Cisco 1-Port 10 Gigabit Ethernet (10GE) Tunable WDM-PHY Shared Port Adapter

The Cisco® I-Flex design combines shared port adapters (SPAs) and SPA interface processors (SIPs), using an extensible design that enables service prioritization for voice, video, and data services. Enterprise and service provider customers can use the improved slot economics resulting from modular port adapters that are interchangeable across Cisco routing platforms. The I-Flex design maximizes connectivity options and offers superior service intelligence through programmable interface processors, which deliver line-rate performance. I-Flex enhances speed-to-service revenue and provides a rich set of quality-of-service (QoS) features for premium service delivery while effectively reducing the overall cost of ownership. This data sheet contains the specifications for the Cisco 1-Port 10GE Tunable WDM-PHY Interface SPA.

Product Overview

The Cisco 1-Port 10GE Tunable WDM-PHY SPA provides a tunable optical interface that can be used to connect directly to dense wavelength-division multiplexing (DWDM) transport systems, eliminating the need for an optical transponder. The Tunable WDM-PHY SPA provides full 80-channel tunability with 50-GHz spacing across the C band and meets ITU specifications. It supports G.709 framing for robust connectivity and SONET-like operations, administration, maintenance, and provisioning (OAM&P) as well as generic forward error correction (GFEC) for regional applications. For long-haul application support, the high-gain enhanced forward error correction (EFEC) functionality is provided, which can extend optical reach up to 2000 km without optical-electrical regeneration.

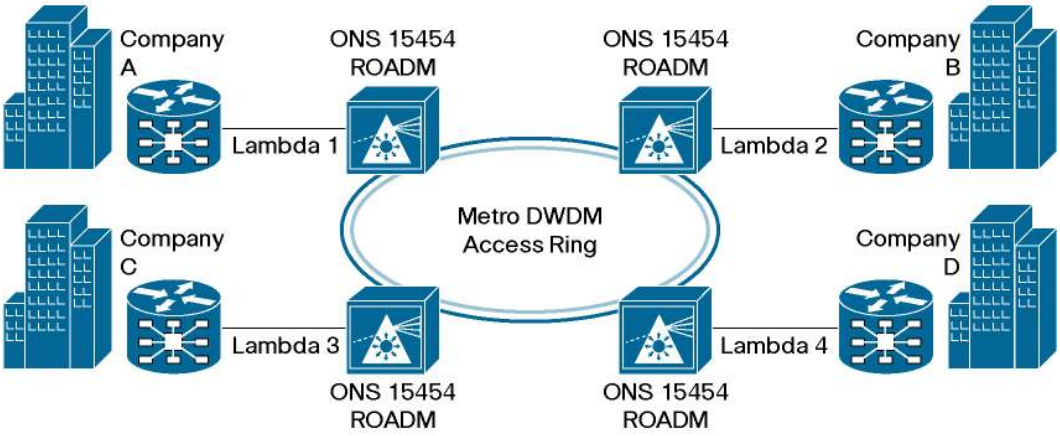
The 10GE Tunable WDM-PHY SPA is part of the Cisco IP-over-DWDM solution portfolio. Service providers benefit from IP-over-DWDM integration through faster service provisioning, increased reliability, and simplified network management. Integrated DWDM transponders simplify the network by reducing the number of network elements and also scale at a lower total cost to reduce bandwidth cost. Finally, IP-over-DWDM solutions allow service providers to more cost-effectively use the rich QoS and IP intelligence of Cisco routers in their transport networks.

Figure 1. Cisco 1-Port 10GE Tunable WDM-PHY Interface SPA

Applications

Figure 2 shows Tunable WDM-PHY SPA applications.

Figure 2. Tunable WDM-PHY SPA Applications



The 1-Port 10GE Tunable WDM-PHY SPA allows the router to connect directly to an optical ring using either a passive DWDM line system or reconfigurable optical add-drop multiplexers (ROADMs), allowing customer traffic to be carried separately and securely on a single DWDM wavelength. It eliminates the need for bulky and expensive optical transponders. It simplifies network operation by allowing DWDM optical functions and wavelengths to be managed as part of the IP network, reducing the number of network elements and simplifying network management.

Combined with the Cisco ONS 15454 Multiservice Transport Platform (MSTP), the 1-Port 10 Gigabit Ethernet Tunable WDM-PHY SPA provides a powerful solution for bringing IP intelligence to metropolitan and core optical transport networks.

Metro-regional DWDM and long-haul applications are both possible with this product. Long-haul applications of up to 2000 km are supported with the use of the built-in EFEC support.

Features and Benefits

The 1-Port 10GE Tunable WDM-PHY SPA is a primary element in the Cisco IP over DWDM solution, integrating an OTN-compliant (Optical Transport Network) and ITU-compliant interface directly onto the router. Furthermore, as a SPA, the customer also gains all the benefits of Cisco I-Flex modularity: improved slot economics, interface interchangeability across platforms, and investment protection. Table 1 summarizes the features and benefits of this product.

Table 1. Features and Benefits

Feature	Benefit
Hardware	
80-Channel Tunability	• Superior wavelength tunability across C-band • Superior provisioning flexibility and scalability • ITU compliant
EFEC Support	• Superior reach; up to 2000 km without regeneration
G.709 OTN Support	• SONET-like management, administration, and performance monitoring

Feature	Benefit
IP-over-DWDM Solution	
Transponder Integration	• No need for external transponder shelves • Less network elements to manage; enhanced reliability • Reduced operating expenses as well as capital expenditures by reducing space, power, and the cost of the transponder and associated shelves and common card
Management Integration	• Single IP-over-DWDM design tool for network planning • SONET/SDH-like OAM&P for performance monitoring • Open architecture for third-party interoperability
Interoperability	• Fully interoperable with Cisco 15454 MSTP • Designed to be interoperable with third-party DWDM equipment

Product Specifications

Detailed product specifications are listed in Table 2.

Table 2. Product Specifications

Feature	Description
Product Compatibility	Cisco 12000 Series Routers Cisco XR 12000 Series Routers
Port Density	1 x 10 Gigabit Ethernet
Ethernet Features	Encapsulations: ARPA, IEEE 802.2/SAP, IEEE 802.3/SNAP IEEE 802.3x flow control 802.1q VLAN support, jumbo frames (9188 bytes) 802.1ad QinQ support IEEE 802.1p tagging Bridge protocol data unit (BPDU), Cisco Discovery Protocol, and VLAN Trunking Protocol (VTP) filtering Layer 2 Protocol (BPDU, Cisco Discovery Protocol, and VTP) tunneling Layer 2 access list (MAC address-based filtering) Up to 8000 VLANs per SPA and subject to a limit of 4000 VLANs per port for 802.1q Up to 5000 MAC accounting entries per SPA (source MAC accounting on the ingress and destination MAC accounting on the egress) Up to 2000 MAC address entries for destination MAC address filtering per SPA, and up to 1000 MAC address filtering entries per port Per-port byte and packet counters for policy drops; oversubscription drops; cyclic-redundancy-check (CRC) error drops; packet sizes; and unicast, multicast, and broadcast packets Per-VLAN byte and packet counters for policy drops; oversubscription drops; and unicast, multicast, and broadcast packets Per-port byte counters for good bytes and dropped bytes
Protocol Support	OTN G.709 compliant, selectable OTN disabled: no OTN (G.709) framing, line rate of 10.3125 Gbps OTN enabled: OTN (G.709) framing, line rate of 11.0975 Gbps Mapping of IEEE 802.3ae 10GBASE-R signal into an overclocked OTU2 running at 11.0975 Gbps Local (internal) and line (network) loopback Local (internal) or loop (recovered from network) timing ±100 ppm local clock accuracy over operating temperature

Feature	Description
Alarms and Performance Monitoring	Alarm reporting: • Loss of signal (LOF) • Loss of OTN frame (LOF) • Loss of OTN multiframe (LOM) • OTU alarm indication signal (OTU-AIS) • OTU backward defect indication (OTU-BDI) • ODU alarm indication signal (ODU-AIS) • ODU open connection indication (ODU-OCI) • ODU locked (ODU-LCK) • ODU backward defect indication (ODU-BDI) • ODU payload type identifier mismatch (ODU-PTIM) • OTU signal fail (OTU_SF_BER) • OTU signal degrade (OTU_SD_BER) OTU_SF_BER and OTU_SD_BER alarms are based on monitoring OTU BIP errors with a user-settable threshold crossing. Error counts: OTU BIP, OTU BEI, ODU BIP, and ODU BEI. Threshold crossing alerts (TCAs) for OTU BIP errors (SM-TCA) and ODU BIP errors (PM-TCA) with user-settable threshold.
FEC Features	No FEC: ability to turn off error correction for use with non-FEC supporting interfaces (for example, Xenpak, XFP). GFEC: standard G.975 Reed-Soloman algorithm EFEC: standard G.975.1 two orthogonally concatenated BCH super FEC code. This FEC scheme contains three parameterizations of the same scheme of two orthogonally interleaved block codes (BCH). The constructed code is decoded iteratively, to achieve the expected performance. FEC statistics for pre-FEC BER, corrected errors (EC) and uncorrected words (UC).
Optical Features	Line rate 10.3125 Gbps ±100 ppm or 11.0957 Gbps ±100 ppm Duplex LC (shuttered) faceplate optical connector Full C-band tunable laser with 50-GHz spacing Optical power monitoring: laser output power (+/-1.5dB), receiver signal average power (+/-1.5dB)
Reliability and Availability	Online insertion and removal (OIR) without affecting system traffic Single SPA software reset
Network Management	Cisco IOS® Software command-line interface (CLI) Simple Network Management Protocol (SNMP) CraftWorks Interface (CWI)
Physical Dimensions	Double-height, double-width SPA. Occupies four standard, single-height SPA slots or two double-height SPA slots Weight: 2.75 lbs (1.25 kg) Height: 1.6 in. (4.06 cm). Double-height form factor. Depth: 7.28 in. (18.49 cm) Width: 13.53 in. (34.36 cm). Double-wide form factor.
Power	46W
Environmental Conditions	Storage temperature: –40 to 70°C (–40 to 158°F) Operating temperature: 5 to 40°C (41 to 104°F)· Operating humidity: 5 to 85% RH Storage humidity: 5 to 95% RH

DWDM Line and Optical Specifications

Table 3 shows the detailed DWDM optical and line specifications for the optical interface.

Table 3. Additional Specifications: DWDM Line Interface

Specification	DWDM Line Interface
DWDM Line Interface	
Bit Rate	10.3125 ±100 ppm 11.0957 ±100 ppm
Nominal Wavelengths (lambdaTnom)	C-band unit: full tunable from 1529.55 to 1561.84
Spectral Range (lambdaTmin to lambdaTmax)	1530 to 1561 nm
Spectral Width at 20 dB (lambda delta20)	≤25 GHz
Optical Transmitter	
Type	Lithium Niobate external modulator
Output Power (PTmin to PTmax)	+3 dBm, +6 dBm
Required Optical Return Loss, Minimum (ORLmin)	27 dB
Extinction Ratio, Minimum (reminx)	>10.5 dB
Laser Safety Class	1
Optical Receiver	
Type	Avalanche photo diode (APD)
Chromatic Dispersion Tolerance (DLRmax)	Up to ±1200 ps/nm (2 dB penalty)[1]
Minimum BER (BERmin)	
FEC Off	10E–12
FEC On	10E–15
EFEC On	10E–15
Reflectance Between Far-End Tx and Near-End Rx (Maximum)	–27 dB
Receiver Reflectance (Maximum)	–14 dB
Input Wavelength Bandwidth (lambdac_rx)	1290 nm to 1605 nm
Connector Type (Tx/Rx)	LC, duplex (shuttered)

Table 4 shows optical performance, with OSNR given in 0.5-nm Res BW.

Table 4. Optical Performance

OSNR	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	CD Tolerance
23 dB	OFF	<10E(–12)	–	–8 to –20 dBm C band	±1200 ps/nm
19 dB	OFF	<10E(–12)	–	–8 to –20 dBm C band	±1000 ps/nm
19 dB	OFF	<10E(–12)	–	–8 to –22 dBm C band	–
10 dB	GFEC	<10E(–5)	<10E(–15)	–8 to –18 dBm	±800 ps/nm
8.5 dB	GFEC	<10E(–5)	<10E(–15)	–8 to –18 dBm	–
19 dB	EFEC	<7x10E(–4)	<10E(–15)	–8 to –26 dBm	±800 ps/nm
19 dB	EFEC	<7x10E(–4)	<10E(–15)	–8 to –27 dBm	–
7 dB	EFEC	<7x10E(–4)	<10E(–15)	–8 to –20 dBm	±800 ps/nm
5 dB	EFEC	<7x10E(–4)	<10E(–15)	–8 to –20 dBm	–

[1] This is not a specification. Chromatic Dispersion Tolerance is listed as an indication of the maximum chromatic dispersion that the interface can tolerate only in the specified case quoted in Table 4 with 23 dB of OSNR.

Approvals and Compliance

The Cisco 1-Port 10GE Tunable WDM-PHY SPA is tested and conforms to the international compliance specifications listed in Table 5.

Table 5. Compliance and Agency Approvals[2]

Feature	Description
Safety Standards	UL/CSA/IEC/EN 60950-1 IEC/EN 60825 Laser Safety AS/NZS 60950 FDA-Code of Federal Regulations Laser Safety
EMI	FCC Class A ICES 003 Class A AS/NZS CISPR 22 Class A CISPR 22 (EN55022) Class A VCCI Class A
ETSI and EN	EN300 386: Telecommunications Network Equipment (EMC) EN55022: Information Technology Equipment (Emissions) EN55024: Information Technology Equipment (Immunity) EN50082-1/EN-61000-6-1: Generic Immunity Standard
Network Equipment Building Standards (NEBS)	This product is designed to meet the following requirements (qualification in progress): SR-3580: NEBS Criteria Levels (Level 3) GR-1089-CORE: NEBS EMC and Safety GR-63-CORE: NEBS Physical Protection

Ordering Information

To place an order, contact your local Cisco representative or visit the Ordering page on the Cisco website. Use the ordering information provided in Table 6. To download software, visit the Cisco Software Center.

Table 6. Ordering Information

Product Name	Part Number
Cisco 1-Port 10GE, C-Band Tunable, WDM-PHY Shared Port Adapter (for LAN PHY Applications)	SPA-1X10GE-L-ITUC

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco services help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to Cisco Technical Support Services or Cisco Advanced Services.

For More Information

For more information about the Cisco SPA/SIP portfolio, visit www.cisco.com/go/spa. For details about the Cisco IP-over-WDM solution, visit www.cisco.com/go/crs. Alternatively, you may contact your local Cisco account representative.

[2] For the most up-to-date compliance and approvals information see “Regulatory Compliance and Safety Information” at www.cisco.com.

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