

Cisco ONS 15454 Any Rate Muxponder and Xponder Cards

The multiport Cisco® ONS 15454 Any Rate Muxponder Card and Cisco ONS 15454 Any Rate Xponder Card (Figures 1 and 2) are plug-in modules for the Cisco ONS 15454 Multiservice Transport Platform (MSTP). The cards provide a high degree of flexibility for the multiservice aggregation transport of a large variety of signals and interfaces into enterprises or metropolitan-area (metro) and regional service provider networks.

Figure 1. Any Rate Muxponder Card



Metro transport networks must support numerous service demands: transmission of low-rate 10/100BASE-T and OC-3/STM-1 signals; higher-rate OC-12/STM-4, Gigabit Ethernet, OC-48/STM-16 signals; video signals such as standard-definition Serial Data Input (SDI) and high-definition SDI (HD-SDI); optical-transport-unit-1 (OTU-1) services; and first-generation (1G), 2G, 4G, and 8G Fibre Channel services. The flexibility to support multiple rates and aggregate them over a dense wavelength-division multiplexing (DWDM) interface using OTN technology brings huge savings in operating and management costs.

Product Overview

The Cisco ONS 15454 Any Rate Xponder and Muxponder Cards provide an 8-port Small Form-Factor Pluggable (SFP)-based muxponder with two XFP ports.

The Cisco ONS 15454 Any Rate Cards support the following services:

- SONET/SDH:
 - STM-1/OC-3
 - STM-4/OC-12
 - STM-16/OC-48
- OTN:
 - OTU-1
 - OTU-2
- Ethernet:
 - Fast Ethernet (FE)
 - Gigabit Ethernet (GE)
- SAN:
 - Enterprise Systems Connection (ESCON)
 - 1 Gigabit Fibre Channel or fiber connectivity (FICON)
 - 2 Gigabit Fibre Channel or FICON
 - 4 Gigabit Fibre Channel or FICON
 - 8 Gigabit Fibre Channel or FICON
- Video:
 - SD-SDI (270 Mbps)
 - HD-SDI (1.485 Gbps)
 - Third-generation SDI (3G-SDI) (2.970 Gbps)

Any Rate cards can aggregate any mix of services on the client SFP ports into an OTU-2 trunk interface. The main difference between the Any Rate Muxponder and Xponder is the supported bandwidth (20 Gbps for the Any Rate Muxponder vs. 40 Gbps for the Any Rate Xponder). Thus the Xponder card supports additional configurations.

Operating Mode Configurations

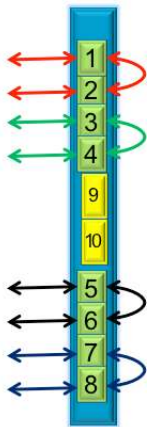
The cards are equipped with pluggables for client and trunk options, and they offer a large variety of configurations. Configurations supported by both Cisco Any Rate Muxponder and Any Rate Xponder Cards follow:

2.5-Gbps Operating Mode

Four 2.5 Gigabit Transponders (Figure 2)

- Up to four transponders mapping client SFP signals onto an OTU-1 trunk DWDM SFP
- Supported rates in such a configuration: OC-3/STM-1, OC-12/STM-4, OC-48/STM-1, 6/FE/GE/ESCON, 1GFC, and 2GFC

Figure 2. Four 2.5 Gigabit Transponder Configuration



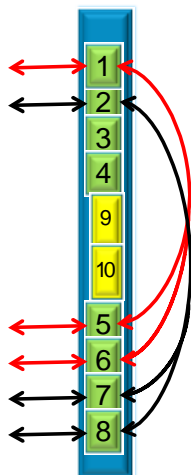
Four 4 Gigabit Fiber Channel Transponders

- Up to four 4 Gigabit Fibre Channel transponders mapping client 4G SFP signals onto a 4G trunk DWDM SFP without an OTN wrapper

Two 2.5 Gigabit Protected Transponders (Figure 3)

- Up to two protected transponders mapping client SFP signals onto a working and protected OTU-1 trunk DWDM SFP
- Supported rates in such a configuration: OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, FE/GE/ESCON, 1GFC, and 2GFC

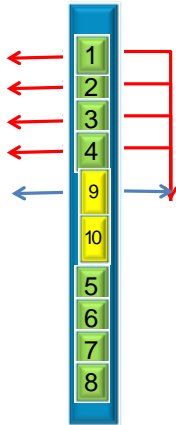
Figure 3. Two 2.5 Gigabit Protected Transponder Configuration



Two 2.5 Gigabit Muxponders (Figure 4)

- Up to two muxponders mapping multiple client SFP signals onto an OTU-1 trunk DWDM SFP
- Supported rates in such a configuration: FE OC-3/STM-1 and OC-12/STM-4 over an OTU-1 trunk or GE 1G FC over an OTU-1 trunk

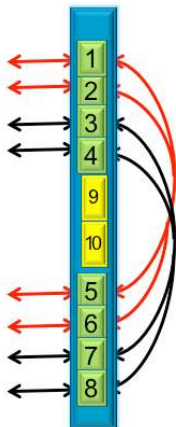
Figure 4. Two 2.5 Gigabit Muxponder Configuration



Two 2.5 Gigabit Protected Muxponders (Figure 5)

- Up to two protected muxponders mapping multiple client SFP signals onto a working and a protection OTU-1 trunk DWDM SFP
- Supported rates in such a configuration: FE OC-3/STM-1 and OC-12/STM-4 over an OTU-1 trunk or GE 1G FC over an OTU-1 trunk

Figure 5. Two 2.5 Gigabit Ethernet Protected Muxponder Configuration



Transponder and muxponder configurations can be mixed; they are limited only by the number of ports.

10-Gbps Operating Mode

- 8:1 muxponder:
 - Up to eight client SFP signals onto one OTU-2 trunk equipped with XFP
 - Supported rates in such a configuration: GE/1G, FC/2G, FC/4G, FC/OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, and OTU-1; flexible bandwidth assignment is offered through a dedicated wizard
- 8:1 data muxponder:
 - Up to eight client SFP signals onto one OTU-2 trunk equipped with XFP
 - Supported rates in such configuration: GE/1G, FC/2G, FC/4G, and FC/GE
- 4:1 2.5 Gigabit Ethernet muxponder:
 - Up to four client SFP signals onto one OTU-2 trunk equipped with XFP
 - Supported rates in such a configuration: OC-48/STM-16/OTU-1
- 8 Gigabit Ethernet FC transponder:
 - 8 Gigabit Ethernet FC XFP client mapped into OTU-2 onto the second XFP
 - 10 Gigabit Ethernet Any-Forward Error Correction (FEC) regenerator
 - Ability to regenerate OTU-2 signals from XFP to XFP port; the cards support a multiple FEC scheme, allowing for interoperability among different Cisco line cards

Configurations supported by both the Cisco Any Rate Cards follow:

- Mixed client and trunk configuration:
 - Supports four 4 Gigabit TXP and one 8 Gigabit TXP on the same card
 - Supports any mix of client-to-trunk aggregation matrix, including a mix of 2.5-Gbps muxponder, 10-Gbps Muxponder, or 2.5 Gigabit transponders
- Fiber switched protection configuration:
 - Can configure the two-trunk XFP ports as working and protection ports
- Two 4:1 data muxponder configuration:
 - Support s two 4:1 data muxponders, because both trunk XFP ports can be used
- Two 4:1 Cisco ONS 15454 Any Rate Muxponder:
 - Supports two 4:1 Cisco ONS 15454 Any-Rate Muxponders, because both trunk XFP ports can be used
- Video Xponder:
 - Can aggregate over one or two trunk XFP ports: SD-SDI, HD-SDI, or 3G-SDI signals

Card Architecture

The Cisco ONS 25454 Any Rate Muxponder and Xponder Cards are plug-in modules to the Cisco ONS 15454 MSTP, providing a cost-effective architecture for aggregating a large variety of services over OTU-1 or OTU-2 signals (Figures 6 and 7). The card architectures include a virtual cross-connect that supports a fully transparent aggregation of incoming signals.

Figure 6. Cisco ONS 15454 Any Rate Muxponder Architecture

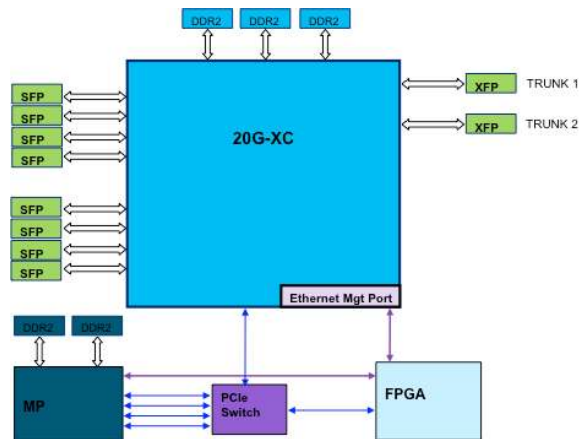
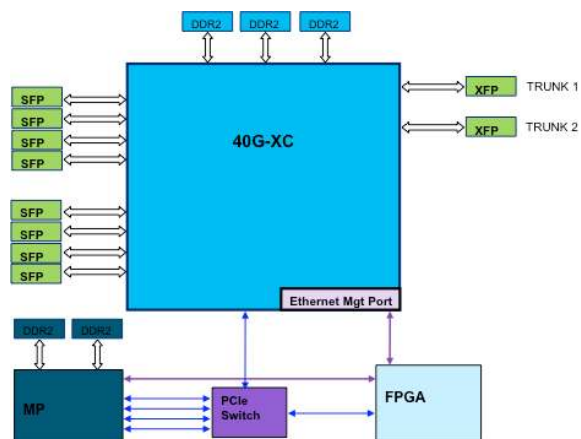


Figure 7. Cisco ONS 15454 Any Rate Xponder Architecture



Pluggable Interfaces

To support such levels of flexibility, any port supports the pluggable interface (ports 1 to 8 are SFP-based, whereas ports 9 and 10 are XFP-based). The interfaces can be gray or xWDM. Tables 1 and 2 list the supported XFPs.

Table 1. Supported XFP

Pluggables	OTN	FC/FICON	DWDM	CWDM
ONS-XC-10G-S1=	X			
ONS-XC-10G-SR-MM=	X			
ONS-XC-8G-SM=		X		
ONS-XC-8G-MM=		X		
ONS-XC-10G-C=	X		X	
ONS-XC-10G-EPxx.x=	X		X	
ONS-XC-10G-xxxxx=	X			X

Table 2. Supported SFP

Pluggables	SONET/SDH	OTN	Ethernet	SAN	Video	DWDM	CWDM
ONS-SC-155-EL=	X						
ONS-SI-155-SR-MM=	X						
ONS-SI-622-SR-MM=	X						
ONS-SI-155-I1=	X						
ONS-SI-155-L1=	X						
ONS-SI-155-L2=	X						
ONS-SI-622-I1=	X						
ONS-SI-622-L1=	X						
ONS-SI-622-L2=	X						
ONS-SI-2G-S1=	X						
ONS-SI-2G-L1=	X						
ONS-SI-2G-L2=	X						
ONS-SE-Z1=	X	X					
ONS-SE-100-BX10U=			X				
ONS-SE-100-BX10D=			X				
ONS-SE-GE-BXU=			X				
ONS-SE-GE-BXD=			X				
ONS-SE-ZE-EL=			X				
ONS-SI-100-FX=			X				
ONS-SI-100-LX10=			X				
ONS-SI-GE-SX=			X				
ONS-SI-GE-LX=			X				
ONS-SI-GE-ZX=			X				
ONS-SE-200-MM=				X			
ONS-SE-4G-MM=				X			
ONS-SE-4G-SM=				X			
ONS-SE-155-xxxx							X
ONS-SC-4G-xx.x ¹						X	
ONS-SE-2G-xxxx= ²		X					X
ONS-SC-2G-xx.x= ¹		X				X	
ONS-SC-HD3GV-TX=					X		
ONS-SC-HD3GV-RX=					X		

¹ xx.x going from 30.3 to 61.4 coping with 40 wavelengths at 100-GHz ITU grid; DWDM SFP ports shall be placed on the last 4 bottom ports in case the Cisco ONS 25454 Any Rate Line Cards are placed on an M12 chassis

² xxxx going from 1470 to 1610 coping with 8 CWDM wavelengths defined by ITU standards

Enhanced FEC Capability

An important feature of the Cisco ONS 25454 Any Rate Muxponder and Xponder Cards is the ability to configure the FEC mode. SFP ports 1 to 8 have two modes of operation, NO FEC and FEC, whereas ports 9 and 10 can also be configured in E-FEC mode.

You can configure error-coding performance:

- NO FEC: No Forward Error Correction
- FEC: Standard G.975 Reed-Salomon algorithm
- E-FEC: Standard G.975.1 I-7 two orthogonally concatenated block (BCH) super FEC codes; this FEC scheme contains three parameterizations of the same scheme of two BCH codes, with the constructed code decoded iteratively to achieve the expected performance
- E-FEC: Standard G.975.1 I-4 two interleaved codes (RS and BCH) super FEC codes

Protocol Transparency

Any Rate Xponder architectures allow you to aggregate multiple signals without terminating the overhead. Thus full signal transparency is maintained also during multiplexing functions over higher bit rates.

Protocol Autosensing

Any Rate Xponder architectures also allow the clients to self-configure the rate-vs.-input signals. The cards automatically set mapping and provisioning without any user provisioning step. The initial release supports autosensing functions among Gigabit Ethernet, OC-3/STM-1, OC-12/STM-4, and OC-48/STM-16.

Proactive FRR Regeneration Implementation

Fast Reroute (FRR) is a Layer 3 protection mechanism that allows for switching of the data path without relying on Layer 1 concerns. The switch in most cases happens with little or no loss of data and is guaranteed to happen within 50 milliseconds. The switch is indirectly triggered by events that would bring the interface down, resulting in almost certain data loss during the time when defects are detected until a FRR switch is completed.

With IP over DWDM (IPoDWDM), the FEC circuitry resides on a router line card. Therefore, the router has visibility into the bit-error-rate (BER statistics) before the FEC mechanism corrects these errors, allowing the router to realize that the working path is degrading beyond a reasonable point (which is defined by a user-settable threshold). At this point, the router can start its protection logic and establish a protection path while traffic continues to flow on the degrading working path. Depending on the failure mode, the router may have tens or even hundreds of milliseconds to move away from the working path before the FEC mechanism fails.

The FEC mechanism detects failures before they actually happen and also corrects errors either introduced during transmission or due to a degrading signal. It was proposed that the DWDM physical layer interface modules (PLIMs) trigger an FRR switch based on the number of FEC corrected bits. The number of FEC corrected bits would provide a good indication that the line is about to have a failure. FEC-based FRR therefore allows for triggering the switch before that failure happens with little or no loss of data. In fact, the FEC function can correct a high BER (up to $10E-3$), providing an error-free signal to the line card connected to the PLIM. Triggering the FRR with a lower BER will cause a FRR before any packet is lost.

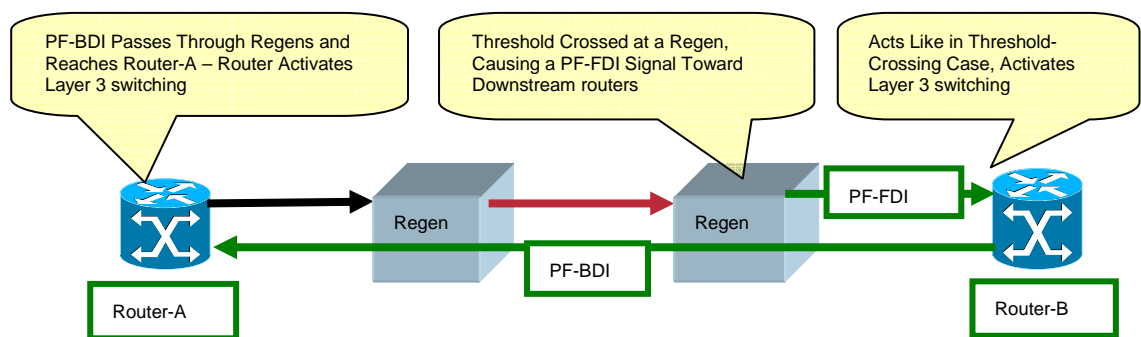
The prevailing video encoding is based on MPEG-2 and MPEG-4 standards, which use differential coding of the frame with reference to a full frame that is sent only relatively infrequently. When this frame (called the I-frame) is lost, a large number of users may experience a visible outage on their screens, lasting for up to several seconds.

High-resolution encoding schemes, such as MPEG-4, are actually more susceptible to longer outages because I-frames are less common in the data stream. For this reason it is important to strive to minimize the packet loss even below the SONET/SDH benchmark, ideally aiming for zero packet loss.

Starting with Release 9.2, OTU-2XP cards support Proactive Protection Regeneration, which notifies the routers of the incoming FEC errors. This feature involves modifying the G709 protection bytes in OverHead (Figure 8).

FRR Regen is supported on ports of OTU-2XP only when the card is in the “Standard Regen” and “Enhanced FEC” card modes for 10 Gigabit Ethernet payloads.

Figure 8. Proactive FRR implementation



- When there is a span between two routers, a Cisco ONS 15454 Any Rate Line Card is used because the OTU-2 Regen is degrading, but the downstream router is not aware of it. (Therefore, the router does not switch to an alternate path.)
- The Cisco ONS 15454 Any Rate Line Card signals to the downstream router about the degradation. This signal is called a pre-FEC error forward defect indicator (PF-FDI) (using the APS/PCC bytes of the G.709 ODU OH).
- The router integrates the PF-FDI for three frames and then acts as if it has detected the BER threshold crossing.
- Router B activates its Layer 3 switching.
- Router B raises a PF-backward defect indicator (PF-BDI) flag to ask router A to switch. This PF-BDI propagates through the Cisco ONS 25454 Any Rate Card.
- When router A gets this PF-BDI message, router A also activates its Layer 3 switching.

The Cisco ONS 25454 Any Rate Card allows you to extend FRR when OTU-2 regeneration is required between the routers, sending PF-FDI when it sees a degrading link.

Flexible Protection Mechanisms

The Cisco ONS 15454 Any Rate XPonder Card provides flexible protection capabilities for both client and DWDM line interfaces, supporting numerous network configurations to uphold the various service-level agreements (SLAs) the customer application requires.

- **Unprotected client and line:** This configuration has no client terminal interface, transponder card, or DWDM line protection. The client signal is transported over a single unprotected transponder card. This configuration is suitable for transporting client payloads over a DWDM network that is being protected by a Layer 2 or Layer 3 protocol.
- **Y-cable client interface:** This configuration provides transponder equipment protection without client terminal equipment interface protection. A single client interface is split into two transponder cards using a Y-protection device.
- **Fiber-switched protection:** This configuration, valid at 10 Gbps only for the Any Rate Xponder, provides redundant DWDM trunk interface protection for a single unprotected client interface.

Management

The Cisco ONS 15454 provides comprehensive management capabilities to support operations, administration, maintenance, and provisioning (OAM&P) capabilities through the integrated Cisco Transport Controller Craft Interface with support from the Cisco Transport Manager Element Management System (EMS). The Cisco ONS 15454 Any Rate Line Cards incorporate provisionable digital-wrapper (G.709) functions, providing per-wavelength performance-management capabilities, especially for services being transported transparently across the network. Without the digital-wrapper functions, a carrier transporting a service transparently would be unable to identify network impairments that may degrade the transported signal and exceed SLA requirements.

The generic communications channel (GCC) of the digital wrapper allows a separate communications channel on a per-wavelength basis. This GCC allows the Cisco ONS 15454 MSTP to extend its advanced network autodiscovery capabilities to DWDM-based services. The integrated Cisco ONS 15454 MSTP Transport Controller Craft Manager and the Cisco Transport Manager EMS give you OAM&P access for the system.

Performance Monitoring

The performance-monitoring capabilities of the Cisco ONS 15454 Any Rate Cards support both transparent and nontransparent signal transport. Calculation and accumulation of the performance-monitoring data is in 15-minute and 24-hour intervals.

For SONET/SDH signals, standard performance-monitoring and threshold-crossing conditions and alarms are supported per Telcordia GR-474, GR-2918, ITU G.783, and ETS 300 417-1 standards (Tables 3 and 4).

Table 3. SONET Performance Monitoring

SONET Performance Monitoring	Section	Line (Near End)	Line (Far End)
Number of coding violations (CVs)	CV-S	CV-L	CV-L
Number of errored seconds (ESs)	ES-S	ES-L	ES-L
Number of severely errored seconds (SESs)	SES-S	SES-L	SES-L
Number of severely errored frame seconds (SEFSs)	SEFS-S	–	–
Number of unavailable seconds (UASs)	–	UAS-L	UAS-L
Number of failure counts (AIS/RFI detected) (FC)	–	FC-L	FC-L

Table 4. SDH Performance Monitoring

SDH Performance Monitoring	Regenerator Section	Multiplex Section (Near End)	Multiplex Section (Far End)
Number of errored seconds (ESs)	RS-ES	MS-ES	MS-ES
Error seconds ratio (ESR)	RS-ESR	MS-ESR	MS-ESR
Number of severely errored seconds (SESS)	RS-SES	MS-SES	MS-SES
Severely errored seconds ratio (SESR)	RS-SESR	MS-SESR	MS-SESR
Number of background block errors (BBEs)	RS-BBE	MS-BBE	MS-BBE
Background block errors ratio (BBER)	RS-BBER	MS-BBER	MS-BBER
Number of unavailable seconds (UASs)	RS-UAS	MS-UAS	MS-UAS
Number of errored blocks (EBs)	RS-EB	MS-EB	MS-EB

For Ethernet signals, standard performance parameters for transmit and receive signals are based on Remote Monitoring (RMON) Ethernet compliant with RFCs 1573, 1757, 2233, 2358, 3273, and 3635 (Table 5).

For Fibre Channel, the following parameters are available:

- txTotalPkts, rxTotalPkts, mediaIndStatsTxFramesBadCRC, mediaIndStatsRxFramesTruncated, ifOutOversizePkts, mediaIndStatsRxFramesTooLong, mediaIndStatsRxFrameBadCRC, ifOutOctects, ifInOctects, and ifInErros

Each digital-wrapper channel is monitored per ITU-T digital-wrapper requirements (G.709).

Table 5. OTN Performance Monitoring

OTUk SM Counters	ODUk SM PM Counters	Description
BBE-SM	BBE-PM	Number of background block errors
BBER-SM	BBER-PM	Background block errors ratio
ES-SM	ES-PM	Number of errored seconds
ESR-SM	ESR-PM	Errored seconds ratio
SES-SM	SES-PM	Number of errored seconds ratio
SESR-SM	SESR-PM	Severely errored seconds ratio
UAS-SM	EAS-PM	Number of unavailable seconds
FC-SM	FC-PM	Number of failure counts

FEC and Enhanced FEC (EFEC) performance-monitoring parameters are also available; they are listed in Table 6.

Table 6. FEC Performance Monitoring

Counters	Description
Bit errors	Number of corrected bit errors
Uncorrectable words	Number of uncorrectable words

Optical parameters on the DWDM line interface are supported, including laser bias, transmit optical power, and receiver optical power.

For any client interface, optical parameters such as transmit optical power and receiver optical power are also supported.

The Cisco Any Rate line cards incorporate faceplate-mounted LEDs to provide a quick visual check of the operational status of the card. An orange circle is printed on the faceplate, indicating the shelf slots where the card can be installed.

Application Description

The Cisco ONS 15454 Any Rate Cards provide an unprecedented flexibility to aggregate and transport a large variety of different services over 10-Gbps signals. This capability allows the line cards to provide a solution to a multiple set of applications.

Data Center Interconnections

The Cisco Any Rate Cards effectively address 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. 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 Cisco Any Rate line cards provide the capability to efficiently aggregate mission-critical Gigabit Ethernet, ESCON, Fibre Channel (up to 8 Gigabit Ethernet Fibre Channel), and FICON services across the metro optical transport network, enabling real-time synchronous replication of information between the primary and backup data centers.

Managed Service Network

DWDM transport networks are offering service providers a basic transport layer. The capability to optimize wavelength efficiency is a critical achievement for managed service networks in order to provide a significant return on investment for service providers. The supercharged flexibility of Cisco Any Rate line cards to multiplex any mix of different services (Ethernet, SONET, SDH, OTN, SAN, or video) allows you to optimize the number of wavelengths used in the network, thereby significantly reducing capital expenditures (CapEx) for the transport infrastructure.

OTN Hand-Off

The OTN is always becoming the predominant standard for interconnecting network interfaces of different DWDM network providers. It guarantees total transparency of the wrapped payload as well as a defined standard for the interfaces. Any Rate line cards provide fully standards-based OTU-1 and OTU-2 interfaces, allowing service providers to hand off services to other service providers with full SLA support.

OTU-2 EFEC Regenerator and Translator

The market offers multiple EFEC algorithms, but the vast majority of deployments use G.795.1 I-4 and I-7 options. This situation creates interoperability problems between equipment because of the different coding mechanisms. Cisco Any Rate line cards can regenerate OTN signals with different EFEC algorithms, allowing them to connect equipment that cannot be interconnected. An example of this application is regeneration of OTU-2 signals coming out from the Cisco CRS-1 Carrier Routing System platform that need to be terminated over a Cisco 7600 Series Router or Cisco ASR 9000 Series Aggregation Services Router.

HD Video Aggregation

Video signals are increasingly popular for service providers. The requirement is not only to deploy a Layer 2 or Layer 3 network dedicated to video applications but also to support natively such services over a DWDM system. Stringent latency requirements and the capability to transmit signals without compression are becoming requirements for DWDM networks. Cisco Any Rate line cards natively support the capability to multiplex SD-SDI,

HD-SDI, and 3G-SDI over an OTU-2 trunk interface, allowing you to maximize the wavelength bandwidth, maintain full transparency for uncompressed signals, and dramatically reduce the latency.

Licensing Approach

The Cisco ONS 15454 Any Rate line cards offer you unprecedented flexibility. The line cards can support a wide range of different applications and configurations. To help you take advantage of such flexibility to lower capital expenditures (CapEx) on your network, Cisco provides a licensing model for those products.

Each version of the Cisco Any Rate line card is available in two declinations: one includes the full list of functions, and the second one offers only basic functions but is upgradable with a “SW license” that enables the feature you want.

A licensed version of the card supports as basic functions only client SFP traffic with the XFP port disabled. Any rate transponders or 2.5 Gigabit Ethernet data muxponder functions are supported, but no access to 10 Gigabit Ethernet ports is allowed.

You can order one or more upgrade SW licenses to enable the specific card configurations shown in Table 7.

Table 7. Supported Software Licenses

License PID	License Description	Card Applicability	Supported Configuration
15454-LIC-TXP-8G=	ONS15454 Any-Rate Muxponder – 8G FC TXP SW License	AR-MXP and AR-XP	Enable 8G FC Transponder configuration
15454-LICMXP4x2.5=	ONS15454 Any-Rate Muxponder – 4xOC48 / 4xSTM-16 SW License	AR-MXP and AR-XP	Enable 4x2.5G Muxponder Configuration OC48/STM-16/OTU1 signals are supported
15454-LIC-10G-DM=	ONS15454 Any-Rate Muxponder – Data Muxponder SW License	AR-MXP and AR-XP	Enable 10G Data Muxponder Configuration GE/1G/2G/4G FC signals are supported
15454-LIC-MXP-AR=	ONS15454 Any-Rate Muxponder – Any Rate Muxponder SW License	AR-MXP and AR-XP	Enable 10G Any-Rate Muxponder Configuration support OC3/OC12/OC48/STM-16/OTU1 GE/1G/2G/4G FC, SD-SDI and HD-SDI signals are supported
15454-LIC-VD-XP=	ONS15454 Any-Rate Muxponder – Video Xponder SW License	AR-XP	Enable Video Signal Muxponder Configuration: 3G-SDI signals are supported
15454-LIC-REG-10G	ONS15454 Any-Rate Muxponder – 10GE over OTN Regen SW License	AR-MXP and AR-XP	Enable OTU2 regeneration function with capability to support various EFEC modes

More information about the Cisco licensing policy is available at:

http://www.cisco.com/en/US/docs/general/warranty/English/EU1KEN_.html.

Cisco ONS 15454 Any Rate Muxponder and Xponder Cards Features and Specifications

Compact Design

- Single-width card slot design for high-density multirate solutions
- Up to 12 Cisco ONS 15454 Any-Rate line cards on M12 shelf assembly
- Up to 6 Cisco ONS 15454 Any-Rate line cards on M6 shelf assembly
- Flexible restoration options
 - Fiber switched (on Cisco Any Rate Xponder only)
 - Client Y-protection
 - Unprotected (0 + 1)

Regulatory Compliance, System Requirements, Specifications, and Ordering Information

Table 8 lists regulatory compliance information, Table 9 gives system requirements, Table 10 gives card specifications, and Table 11 gives ordering information.

Table 8. Regulatory Compliance Information

SONET/ANSI System	SDH/ETSI System
Countries Supported	
<ul style="list-style-type: none">• Canada• United States• Mexico• Korea• Japan• European Union	<ul style="list-style-type: none">• European Union• Australia• New Zealand• Singapore• China• Mexico• Hong Kong• Korea
EMC (Class A)	
<ul style="list-style-type: none">• ICES-003 Issue 4 (2004)• GR-1089-CORE, Issue 4 (Type 2 and Type 4 equipment)• GR-1089-CORE – Issue 03 (Oct 2002) (Objective O3-2 – Section 3.2.1 – Radiated Emissions requirements with all doors open)• FCC 47CFR15, Class A subpart B (2006)	<ul style="list-style-type: none">• EN 300 386 v1.3.3 (2005) and v1.4.1 (2007)• CISPR 22 – Fifth edition (2005-04) Class A and the amendment 1 (2005-07)• CISPR 24 – First edition (1997-09) and amendment 1 (2001-07) and amendment 2 (2002-10)• EN 55022:1998 Class A – CENELEC Amendment A2:2003• EN 55024:1998 – CENELEC Amendment A1:2001 and Amendment A2:2003
Safety	
<ul style="list-style-type: none">• CAN/CSA-C22.2 No.950-95, 3rd Edition• GR-1089-CORE, Issue 4 (Type 2 and Type 4 equipment)	<ul style="list-style-type: none">• UL/CSA 60950 –1 First Edition (2003)• IEC 60950-1 (2001/10)/Amendment 11:2004 to EN 60950-1:2001, 1st Edition (with all country deviations)
Optical Safety	
<ul style="list-style-type: none">• EN or IEC-60825-2 Third edition (2004-06)• EN or IEC 60825-1 Consol. Ed. 1.2 – incl. am1+am2 (2001-08)• 21CFR1040 (2004/04) (Accession Letter and CDRH Report)• IEC-60825-2 Third edition (2004-06)• ITU-T G.664 (2006)	

SONET/ANSI System		SDH/ETSI System	
Environmental			
<ul style="list-style-type: none">GR-63-CORE, Issue 3 (2006)		<ul style="list-style-type: none">ETS 300-019-2-1 V2.1.2 (Storage, Class 1.1)ETS 300-019-2-2 V2.1.2 (Transportation, Class 2.3)ETS 300-019-2-3 V2.1.2 (Operational, Class 3.1E)EU WEEE regulationEU RoHS regulation	
Optical			
<ul style="list-style-type: none">GR-253-CORE – Issue 04ITU-T G.691		<ul style="list-style-type: none">ITU-T G.709ITU-T G.975	
Quality			
<ul style="list-style-type: none">TR-NWT-000332, Issue 4, Method 1 calculation for 20-year mean time between failure (MTBF)			
Miscellaneous			
<ul style="list-style-type: none">AT&T Network Equipment Development Standards (NEDS) Generic Requirements, AT&T 802-900-260, Issue 3, December 1999SBC TP76200MP, May 2003		<ul style="list-style-type: none">Verizon SIT.NEBS.NPI.2002.010, October 2002Worldcom ESD requirement	

Table 9. System Requirements

Component	Cisco ONS 15454 ANSI	Cisco ONS 15454 ETSI	Cisco ONS 15454 M6	Cisco ONS 15454 M2
Processor	TCC3, TCC2P, or TCC2	TCC3, TCC2P, or TCC2	TNC, TSC, TNC-E, or TSC-E	TNC, TSC, TNC-E, or TSC-E
Cross-connect	All (not required)	All (not required)	–	–
Shelf assembly	15454-SA-HD or 15454-SA-HD-DDR shelf assembly with CC-FTA version fan-tray assembly	15454-SA-ETSI shelf assembly with CC-FTA fan-tray assembly	15454-M6-SA shelf assembly	15454-M2-SA shelf assembly
System software	Release 9.4 ANSI or later	Release 9.4 ETSI or later	Release 9.4 ANSI/ETSI or later	Release 9.4 ANSI/ETSI or later
Slot compatibility	1–6, 12–17	1–6, 12–17	2–7	2–3

Table 10. Card Specifications

Specification	
Management	
Card LEDs <ul style="list-style-type: none"> Failure (FAIL) Active/standby (ACT/STBY) Signal fail (SF) 	Red Green/yellow Yellow
Client port LEDs <ul style="list-style-type: none"> Active input signal 	Green
DWDM port LEDs <ul style="list-style-type: none"> Active input signal Output wavelength 	Green Green
Power	
Card power draw <ul style="list-style-type: none"> Typical Maximum 	50W (with no pluggables) 74W (fully loaded)
Physical	
Dimensions	Occupies one slot
Weight	3.13 lb (1.4 kg)

Specification	
Reliability and Availability	
MTBF	223,522 hours
Latency	
8G FC TXP	
G.709 On – No FEC/ GFEC	57.1
G.709 On – EFEC I.4	108
G.709 On – EFEC I.7	183.7
4G FC over OTU-2 MXP	
G.709 On – No FEC/ GFEC	27
G.709 On – EFEC I.4	78
G.709 On – EFEC I.7	154.1
Operating Environment Long term	
Temperature	32 to 111°F (0 to 45°C)
Humidity	5 to 85% noncondensing
Operating Environment Short term (96 hours/year)	
Temperature	23 to 131°F (–5 to 55°C)
Humidity	5 to 95% noncondensing
Storage Environment	
Temperature	23 to 131°F (–5 to 55°C)
Humidity	5 to 95% noncondensing

Table 11. Ordering Information

Part Number	Description
15454-AR-MXP=	ONS15454 Any-Rate Muxponder
15454-AR-MXP-LIC=	ONS15454 Any-Rate Muxponder – Software License Upgradeable
15454-AR-XP=	ONS15454 Any-Rate Xponder
15454-AR-XP-LIC=	ONS15454 Any-Rate Xponder – Software License Upgradeable
15454-LIC-TXP-8G=	ONS15454 Any-Rate Muxponder – 8G FC TXP Software License
15454-LIC-TXP-8G	ONS15454 Any-Rate Muxponder – 8G FC TXP Software License
15454-LICMXP4x2.5=	ONS15454 Any-Rate Muxponder – 4xOC48 / 4xSTM-16 Software License
15454-LICMXP4x2.5	ONS15454 Any-Rate Muxponder – 4xOC48 / 4xSTM-16 Software License
15454-LIC-10G-DM=	ONS15454 Any-Rate Muxponder – Data Muxponder Software License
15454-LIC-10G-DM	ONS15454 Any-Rate Muxponder – Data Muxponder Software License
15454-LIC-MXP-AR=	ONS15454 Any-Rate Muxponder – Any Rate Muxponder Software License
15454-LIC-MXP-AR	ONS15454 Any-Rate Muxponder – Any Rate Muxponder Software License
15454-LIC-VD-XP=	ONS15454 Any-Rate Muxponder – Video Xponder Software License
15454-LIC-VD-XP	ONS15454 Any-Rate Muxponder – Video Xponder Software License
15454-LIC-REG-10G=	ONS15454 Any-Rate Muxponder – 10GE over OTN Regen Software License
15454-LIC-REG-10G	ONS15454 Any-Rate Muxponder – 10GE over OTN Regen Software License

For pluggable support and software release dependency, please refer to the Pluggables Configuration Guide at: www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/brochure_c02-452560.html.



Americas Headquarters
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