Cisco ONS 15454 10-Port 10 Gbps Line Card

Product Overview

The Cisco® ONS 15454 Multiservice Transport Platform (MSTP) supports the Cisco ONS 15454 10-Port 10 Gbps Line Card, which simplifies the integration and transport of 10-Gbps interfaces and services into enterprise or service provider optical networks (Figure 1).

Release 9.6 of the Cisco ONS 15454 MSTP extends the total data transport capacity by a factor of three, allowing Dense Wavelength-Division Multiplexing (DWDM) transmission of up to 9.6 Tbps (96 wavelengths at 100 Gbps each) in the C-band.

Figure 1.   Cisco ONS 15454 10-Port 10 Gbps Line Card

Challenge and Solution

The bandwidth carried on core and metropolitan DWDM networks is growing exponentially, while operators' revenues are not keeping pace. The Cisco ONS 15454 100-Gbps solution can dramatically lower the cost-to-carry bandwidth, helping to maintain and improve customers' profitability. Internet growth is still exponential, mainly due to demand for next-generation services such as quadruple play (data, voice, video, and mobility), video distribution, Internet Protocol Television (IPTV), and other high-bandwidth services.

Due to advanced modulation techniques, the ability to transmit 100-Gbps wavelengths on existing or new DWDM systems maximizes return on investment by increasing the overall capacity per fiber pair without impacting the unregenerated transmission distance supported by the system. Scaling from 10 Gbps to 40 Gbps and now 100 Gbps multiplies by a factor of 10 the bandwidth that can be transported over existing fiber networks.

New Coherent Polarization-Multiplexing Differential Quadrature Phase Shift Keying (CP-DQPSK) modulation supports 9.6 Tbps capacity transmission over Ultra-Long-Haul (ULH) networks, up to 3000 km of unregenerated optical spans.

The Cisco ONS 15454 10-Port 10 Gbps Line Card is designed to provide up to 10 ports of 10-Gbps services aggregated over 100-Gbps DWDM wavelengths when combined with the Cisco ONS 15454 100 Gbps Coherent DWDM Trunk Card.

Product Features and Benefits

The Cisco ONS 15454 10-Port 10 Gbps Line Card consists of 10 Enhanced Small Form-Factor Pluggable (SFP+) based ports and one 100-Gbps Channel Express (CXP) based port. Each of the 10-Gbps SFP+ based ports can support the following services:

- OC-192/STM-64 (9.95328 Gbps)
- 10 Gigabit Ethernet LAN PHY (10.3125 Gbps)
- 10-Gbps Fibre Channel (10.518 Gbps)
- 8-Gbps Fibre Channel
- OTU-2
    - Standard G.709 (10.70923 Gbps)
    - G.709 overclocked to transport 10 Gigabit Ethernet as defined by ITU-T G; Sup43 Clause 7.1 (11.0957 Gbps)

Client ports can be equipped with a large variety of pluggable SFP+ transceivers, including grey or DWDM optics.

The Cisco ONS 15454 10-Port 10 Gbps Line Card provides many carrier-class features and advanced capabilities necessary to deliver 10-Gbps services, including protocol transparency, wavelength tunability, flexible protection mechanisms, flow-through timing, and management and performance monitoring capabilities (Figure 2).

Figure 2.   Cisco ONS 15454 10-Port 10 Gbps Line Card Block Diagram
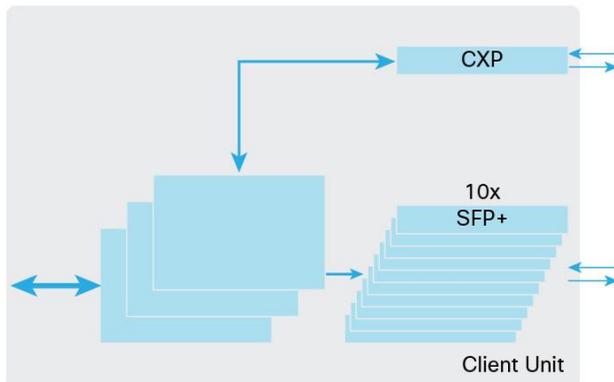
Operating Modes

The Cisco ONS 15454 10-Port 10 Gbps Line Card can support multiple applications.

10-Port 10-Gbps Muxponder Application

The Cisco ONS 15454 100 Gbps Coherent DWDM Trunk Card can be coupled with the Cisco ONS 15454 10-Port 10 Gbps Line Card to support 10 ports of 10-Gbps muxponder capabilities. The trunk card can be connected through the M6 or M2 backplane (no client CXP required) to the line card, providing Optical Transport Network (OTN) multiplexing of the 10-Gbps data streams into a single 100-Gbps DWDM OTU-4 wavelength. Supported client signals are any combination of 10 Gigabit Ethernet LAN-PHY, OC-192, STM-64, 10-Gigabit Fibre Channel (FICON), 8-Gigabit Fibre Channel (FICON) or OTU-2 data rates.

Please refer to the Cisco ONS 15454 100 Gbps Coherent DWDM Trunk Card data sheet for additional information.

Figure 3. Three Cisco ONS 15454 10-Port 10-Gbps Muxponder Applications in an M6 Chassis
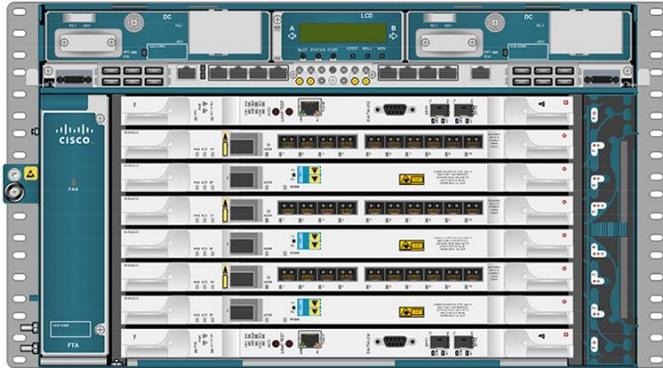
5-Port 10-Gbps Transponder or Regenerator Application

The Cisco ONS 15454 10-Port 10 Gbps Line Card can work in a standalone mode supporting multiple 10-Gbps transponder functionalities. The 10-Gbps SFP+ ports are paired (Port 1 with Port 2, Port 3 with Port 4, and so on), providing 10-Gbps transponder functionality for each pair of ports. The most common use case is to use a grey SFP+ to connect to the client equipment and a DWDM SFP+ facing the network side. In this way, up to five 10-Gbps transponders can be supported by a single line card. Up to six Cisco ONS 15454 10-Port 10 Gbps Line Cards can be supported in an M6 chassis, allowing for thirty 10-Gbps transponders in a single shelf.

All ports can be equipped with or without a G.709 digital wrapper, providing wide flexibility in supported services. It is also possible to equip both SFP+ transceivers in a pair of ports with DWDM SFP+ pluggables, allowing 10-Gbps regenerator functionality.

CXP Fan Out Application

The Cisco ONS 15454 10-Port 10 Gbps Line Card can operate in a Fan Out mode providing a 10x 10GE interface on the client CXP into/from the individual 10 SFP+ interfaces on the card.

Licensing Approach

The Cisco ONS 1545410-Port 10 Gbps Line Card includes the ability to cost-effectively transport 10-Gbps services through a pay-as-you-grow licensing model for the 10-port 10 Gbps muxponder application (Table 1). A licensed version of the Cisco ONS 15454 100 Gbps Coherent DWDM Trunk Card works in conjunction with a licensed version of the Cisco ONS 15454 10-Port 10 Gbps Line Card, offering a cost-effective solution for aggregation and transport of 10-Gbps services. These two cards can only work in this configuration. Additional 10-Gbps services will be provided by mounting a 10-Gbps license through software key distribution. Up to nine 10-Gbps licenses can be added to the line card (only one 10-Gbps license is provided in the initial configuration).

Table 1. Supported Software Licenses

License Product Number	License Description	Card Applicability	Card Description
15454-M-LIC-10G=	1-Port 10-Gbps License for 100-Gbps Muxponder	15454-M-10X10-LIC=	10-Port 10 Gbps Multirate Client LC Licensed with 1 License at 10 Gbps
15454-M-LIC-100G=	100-Gbps Transponder/Regenerator License for 100-Gbps Trunk Card	15454-M-100GC-LIC=	100G OTU-4 ITU-T CP-DQPSK Full C Band Tuneable LC: Licensed

More information about the Cisco licensing policy is available at:
http://www.cisco.com/en/US/docs/general/warranty/English/EU1KEN_.html.

Enhanced FEC Capability

The card can support a Forward Error Correction (FEC) mechanism on any of the SFP+ interfaces. This can be independently enabled or disabled on all the ports. For low-latency applications, a specific configuration is supported with FEC and OTN disabled for all the ports.

Two software-configurable Forward Error Correction coding options are available:

- GFEC: Standard G.975 Reed-Salomon algorithm with 7 percent OverHead (OH)
- EFEC: Standard G.975.1 (Sub-clause I.7) with 7 percent overhead; this FEC scheme uses two orthogonally concatenated BCH super-FEC codes, and the constructed code is decoded iteratively to rebuild the original frame

Protocol Transparency

The Cisco ONS 15454 10-Port 10 Gbps Line Card can transparently deliver any 10-Gbps service for cost-effective, point-to-point transport within the Cisco ONS 15454 MSTP platform.

In the 100-Gbps muxponder application, clients are mapped into an OTU-4 DWDM wavelength using the mapping methods indicated in Table 2.

Table 2.   Client Configurations and Mapping

Client		Mapping
Format	Rate (Gbps)	
10GE LAN-PHY	10.3125	CBR-BMP clause 17.2.4 (ex G sup43 7.1) + GMP ODU2e to OPU3e4
	10.3125	GFP-F clause 17.4.1 (ex G sup43 7.3) + GMP ODU2 to OPU3e4
OC-192/STM-64	9.953	CBR-BMP clause 17.2.2 (Sync) + GMP ODU2 to OPU3e4
10G FC	10.518	513b Transc + AMP GFP-F clause 17.8.2 + GMP ODU2e to OPU3e4
8G FC	8.500	CBR-BMP clause 17.9 (OduFlex) + GMP ODU2 to OPU3e4
OTU2	10.709	ODU transparent + GMP ODU2 to OPU3e4
OTU2e	11.096	ODU transparent + GMP ODU2 to OPU3e4

Wavelength Tunability

The Cisco ONS 15454 10-Port 10 Gbps Line Card is software provisionable and tunable across the full C-band, on 96 channels on the 50-GHz grid using tunable SFP+ pluggables. Tunability provides flexibility and reconfigurability of services transported on Reconfigurable Optical Add-Drop Multiplexer (ROADM) based networks, but also allows management of a single element from a deployment and sparing perspective.

Flexible Protection Mechanism Support

The Cisco ONS 15454 10-Port 10 Gbps Line Card supports multiple protection mechanisms commonly used in optical transport networks. Table 3 outlines the available protection options and the associated Service-Level Agreements (SLAs) that can be provided.

Table 3.   Protection Formats

Protection Type	Capabilities
Unprotected	No client terminal interface, transponder card, or DWDM line protection. The client signal is transported over a single unprotected transponder card or optical path.
Y-cable protection	Provides transponder card and DWDM line protection without requiring client terminal interface protection. Uses Y-protection devices to optically split a single client interface to two transponder cards. The Cisco ONS 15454 system controls the transponder card active or standby status to provide a single signal feed to client equipment.
OCH-trail protection	Provides protection for the DWDM signal through external optical switch units (Protection Switch Module [PSM]).

Protection Type	Capabilities
Splitter Protection	Provides DWDM line and DWDM interface protection without client interface protection. Internally splits a single client signal into two DWDM interfaces on the same card, which operate as active/standby.

Flow-Through Timing

The Cisco ONS 15454 10-Port 10 Gbps Line Card allows the timing to flow through from client to line optical interface. The received timing from the client interface is used to time the line transmitter interface. This flow-through timing allows multiple line cards to be placed in the same shelf, each timed independent of the network element timing.

Management

The Cisco ONS 15454 MSTP provides comprehensive management capabilities to support the Operations, Administration, Maintenance, and Provisioning (OAM&P) capabilities through the integrated Cisco Transport Controller craft interface with support from the Cisco Prime™ Optical element management system. The Cisco ONS 15454 10-Port 10 Gbps Line Card features provisionable digital wrapper (G.709) functionalities, providing per-wavelength performance management capabilities, especially for services 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 violate the SLA agreements. The digital wrapper's Generic Communication Channel (GCC) provides a separate communications channel on a per-wavelength basis to be used by the platform when transparent signals are transported. GCC allows the Cisco ONS 15454 MSTP system to extend its advanced network autodiscovery capabilities to DWDM-based services. The integrated Cisco Transport Controller craft manager and Cisco Prime Optical provide the user with OAM&P functionalities for the system.

Far-End-Laser-Off Behavior

The Cisco ONS 15454 10-Port 10 Gbps Line Card can provision the far-end-laser-off behavior in case of SONET/SDH/OTN payloads. Customers can use Cisco Transport Controller to configure how the remote client interface will behave following a fault condition. It is possible to configure the remote client to Squelch or to send an Alarm Indication Signal (AIS).

For 10 Gigabit Ethernet or 10-Gbps or 8-Gbps Fibre Channel signals, the default behavior is Squelching.

Performance Monitoring

The digital wrapper channel is monitored according to G.709 (OTN) and G.8021 standards. Performance monitoring of optical parameters on the client and DWDM line interface include Loss of Signal (LOS), Laser Bias Current, Transmit Optical Power, and Receive Optical Power. Calculation and accumulation of the performance monitoring data are supported in 15-minute and 24-hour intervals as per G.7710.

- SONET performance monitoring is available according to the Telcordia GR-253 standard.
- SDH performance monitoring is available according ITU-T G826 and ITU-T G.828.
- 10 Gigabit Ethernet and partially Fiber Channel rates are compatible with the Remote Monitoring (RMON) standard.

A detailed list of performance monitors is given in Table 6.

The Cisco ONS 15454 10-Port 10 Gbps Line Card incorporates 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 slot in which the card can be installed.

Application Description

The Cisco ONS 15454 10-Port 10 Gbps Line Card provides the ability to cost-effectively transport 10-Gbps services within the Cisco ONS 15454 MSTP platform.

Two main applications include:

- 10-Gbps hyper-dense termination requirements, providing up to four hundred twenty 10-Gbps transponders in a 42-Rack-Unit (RU) bay frame, representing an optimal footprint-constrained application.
- Large 10-Gbps bandwidth demand services, where the capability to transport up to nine hundred and sixty 10-Gbps signals into ninety six 100-Gbps DWDM wavelengths is obtained by combining the Cisco ONS 15454 10-Port 10 Gbps Line Card with the Cisco ONS 15454 100 Gbps Coherent DWDM Trunk Card.

Product Specifications

Compact Design

- Single-slot card design for high-density, 10-Gbps and 100-Gbps solutions
- Up to six 10-port 10-Gbps line cards per Cisco ONS 15454 M6 shelf assembly, allowing support of four hundred and twenty 10-Gbps ports per 42-RU bay frame

Flexible Restoration Options

- Transparent support for UPSR, SNCP, BLSR, MS-SPRing, and 1+1 APS/MSP
- Client Y-protection
- OCH-trail protection through PSM
- Unprotected (0+1)

Tables 4 and 5 list regulatory compliance information and system requirements for the Cisco ONS 15454 10-Port 10 Gbps Line Card. Table 6 provides the performance monitoring parameters, Table 7 provides card specifications, and Table 8 lists ordering information for the card.

Regulatory Compliance

Important: All compliance documentation may not be completed at the time of product release. Please check with your Cisco sales representative for countries other than Canada, the United States, and the European Union.

Table 4.   Regulatory Compliance

ANSI System	ETSI System
Countries Supported	
- Canada - United States - Korea - Japan - European Union	- European Union - Africa - CSI - Australia - New Zealand - China - Korea - India - Saudi Arabia - South America

ANSI System	ETSI System
EMC (Class A)	
• ICES-003, 2004 • GR-1089-CORE Issue 4, NEBS EMC and Safety, June 2006 • FCC 47CFR15, 2007	• ETSI EN 300 386 V1.4.1 (2008-04) Telecommunication network equipment EMC requirements (**Note:** EMC-1) • CISPR22:2008 and EN55022:2006/A1:2007 Information Technology Equipment (Emissions) (EMC-2) • CISPR24: 1997/A1:2001/A2:2002 and EN55024:1998/A1:2001/A2:2003: Information Technology Equipment - Immunity characteristics - Limits and Methods of Measurement (test levels)
Safety	
• CSA C22.2 #60950-1 - Edition 7, March 2007 • UL 60950-1 - Edition 2, March 2007 • GR-1089-CORE Issue 4, NEBS EMC and Safety, June 2006	• UL 60950-1 - Edition 2, March 2007 • IEC 60950-1 Information technology equipment Safety Part 1: General requirements - Edition 2, 2005 and National Differences as per CB Bulletin 112A • IEC/EN 60950-1 (2006/10) with Amendment 11:2004 to EN 60950-1:2001, 1st Edition and National Differences as per CB Bulletin 112A • EN 60950-1, Edition 2 (2006) Information technology equipment - Safety - Part 1: General requirements • CE Safety Directive: 2006/95/EC
Laser	
• UL 60950-1 - Edition 2, March 2007 • IEC 60825-1: 2001 Ed.1.2 (incl. am1+am2) Safety of laser products Part 1: Equipment classification, requirements and users guide • IEC60825-2 Ed.3 (2004) Safety of laser products Part 2: Safety of optical fiber communication systems + A1:2006	• IEC 60825-1: 2001 Ed.1.2 (incl. am1+am2) Safety of laser products Part 1: Equipment classification, requirements and users guide • IEC60825-2 Ed.3 (2004) Safety of laser products Part 2: Safety of optical fibre communication systems + A1:2006 • 21CFR1040 (2008/04) (Accession Letter and CDRH Report) Automatic Laser Shutdown and restart (ALS) according to ITU-T G.664 (03/06). Guidance for Industry and FDA Staff (Laser Notice No. 50), June 2007 • Laser Products - Conformance with IEC 60825-1 and IEC 60601-2-22; Guidance for Industry and FDA Staff (Laser Notice No. 50), June 2007
Environmental	
• GR-63-CORE Issue 3, NEBS Physical Protection, March-2006	• ETS 300-019-2-1 V2.1.2 (Storage, Class 1.1) • ETS 300-019-2-2 V2.1.2 (1999-09): Transportation, Class 2.3 • ETS 300-019-2-3 V2.2.2 (2003-04): Operational, Class 3.1E
Optical	
• GR-253-CORE - Issue 04 • ITU-T G.691	• ITU-T G.709 • ITU-T G.975
Quality	
• TR-NWT-000332, Issue 4, Method 1 calculation for 20-year Mean Time Between Failure (MTBF)	
Miscellaneous	
• GR-1089-CORE Issue 4, NEBS EMC and Safety (June 2006) (**Note:** NEBS-1) • GR-63-CORE Issue 3, NEBS Physical Protection (March 2006) (**Note:** NEBS-2) • ATT-TP-76200: 2008 • ANSI T1.315-2001 • GR-499: 2004 Transport Systems Generic Requirements (TSGR): Common Requirements	

System Requirements and Other Specifications

Table 5.   System Requirements

Component	Cisco ONS 15454 M6	Cisco ONS 15454 M2
Processor	TNC/TSC/TNC-E/TSC-E	TNC/TSC/TNC-E/TSC-E
Shelf assembly	Cisco ONS 15454 M6-SA shelf assembly with FTA2	Cisco ONS 15454 M2-SA shelf assembly with FTA2
System software	Release 9.6 ANSI/ETSI or later	Release 9.6 ANSI/ETSI or later
Slot compatibility	2 through 7	2 through 3

Table 6.   Performance Monitoring Parameters

Area	Parameter Name		Description
OTN	OTUk SM	ODUk PM	
	BBE-SM	BBE-PM	Number of background block errors
	BBER-SM	BBER-PM	Background block error ratio
	ES-SM	ES-PM	Number of errored seconds
	ESR-SM	ESR-PM	Errored seconds ratio
	SES-SM	SES-PM	Number of severely errored seconds
	SESR-SM	SESR-PM	Severely errored seconds ratio
	UAS-SM	UAS-PM	Number of unavailable seconds
	FC-SM	FC-PM	Number of failure counts
FEC	Bit errors		Number of corrected bit errors
	Uncorrectable words		Number of uncorrectable words
Trunk optical performance monitoring	OPT		Transmit optical power
	LBC		Transmitter laser bias current
	OPR		Receiver optical power

Table 7.   Card Specifications

Management	
Card LEDs	
• Failure (FAIL)	Red
• Active/standby (ACT/STBY)	Green/yellow
• Signal fail (SF)	Yellow
Client port LEDs (per port)	
• Active input signal	Green
Power (Including Worst-Case Pluggable)	
Typical	133W (25C & -48VDC)
Maximum	147W (55C & -38VDC)
Physical	
Dimensions	Occupies 1 slot
Weight	1.24 kg (2.73 lbs)
Reliability and Availability	
Mean Time Between Failures (MTBF)	171,199 hrs

Management	
Latency (End to End)	
Low Latency Mode G.709 disabled - FEC disabled G.709 - FEC disabled G.709 - Standard FEC G.709 - EFEC	10 nanoseconds 4 microseconds 7 microseconds 11 microseconds 146 microseconds
Storage temperature	-40ºC to 70ºC (-40ºF to 158ºF)
Operating temperature • Normal • Short-term[1, 2]	 0ºC to 40°C (32°F to 104°F) -5ºC to 55ºC (23ºF to 131ºF)
Relative humidity • Normal • Short-term[1]	 5% to 85%, noncondensing 5% to 90% but not to exceed 0.024 kg water/kg of dry air

[1] Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year (a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period). The values shown are valid for M6 or M2 chassis.

[2] When ONS-SC+-10G-C= pluggable is inserted for operation on the module, the short term operating temperature is limited to a max of 50°C(122°F)

Ordering Information

Table 8.   Ordering Information - Card and License

Part Number	Description
15454-M-10X10G-LC=	10-Port 10 Gbps Multirate Client Line Card
15454-M-10X10-LIC=	10-Port 10 Gbps Multirate Client LC Licensed w/ 1 Licence at 10G
15454-M-LIC-10G=	One Port 10G License for 100G Muxponder

Table 9.   Ordering Information - 10G SFP+, Fixed Wavelength

Part Number	Description
ONS-SC+-10G-30.3=	10G MR, SFP+ 1530.33, 100 GHz, LC
ONS-SC+-10G-31.1=	10G MR, SFP+ 1531.12, 100 GHz, LC
ONS-SC+-10G-31.9=	10G MR, SFP+ 1531.90, 100 GHz, LC
ONS-SC+-10G-32.6=	10G MR, SFP+ 1532.68, 100 GHz, LC
ONS-SC+-10G-33.4=	10G MR, SFP+ 1533.47, 100 GHz, LC
ONS-SC+-10G-34.2=	10G MR, SFP+ 1534.25, 100 GHz, LC
ONS-SC+-10G-35.0=	10G MR, SFP+ 1535.04, 100 GHz, LC
ONS-SC+-10G-35.8=	10G MR, SFP+ 1535.82, 100 GHz, LC
ONS-SC+-10G-36.6=	10G MR, SFP+ 1536.61, 100 GHz, LC
ONS-SC+-10G-37.4=	10G MR, SFP+ 1537.40, 100 GHz, LC
ONS-SC+-10G-38.1=	10G MR, SFP+ 1538.19, 100 GHz, LC
ONS-SC+-10G-38.9=	10G MR, SFP+ 1538.98, 100 GHz, LC
ONS-SC+-10G-39.7=	10G MR, SFP+ 1539.77, 100 GHz, LC
ONS-SC+-10G-40.5=	10G MR, SFP+ 1540.56, 100 GHz, LC
ONS-SC+-10G-41.3=	10G MR, SFP+ 1541.35, 100 GHz, LC
ONS-SC+-10G-42.1=	10G MR, SFP+ 1542.14, 100 GHz, LC
ONS-SC+-10G-42.9=	10G MR, SFP+ 1542.94, 100 GHz, LC
ONS-SC+-10G-43.7=	10G MR, SFP+ 1543.73, 100 GHz, LC
ONS-SC+-10G-44.5=	10G MR, SFP+ 1544.53, 100 GHz, LC

Part Number	Description
ONS-SC+-10G-45.3=	10G MR, SFP+ 1545.32, 100 GHz, LC
ONS-SC+-10G-46.1=	10G MR, SFP+ 1546.12, 100 GHz, LC
ONS-SC+-10G-46.9=	10G MR, SFP+ 1546.92, 100 GHz, LC
ONS-SC+-10G-47.7=	10G MR, SFP+ 1547.72, 100 GHz, LC
ONS-SC+-10G-48.5=	10G MR, SFP+ 1548.51, 100 GHz, LC
ONS-SC+-10G-49.3=	10G MR, SFP+ 1549.32, 100 GHz, LC
ONS-SC+-10G-50.1=	10G MR, SFP+ 1550.12, 100 GHz, LC
ONS-SC+-10G-50.9=	10G MR, SFP+ 1550.92, 100 GHz, LC
ONS-SC+-10G-51.7=	10G MR, SFP+ 1551.72, 100 GHz, LC
ONS-SC+-10G-52.5=	10G MR, SFP+ 1552.52, 100 GHz, LC
ONS-SC+-10G-53.3=	10G MR, SFP+ 1553.33, 100 GHz, LC
ONS-SC+-10G-54.1=	10G MR, SFP+ 1554.13, 100 GHz, LC
ONS-SC+-10G-54.9=	10G MR, SFP+ 1554.94, 100 GHz, LC
ONS-SC+-10G-55.7=	10G MR, SFP+ 1555.75, 100 GHz, LC
ONS-SC+-10G-56.5=	10G MR, SFP+ 1556.55, 100 GHz, LC
ONS-SC+-10G-57.3=	10G MR, SFP+ 1557.36, 100 GHz, LC
ONS-SC+-10G-58.1=	10G MR, SFP+ 1558.17, 100 GHz, LC
ONS-SC+-10G-58.9=	10G MR, SFP+ 1558.98, 100 GHz, LC
ONS-SC+-10G-59.7=	10G MR, SFP+ 1559.79, 100 GHz, LC
ONS-SC+-10G-60.6=	10G MR, SFP+ 1560.61, 100 GHz, LC
ONS-SC+-10G-61.4=	10G MR, SFP+ 1561.43, 100 GHz, LC
ONS-SC+-10G-30.7=	10G MR, SFP+ 1530.72, 100 GHz, LC
ONS-SC+-10G-31.5=	10G MR, SFP+ 1531.51, 100 GHz, LC
ONS-SC+-10G-32.2=	10G MR, SFP+ 1532.29, 100 GHz, LC
ONS-SC+-10G-33.0=	10G MR, SFP+ 1533.07, 100 GHz, LC
ONS-SC+-10G-33.8=	10G MR, SFP+ 1533.86, 100 GHz, LC
ONS-SC+-10G-34.6=	10G MR, SFP+ 1534.64, 100 GHz, LC
ONS-SC+-10G-35.4=	10G MR, SFP+ 1535.43, 100 GHz, LC
ONS-SC+-10G-36.2=	10G MR, SFP+ 1536.22, 100 GHz, LC
ONS-SC+-10G-37.0=	10G MR, SFP+ 1537.00, 100 GHz, LC
ONS-SC+-10G-37.7=	10G MR, SFP+ 1537.79, 100 GHz, LC
ONS-SC+-10G-38.5=	10G MR, SFP+ 1538.58, 100 GHz, LC
ONS-SC+-10G-39.3=	10G MR, SFP+ 1539.37, 100 GHz, LC
ONS-SC+-10G-40.1=	10G MR, SFP+ 1540.16, 100 GHz, LC
ONS-SC+-10G-40.9=	10G MR, SFP+ 1540.95, 100 GHz, LC
ONS-SC+-10G-41.7=	10G MR, SFP+ 1541.75, 100 GHz, LC
ONS-SC+-10G-42.5=	10G MR, SFP+ 1542.54, 100 GHz, LC
ONS-SC+-10G-43.3=	10G MR, SFP+ 1543.33, 100 GHz, LC
ONS-SC+-10G-44.1=	10G MR, SFP+ 1544.13, 100 GHz, LC
ONS-SC+-10G-44.9=	10G MR, SFP+ 1544.92, 100 GHz, LC
ONS-SC+-10G-45.7=	10G MR, SFP+ 1545.72, 100 GHz, LC
ONS-SC+-10G-46.5=	10G MR, SFP+ 1546.52, 100 GHz, LC
ONS-SC+-10G-47.3=	10G MR, SFP+ 1547.32, 100 GHz, LC
ONS-SC+-10G-48.1=	10G MR, SFP+ 1548.11, 100 GHz, LC

Part Number	Description
ONS-SC+-10G-48.9=	10G MR, SFP+ 1548.91, 100 GHz, LC
ONS-SC+-10G-49.7=	10G MR, SFP+ 1549.71, 100 GHz, LC
ONS-SC+-10G-50.5=	10G MR, SFP+ 1550.52, 100 GHz, LC
ONS-SC+-10G-51.3=	10G MR, SFP+ 1551.32, 100 GHz, LC
ONS-SC+-10G-52.1=	10G MR, SFP+ 1552.12, 100 GHz, LC
ONS-SC+-10G-52.9=	10G MR, SFP+ 1552.93, 100 GHz, LC
ONS-SC+-10G-53.7=	10G MR, SFP+ 1553.73, 100 GHz, LC
ONS-SC+-10G-54.5=	10G MR, SFP+ 1554.54, 100 GHz, LC
ONS-SC+-10G-55.3=	10G MR, SFP+ 1555.34, 100 GHz, LC
ONS-SC+-10G-56.1=	10G MR, SFP+ 1556.15, 100 GHz, LC
ONS-SC+-10G-56.9=	10G MR, SFP+ 1556.96, 100 GHz, LC
ONS-SC+-10G-57.7=	10G MR, SFP+ 1557.77, 100 GHz, LC
ONS-SC+-10G-58.8=	10G MR, SFP+ 1558.58, 100 GHz, LC
ONS-SC+-10G-59.3=	10G MR, SFP+ 1559.39, 100 GHz, LC
ONS-SC+-10G-60.2=	10G MR, SFP+ 1560.20, 100 GHz, LC
ONS-SC+-10G-61.0=	10G MR, SFP+ 1561.01, 100 GHz, LC
ONS-SC+-10G-61.8=	10G MR, SFP+ 1561.82, 100 GHz, LC

Table 10.   Ordering Information - DWDM Modules, 10G Edge Performance, Fixed Wavelength

Part Number	Description
ONS-SC+-10GEP30.3=	10G EP, SFP+ 1530.33, 100 GHz, LC
ONS-SC+-10GEP31.1=	10G EP, SFP+ 1531.12, 100 GHz, LC
ONS-SC+-10GEP31.9=	10G EP, SFP+ 1531.90, 100 GHz, LC
ONS-SC+-10GEP32.6=	10G EP, SFP+ 1532.68, 100 GHz, LC
ONS-SC+-10GEP33.4=	10G EP, SFP+ 1533.47, 100 GHz, LC
ONS-SC+-10GEP34.2=	10G EP, SFP+ 1534.25, 100 GHz, LC
ONS-SC+-10GEP35.0=	10G EP, SFP+ 1535.04, 100 GHz, LC
ONS-SC+-10GEP35.8=	10G EP, SFP+ 1535.82, 100 GHz, LC
ONS-SC+-10GEP36.6=	10G EP, SFP+ 1536.61, 100 GHz, LC
ONS-SC+-10GEP37.4=	10G EP, SFP+ 1537.40, 100 GHz, LC
ONS-SC+-10GEP38.1=	10G EP, SFP+ 1538.19, 100 GHz, LC
ONS-SC+-10GEP38.9=	10G EP, SFP+ 1538.98, 100 GHz, LC
ONS-SC+-10GEP39.7=	10G EP, SFP+ 1539.77, 100 GHz, LC
ONS-SC+-10GEP40.5=	10G EP, SFP+ 1540.56, 100 GHz, LC
ONS-SC+-10GEP41.3=	10G EP, SFP+ 1541.35, 100 GHz, LC
ONS-SC+-10GEP42.1=	10G EP, SFP+ 1542.14, 100 GHz, LC
ONS-SC+-10GEP42.9=	10G EP, SFP+ 1542.94, 100 GHz, LC
ONS-SC+-10GEP43.7=	10G EP, SFP+ 1543.73, 100 GHz, LC
ONS-SC+-10GEP44.5=	10G EP, SFP+ 1544.53, 100 GHz, LC
ONS-SC+-10GEP45.3=	10G EP, SFP+ 1545.32, 100 GHz, LC
ONS-SC+-10GEP46.1=	10G EP, SFP+ 1546.12, 100 GHz, LC
ONS-SC+-10GEP46.9=	10G EP, SFP+ 1546.92, 100 GHz, LC
ONS-SC+-10GEP47.7=	10G EP, SFP+ 1547.72, 100 GHz, LC
ONS-SC+-10GEP48.5=	10G EP, SFP+ 1548.51, 100 GHz, LC

Part Number	Description
ONS-SC+-10GEP49.3=	10G EP, SFP+ 1549.32, 100 GHz, LC
ONS-SC+-10GEP50.1=	10G EP, SFP+ 1550.12, 100 GHz, LC
ONS-SC+-10GEP50.9=	10G EP, SFP+ 1550.92, 100 GHz, LC
ONS-SC+-10GEP51.7=	10G EP, SFP+ 1551.72, 100 GHz, LC
ONS-SC+-10GEP52.5=	10G EP, SFP+ 1552.52, 100 GHz, LC
ONS-SC+-10GEP53.3=	10G EP, SFP+ 1553.33, 100 GHz, LC
ONS-SC+-10GEP54.1=	10G EP, SFP+ 1554.13, 100 GHz, LC
ONS-SC+-10GEP54.9=	10G EP, SFP+ 1554.94, 100 GHz, LC
ONS-SC+-10GEP55.7=	10G EP, SFP+ 1555.75, 100 GHz, LC
ONS-SC+-10GEP56.5=	10G EP, SFP+ 1556.55, 100 GHz, LC
ONS-SC+-10GEP57.3=	10G EP, SFP+ 1557.36, 100 GHz, LC
ONS-SC+-10GEP58.1=	10G EP, SFP+ 1558.17, 100 GHz, LC
ONS-SC+-10GEP58.9=	10G EP, SFP+ 1558.98, 100 GHz, LC
ONS-SC+-10GEP59.7=	10G EP, SFP+ 1559.79, 100 GHz, LC
ONS-SC+-10GEP60.6=	10G EP, SFP+ 1560.61, 100 GHz, LC
ONS-SC+-10GEP61.4=	10G EP, SFP+ 1561.43, 100 GHz, LC
ONS-SC+-10GEP30.7=	10G EP, SFP+ 1530.72, 100 GHz, LC
ONS-SC+-10GEP31.5=	10G EP, SFP+ 1531.51, 100 GHz, LC
ONS-SC+-10GEP32.2=	10G EP, SFP+ 1532.29, 100 GHz, LC
ONS-SC+-10GEP33.0=	10G EP, SFP+ 1533.07, 100 GHz, LC
ONS-SC+-10GEP33.8=	10G EP, SFP+ 1533.86, 100 GHz, LC
ONS-SC+-10GEP34.6=	10G EP, SFP+ 1534.64, 100 GHz, LC
ONS-SC+-10GEP35.4=	10G EP, SFP+ 1535.43, 100 GHz, LC
ONS-SC+-10GEP36.2=	10G EP, SFP+ 1536.22, 100 GHz, LC
ONS-SC+-10GEP37.0=	10G EP, SFP+ 1537.00, 100 GHz, LC
ONS-SC+-10GEP37.7=	10G EP, SFP+ 1537.79, 100 GHz, LC
ONS-SC+-10GEP38.5=	10G EP, SFP+ 1538.58, 100 GHz, LC
ONS-SC+-10GEP39.3=	10G EP, SFP+ 1539.37, 100 GHz, LC
ONS-SC+-10GEP40.1=	10G EP, SFP+ 1540.16, 100 GHz, LC
ONS-SC+-10GEP40.9=	10G EP, SFP+ 1540.95, 100 GHz, LC
ONS-SC+-10GEP41.7=	10G EP, SFP+ 1541.75, 100 GHz, LC
ONS-SC+-10GEP42.5=	10G EP, SFP+ 1542.54, 100 GHz, LC
ONS-SC+-10GEP43.3=	10G EP, SFP+ 1543.33, 100 GHz, LC
ONS-SC+-10GEP44.1=	10G EP, SFP+ 1544.13, 100 GHz, LC
ONS-SC+-10GEP44.9=	10G EP, SFP+ 1544.92, 100 GHz, LC
ONS-SC+-10GEP45.7=	10G EP, SFP+ 1545.72, 100 GHz, LC
ONS-SC+-10GEP46.5=	10G EP, SFP+ 1546.52, 100 GHz, LC
ONS-SC+-10GEP47.3=	10G EP, SFP+ 1547.32, 100 GHz, LC
ONS-SC+-10GEP48.1=	10G EP, SFP+ 1548.11, 100 GHz, LC
ONS-SC+-10GEP48.9=	10G EP, SFP+ 1548.91, 100 GHz, LC
ONS-SC+-10GEP49.7=	10G EP, SFP+ 1549.71, 100 GHz, LC
ONS-SC+-10GEP50.5=	10G EP, SFP+ 1550.52, 100 GHz, LC
ONS-SC+-10GEP51.3=	10G EP, SFP+ 1551.32, 100 GHz, LC
ONS-SC+-10GEP52.1=	10G EP, SFP+ 1552.12, 100 GHz, LC

Part Number	Description
ONS-SC+-10GEP52.9=	10G EP, SFP+ 1552.93, 100 GHz, LC
ONS-SC+-10GEP53.7=	10G EP, SFP+ 1553.73, 100 GHz, LC
ONS-SC+-10GEP54.5=	10G EP, SFP+ 1554.54, 100 GHz, LC
ONS-SC+-10GEP55.3=	10G EP, SFP+ 1555.34, 100 GHz, LC
ONS-SC+-10GEP56.1=	10G EP, SFP+ 1556.15, 100 GHz, LC
ONS-SC+-10GEP56.9=	10G EP, SFP+ 1556.96, 100 GHz, LC
ONS-SC+-10GEP57.7=	10G EP, SFP+ 1557.77, 100 GHz, LC
ONS-SC+-10GEP58.8=	10G EP, SFP+ 1558.58, 100 GHz, LC
ONS-SC+-10GEP59.3=	10G EP, SFP+ 1559.39, 100 GHz, LC
ONS-SC+-10GEP60.2=	10G EP, SFP+ 1560.20, 100 GHz, LC
ONS-SC+-10GEP61.0=	10G EP, SFP+ 1561.01, 100 GHz, LC
ONS-SC+-10GEP61.8=	10G EP, SFP+ 1561.82, 100 GHz, LC

Table 11.   Ordering Information - DWDM module, full C-Band tunable

Part Number	Description
ONS-SC+-10G-C=	10G full C-Band tunable SFP+, 50GHz, LC

Table 12.   Ordering Information - Grey SFP+ Modules

Part Number	Description
ONS-SC+-10G-SR=	SFP+ SR - Commercial Temp
ONS-SC+-10G-ER=	SFP+ ER - Commercial Temp
ONS-SC+-10G-LR=	SFP+ LR - Commercial Temp
ONS-SC+-10G-ZR=	SFP+ ZR - Commercial Temp

Table 13.   Ordering Information - Active Cable

Part Number	Description
ONS-SC+-10-CU1=	10G BASE-CU SFP+ Cable 1 Meter
ONS-SC+-10-CU3=	10G BASE-CU SFP+ Cable 3 Meter
ONS-SC+-10-CU5=	10G BASE-CU SFP+ Cable 5 Meter
ONS-SC+-10-CU7=	10G BASE-CU SFP+ Cable 7 Meter

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C78-713296-07   06/17