

Cisco MSPP-on-a-Blade Card: Multiservice Aggregation for the Cisco ONS 15454 Platform

Cisco® introduces the new Cisco Multiservice Provisioning Platform (MSPP-on-a-Blade) Card for the Cisco ONS 15454 Multiservice Transport Platform (MSTP). This multiservice aggregation card improves system flexibility by integrating time-division multiplexing (TDM) and dense wavelength-division multiplexing (DWDM) functions in a single card (Figure 1).

Figure 1. Cisco ONS 15454 MSPP-on-a-Blade Card



Background

Metropolitan (metro) transport networks must support numerous service demands, from low-rate DS-1/T1, DS-3/E3, 10/100BASE-T, and OC-3/STM-1 to higher-rate OC-12/STM-4, Gigabit Ethernet, OC-48/STM-16, OC-192/STM-64, and 10 Gigabit Ethernet services. As broadband data services are being widely adopted and Ethernet is becoming a basic protocol, service providers need more and more integration between Ethernet switching and transport to optimize capital investment and minimize operating costs. Industry trends indicate that DWDM technology is being used to transport the huge amount of bandwidth that broadband services are consuming. However traditional traffic still needs to be transported because the total Ethernet migration is still underway.

Product Overview

The Cisco Multiservice Aggregation MSPP-on-a-Blade card is a dual-slot Cisco ONS 15454 board that provides 16 Small Form-Factor Pluggable (SFP)-based client ports and three 10 Gigabit Small Form-Factor Pluggable (XFP)-based OC-192/STM-64 ports. One of the three OC-192/STM-64 ports is an interlink port and is used to provide interconnection with an identical board for the protection schemes or an OC-192/STM-64 client port in single-card configuration. The second of the three OC-192/STM-64 ports can operate as interlink in case of dual-card protection and as DWDM trunk interface in case of single-card operation. The third OC-192/STM-64 port supports G.709 digital-wrapper and Enhanced Forward Error Correction (E-FEC) capability. This trunk port can be equipped with DWDM XFP, developed to meet wavelength-division multiplexing (WDM) filter specifications and give the transponder the DWDM interface.

The 16-client port can be equipped with different SONET/SDH (OC-3/STM-1, OC-12/STM-4, or OC-48/STM-16) or Gigabit Ethernet SFPs (SX, LX, or ZX).

The Cisco MSPP-on-a-Blade combines add/drop multiplexer (ADM) and transponder functions using multirate SFP (client) and XFP (trunk) configurable interfaces to consolidate many of the aggregation functions that are traditionally performed on an MSPP with multiple service blades and common cards, including high-order SONET/SDH and Ethernet over SONET/SDH (EoS) traffic grooming and aggregation, without any need for separate cross-connect cards (Figure 2).

Figure 2. Cisco ONS 15454 MSPP-on-a-Blade Card: Physical Scheme

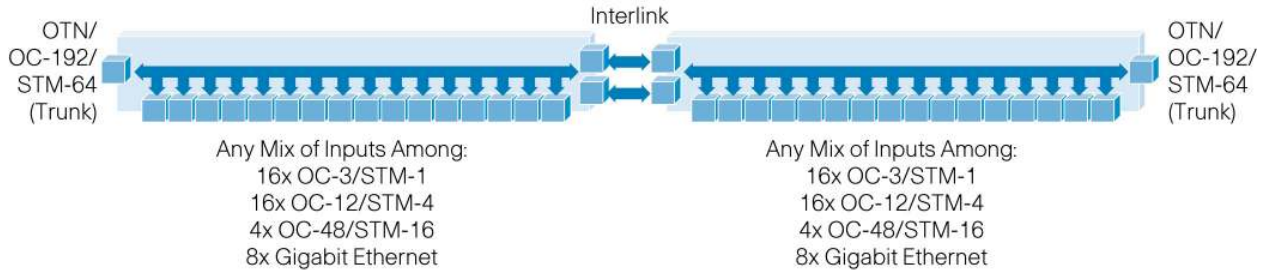
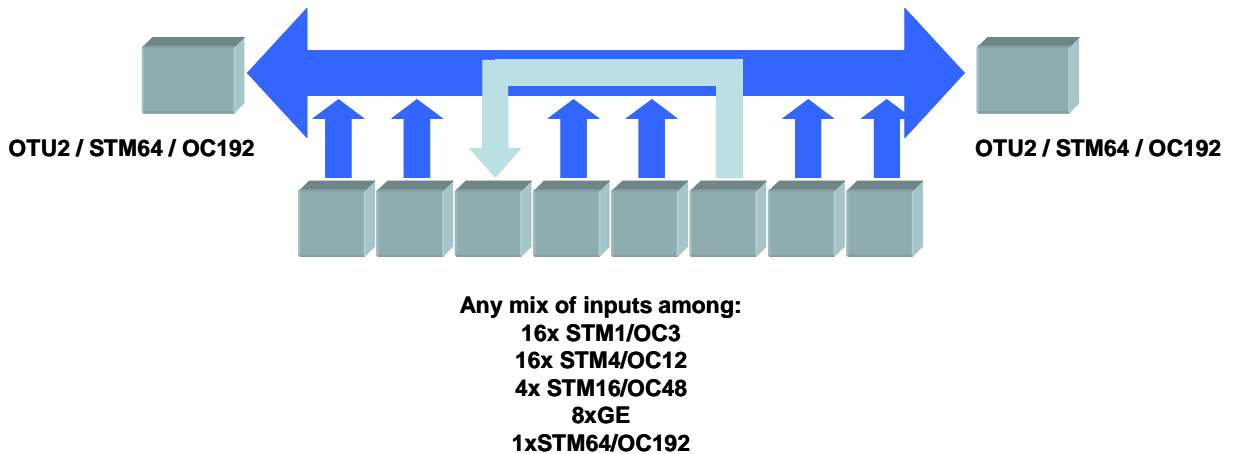


Figure 3. Cisco MSPP-on-a-Blade Physical Scheme with Single-Card Operation



The Cisco MSPP-on-a-Blade card can carry concatenated payloads of STS-3c/VC4, STS-6c/VC4-2c, STS-12c/VC4-4c, STS-18c/VC4-6c, STS-24c/VC4-8c, STS-36c/VC4-12c, and STS-48c/VC4-16c, as well as nonconcatenated payloads on an STS-1/VC4 basis. In SONET applications, the card is software-provisionable to transport SDH payloads over SONET in the form of STS-Nc-concatenated payloads (N = multiple of 3).

The card is supported by the integrated Cisco Transport Controller Craft Manager for the Cisco ONS 15454 MSPP. The controller gives the user access to operations, administration, maintenance, and provisioning (OAM&P) for the system. Access to inventory data for the installed MSPP-on-a-Blade card and pluggable optics modules is available through the craft manager, Cisco Transport Manager element management system (EMS), and Transaction Layer 1 (TL1) requests.

Maximum card bandwidth is OC-192/STM-64, the bit rate on the trunk port. Client signals can be configured and aggregated to transport up to 192 STS-1/64 VC4 equivalent traffic loads, according to the port configuration rule shown in Figure 4.

Figure 4. Port Configuration Rules for Double-Card Configuration

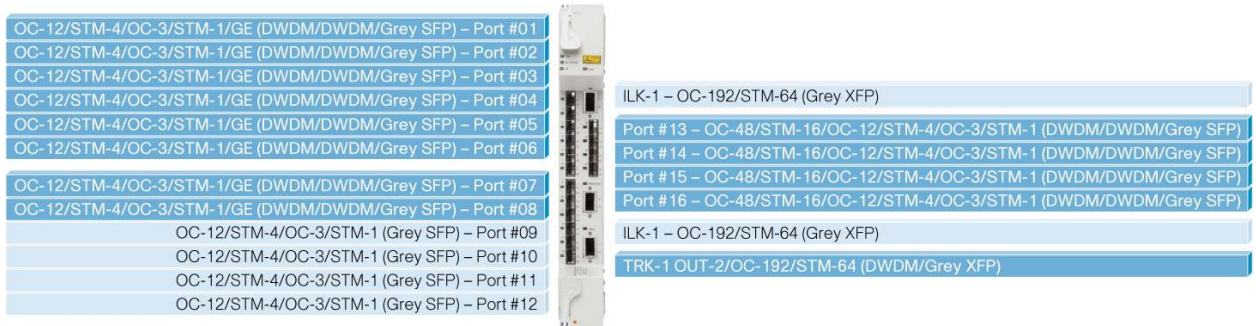
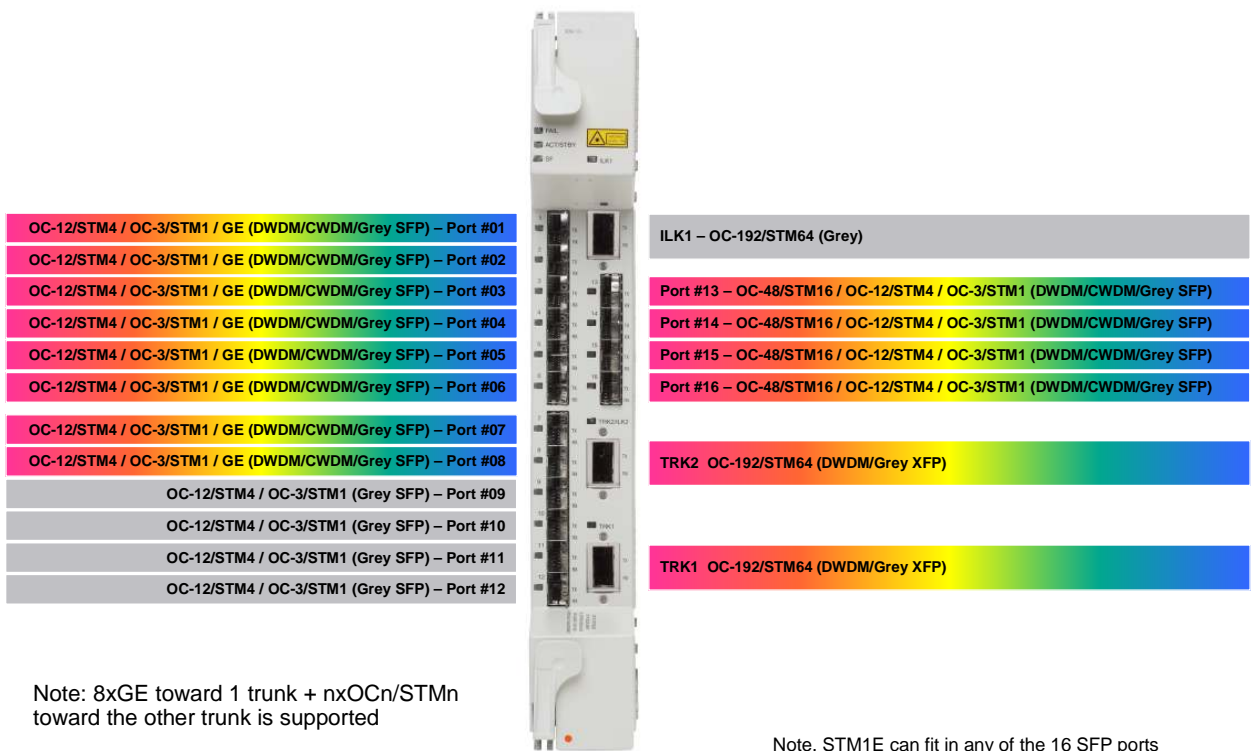


Figure 5. Port Configuration Rules for Single-Card Configuration



When provisioning an OC-48/STM-16 client on one of the following ports, no OC traffic can be provisioned on the related three ports.

Port relation:

- OC-48/STM-16 on port 13: No OC-x/STM-n on ports 1, 2, or 3
- OC-48/STM-16 on port 14: No OC-x/STM-n on ports 4, 5, or 6
- OC-48/STM-16 on port 15: No OC-x/STM-n on ports 7, 8, or 9
- OC-48/STM-16 on port 16: No OC-x/STM-n on ports 10, 11, or 12

This restriction does not affect Gigabit Ethernet payload. In any case, for each trunk, the total traffic rate on each board or for each Cisco MSPP-on-a-Blade Card peer group cannot exceed an OC-192/STM-64.

Gigabit Ethernet mapping is done through a fully standardized frame-mapped generic framing procedure (GFP-F) mechanism over STS-24c/VC4-8c concatenation.

The card also supports SDH tunneling, which allows transport of SDH signals over SONET.

Enhanced FEC Capability

A critical feature of the Cisco MSPP-on-a-Blade Card is the possibility to configure the operating mode of the trunk port through software provisioning. The following three modes (in addition to the direct OC-192/STM-64 mapping on the trunk port – 9.95328 Gbps) can be supported when G.709 operating mode is enabled:

- NO FEC: No forward error correction (10.70923 Gbps)
- FEC: Standard G.975 Reed-Salomon algorithm (10.70923 Gbps)
- E-FEC: Standard G.975.1 two orthogonally concatenated BCH super FEC codes; 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 (10.70923 Gbps)

Flexible Protection Mechanisms

The Cisco MSPP-on-a-Blade Card supports unidirectional-path switched ring/subnetwork connection protection (UPSR/SNCP) on both the trunk and client side. Unidirectional-path switched ring/subnetwork connection protection (UPSR/SNCP) is supported both in single- and double-card operation.

1 + 1 automatic protection switching/line multiplex section protection (APS/LMSP) is supported on client ports in double-card operation, both with bidirectional K1/K2 protocol and unidirectional scheme.

The rich number of available protection schemes provides the flexibility to build the type of networks required to meet service demands, traffic patterns, and user needs. This card-provisioning flexibility also helps reduce the cost of inventory and simplifies engineering and deployment.

Unprotected traffic is also supported.

Management

The Cisco ONS 15454 provides comprehensive management capabilities to support the OAM&P capabilities through the integrated Cisco Transport Controller craft interface with support from the Cisco Transport Manager EMS. The Cisco MSPP-on-a-Blade Card incorporates 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 service-level agreement (SLA) requirements. The generic communications channel (GCC) of the digital wrapper enables a separate communications channel on a per-wavelength basis. This GCC enables the Cisco ONS 15454 to extend its advanced network auto-discovery capabilities to DWDM-based services. The integrated Cisco ONS 15454 Transport Controller Craft Manager and the Cisco Transport Manager EMS give users OAM&P access for the system.

SONET and SDH management comply with relevant international standards.

Performance Monitoring

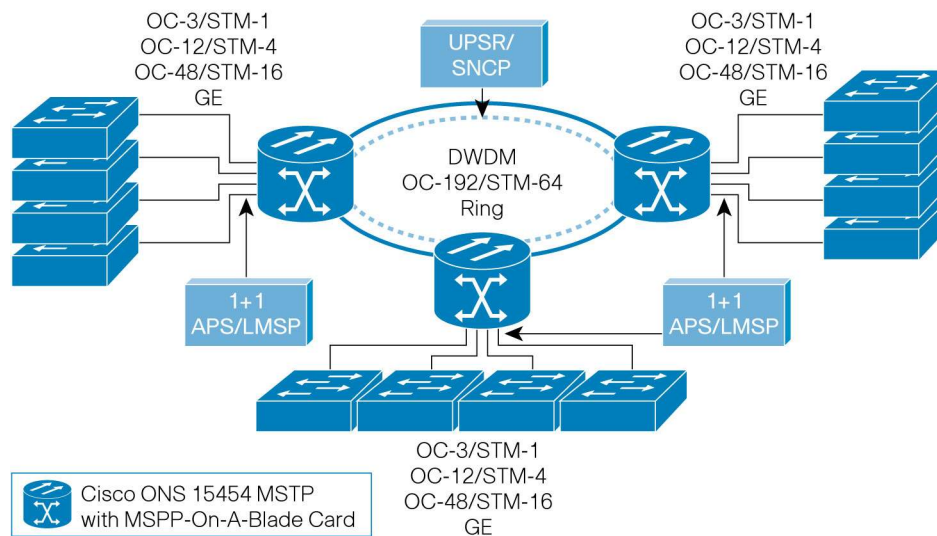
For SONET/SDH-terminated signals, standard performance monitoring and threshold crossing conditions and alarms are supported per Telcordia GR-474, GR-253, and GR-2918 (SONET system) and per ITU-T G.826 and G.828 (SDH system), as well as ITU-T G.7710, G.784, and G.8210. For Gigabit Ethernet signals, standard performance parameters for transmit and receive signals are based on RFC 3635, RFC 2358, RFC 2233, and RFC 1757. Each digital-wrapper channel is monitored per ITU-T digital-wrapper requirements (G.8201). Optical parameters on the DWDM line interface are supported, including laser bias, transmit optical power, and receiver optical power. Calculation and accumulation of the performance monitoring data is in 15-minute and 24-hour intervals.

The Cisco MSPP-on-a-Blade 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 slots into which the card can be installed.

Application Description

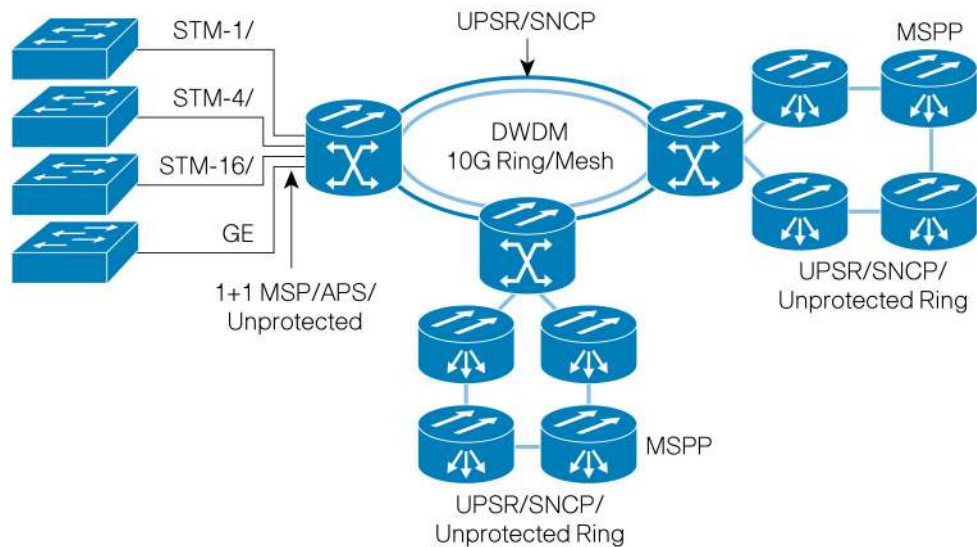
The critical capability of this unit is to enable the function of an OC-192/STM-64 node in two modules native to a next-generation DWDM system. If the clients are based on OC-3/STM-1, OC-12/STM-4, or OC-48/STM-16 and Gigabit Ethernet, then this method is very efficient for putting low-bit-rate SONET/SDH over DWDM. When a mix of SONET/SDH and Gigabit Ethernet traffic is required, the Cisco MSPP-on-a-Blade Card is especially efficient because of its ability to map Gigabit Ethernet and OC circuits onto the same wavelength with multiple protection options (Figure 6).

Figure 6. Key Applications of Cisco ONS 15454 MSPP-on-a-Blade Card



Reducing network complexity and lowering capital expenditures are primary goals in the marketplace. The high port density and multiple-reach support through pluggable optics modules enable users to consolidate network elements as well as simplify operations by reducing internetwork element cabling. In fact, the high-density Cisco MSPP-on-a-Blade Card with its flexible optical rate and reaches helps users consolidate many network elements and significantly reduce the complexity of interworkings between the various networks. Manual cabling by an onsite technician is replaced by electronic cross-connections using the Cisco Transport Controller craft management system from anywhere with network connectivity, helping improve response times to circuit additions and changes.

Figure 7. Cisco ONS 15454 MSPP-on-a-Blade Card as TDM Ring Aggregation Card



With its flexibility, density, and wide selection of service modules, the Cisco ONS 15454 MSTP supports a comprehensive mix of applications, allowing a single platform type to meet many customer requirements. These capabilities allow users to lower their operational costs by reducing technician training to a smaller base of platform types, reducing sparing requirements, and decreasing service turn-up time for improved revenue.

The Cisco Advantage

The Cisco ONS 15454 MSPP-on-a-Blade Card complements and extends the service capabilities of the Cisco ONS 15454 MSTP. The card enables carriers to take advantage of their existing fiber plant and installed base of Cisco ONS 15454 systems, while providing a completely new way to integrate SONET/SDH aggregation over the same Cisco ONS 15454 MSTP.

The Cisco ONS 15454 optical transport solution offers significant advantages over traditional network element offerings, including:

- Unprecedented service densities: The Cisco ONS 15454 MSPP-on-a-Blade supports up to 288 unprotected high-order cross connects, as well up to 192 protected (UPSR/SNCP) per card, which means 1728/1152 high-order cross connects per shelf. When installed in a typical central-office bay frame, a bay can support up to 5178/3456 high-order bidirectional cross-connection-equivalent capabilities.
- Single software load: One software load supports all restoration types listed previously, eliminating unnecessary guesswork when ordering. All protection configurations are covered under a single right-to-use software license. After the software is purchased, all features and full functions are available to the user.
- Common chassis: A common chassis supporting all optical interface speeds allows the technician to spend time deploying bandwidth and services instead of learning about multiple equipment platforms. Many equipment vendors offer optical line speed-specific platforms (for example, OC-3/STM-1 or OC-12/STM-4) and categorize platforms by restoration mechanisms, not only causing ordering confusion, but also bringing into question whether the inventoried equipment will accommodate the functions required to support the desired application. The line-rate and restoration flexibility of the Cisco ONS 15454 platform makes ordering and deploying simple, fast, and easy.

- Single TID management: The Cisco ONS 15454 platform allows common management under a single Target Identifier (TID) of all the colocated Cisco ONS 15454 shelves, integrating the SONET/SDH multiservice provisioning functionalities of the Cisco MSPP-on-a-Blade units with the transport functionalities of the pure DWDM units.
- Network-level alarm correlation: End-to-end optical circuit provisioning extended to manage the OTU-2/OC-192/STM-64 DWDM trunk port of the Cisco MSPP-on-a-Blade units allows alarm correlation at the network level to simplify network management and fault troubleshooting.

Features and Specifications

Compact Design

- Double-width card slot design for high-density ADM aggregation over OC-192/STM-64 signals
- Up to six Cisco MSPP-on-a-Blade Cards per shelf assembly

Flexible Protection Scheme

- UPSR on OC-192/SNCP on STM-64 trunk
- UPSR on OC-n/SNCP on STM-n client
- Double card with 1+1 protection group
- Single card with UPSR/SNCP on client
- Client 1+1 APS/LMSP
- Hairpinning on client side
- Unprotected (0+1)

Product Specifications

Table 1 lists regulatory compliance information and Table 2 gives system requirements for the Cisco ONS 15454 MSPP-on-a-Blade Card. Tables 3 through 7 give supported pluggable specifications, Table 8 gives card specifications, and Table 9 provides ordering information.

Table 1. Regulatory Compliance*

ANSI (SONET) System	ETSI (SDH) System
Supported Countries	
<ul style="list-style-type: none"> • Canada • United States 	<ul style="list-style-type: none"> • Europe • Latin America • Japan • Asia Pacific • Middle East and Africa
EMC (Class A)	
<ul style="list-style-type: none"> • ICES-003 Issue 3 (1997) • GR-1089-CORE, Issue 3 • FCC 47CFR15 subpart B (2004) 	<ul style="list-style-type: none"> • EN 300 386 v1.3.3 (2005) • CISPR22 (2005), CISPR24 (+ Am 1, Am.2 2002) • EN55022 and EN55024
Safety	
<ul style="list-style-type: none"> • UL/CSA 60950 – 1 First Edition (2003) • GR-1089-CORE , Issue 3 	<ul style="list-style-type: none"> • UL/CSA 60950 – 1 First Edition (2003) • IEC 60950 – 1 (2001-01) First Edition/EN60950 – 1 (2001), First Edition
Laser	

ANSI (SONET) System	ETSI (SDH) System
<ul style="list-style-type: none"> UL/CSA 60950 – 1 First Edition (2003) IEC 60950 – 1 (2001-01) First Edition/EN60950 – 1 (2001), First Edition IEC 60825 – 2 (2004-06) Third Edition IEC 60825 – 1 +Am.1+ Am.2 (2001) CDRH (Accession letter and report) 	
Environmental	
<ul style="list-style-type: none"> GR-63-CORE, Issue 2 and Issue 3 	<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)
Optical	
<ul style="list-style-type: none"> G.709 G.975 	
Miscellaneous	
<ul style="list-style-type: none"> AT&T Network Equipment Development Standards (NEDS) Generic Requirements, AT&T 802-900-260 SBC TP76200MP Verizon SIT.NEBS.NPI.2002.010 Worldcom ESD requirement 	

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

Table 2. System Requirements

Component	Cisco ONS 15454 ANSI (SONET)	Cisco ONS 15454 ETSI (SDH)
Processor	TCC2P and TCC2	TCC2P and TCC2
Cross-connect	Not supported	Not supported
Shelf assembly	15454-SA-HD or 15454-SA-HD-DDR shelf assembly with CC-FTA version fan-tray assembly	15454E-SA-ETSI shelf assembly with CC-FTA version fan-tray assembly
System software	Release 8.0 or later	Release 8.5 or later
Slot compatibility	1 to 6 and 12 to 17	1 to 6 and 12 to 17

Table 3. Supported SFP Specifications*

Product ID	Supported Bit Rates	Operating Mode	Port Number
ONS-SC-155-EL=	STM1 Electrical	Electrical	From 1 to 16
ONS-SI-155-L2=	OC-3 LR1/STM-1 L-1.2	1550 nm	From 1 to 16
ONS-SI-622-I1=	OC-3 IR1/STM-1 S-1.1 OC-12 IR1/STM-4 S-4.1	1310 nm	From 1 to 16
ONS-SI-2G-S1=	OC-48 SR1/STM-16 I-16.1	1310 nm	From 13 to 16
ONS-SI-2G-L2=	OC-48 LR2/STM-16 L-16.2	1550 nm	From 13 to 16
ONS-SE-Z1=	OC-3 SR1/STM-1 I-1.1 OC-12 SR1/STM-4 I-4.1 OC-48 IR1/STM-16 S-16.1 GE 1000BASE-LX	1310 nm	From 1 to 16 From 1 to 16 From 13 to 16 From 1 to 8
ONS-SC-2G-xx.x=	OC-48 DWDM/STM-16 DWDM GE DWDM	DWDM	From 13 to 16 From 1 to 8
ONS-SC-Z3-xxxx=	OC-48 CWDM/STM-16 CWDM GE CWDM	CWDM	From 13 to 16 From 1 to 8
ONS-SE-G2F-LX=	GE 1000BASE-LX	1310 nm	From 1 to 8
ONS-SE-G2F-SX=	GE 1000BASE-SX	850 nm	From 1 to 8
ONS-SI-GE-ZX=	GE 1000BASE-ZX	1550 nm	From 1 to 8

* For up-to-date information on pluggables qualified for use with the Cisco MSPP-on-a-Blade Card, please visit: http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/brochure_c02-452560.html

Table 4. Supported XFP Specifications*

Product ID	Supported Bit Rates	Operating Mode	Port Number
ONS-XC-10G-S1=	OC-192 SR1/STM-64 I-64.1	1310 nm	ILK1, TRK2/ILK2, TRK1
ONS-XC-10G-xx.x=	OC-192 DWDM/STM-64 DWDM OTU-2 DWDM	DWDM	TRK1, ILK2
ONS-XC-10G-C=	OC-192 DWDM/STM-64 DWDM OTU-2 DWDM	DWDM	TRK1, ILK2

* For up-to-date information on pluggables qualified for use with the Cisco MSPP-on-a-Blade Card, please visit: http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/brochure_c02-452560.html.

Table 5. xWDM Optical Specifications

Specification	DWDM XFP (ONS-XC-10G-xx.x=)	DWDM SFP (ONS-SC-2G-xx.x=)	CWDM SFP (ONS-SC-Z3-xxxx=)
Automatic Laser Shutdown and Restart	Compliant with ITU-T G.664 (06/99)	Compliant with ITU-T G.664 (06/99)	Compliant with ITU-T G.664 (06/99)
Transmitter Wavelength Range	Single wavelength on 100-GHz grid (see Table 6)	Single wavelength on 100-GHz grid (see Table 6)	Single wavelength on 100-GHz grid (see Table 7)
Transmitter Output Power	-1 dBm (min.) / 3 dBm (max.)	0 dBm (min.) / 4 dBm (max.)	0 dBm (min.) / 4 dBm (max.)
Receiver Wavelength Range	1260 nm to 1607 nm	1260 nm to 1607 nm	1460 nm to 1620 nm
Input Power Sensitivity (Power Limited)	-7 dBm to -24 dBm (BER $\leq 7 \times 10^{-4}$) (E-FEC), OSNR ≥ 23 dB (0.5 nm RBW), CD tolerance -500 ps/nm to 1300 ps/nm)	-9 dBm to -25 dBm (BER $\leq 10^{-12}$) (no FEC), OSNR ≥ 14 dB (0.5 nm RBW), CD tolerance -800 ps/nm to 2400 ps/nm)	-9 dBm to -28 dBm (BER $\leq 10^{-10}$) (no FEC))
Input Power Sensitivity (OSNR Limited)	-7 dBm to -18 dBm (BER $\leq 7 \times 10^{-4}$) (E-FEC), OSNR ≥ 9 dB (0.5 nm RBW), CD tolerance -500 ps/nm to 1100 ps/nm)	-9 dBm to -19 dBm (BER $\leq 10^{-12}$) (no FEC), OSNR ≥ 9 dB (0.5 nm RBW), CD tolerance -800 ps/nm to 2400 ps/nm)	-

Table 6. Supported Wavelengths on DWDM Pluggable Units – C Band

xx.x	(nm)	ONS-XC-10G-xx.x=	ONS-SC-2G-xx.x=
28.7	1528.77		X
30.3	1530.33	X	X
31.1	1531.12	X	X
31.9	1531.90	X	X
32.6	1532.68	X	X
33.4	1533.46	X	X
34.2	1534.25	X	X
35.0	1535.04	X	X
35.8	1535.82	X	X
36.6	1536.61	X	X
37.4	1537.40	X	
38.1	1538.19	X	X
38.9	1538.98	X	X
39.7	1539.77	X	X
40.5	1540.56	X	X
41.3	1541.34	X	X
42.1	1542.14	X	X
42.9	1542.94	X	X
43.7	1543.73	X	X

xx.x	(nm)	ONS-XC-10G-xx.x=	ONS-SC-2G-xx.x=
44.5	1544.53	X	X
45.3	1545.32	X	
46.1	1546.12	X	X
46.9	1546.92	X	X
47.7	1547.72	X	X
48.5	1548.51	X	X
49.3	1549.31	X	X
50.1	1550.12	X	X
50.9	1550.92	X	X
51.7	1551.72	X	X
52.5	1552.52	X	X
53.3	1553.32	X	
54.1	1554.13	X	X
54.9	1554.94	X	X
55.7	1555.75	X	X
56.5	1556.55	X	X
57.3	1557.36	X	X
58.1	1558.17	X	X
58.9	1558.98	X	X
59.7	1559.79	X	X
60.6	1560.61	X	X
61.4	1561.41	X	

Table 7. Supported Wavelengths on CWDM SFP Units

xxxx	λ (nm)	ONS-SC-Z3-xxxx=
1470	1470	X
1490	1490	X
1510	1510	X
1530	1530	X
1550	1550	X
1570	1570	X
1590	1590	X
1610	1610	X

Table 8. Card Specifications

Specification	
Management	
Card LEDs <ul style="list-style-type: none"> • Failure (FAIL) • Active/standby (ACT/STBY) Signal fail (SF) Client port LEDs <ul style="list-style-type: none"> • Active input signal DWDM port LEDs <ul style="list-style-type: none"> • Active input signal • Output wavelength 	Red Green/yellow Yellow Green Green Green

Specification	
General Specifications	
Card power draw <ul style="list-style-type: none"> • Typical • Maximum 	109W (no pluggables included) 155W (including all worst-case pluggables)
Weight (not including clam shell)	5.07 lbs (2.3 kg)
Reliability	
Predicted MTBF	146,930 hours
Operating Environment	
Temperature	23 to 131F (-5 to 55°C)
Humidity	5 to 95% non condensing
Storage Environment	
Temperature	23 to 131F (-5 to 55°C)
Humidity	5 to 95% non condensing
Transportation Environment	
Temperature	-40 to 158F (-40 to 70°C)
Humidity	5 to 95% non condensing

Table 9. Ordering Information*

Part Number	Description
15454-ADM-10G =	MSPP-on-a-Blade OC192 3/12/48/GE 16-Client
ONS-XC-10G-xx.x=	OC-192/STM64/10GE, XFP, 15xx.xx (see Table 6), 100 GHz, LC
ONS-XC-10G-C=	OC-192/STM64/10GE, XFP, Full C band, 50 Ghz
ONS-XC-10G-S1=	10 Gigabit SFP OC-192/STM-64/10 GE/10-Gbps Fibre Channel, 1310 SR-SM LC connectors
ONS-SC-155-EL=	SFP – STM1 Electrical
ONS-SI-155-L2=	OC3/STM1 LR, 1550 nm, Small Form Pluggable (SFP), ITEMP
ONS-SI-622-I1=	OC12/STM4 and OC3/STM1 IR, 1310 nm, SFP ITEMP
ONS-SI-2G-S1=	OC48/STM16, SR1, 1310nm, Small Form Pluggable (SFP), I-Temp
ONS-SI-2G-L2=	OC48/STM16, LR2, 1550nm, Small Form Pluggable (SFP), I-Temp
ONS-SE-Z1=	OC48IR1,12/3SR1,GE LX STM S-16.1,I-4,I-1 EXT
ONS-SC-2G-xx.x=	SFP – OC-48/STM16, 15xx.xnm, 100 GHz, SM, LC
ONS-SC-Z3-xxxx=	SFP – OC48/STM16/GE, CWDM, xxxx nm, Commercial Temp
ONS-SE-G2F-LX=	GE/1G-FC/2G-FC/HDTV – 1310nm – SM – LC - EXT TEMP
ONS-SE-G2F-SX=	GE/1G-FC/2G-FC – 850nm – MM – LC – EXT TEMP
ONS-SI-GE-ZX=	SFP – 1000BASE-ZX Gigabit Ethernet, 1550, SM, I-Temp

* For up-to-date information on pluggables qualified for use with the Cisco MSPP-on-a-Blade Card, please visit:
http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/brochure_c02-452560.html



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