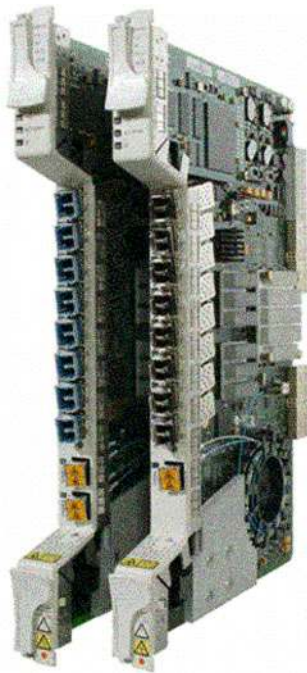


2.5-Gbps Multiservice Aggregation Line Card for the Cisco ONS 15454 Multiservice Transport Platform

The 2.5-Gbps multiservice aggregation line card for the Cisco® ONS 15454 Multiservice Transport Platform (MSTP) provides a highly scalable solution that addresses today's ever-growing requirement for data and storage bandwidth in enterprises as well as metropolitan-area (metro) and regional managed service providers. This 8-port multiservice aggregation card (Figure 1) efficiently uses wavelengths by aggregating Gigabit Ethernet, Fibre Channel, IBM Fiber Connection (FICON), and Enterprise Systems Connection (ESCON) services into a 2.5-Gbps wavelength.

Figure 1

Cisco ONS 15454 MSTP 2.5-Gbps Multiservice Aggregation Line Card



Background

Increasing use of mission-critical business applications has resulted in an exponential growth in data and storage requirements. For many enterprises as well as metro and regional service providers, dense wavelength-division multiplexing (DWDM) is the ideal technology to address the requirement for high service density and flexibility. Furthermore, by aggregating multiple data streams into a single wavelength, the overall service density of a fiber increases drastically. The enhanced scalability ultimately results in lower total cost of ownership (TCO) and a more scalable solution for end users.

Product Overview

The 2.5-Gbps multiservice aggregation card provides service aggregation of Gigabit Ethernet, Fibre Channel, FICON, and ESCON services over a 2.5-Gbps 100-GHz, ITU-compliant wavelength, with 50-GHz wavelength stability for future 64-channel operation. The card architecture contains eight client interfaces that are electronically multiplexed and converted to a single-line DWDM interface, without accessing the Cisco ONS 15454 shelf cross-connect fabric. A single card multiplexes up to two Gigabit Ethernet, 1-Gbps Fibre Channel or FICON services as well as a single 2-Gbps Fibre Channel or FICON service and up to eight ESCON services. The interface to the client is through a variety of Small Form-Factor Pluggable (SFP) optics modules, facilitating a wide service mix, including Gigabit Ethernet, 1-Gbps or 2-Gbps Fibre Channel, FICON and ESCON, and different fiber types (single-mode and multimode), wavelengths (850 and 1310 nanometers [nm]), and fiber reach (short reach for intraoffice, intermediate reach for short haul, etc.). The SFP optics modules are equipped with LC connectors to enable high-density placement on the card. Because the 2.5-Gbps multiservice aggregation card incorporates both client and DWDM line interfaces into a single card, up to 12 cards can be deployed in the Cisco ONS 15454 platform.

The DWDM line interface provides one long-reach or long-haul, ITU-compliant, 100-GHz spaced optical interface. The DWDM output line interface is tunable across four adjacent 100-GHz wavelengths, facilitating support for 32-channel DWDM networks using only eight separate cards. At each wavelength, the 2.5-Gbps multiservice aggregation card wavelength is offered in protected or unprotected versions. The protected version includes a second DWDM line output or input, helping enable optical line protection over a DWDM network.

The 2.5-Gbps multiservice aggregation card supports many carrier-class features and advanced capabilities including service flexibility, ability to tune wavelengths, flexible protection mechanisms, management, storage-area network (SAN) extension beyond the metro, and performance-monitoring capabilities outlined in the following sections.

Service Flexibility

The 2.5-Gbps multiservice aggregation card supports up to two Gigabit Ethernet, 1-Gbps Fibre Channel and FICON ports, as well as a single 2-Gbps Fibre Channel and FICON port and up to eight ESCON ports. The client interfaces can be mixed, allowing the user to efficiently and cost-effectively aggregate data and storage protocols over a single wavelength.

Tunable Wavelengths

The 2.5-Gbps service aggregation cards operate on the 100-GHz ITU grid and are tunable across four adjacent 100-GHz channels per card. The ability to tune the output ITU laser enables only eight discrete cards to cover the entire 32-wavelength plan, which reduces the burden of the spares inventory by 75 percent.

Flexible Protection Mechanisms

The 2.5-Gbps multiservice aggregation card provides flexible protection capabilities for both client and DWDM line interfaces, enabling a wide variety of network configurations required to deliver the various service-level agreements (SLAs) required by the customer application (Table 1).

Table 1. Protection Formats

Protection Type	Capabilities
Unprotected client and DWDM line interfaces (Figure 2)	No protection is offered on either the client equipment or the DWDM transport layer. The client signal is transported over a single, unprotected multiservice aggregation card.
Y-cable client interface (Figure 3)	This interface provides transponder equipment and DWDM transport protection without client terminal equipment interface protection. A single client interface is split to 2 multiservice aggregation cards. This feature is not supported on the protected version of the 2.5-Gbps multiservice aggregation card.
Protected DWDM line interface (Figure 4)	This interface provides network protection for a single client signal using the protected version of the 2.5-Gbps multiservice aggregation card. This card splits the outbound signal into 2 wavelength paths and the receiver at the termination node determines which signal is used.

Figure 2

Unprotected Configuration

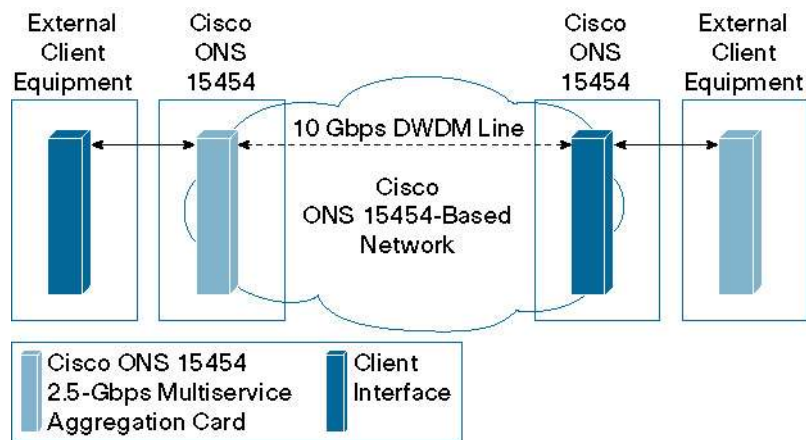


Figure 3

Y-Protection Configuration

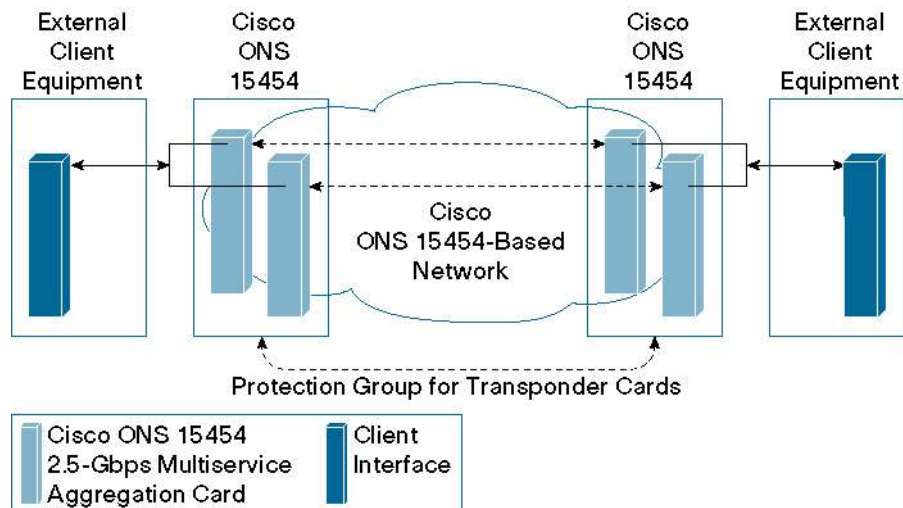
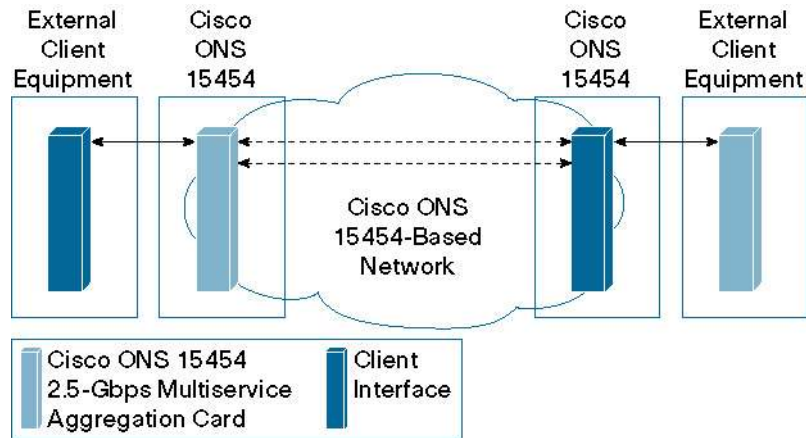


Figure 4
Protected DWDM Line Configuration



SAN Extension Beyond the Metro

When a Fibre Channel link is extended over a long distance, the inherent flow-control mechanism can significantly reduce the overall throughput performance. The 2.5-Gbps multiservice aggregation card implements a buffer-to-buffer credit-spoofing scheme which effectively increases the supported distance up to 1600 km for 1-Gbps Fibre Channel protocol. Buffer-to-buffer credit spoofing allows the users to extend their business continuance and disaster recovery applications beyond the boundaries of a metro network.

Performance Monitoring

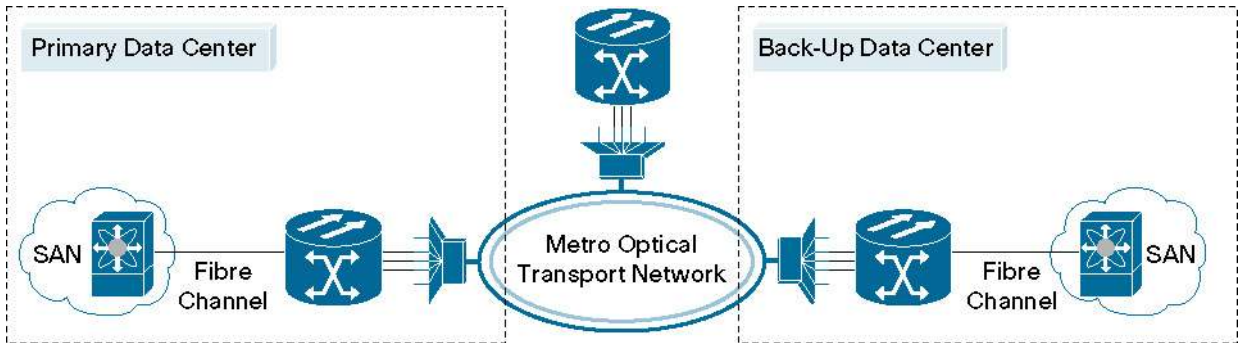
The 2.5-Gbps multiservice aggregation card provides extensive performance-monitoring capability, by wavelength or service level. At the wavelength level, the card continuously monitors transmit and receive power, loss of signal or frame, alarm-indication signal, and remote defect indication. Additionally, based on the protocols of the client interfaces which include Gigabit Ethernet, 1-Gbps Fibre Channel, and 2-Gbps Fibre Channel, FICON, and ESCON, the card provides detailed performance statistics and alarms including 8b/10b code violation, received and transmit frame or packet count, and received and transmit R_RDY count (Fibre Channel only). Enhanced performance monitoring allows the user to define additional criteria to better assess the health of the network and support the decision for protection switching.

Application Description

The 2.5-Gbps multiservice aggregation card effectively addresses demands for high-density data and storage service aggregation. Whether they are using a dedicated enterprise infrastructure or a metro or regional service provider's network, customers can efficiently and cost-effectively scale their business continuance applications and consolidate their backbone network infrastructures.

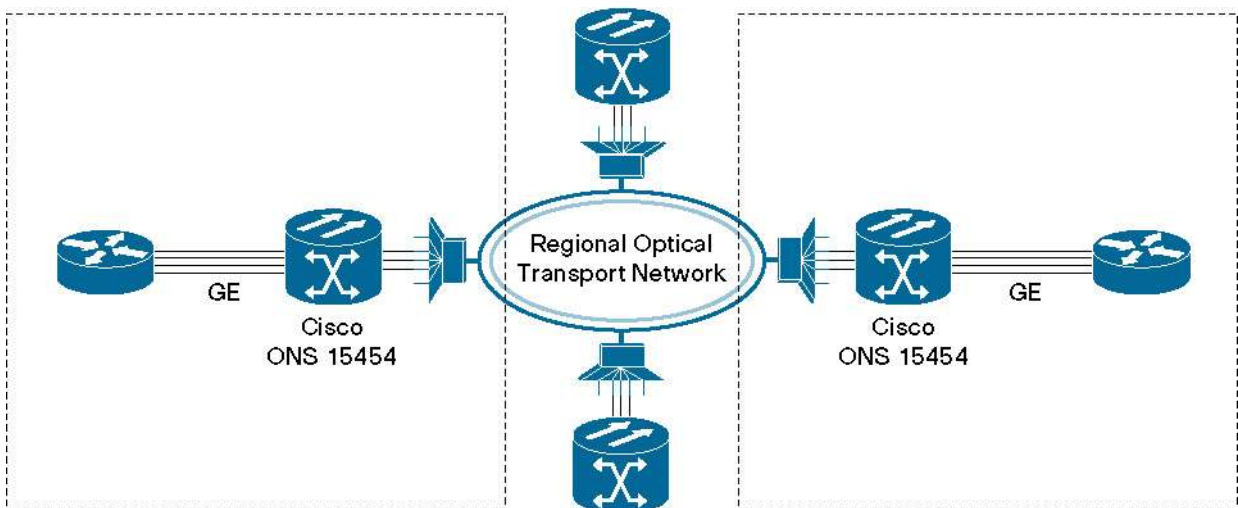
The tremendous growth of business applications is quickly heightening data-storage requirements and network expectations. As shown in Figure 5, customers demand uninterrupted access to corporate systems and data. Enterprises must respond to this surge in demand by providing robust, highly secure, interconnected SANs and geographically dispersed data-recovery solutions. The 2.5-Gbps multiservice aggregation card provides the capability to efficiently aggregate mission-critical Gigabit Ethernet, Fibre Channel, FICON, and ESCON services across the metro optical transport network, enabling real-time synchronous replication of information between the primary and backup data centers. For enterprise customers with less stringent requirements, the card provides a highly cost-effective data and storage transport solution for asynchronous disk mirroring or tape backup applications.

Figure 5
SAN Connectivity for Disaster Recovery



Additionally, because of the massive fiber buildout of the past years and the emergence of a new generation of Ethernet services in the metro, the 2.5-Gbps multiservice aggregation card provides a scalable and reliable optical infrastructure for transporting Gigabit Ethernet services over DWDM. Instead of mapping each Gigabit Ethernet to a wavelength, the 2.5-Gbps multiservice aggregation card multiplexes two Gigabit Ethernet streams into a wavelength, as shown in Figure 6, doubling the overall service density.

Figure 6
Transparent LAN Services



The Cisco Advantage

The 2.5-Gbps multiservice aggregation card complements and extends the services capabilities of the Cisco ONS 15454 MSTP by helping users to deliver high-density data and storage services over DWDM on top of their existing fiber plant. The Cisco ONS 15454 solution reduces the need to deploy standalone metro DWDM platforms and Multiservice Provisioning Platforms (MSPPs) to transport a mixture of services, as outlined in Figures 7 and 8.

Figure 7

Today's DWDM Architectures

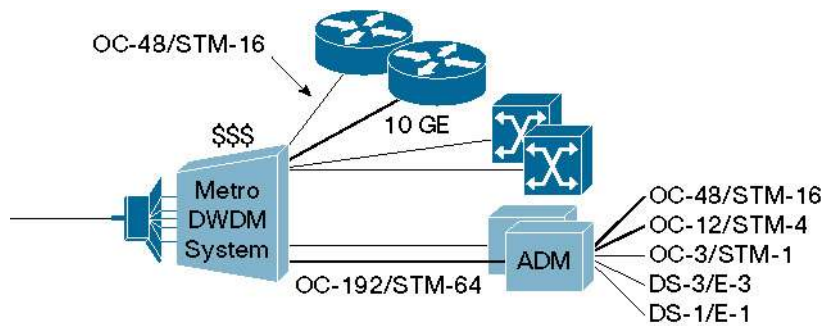
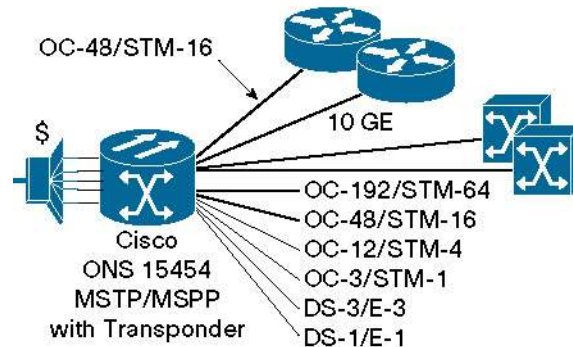


Figure 8

Cisco ONS 15454 Hybrid DWDM Architecture



The Cisco ONS 15454 optical platforms (MSPP and MSTP) offers significant advantages over traditional network elements, including:

- *Unprecedented service-interface selection* – The Cisco ONS 15454 platforms support the broadest range of service interfaces available on a single chassis type by using software personality loads, including asynchronous (DS-1/E1, DS-3/E3), SONET/SDH (EC-1, OC-3/STM-1 to OC-192/STM-64), Ethernet (10, 100, 1000, and 10,000 Mbps), SAN (ESCON, FICON, 1- and 2-Gbps Fibre Channel), and video (D1 and C-C or DV6000) interfaces.
- *Multiple restoration types when used in the hybrid DWDM and SONET/SDH mode* – The Cisco ONS 15454 platforms support 2- or 4-fiber bidirectional line switched ring/multiplex section-shared protection ring (BLSR/MS-SPR), unidirectional-path switched ring/subnetwork connection protection (UPSR/SNCP), linear automatic protection switching/subnetwork connection (APS/SNC), and path-protected mesh

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networking (PPMN). This allows the service provider to deploy the platform in all areas of the transport networking applications, including the interoffice network, normally deployed using 2- or 4-fiber BLSR/MS-SPR restoration, as well as the collector or fiber to the building networks, normally using UPSR/SNCP restoration.

- *Common line cards and chassis* – Optical line cards are not restoration-type-dependent, reducing sparing costs and technician confusion. Additionally, as networks change and customer-interface demands evolve, users can easily and simply redeploy optical circuit packs as necessary.
- *Common chassis type* – A common chassis supporting all optical interface speeds allows the technician to spend time deploying bandwidth and services instead of learning about multiple equipment platforms, which not only causes confusion when ordering, but also may bring into question whether the required platform will be available to support the desired application. The line rate and restoration flexibility of the Cisco ONS 15454 makes ordering and deploying simple, fast, and easy.

The Cisco ONS 15454, the industry’s leading metro optical transport platform, delivers supercharged SONET/SDH transport, integrated optical networking, unprecedented multiservice interfaces, and competitive economic benefits.

Cisco ONS 15454 2.5-Gbps Multiservice Aggregation Line Card Features and Specifications

Compact Design

- High-density solution with single-chassis slot design supporting bidirectional client to DWDM operation
- Up to 12 bidirectional 2.5-Gbps multiservice aggregation cards per shelf assembly, 48 cards per bay

Flexible Protection Options

- Y-cable client protection
- Protected DWDM line option

Regulatory Compliance¹

Table 2 lists the regulatory compliance of the 2.5-Gbps multiservice aggregation card. See Table 3 for system requirements, Table 4 for specifications, Table 5 for supported wavelengths, and Table 6 for ordering information.

Table 2. Regulatory Compliance

Countries Supported	
SONET/ANSI System	SDH/ETSI System ²
<ul style="list-style-type: none"> • Canada • United States • Mexico • Korea • Japan • EU 	<ul style="list-style-type: none"> • EU • Australia • New Zealand • Singapore • China • Mexico • Hong Kong • Korea

¹ All compliance testing and documentation may not be completed at release of the product. Check with your sales representative for countries outside of Canada, the United States, and the European Union.

² For other countries with SDH/ETSI requirements, confirm compliance with a Cisco account representative.

Countries Supported	
EMC Emissions (radiated, conducted)	
<ul style="list-style-type: none"> ICES-003 GR-1089-CORE 47CFR15 VCCI V-3/2000.04 CISPR22 	<ul style="list-style-type: none"> EN 300 386-TC EN50081-1 EN55022 AS/NZS3548, Amendment 1 + 2 1995
EMC Immunity	
<ul style="list-style-type: none"> GR-1089-CORE CISPR24 EN50082-2 	<ul style="list-style-type: none"> EN300-386-TC EN55024
Safety	
<ul style="list-style-type: none"> CAN/CSA-C22.2 No. 60950-00 Third Ed., 12/1/2002 GR-1089-CORE GR-63-CORE TS001 	<ul style="list-style-type: none"> UL 1950 Third Ed., 12/1/2000 EN60950 (to A4) IEC60950/EN60950, Third Ed. AS/NZS3260 Supplements 1, 2, 3 ,4, 1997
Environmental	
<ul style="list-style-type: none"> GR-63-CORE AT&T Network Equipment Design Specification (NEDS) 	<ul style="list-style-type: none"> ETS 300-019-2-1 (Class 1.1) ETS 300-019-2-2 (Class 2.3) ETS 300-019-2-3 (Class 3.1E)
Structural Dynamics	
<ul style="list-style-type: none"> GR-63-CORE AT&T NEDS 	<ul style="list-style-type: none"> ETS 300-019 (Class 3.1E)
Power and Grounding	
<ul style="list-style-type: none"> SBC (TP76200MP) ETS 300-132-1 (DC power) 	<ul style="list-style-type: none"> ETS 300-253 (grounding)
Optical	
<ul style="list-style-type: none"> GR-253-CORE G.691 	<ul style="list-style-type: none"> G.975
Quality	
TR-NWT-000332, Issue 4, Method 1 calculation for 20-year mean time between failure (MTBF)	

Table 3. System Requirements

Component	Cisco ONS 15454 ANSI	Cisco ONS 15454 ETSI
Processor	TCC2P/TCC2	TCC2P/TCC2
Cross-connect	All (not required)	All (not required)
Shelf assembly	15454-SA-HD or 15454-SA-HD-DDR shelf assembly with FTA3 version fan-tray assembly	15454-SA-ETSI shelf assembly with SDH 48V fan-tray assembly
System software	Release 7.0.0 or greater	Release 7.0.0 or greater
Slot compatibility	1–6, 12–17	1–6, 12–17

Table 4. Card Specifications

Specification	Description
Client Interfaces	
Input bit rate	200 Mbps to 2.0 Gbps
Supported interfaces (Small Form-Factor Pluggable [SFP]-based)	
Gigabit Ethernet	850 nm, multimode fiber (MMF), 0.5 km, 1000BASE-SX 1310 nm, single-mode fiber (SMF), 10 km, 1000BASE-LX
Fibre Channel or FICON – 1 Gbps (client wavelength, fiber type, maximum supported distance)	850 nm, MMF (62.5 μm), 0.3 km 1310 nm, SMF, 10 km
Fibre Channel or FICON – 2 Gbps (client wavelength, fiber type, maximum supported distance)	850 nm, MMF (62.5 μm), 0.3 km 1310 nm, SMF, 10 km
ESCON – 200 Mbps (client wavelength, fiber type, maximum supported distance)	1310 nm, multimode fiber (MMF – 62.5 μm and 50 μm), 2 km , ()
Port provisioning, maximum	1 x Fibre Channel or FICON – 2 Gbps or 2 x Gigabit Ethernet or 2 x Fibre Channel or FICON – 1 Gbps or 1 x Fibre Channel or FICON – 1 Gbps plus 1 x Gigabit Ethernet 8 x ESCON 1 x Fibre Channel or FICON – 1 Gbps plus + 4 ESCON 1 x Gigabit Ethernet – 1 Gbps plus + 4 ESCON
Connector type (Tx/Rx)	LC, duplex
DWDM Line Interface	
Output bit rate	2.48 Gbps
Automatic laser shutdown and restart	ITU-T G.664 (06/99)
Wavelength, nominal (λ_{Tnom})	4-channel tunable (Table 5)
Spectral range (λ_{Tmin} to λ_{Tmax})	1530 to 1565 nm
Spectral width at 20 dB ($\Delta\lambda_{20}$)	±0.025 nm
Connector type (Tx/Rx)	LC, duplex
Optical Transmitter	
Type	Direct modulated
Output power (P_{Tmin} to P_{Tmax})	
Unprotected card	+2 to +4 dBm
Protected card	-1 dBm to 1 dBm
Required optical return loss, minimum	20 dB
Extinction ratio, minimum (r_{eminix})	8.2 dBm
Laser safety class	1
Optical Receiver	
Type	APD
Receiver reflectance (maximum)	-27 dB
Input wavelength bandwidth ($\lambda_{c,rx}$)	Third window, ITU G.692, 1530–1565 nm

Specification	Description
Management	
Card LEDs	
Failure (FAIL)	Red
Active/standby (ACT/STBY)	Green/yellow (Y-protection)
Signal fail (SF)	Yellow
Client port LEDs (bicolor)	
Active-no alarms/alarm	Green/red
DWDM port LEDs (tricolor)	
Active/standby (protection card only)/alarm	Green/yellow/red
Power	
Protected card	
Typical	45W
Maximum	54W
Unprotected card	
Typical	42W
Maximum	50W
Operating Environment	
Temperature	23 to 131°F -5 to 55°C
Humidity	5 to 95% noncondensing
Storage Environment	
Temperature	-40 to 185°F 40 to 85°C
Humidity	5 to 95% noncondensing

Table 5. DWDM Receive Side Optical Performance

OSNR	Guaranteed BER	Input Power Sensitivity	CD Tolerance
10 dB	<10E(-12)	-9 to -23 dBm	—
10 dB	<10E(-12)	-9 to -22 dBm	±1800 ps/nm
10 dB	<10E(-12)	-9 to -21 dBm	±5400 ps/nm
11 dB	<10E(-12)	-9 to -23 dBm	±1800 ps/nm
12 dB	<10E(-12)	-9 to -23 dBm	±5400 ps/nm
14 dB	<10E(-12)	-9 to -30 dBm	—
14 dB	<10E(-12)	-8 to -29 dBm	±1800 ps/nm
14 dB	<10E(-12)	-8 to -28 dBm	±5400 ps/nm
15 dB	<10E(-12)	-9 to -30 dBm	±1800 ps/nm
16 dB	<10E(-12)	-9 to -30 dBm	±5400 ps/nm

Table 6. Supported Wavelengths on 2.5-Gbps Multirate Transponder Cards³

Card (xx.x)	λ (nm)	Card (xx.x)	λ (nm)	Card (xx.x)	λ (nm)	Card (xx.x)	λ (nm)
30.3	1530.33	38.1	1538.19	46.1	1546.12	54.1	1554.13
	1531.12		1538.98		1546.92		1554.94
	1531.90		1539.77		1547.72		1555.75
	1532.68		1540.56		1548.51		1556.55
34.2	1534.25	42.1	1542.14	50.1	1550.12	58.1	1558.17
	1535.04		1542.94		1550.92		1558.98
	1535.82		1543.73		1551.72		1559.79
	1536.61		1544.53		1552.52		1560.61

Table 7. Ordering Information

Part Number	Description
15454-DM-L1-xx.x=	2.5-Gbps data muxponder card, 8 SFP-based client interfaces, 4-channel tunable on 100-GHz ITU wavelengths (50 GHz stability), unprotected DWDM line with LC connectors – C band
15454-DMP-L1-xx.x=	2.5-Gbps data muxponder card, 8 SFP-based client interfaces, 4-channel tunable on 100-GHz ITU wavelengths (50 GHz stability), protected DWDM line with LC connectors – C band
ONS-SE-200-MM=	ESCON SFP, short-reach, 1310-nm, multimode, LC connectors
15454-SFP-GE+-LX=	GE, Fibre Channel (1- and 2-Gbps) and HDTV SFP, 1310-nm, single-mode, LC connectors
ONS-SE-G2F-LX=	GE, Fibre Channel (1- and 2-Gbps) and HDTV SFP, long-reach, 1310-nm, single-mode, LC connectors
15454-SFP-GEFC-SX=	GE and Fibre Channel (1- and 2-Gbps) SFP, 850-nm, multimode, LC connectors
ONS-SE-G2F-SX=	GE and Fibre Channel (1- and 2-Gbps) SFP, short-reach, 850-nm, multimode, LC connectors

³ Lead times on wavelength-based optical modules vary substantially. For assistance with wavelength selection, refer to Cisco price list or lead-time tool, available on Cisco ordering page at the following URL: <http://www.cisco.com/en/US/ordering/index.shtml>

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