card protected, or switch fabric protected applications (see [Figure 1-28](#)). The splitter version of the 10-Gbps ITU trunk card has two pairs of optical connectors on the front panel, which connect to the east and west OADM modules, and is designed for splitter protected applications (see [Figure 1-29](#)).

The Cisco ONS 15530 supports up to four 10-Gbps ITU trunk cards for a total of four channels.

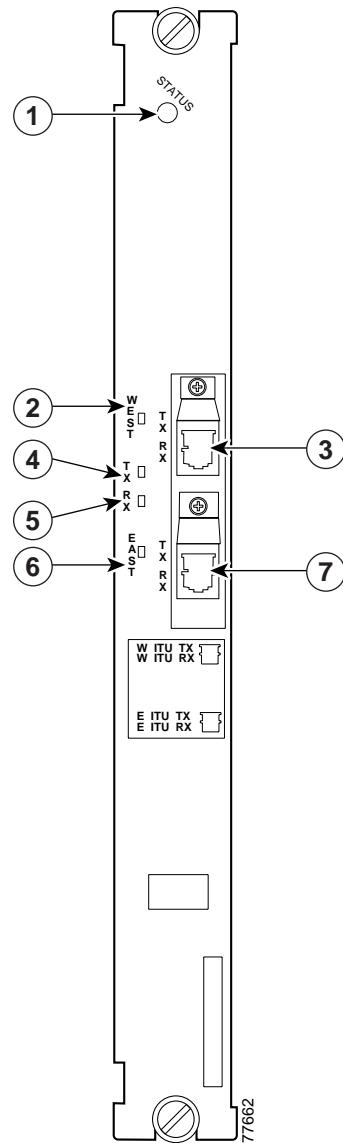
Figure 1-28 10-Gbps ITU Trunk Card (Nonsplitter)



1	Card status LED	3	Transmit LED
2	ITU port	4	Receive LED



Figure 1-29 10-Gbps ITU Trunk Card (Splitter)



1	Card status LED	5	Receive LED
2	West side port LED	6	East side port LED
3	West side port	7	East side port
4	Transmit LED		

Table 1-21 describes the 10-Gbps ITU trunk card LED status.

**Table 1-21** 10-Gbps ITU Trunk Card LEDs

LED	Status	Description
STATUS	Green	Card is properly initialized.
WEST	Green	Card is listening to the west side signal.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.
EAST	Green	Card is listening to the east side signal.

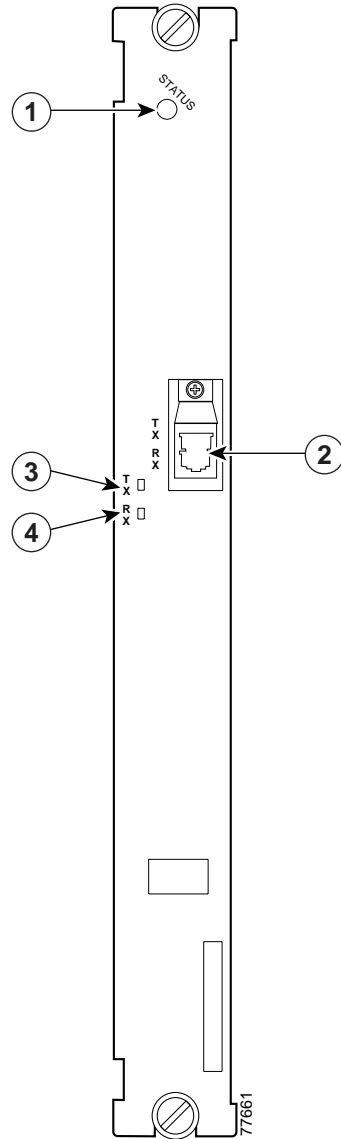
## 10-Gbps ITU Tunable Trunk Cards

The 10-Gbps ITU tunable trunk card works similar to the 10-Gbps ITU trunk card. The 10-Gbps ITU tunable trunk card sends and receives the ITU grid wavelength signal to and from an OADM module. This card accepts up to four 2.5-Gbps (3.125-Gbps line rate) electrical signals from the 10-port ESCON aggregation cards and 8-port FC/GE aggregation cards, and combines them into one 10-Gbps signal, which is converted to the ITU grid wavelength, or channel. The 10-Gbps ITU tunable trunk card has four separate redundant interfaces to the backplane, each connecting to the switch fabrics on the active and standby CPU switch modules.

The 10-Gbps ITU tunable trunk card has two versions: nonsplitter and splitter. The nonsplitter version has only one pair of optical connectors on the front panel, which connects to either the east or the west OADM module, and can be used for unprotected, line card protected, or switch fabric protected applications (see [Figure 1-30](#)). The splitter version of the 10-Gbps ITU tunable trunk card has two pairs of optical connectors on the front panel, which connect to the east and west OADM modules, and is designed for splitter protected applications (see [Figure 1-31](#)).

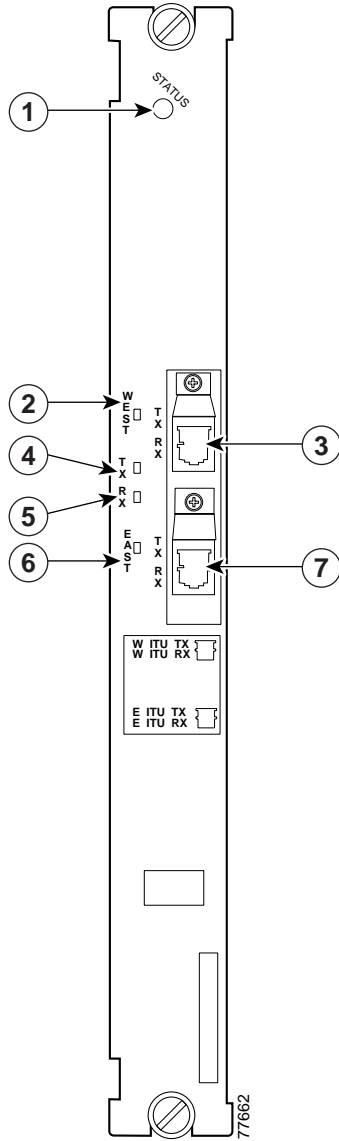
The Cisco ONS 15530 supports up to four 10-Gbps ITU tunable trunk cards for a total of four channels. The 10-Gbps ITU tunable trunk cards are equipped with Universal Transponders (UT1) with tuneable lasers. The cards are programmable to four different frequencies belonging to one of the A, B, C, D, E, F, G, or H bands. For more information on tuneable frequencies, see *Cisco ONS 15530 Planning Guide*.

Figure 1-30 10-Gbps ITU Tunable Trunk Card (Nonsplitter)



1	Card status LED	3	Transmit LED
2	ITU port	4	Receive LED

Figure 1-31 10-Gbps ITU Tunable Trunk Card (Splitter)



1	Card status LED	5	Receive LED
2	West side port LED	6	East side port LED
3	West side port	7	East side port
4	Transmit LED		

Table 1-22 describes the 10-Gbps ITU tunable trunk card LED status.

**Table 1-22** 10-Gbps ITU Tunable Trunk Card LEDs

LED	Status	Description
STATUS	Green	Card is properly initialized.
WEST	Green	Card is listening to the west side signal.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.
EAST	Green	Card is listening to the east side signal.

## 10-Gbps Uplink Cards

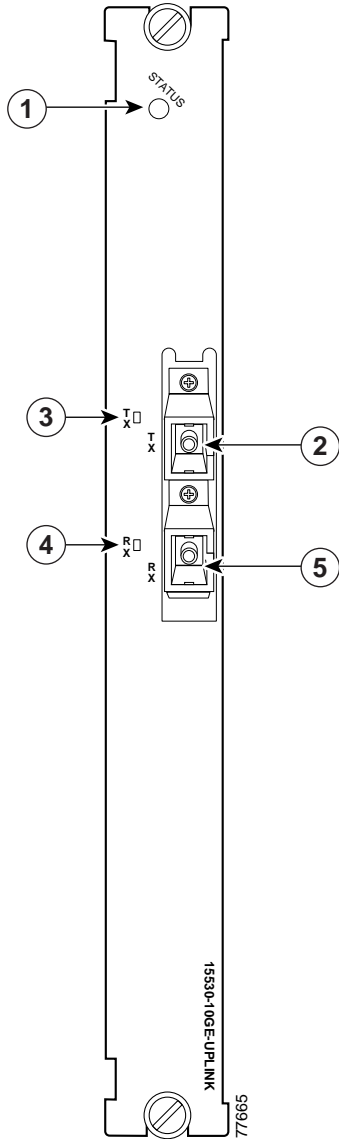
The 10-Gbps uplink card, shown in Figure 1-32, sends and receives a 10-GE 1310-nm signal to and from a 10-GE uplink card on another Cisco ONS 15530, or to and from a 10-GE transponder module on a Cisco ONS 15540 ESP or Cisco ONS 15540 ESPx. This card accepts up to four (3.125-Gbps line rate) electrical signals from 10-port ESCON aggregation cards and 8-port FC/GE aggregation cards, and combines them into one 10-GE signal.

The 10-Gbps uplink card has four separate redundant interfaces to the backplane. Each interface connects to the switch fabric on the active and standby CPU switch modules.

The 10-Gbps uplink card has only one version: nonsplitter. The nonsplitter version has only one pair of optical connectors on the front panel and can be used for unprotected or line card protected applications. For splitter protected configurations, the splitter line card motherboards on the Cisco ONS 15540 ESP and the Cisco ONS 15540 ESPx provide the facility protection.

The Cisco ONS 15530 supports up to four 10-Gbps uplink cards for a total of four signals.

Figure 1-32 10-Gbps Uplink Card



1	Card status LED	4	Receive LED
2	Transmit port	5	Receive port
3	Transmit LED		

Table 1-23 describes the 10-Gbps uplink line card LED status.

Table 1-23 10-Gbps Uplink Line Card LEDs

LED	Status	Description
STATUS	Green	Card is properly initialized.
TX	Green	Port is up and transmit laser is enabled.
RX	Green	Light reception exists at the port.