Data Sheet

Cisco ONS 15454 SL-Series 4-Port Fibre Channel Multiservice over SONET/SDH Card

Storage

The Cisco® ONS 15454 SONET/SDH Multiservice Provisioning Platform (MSPP) provides a cost-effective means of transporting 1-Gigabit or 2-Gigabit Fibre Channel/FICON over a MAN or WAN.

Figure 1
Cisco ONS 15454 SL-Series Fibre Channel Card

Background

Storage represents the largest component of enterprise IT spending today, and is expected to remain so for the foreseeable future. Enterprise storage media contains the most valuable business asset in today's environment of electronic business and commerce – information. The complexity of storing and managing this invaluable information has brought about significant growth in the area of storage area networks (SANs). Alongside the growth of SAN implementations is the desire to consolidate and protect the information within a SAN, for the purposes of business continuance and disaster recovery, by transporting storage protocols between primary and backup data centers. Enterprises and service providers alike have found that one of the technologies that best facilitates the connectivity of multiple sites within the MAN and the WAN is SONET/SDH. Cisco Systems® has recognized the need for the transport of storage protocols over SONET/SDH networks, and has developed the SL-Series Card for the Cisco ONS 15454 MSPP and Multiservice Transport Platform (MSTP). This helps Cisco ONS 15454 customers to transparently transport Fibre Channel and FICON.

Fibre Channel technology has become the protocol of choice for the SAN environment. It has also become commonplace as a service interface in metro dense wavelength-division multiplexing (DWDM) networks, and is considered one of the primary factors in the DWDM market segment. However, the lack of dark fiber available for lease in the access portion of the network has left data center managers searching for an affordable and realizable solution to their storage transport needs. Thus, service providers have an opportunity to create tariffs to efficiently connect to and transport the user's data traffic through Fibre Channel handoffs. Service providers must deploy metro transport equipment that will enable them to deliver these services cost effectively and with the reliability required by their service-level agreements (SLAs). This growth mirrors the growth in Ethernet-based services, and will follow a similar path to adoption – namely, a transport evolution whereby time-division multiplexing (TDM), Ethernet, and now SAN protocols move across the same infrastructure, meeting the needs of the enterprise end user without requiring a complete hardware upgrade of a service provider's existing infrastructure.

Product Overview

The Cisco ONS 15454 with the SL-Series Card provides Cisco MSPP customers with a carrier-class, private-line Fibre Channel/FICON transport service vehicle integrated into a SONET/SDH optical transport platform. The SL-Series Card is a four-port, 1.0625- or 2.125-Gbps Fibre Channel/FICON card. It uses pluggable gigabit interface converter (GBIC) optical modules for the client interfaces, enabling greater user flexibility when terminating multiple equipment types on to the same SL-Series Card. This card has four virtual SONET/SDH interfaces and the virtual ports can be provisioned using Contiguous Concatenation (CCAT) or Virtual Concatenation (VCAT) in sizes ranging from STS1-Nv to STS-3c-Nv in a SONET environment and VC-4-Nv in an SDH environment.

The payload from a client interface is mapped directly to a virtual port via Generic Framing Procedure-Transparent (GFP-T) encapsulation. The virtual ports are then cross-connected to the Cisco ONS 15454 system's optical interfaces (from 2.5 Gbps to 10 Gbps) for transport (along with other services) to other network elements. The Cisco SL-Series payloads can be transported over either protected TDM circuits (unidirectional path switched ring [UPSR], path-protected mesh network [PPMN], bidirectional line switch ring [BLSR], Protection Channel Access [PCA], and 1+1) or unprotected circuits. This flexibility enables the network administrator to determine the architecture and specify the level of resiliency to be implemented. The scalability of the virtual port size enables the system administrator to match the client ingress bandwidth requirements to the transport bandwidth consumed.

Flexible Gigabit Networking

The Cisco ONS 15454, coupled with the Cisco SL-Series Fibre Channel/FICON Card, provides the following capabilities:

- Eliminates the need for overlay networks
- Carrier-class Fibre Channel/FICON
  - 50 ms of failover via SONET/SDH protection
  - Hitless software upgrades
- Integrated DWDM
- Remote Fibre Channel/FICON circuit bandwidth upgrades via integrated Cisco Transport Controller
- Efficient gigabit packing, up to 256-wire-speed Fibre Channel/FICON per metro ring (OC-192/STM-16 ITU optics at 100 GHz)
- Multiple management options with Cisco Transport Controller, Cisco Transport Manager, TL1 (for SONET only), and SNMP

Feature Summary

Table 1 lists the features of the Cisco SL-Series Fibre Channel/FICON Card for the Cisco ONS 15454 MSPP.

Table 1. Cisco SL-Series Card Features

Feature	Benefit
Bit-rate and format-transparent block-coded protocol transport	GFP-T encapsulation provides the highest possible level of protocol transparency, as no MAC layer functionality is required. 8B/10B encoded characters are converted to GFP-T with cut-through processing, without introducing unnecessary store-and-forward delay into the data path.
Low latency	Fibre Channel is an acknowledgment-based protocol, and is sensitive to latency as it affects overall data throughput. The Cisco SL-Series adapts the client protocol with minimal introduction of delay.
Multirate	The prevalence and relative affordability of 1-Gigabit or 2-Gigabit Fibre Channel switch ports means that any storage extension product must support both rates. User has the option of 1-Gb fixed-rate pluggable optics or dual rate optics that operate at 1 or 2 Gigabit per second.
Multiprotocol	FICON is an IBM protocol with a framing layer based on the ANSI standard Fibre Channel-Physical and Signaling Interface (FC-PH), which specifies the signal, cabling, and transmission speeds. Because the Cisco SL-Series adapts the client protocol at the encoding layer, FICON is automatically supported.
Distance extension	Fibre Channel uses buffer-to-buffer credits for flow control between endpoints. Frames will not be sent unless the receiver has sufficient buffer credits to accommodate them. Buffer-to-buffer credits allow full line-rate speed, even at longer distances, because the sender only needs to know if credits are available, not wait for each frame to be acknowledged. The Cisco SL-Series has enough buffer credits to support full line rate of 1 Gbps to 2300 km and 2 Gbps to 1150 km.
Subrate	Although the Cisco SL-Series supports both 1-Gigabit and 2-Gigabit Fibre Channel and FICON interfaces, the amount of traffic or the SONET/SDH circuit size can be defined in smaller sizes using both CCAT and VCAT.
Efficient bandwidth usage	VCAT is used to match or “right size” the SONET/SDH circuit for the amount of data being carried. CCAT sizes are defined by the SONET/SDH hierarchy and are mapped end to end. VCAT sizing allows finer granularity of circuit size by combining multiple timeslots into a single virtual concatenation group (VCG). The Cisco SL-Series supports VCAT granularity of STS1/STS3c (SONET) and VC4 (SDH).
Differential delay	When implementing VCAT, the routing of the individual paths of the VCG through the network can be physically diverse, which results in differences in delay when recombined at the destination end. Differential Delay compensates for the propagation variations. The Cisco SL-Series supports 128 ms of Differential Delay which allows distances exceeding 25,000 km.

Applications

The primary factor for transport of storage across MANs and WANs is replication of data between storage disk arrays for the purposes of business continuance and disaster recovery. There are two primary types of data replication – asynchronous and synchronous mirroring, both of which are candidates for SAN extension over SONET/SDH. The primary characteristic that separates the two types of data replication is sensitivity to latency – asynchronous applications are *not* latency-sensitive, while synchronous applications are extremely latency-sensitive. Figures 2 and 3 illustrate the processing steps that occur in mirroring data across distances. The main reason synchronous applications are sensitive to delay is that application I/O processing (Oracle CRM, for example) does not resume until the remote system acknowledges receipt of the mirrored data, thus exposing the higher-layer application to the potential for I/O timeouts.

The trade-off between synchronous and asynchronous mirroring is the level of data protection provided. Synchronous mirroring guarantees near-zero data loss, while asynchronous mirroring allows the user to trade off data loss with performance – providing a lower tier of data protection, but a higher degree of flexibility in business-continuance and disaster-recovery planning.

Figure 2
Asynchronous Mirroring

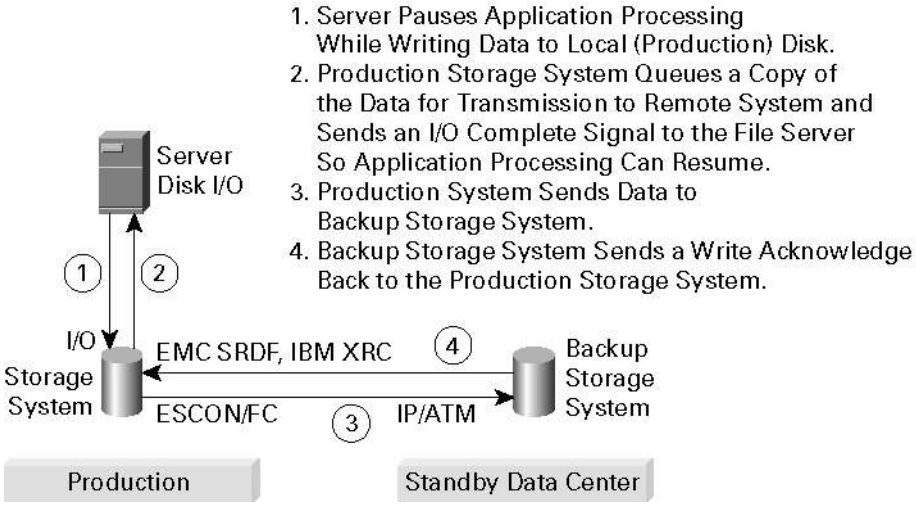
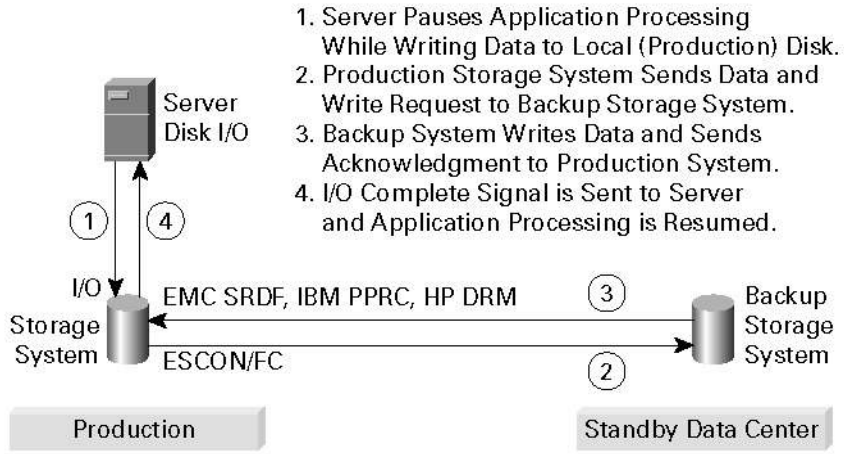


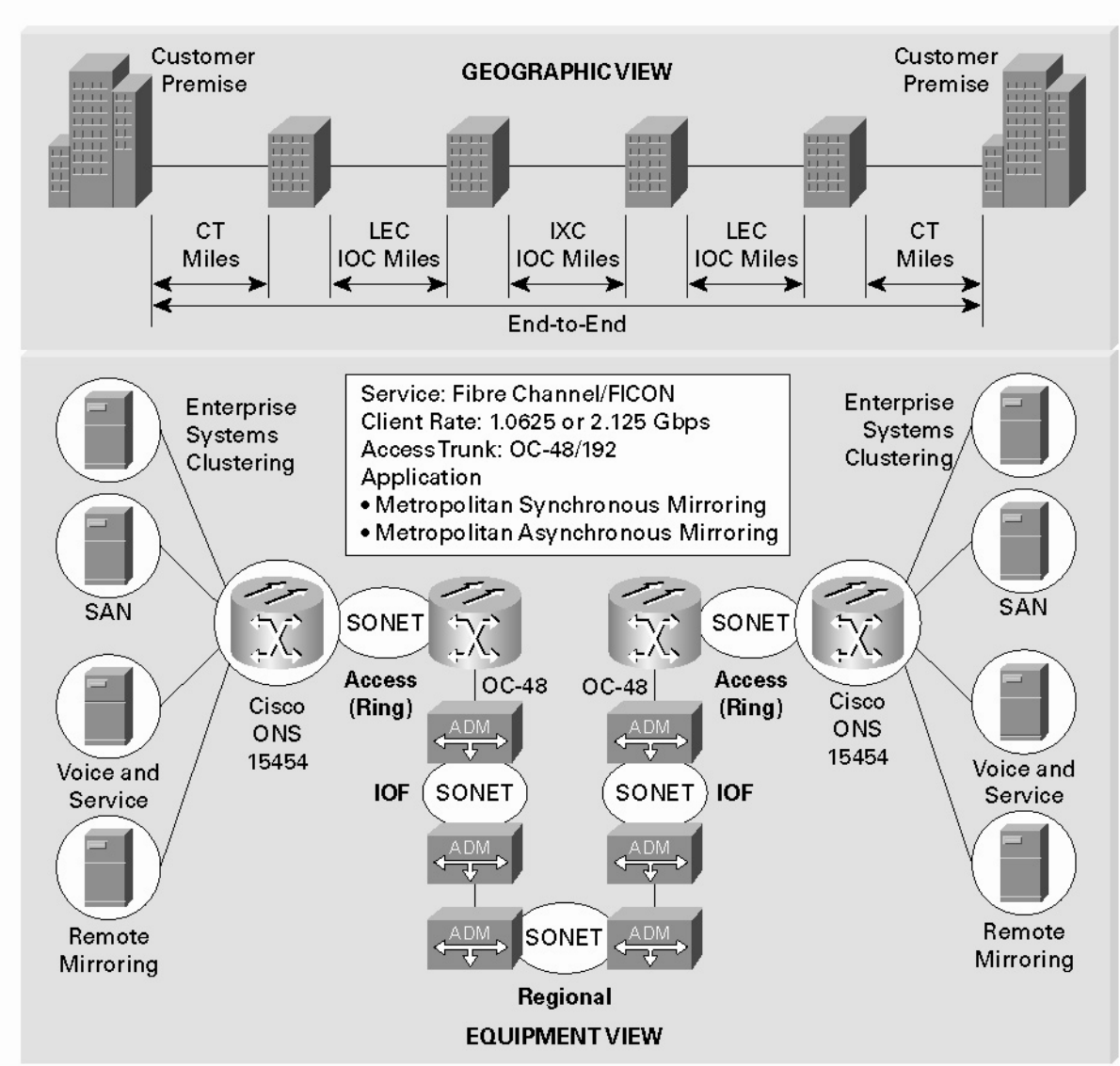
Figure 3
Synchronous



The Cisco SL-Series is another step in the journey toward network convergence, combining the operational familiarity of SONET/SDH with the support of native client protocols to enable complete service coverage in data center environments. Service providers and enterprises alike will benefit from the proliferation of native service tariffs that allow transparent connectivity between primary and backup locations through private-line Fibre Channel/FICON services. Figure 4 outlines the geographic and equipment views of a typical data center networking architecture.

Figure 4

Data Center Networking – Point-to-Point Private Line with Ring Protection



Managing the Optical Transport Platforms

Provisioning and managing an optical transport device with Cisco Transport Manager's Java-based GUI is easier than ever. Cisco Transport Manager is the carrier-class element management system (EMS) for Cisco optical product lines. It provides advanced capabilities in the functional management areas of configuration, faults, performance, and security for Cisco optical network elements, subnetworks, and networks. Cisco Transport Manager is based on a client/server architecture that scales to support up to 1000 network elements and 100 simultaneous clients. It is a primary enabler for automation of the operations support system (OSS) through the northbound interfaces to a network management system (NMS) or OSS.

The Cisco Advantage

The Cisco ONS 15454 MSPP and MSTP solutions offer significant advantages over traditional optical network elements combined with external Layer 2 and Layer 3 devices, including:

- Integrated multiservice capabilities – Enable support for traditional TDM-based, private-line services (DS-1/E1, DS-3/E3, and OC-N/STM-N, for example) along with advanced Ethernet and storage-based services, simplifying the service provider's migration to new data tariffs or interface flexibility for enterprise users.
- Flexible architectures – The Cisco ONS 15454 platform supports two- or four-fiber BLSR/MS-SPR, UPSR/SNCP (CCAT only), linear APS/SNC, and PPMN. The Cisco SL-Series cards can be deployed over any of these architectures and protection schemes, enabling the service provider to build a network meeting the customer's SLA requirements. The platform enables in-service optical bandwidth expansion via card upgrades, allowing customers to grow their networks to match demand without a forklift replacement, and allowing network expenditures to better match revenues or bandwidth requirements.
- Efficient network management – Management is simplified through a common data communications network connection and user access for Ethernet and optical functioning.
- Unified software load – One software load supports transport and data capabilities, simplifying ordering, installation, and upgrades.

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 SL-Series Fibre Channel/FICON Card Features and Specifications

Compact Design

- Single-width card slot design for increased shelf flexibility and scalability
- Up to eight SL-Series cards per shelf assembly

Optical Transport Options

- UPSR/SNCP (CCAT)
- 2F- and 4F-BLSR/MS-SPR (VCAT and CCAT)
- APS/SNC (1+1 uni- or bidirectional)
- PPMN
- Unprotected (0+1)

Network Architecture Flexibility

- Ring
- Multiple rings
- Linear add/drop multiplexer
- Terminal

Tables 2 and 3 list regulatory compliance and system requirements for the Cisco ONS 15454 SL-Series Fibre Channel/FICON Card. Tables 4 and 5 list technical specifications.

Regulatory Compliance

Table 2. Regulatory Compliance

Description	Specification	
SONET/ANSI System	Countries • Canada • United States • Mexico	 • Korea • Japan • European Union
SDH/ETSI System	Countries • European Union • Australia • New Zealand • Singapore	 • China • Mexico • Hong Kong • Korea
EMC Emissions (Radiated, conducted)	• ICES-003 • GR-1089-CORE • 47CFR15 • VCCI V-3/2000.04	• EN 300 386-TC • EN50081-1 • EN55022 • AS/NZS3548, Amendment 1 + 2 1995
EMC Immunity	• GR-1089-CORE • CISPR24 • EN50082-2	• EN300-386-TC • EN55024
Safety	• CAN/CSA-C22.2 No. 60950-00 Third Ed., 12/1/2002 • GR-1089-CORE • GR-83-CORE • TS001	• UL 60950 Third Ed., 12/1/2000 • EN60950 (to A4) • IEC60950/EN60950, Third Ed. • AS/NZS3260 Supplement 1,2,3,4, 1997
Environmental	• GR-63-CORE • AT&T Network Equipment	• ETS 300-019 (Class 3.1E) • ETS 300 019-2-1 (Storage, Class 1.1) • ETS 300 019-2-2 (Transportation, Class 2.3)
Structural Dynamics	• GR-63-CORE • AT&T Network Equipment	• ETS 300-019 (Class 3.1E)
Power and Grounding	• SBC (TP76200MP) • ETS 300-132-1 (DC power)	• ETS 300-253 (grounding)

Table 3. System Requirements

Component	Cisco ONS 15454 SONET	Cisco ONS 15454 SDH
Processor	TCC2	TCC2
Cross-connect	XC-VT, XC-10G, XC-VXC-10G	XC-10G, XC-VXL-10G, XC-VXL-2.5G, XC-VXC-10G
Shelf assembly	NEBS/NEBS3E/ANSI versions with appropriate fan tray assembly	ETSI version with SDH 48V fan tray assembly
System software	Release 5.0.0 or greater Release 6.0 or greater (Differential delay)	Release 5.0 or greater Release 6.0 or greater (Differential delay)
Slot compatibility	XC-VT: slots 5, 6, 12, 13 XC-10G, XC-VXC-10G: slots 1–6, 12–17	XC-10G, XC-VXL-2.5G, XC-VXL-10G, XC-VXC-10G: slots 1–6, 12–17

Table 4. Specifications: SL-Series Cards

Attribute	15454-FC-MR-4
Client Interfaces	
Ports • Card • Shelf (maximum of 8 cards) • Rack (maximum of 4 shelves)	 4 GBICs 1-Gbps FC/FICON: 16 ports – 8 per OC-192 (protected) trunk 2-Gbps FC/FICON: 8 ports – 4 per OC-192 (protected) trunk 1-Gbps FC/FICON: up to 64 2-Gbps FC/FICON: up to 32
Data rate	1.0625 and 2.125 Gbps
Autodetection of data rate	Yes. Alarm on provisioned versus detected rate mismatch.
SONET/SDH Virtual Interfaces	
Ports	4
Speed	SONET: STS-24c, STS-48c, STS-1-Nv, STS-3c-Nv VCAT support SDH: VC-4-8c, VC-4-16c, VC-4-Nv VCAT support
Maximum card bandwidth	SONET: STS-48 SDH: VC-4-16
Circuit type	Point-to-point
Network protection types	Ring: UPSR/SNCP, BLSR/MS-SPR (2- and 4-fiber) Linear: 1+1 APS/SNC Mesh protection: PPMN Unprotected: 0+1
Encapsulation	ITU-T G.7041 GFP-T
Protocols	
Fibre Channel	ANSI FC-PH
FICON	ANSI FC-PH
Performance	
Throughput	Wire-rate performance at 1.0625 Gbps and 2.125 Gbps
Distance Extension	
1 Gbps	2300 km
2 Gbps	1150 km
Differential Delay	
128 ms	25,600 km
Management Interfaces	
Transport (SONET/SDH)	Cisco Transport Controller or TL-1 via Telnet or serial port SNMP traps and TL-1 autonomous messages

Attribute	15454-FC-MR-4
TCC card	
• LAN Access and Cisco Transport Controller	RJ-45 jack, 10BASE-T
• Serial port	DB-9 jack
Card LEDs	
• Failure (FAIL)	Red
• Status (ACT)	Green
Port LEDs (per port)	
• Link (LINK)	Green
• Activity (ACT)	Amber (flash)
Performance Monitoring	
Fibre Channel	Transmit and Receive Frame counter Transmit and Receive Frame octets counter Transmit and Receive buffer frame overflow counter Transmit 10B_ERR counter Receive frame CRC error counter Receive oversize frame counter Receive undersize frame counter FC Transmit and Receive Utilization FC Rate Mismatch between GBIC and FC rate Auto detection of FC switch B2B credits
GFP	Transmit and Receive data frame count Receive single-bit-errored core header count Receive multibit-errored core header count Receive super-block CRC error count Out of Frame Alarm Client Signal Fail Alarm Payload Type Mismatch Alarm Extension Header Alarm Distance Extension Mismatch Alarm Distance Extension No Buffers Alarm Automatic GFP Buffers adjustment Automatic Credits recovery
Defect Monitoring	
Fibre Channel	Loss of signal Loss of receive synchronization Lack of FC Credits
GFP	Loss of client signal Loss of client corrective synchronization
SONET (virtual ports)	The following SONET/SDH path alarms are supported: • Alarm Indication Signal (AIS) • Loss of Pointer (LOP) • Unequipped (UNEQ)

Attribute	15454-FC-MR-4
	• Remote Failure Indicator (RFI) • Trace Identifier Mismatch (TIM) • Payload Mismatch (PLM) • Payload Defect Indicator (PDI) Bit Error Rate Signal Fail/Signal Degrade (SF/SD) • Transport Fail (TPTFAIL) • Path trace (J1 byte) – Transmit and receive
Power	
Card	60W
Physical Size (H x W x D)	 Single-card slot 12.65 x 0.72 x 9.00 in. (32.13 x 1.83 x 22.86 cm)
Weight	1.17 kg (2.59 lb)
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. Specifications: GBIC Optical Modules

Attribute	MM – Short-Wave, Dual-Rate	SX – Short-Reach	SM – Long-Wave, Dual-Rate	LX – Long-Reach
Connector	SC – Duplex	SC – Duplex	SC – Duplex	SC – Duplex
Transmission rate	1.0625 Gbps 2.125 Gbps	1.0625 Gbps	1.0625 Gbps 2.125 Gbps	1.0625 Gbps
Nominal wavelength	850 nm	850 nm	1310 nm	1310 nm
Fiber type	Multimode fiber (MMF)	MMF	Single-mode fiber (SMF)	SMF
Fiber distance (dispersion limited)	550 m	550 m	10 km	10 km
Transmit power	–5.0 to –9.5 dBm	–4.0 to –9.5 dBm	–3.0 to –9.5 dBm	–3.0 to –9.5 dBm
Receiver sensitivity	–20.5 dBm (at 1G) –15.5 dBm (at 2G)	–17.0 dBm	–20.5 dBm (at 1G) –15.5 dBm (at 2G)	–20.5 dBm

Table 6. Ordering Information

Part Number	Description
15454-FC-MR-4	1- or 2-Gbps Fibre Channel/FICON card, 4 ports, SONET/ANSI system
15454E-FC-MR-4	1- or 2-Gbps Fibre Channel/FICON card, 4 ports, SDH/ETSI system
ONS-GX-2FC-MMI	Dual-rate 1.0625 or 2.125 Gbps Fibre Channel (FC-PI 10.0 compliant), 850 nm, multimode, GBIC, SC connectors
ONS-GX-2FC-SML	Dual-rate 1.0625 or 2.125 Gbps Fibre Channel (FC-PI 10.0 compliant), 1310 nm, single-mode, GBIC, SC connectors
15454-GBIC-SX	1000BASE-SX, short-reach, multimode, GBIC, SC connectors (GE/1 Gb FC only)
15454-GBIC-LX	1000BASE-LX, long-reach, single-mode, GBIC, SC connectors (GE/1 Gb FC only)

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