

Cisco ONS 15216 Metropolitan Dense Wavelength Division Multiplexing

The Cisco ONS 15216 Cisco's Metropolitan Dense Wavelength-Division Multiplexing (DWDM) solution is the first metro DWDM solution to deliver instant wavelengths to buildings, premises, or points of presence (POPs). The Cisco ONS 15216 supercharges wavelength services by supporting up to 32 ITU-grid wavelengths, and provides unprecedented transport flexibility with optical filtering, optical add/drop multiplexing (OADM), optical performance monitoring, and amplification. The Cisco ONS 15216 allows service providers to deliver more services per wavelength and more wavelengths per fiber to achieve radical economic benefits.

The Cisco ONS 15216 optical filter solution enables service providers to deploy point-to-point, bus, ring, and meshed networks using the terminal filter multiplexing and demultiplexing and OADM. The Cisco ONS 15216 platform provides an open and flexible solution to combine wavelengths launched by the Cisco ONS 15454, ONS 15252, ONS 15201, and ONS 15530. The Cisco ONS 15216 supercharges wavelength services and extends Cisco's optical leadership to metro regional DWDM.

The Cisco ONS 15216 Metropolitan DWDM filter solution for 100-GHz wavelength spacing includes the following elements:

- 32-wavelength terminal filter solution (multiplexing and demultiplexing)
 - 16-wavelength base red filter
 - 16-wavelength upgrade blue filter
- OADMs
 - One-channel, two-path OADM
 - Two-channel, two-path OADM
 - Four-channel, two-path OADM

32-Wavelength Terminal Filter

The Cisco ONS 15216 red and blue filters allow service providers to multiplex multiple ITU grid wavelengths launched by the Cisco ONS 15454 and ONS 15252 onto a single fiber, maximizing network capacity and fiber utilization.

The Cisco ONS 15216 Base Red Filter

The base filter assembly, the Cisco ONS 15216 red filter, is a passive unit comprising a 100-GHz 16-x-1 wavelength unidirectional multiplexer (mux) and a 100-GHz 1-x-16 wavelength unidirectional demultiplexer (demux) operating in the 1546- to 1561-nanometer (nm) frequency band. The mux and demux systems connect independent fibers to the carrier's fiber facilities through the common ports on the chassis faceplate. The base unit integrates two pairs of expansion ports, enabling in-service upgrades from 16 mux/demux wavelengths to 32 wavelengths. The base unit also incorporates two monitor ports, allowing the user unobtrusive access to the transmit and receive signals (see Figure 1) for monitoring or analysis. The filter mounts in a 19- or 23-inch rack and occupies two rack units (RU).

The Cisco ONS 15216 Upgrade Blue Filter

The upgrade filter assembly, the Cisco ONS 15216 blue filter, is a passive unit comprising a 100-GHz 1-x-16 wavelength unidirectional multiplexer and a 100-GHz 1-x-16 wavelength unidirectional demultiplexer operating in the 1530- to 1545-nm frequency band. The front-panel common connector ports on the upgrade filter are used to connect to the base unit's upgrade ports via user-supplied optical patch cords. The filter mounts in a 19- or 23-inch rack and occupies two RU.

Figure 1
Cisco ONS 15216 Base Red Filter



Figure 2
Cisco ONS 15216 Upgrade Blue Filter



Cisco ONS 15216 OADMs

The Cisco ONS 15216 optical add/drop multiplexers (OADMs) allow service providers to deliver wavelengths to the building in single-channel increments, and to combine wavelengths from the Cisco ONS 15454, ONS 15252, ONS 15201, and ONS 15530 platforms.

The Cisco ONS 15216 offers three OADMs: A one-channel, two-path OADM that allows service providers to add and drop one protected channel (one in each direction east and west) at any point in a DWDM ring; a two-channel, two-path OADM that allows service providers to add and drop two protected channels; and a four-channel, two-path OADM that allows service providers to add and drop four protected channels (See Figures 3, 4, and 5). The 1 and 2 Channel OADMs are packaged in a compact, 1-RU 19- or 23-inch rack-mounted shelf. The 4 Channel OADM is packaged in a compact, 2-RU 19- or 23-inch rack-mounted shelf. Software-controlled variable optical attenuators are available at the add ports of the units to attenuate the power level of the added channel to match the express stream. This enables the user to ensure the channel being added does not negatively impact the uniformity of the spectrum. This is particularly important for amplified applications where the flatness response of the C-band erbium doped fiber amplifier (EDFA) is directly linked to the uniformity of the input stream. Two output monitor tap ports are also provided in the same chassis to monitor the outgoing signals in east and west directions.

Figure 3
Front-Panel Port Layouts for the Cisco ONS 15216 100-GHz OADM1



Figure 4
Front-Panel Port Layouts for the Cisco ONS 15216 100-GHz OADM2



Figure 5
Front-Panel Port Layouts for the Cisco ONS 15216 100-GHz OADM4



Cisco ONS 15216 EDFA-2

The Cisco ONS 15216 Erbium Doped Fiber Amplifier 2 (EDFA-2) is a C-Band amplifier, which allows all of the 32 channels to be amplified. This is a unidirectional device and is packaged in a 1-RU 19- or 23-inch rack-mounted shelf. The amplifier's high gain and performance allows for the design of systems which have channels that span hundreds of kilometers. Using the Automatic Gain Control, designs and systems can gracefully grow from 1 to 32 channels without complete equipment upgrades. This amplifier has active monitoring capabilities via its Ethernet or RS-232 interfaces. It also incorporates an output tap for unobtrusive monitoring of the launched DWDM signal and contact closure outputs for alarm reporting.

Figure 6
Front-Panel Port Layouts for the Cisco ONS 15216 EDFA-2



Cisco ONS 15216 OPM

The Cisco ONS 15216 Optical Performance Monitor (OPM) is a device that provides proactive monitoring and alarming capabilities of the DWDM line by monitoring each of the wavelengths within the DWDM system. On a per-wavelength basis, the OPM can monitor and alarm the center wavelength, channel power, and optical signal-to-noise ratio (OSNR). This active monitoring function is done in a 2-RU 19- or 23- inch rack-mounted shelf. It can monitor up to two DWDM lines per device. This is important for detecting degradation of optical signals and for ease of troubleshooting in complex DWDM systems.

Figure 7
Front-Panel Port Layouts for the Cisco ONS 15216 OPM



Cisco ONS 15216 DCU

The Cisco ONS 15216 dispersion compensation units (DCUs) are devices that provide compensation of chromatic dispersion for SMF-28 fiber. These units apply to the entire C-band allowing one or many wavelengths to be compensated. These devices are mounted in a 1-RU 19- or 23- inch rack mounted shelf. This shelf offers two slots that can be populated with 350, 750, or 1150 ps/nm passive DCU modules. These devices are critical in extending the distance between 3R regeneration points for 10-Gbps networks.

Figure 8
Front-Panel Port Layouts for the Cisco ONS 15216 DCU

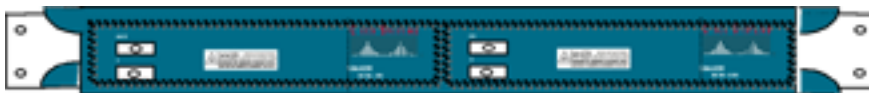


Table 1 Dispersion Compensation

Connector type	LC-UPC
Negative effect wavelength range	1525-1565 nm
Reference wavelength	1545.32 nm
DCU-350 ps/nm	<2.6dB typical loss (< 3.0dB worse case)
DCU-750 ps/nm	<4.4dB typical loss (< 4.8dB worse case)
DCU-1150 ps/nm	<5.8dB typical loss (< 6.2dB worse case)
Temperature range	-5-55 C
Relative humidity	95% maximum, non-condensing
Dispersion value over temperature	Dispersion Value +/-3%
Insertion loss variance over temperature	<0.6dB
Polarization mode dispersion (PMD)	<1ps
Dimensions (H x W x D)	1.62 x 8.20 x 8.07 in. (41.1 x 208.2 x 204.9 mm)
Weight	Minimum 4.4 lb (2 kg) Maximum 7.7 lb (3.5 kg)

Cisco ONS 15216 Solution Benefits

- *Supercharged wavelength services*—Allows service providers to aggregate subwavelength services onto DWDM networks to maximize service density and revenue per wavelength. Subwavelength services can be combined with wavelength services on the same network.
- *Unprecedented transport flexibility*—Supports a range of applications from point-to-point DWDM to more advanced OADM rings scaling to several-hundred-kilometer ring circumferences. Supports up to 32 OADM sites, using a combination of Cisco ONS 15252, ONS 15201 metro DWDM platforms, and ONS 15454 and ONS 15327 optical transport platforms.
- *Radical economics*—Value reduces network costs by eliminating transponders using the ITU interfaces available for the Cisco ONS 15454 or other ITU-enabled, multiservice platforms. Also provides highly cost-effective solutions for transponder-based services using the Cisco ONS 15252 and ONS 15201, particularly for amplified networks where the Cisco ONS 15216 EDFA is used.
- *Small footprint*—The one-channel and two-channel OADMs are only a single RU, and the mux/demux terminal filters and four-channel OADMs are only two RUs, saving costly equipment space.
- *Easy channel upgrades*—Upgrades from base red filters to blue filters can be accomplished without disturbing existing channels on the red filter. Additional OADM sites can easily be added by switching over traffic to the protection path.
- *Network management integration*—The active components in the filter solution—the OADMs—are managed through the Cisco Transport Manager element management system. Cisco Transport Manager provides integrated management of the complete optical network, including all other Cisco optical products.

Specifications

Table 2 Multiplexing/Demultiplexing Terminal Filters

Optical parameters	Cisco 15216 mux/demux
Channel spacing	100 GHz
Center wavelengths, base red filter	1546.12 nm 1546.92 nm 1547.72 nm 1548.51 nm 1550.12 nm 1550.92 nm 1551.72 nm 1552.52 nm 1554.13 nm 1554.94 nm 1555.75 nm 1556.55 nm 1558.17 nm 1558.98 nm 1559.79 nm 1560.61 nm
Center wavelengths, upgrade blue filter	1530.33 nm 1531.12 nm 1531.90 nm 1532.68 nm 1534.25 nm 1535.04 nm 1535.82 nm 1536.61 nm 1538.19 nm 1538.98 nm 1539.77 nm 1540.56 nm 1542.14 nm 1542.94 nm 1543.73 nm 1544.53 nm
End-to-end insertion loss, mux+demux	<11 dB
Channel uniformity, mux+demux	<1.2 dB
Filter passband	ITU +/-0.11 nm
Passband flatness	<0.5 dB
Isolation of dropped channels	>25 dB for adjacent >28 dB for second adjacent >40 dB for nonadjacent
Polarization dependent loss	<0.35 dB
Polarization mode dispersion	<0.5 ps
Directivity	>50 dB
Optical return loss	>40 dB
Insertion loss of monitor ports	17.8 +/- 1 dB

Table 2 Multiplexing/Demultiplexing Terminal Filters

Optical parameters	Cisco 15216 mux/demux
Temperature	
Operating	0 to 70 C
Storage	-40 to +85 C
Connector type	SC/UPC
Dimensions H x W x D	3.5 x 17 x 11 in. (89 x 437 x 279 mm)
Certification	NEBS3, UL

Table 3 Cisco 15216 OADMs

Parameters	Cisco 15216 OADM1	Cisco 15216 OADM2	Cisco 15216 OADM4
Channel spacing	100 GHz	100 GHz	100 GHz
Number of wavelength versions	32	16	8
End-to-end insertion loss	<1.6 dB pass through <2.2 dB drop <3.2 dB add	<2.0 dB pass through <2.5 dB drop <3.5 dB add	<1.5 dB pass through <3.6 dB drop <4.5 dB add
Filter passband	ITU +/- 0.10 nm	ITU +/- 0.10 nm	ITU +/- 0.10 nm
Passband flatness	<0.5 dB	<0.5 dB	<0.5 dB
Isolation of dropped channels	>25 dB for adjacent >40 dB for non adjacent	>25 dB for adjacent >40 dB for non adjacent	>25 dB for adjacent >40 dB for non adjacent
Polarization mode dispersion	<0.1 ps	<0.1 ps	<0.1 ps
Directivity	>40 dB	>40 dB	>40 dB
Optical return loss	>40 dB	>40 dB	>40 dB
Insertion loss of monitor ports	17.8 +/- 1 dB	17.8 +/- 1 dB	17.8 +/- 1 dB
VOA dynamic range	>35 dB	>35 dB	>35 dB
Connector type	SC/UPC	SC/UPC	SC/UPC
Temperature			
Operating	0 to 55 C	0 to 55 C	0 to 55 C
Storage	-40 to 85 C	-40 to 85 C	-40 to 85 C
Input voltage	-48 VDC A+B	-48 VDC A+B	-48 VDC A+B
Power consumption	<25W	<25W	<25W
Network management			
Physical interfaces	Ethernet, RS232 contact closures	Ethernet, RS232 contact closures	Ethernet, RS232 contact closures
Protocols supported	FTP, TL1, CLI	FTP, TL1, CLI	FTP, TL1, CLI
Dimensions H x W x D	1.75 x 17 x 11 in. (44 x 437 x 279 cm)	1.75 x 17 x 11 in. (44 x 437 x 279 cm)	3.5 x 17 x 11 in. (44 x 437 x 279 cm)
Certification	NEBS3, UL	NEBS3, UL	NEBS, UL

Table 4 Cisco 15216EDFA-2

Parameters	Cisco 15216 EDFA-2
Channel spacing	100 or 200 GHz
Connector type	SC/UPC
Gain range	13-22 dB +/-1.25dB
Optical return at input	27dB
Optical reflectance at output	27dB
Input signal wavelength	1530 to 1563 nm
Total output power	17+/-0.6dBm
Total input power	-27 dBm to +4 dBm
VOA range	10dB
VOA turning speed	20ms for 10dB
Noise figure @ 22dB gain	7 dB
Polarization dependent gain	+/-0.6dB
Backward amplified spontaneous emission	<-25dBm
Polarization mode dispersion	<0.6ps
Gain flatness	<2.0dB
Connector type	SC/UPC
Temperature	
Operating	0 to 55 C
Storage	-40 to 85 C
Input voltage	-48 VDC A+B
Power consumption	<25W
Network management	
Physical interfaces	Ethernet, RS232, contact closures
Protocols supported	FTP, SNMP, CLI
Dimensions H x W x D	1.75 x 17 x 11 in. (44 x 437 x 279 mm)
Certifications	NEBS3, UL

Table 5 Cisco 15216 OPM

Parameters	Cisco 15216 OPM
Number of channels	20 channels at 200 Ghz, 40 channels at 100 Ghz
Wavelength range	1530.334 to 1561.419 (variable range)
Fiber connector type	SC/UPC
Channel spacing	100 Ghz or greater channel spacing

Table 5 Cisco 15216 OPM

Parameters	Cisco 15216 OPM
Spectral width (peak-to-peak)	31.5 nm
Band type	C
Wavelength accuracy	+/- 0.02 nm
Wavelength resolution	0.01 nm
Wavelength stability	0.01 nm
Power accuracy	+/-0.5 dB
Power resolution	0.1 dB
Power Measurement Range	
Peak finding mode	-10 dBm +/-3 dB to -50 dBm +/-3 dB
Channel monitoring mode	-10 dBm +/-3 dB to -70 dBm +/-3 dB
Noise floor	-70 dBm +/- 3 dB
OSNR	30 dB@0.1 nm bandwidth
Power, and wavelength measurement Interval	10 msec
OSNR measurement Interval	100 msec
Operating temperature	0-50 C
Storage temperature (ambient)	-10 to 70 C
Humidity storage (non-condensing, 29 C ambient temp, with humidity of 0.024 lb of water per pound of dry air)	5 to 95%
Humidity operation (non-condensing, 29 C ambient temp, with humidity of 0.024 lb of water per pound of dry air)	5 to 95%
Electrical power consumption	10W maximum
Front panel LEDs	Active Green LED when power on and functional; Yellow LED when threshold alarm or minor fault; Red LED on Failure
Alarm output	8 wire via RJ45 connector, allowing up to 4 form C discrete external alarm outputs. Default state of alarm outputs will be N.O. (Normally Open). Discrete external alarms reported include: Minor, Major, Critical, and Informational
Power supply input voltage	Power supplies can vary: One (1) or two (2) -48V DC
Voltage range (function)	40.5V dc to -57.0V dc. Will handle 0V dc to -60.0Vdc without damage
Power supply connections	Via screw-on (4 screw) terminal block on front panel
Power supply feeds	Dual feeds available from rear or front panel depending on configuration
Console interface connector(s)	Local access via One (1)-RS-232/DB9, Local or remote access via Two (2)-10BASET/RJ45s available in front or rear of chassis
Chassis dimensions (W x D x H)	2RU 17.2 x 11 x 3.5 in.
Rack mount	19, 23 in.

Cisco CLI Software Features	
Command line interface (CLI) <ul style="list-style-type: none"> • Configuration and retrieval of LAN interface (10BASET) commands • Retrieval of ONS 15216 OPM device specific parameters • Configuration of threshold alarms • Retrieval commands of ONS 15216 OPM monitored device • Retrieval of alarms generated by ONS 15216 OPM • Configuration of security • Events log • Alarm thresholds (User configurable) 	<p>CLI will be available for provisioning and monitoring IP address, subnet mask</p> <p>ONS 15216 OPM name, ONS 15216 OPM time, temperature, spectrum, spectrum power, status</p> <p>Wavelength threshold, power threshold, OSNR threshold</p> <p>Wavelength threshold, wavelength value, power threshold, power value, OSNR threshold, OSNR value</p> <p>Channel alarms, ONS 15216 OPM power supply, software/hardware errors, device alarms, temperature, security</p> <p>Ability to configure user password security</p> <p>Up to 1000 events can be stored</p> <p>Yes, on power, wavelength and OSNR</p>
Switch monitoring	This feature will switch between 2 fiber ports every 30 seconds.
Performance data logging	The ONS 15216 OPM will retain data using sixty 60 one-minute buckets, 24 one-hour buckets, and 7 one-day buckets.
General Software Features	
Software download	The ONS 15216 OPM will have the ability to store 2 ONS 15216 OPM software images, where either image can be loaded via CLI.
Time zones	GMT format
FTP server	The ONS 15216 OPM will act as a server for file requests.
Cisco SNMP Software Features	
SNMP V1.0	Yes, for provisioning and monitoring, which includes IETF RFCs 1155, 1212, 1213, 1157, 1215
SNMP v2c	Yes, for provisioning and monitoring, which includes IETF RFCs 1155, 1157, 1213, 1901, 1905, 1906, 2237, 2578, 2579, 2580
SNMP Set/Get commands	Set and Get commands will mirror what is available via the Cisco CLI with exceptions such as IP address, Subnet Mask and IP routing
SNMP fault management: SNMP traps/alarm table	This functionality is based on alarm events. The ONS 15216 OPM will issue clear trap when each alarm is cleared.
SNMP ONS 15216 OPM chassis management (entity MIB)	This functionality provides management of the physical aspects (e.g. chassis inventory information) of the ONS 15216 OPM chassis.
SNMP provisioning/control/configuration	This functionality provides a means to provision, configure and control the ONS 15216 OPM.
SNMP community string	Different community string supported for each SNMP manager.
SNMP security switch for SNMP sets	A switch mechanism will be implemented to disable SNMP "sets" to the ONS 15216 OPM and Cisco Transport Manager application. When the switch is made, an authorized user will only be able to initiate "sets" through the Cisco CLI.
SNMP Manager addresses	Up to 10 supported for trap reporting and SNMP requests
SNMP values acquisition	This functionality provides a means to acquire values for such things as power, wavelength and OSNR.
SNMP alarm definition	This functionality provides the means to define and clear alarms, and alarm thresholds (e.g. minimum value, maximum value). Alarm thresholds are user configurable and alarms can be generated for power, wavelength and OSNR.

Cisco CLI Software Features

SNMP performance data	This functionality provides the means to set up performance data gathering over different time periods. In terms of switch monitoring, this functionality will switch between 2 fiber ports every 30 seconds. The ONS 15216 OPM will retain data using 60 one-minute buckets, 24 one-hour buckets and 7 one-day buckets.
SNMP event history and event log	This functionality allows historical event and channel data to be collected over time. Up to 1000 events can be stored.
SNMP MIB compliance requirements	This portion of the MIB defines the compliance requirements for the application or agent developer in complying with the MIB.

Agency Compliance Version 1.0

NEBS Level 3 per Telcordia SR-3580 (includes sections of GR-063 GR-1089 CORE)	Yes
FCC Part 15/ICES-003 Class A	Yes
UL 1950/CSA 60950 Safety	Yes
CSA C22.2 No. 950-95	Yes
Verizon NEBS RNSA-NEB-95-0003, Rev 10a issued August 1, 2000.	Yes
CE Mark—19 Countries covered, including: Austria, Belgium, Denmark, England (UK), Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxemburg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland.	Yes

For More Information

For more information about the Cisco ONS 15216 visit:

<http://www.cisco.com/en/US/products/hw/optical/ps1996/ps1999/index.html>



Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: 31 0 20 357 1000
Fax: 31 0 20 357 1100

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-7660
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
Capital Tower
168 Robinson Road
#22-01 to #29-01
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Cisco Systems has more than 200 offices in the following countries and regions. Addresses, phone numbers, and fax numbers are listed on the
Cisco Web site at www.cisco.com/go/offices

Argentina • Australia • Austria • Belgium • Brazil • Bulgaria • Canada • Chile • China PRC • Colombia • Costa Rica • Croatia
Czech Republic • Denmark • Dubai, UAE • Finland • France • Germany • Greece • Hong Kong SAR • Hungary • India • Indonesia • Ireland
Israel • Italy • Japan • Korea • Luxembourg • Malaysia • Mexico • The Netherlands • New Zealand • Norway • Peru • Philippines • Poland
Portugal • Puerto Rico • Romania • Russia • Saudi Arabia • Scotland • Singapore • Slovakia • Slovenia • South Africa • Spain • Sweden
Switzerland • Taiwan • Thailand • Turkey • Ukraine • United Kingdom • United States • Venezuela • Vietnam • Zimbabwe

All contents are Copyright © 1992–2003 Cisco Systems, Inc. All rights reserved. Cisco, Cisco IOS, Cisco Systems, and the Cisco Systems logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the U.S. and certain other countries.

All other trademarks mentioned in this document or Web site are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company.
(0304R) VT/LW4437 0503