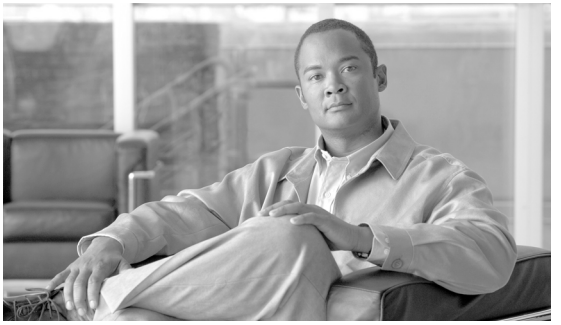


Installing the Cisco ONS 15216 DWDM and CWDM Passive Optical Modules

Introduction

This document explains how to install and operate the Cisco ONS 15216 Dense Wave Division Multiplexing (DWDM) and Coarse wavelength division multiplexing (CWDM) passive optical modules.

The Cisco ONS 15216 DWDM and CWDM passive optical modules are used to build the optical network system.

The Cisco ONS 15216 DWDM and CWDM passive optical modules are 1 rack unit (RU) high and can be installed on:

- 19-inch (482.6 mm) or 23-inch (584.2 mm) EIA standard racks
- 19-inch (482.6 mm) IEC rack
- 600 mm x 600 mm or 600 mm x 300 mm ETSI rack.

The Cisco ONS 15216 DWDM and CWDM passive unit comprises of:

- Rack Mounting Bracket, page 3
- Cisco ONS 15216 4-Channel 100-GHz Add/Drop Module, page 5
- Cisco ONS 15216 8-Channel CWDM Mux/Demux Module, page 16
- Cisco ONS 15216 OSC Combiner/Splitter Module, page 24

Americas Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

- Cisco ONS 15216 Optical Isolator Module, page 30

The non-volatile flash memory of the optical modules store inventory and insertion loss (IL) data of the optical paths. The stored data can be retrieved through the USB port of the optical module by connecting it to the transport node controller card (TNC) of the Cisco ONS 15454 M2 and Cisco ONS 15454 M6 shelf assembly.

Safety Information

Before you install, operate, or service the Cisco ONS 15216 DWDM and CWDM passive optical modules, you must read the *Regulatory Compliance and Safety Information for Cisco Optical Transport Products* document for important safety information and warning translations.

The Cisco ONS 15216 DWDM and CWDM passive optical modules are compliant with the GR 1089, UL60950 /CSA 22.2 No. 60950-00, and IEC 60950 standards.

Laser Radiation Emission Restrictions

The Class 1M Laser safety and warning label affixed to the Cisco ONS 15216 DWDM and CWDM passive optical modules indicate that the product should never be used or installed in an optical network with emissions higher than Class 1M.

Warning **Class 1M laser radiation when open. Do not view directly with optical instruments.** Statement 281

Laser Safety During Operation

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Electrical Safety

The Cisco ONS 15216 DWDM and CWDM passive optical modules are optically and electrically passive and require no electrical connections. No electrostatic discharge (ESD) or other electrical safety considerations apply.

Rack Mounting Bracket

The optical modules are installed in the rack mounting bracket (15216-HD-EXT-PNL=). The rack mounting bracket is 19 inches (482.6-mm) wide and can be mounted on a 19-inch (482.6-mm) ANSI or an IEC equipment rack. However, by using a pair of external brackets (either straight or Z-shaped) it can also be mounted on a 23-inch (584.2-mm) ANSI, a 600 x 600 mm (23.6 x 23.6-inch), or a 600 x 300 mm (23.6 x 11.8-inch) equipment rack.

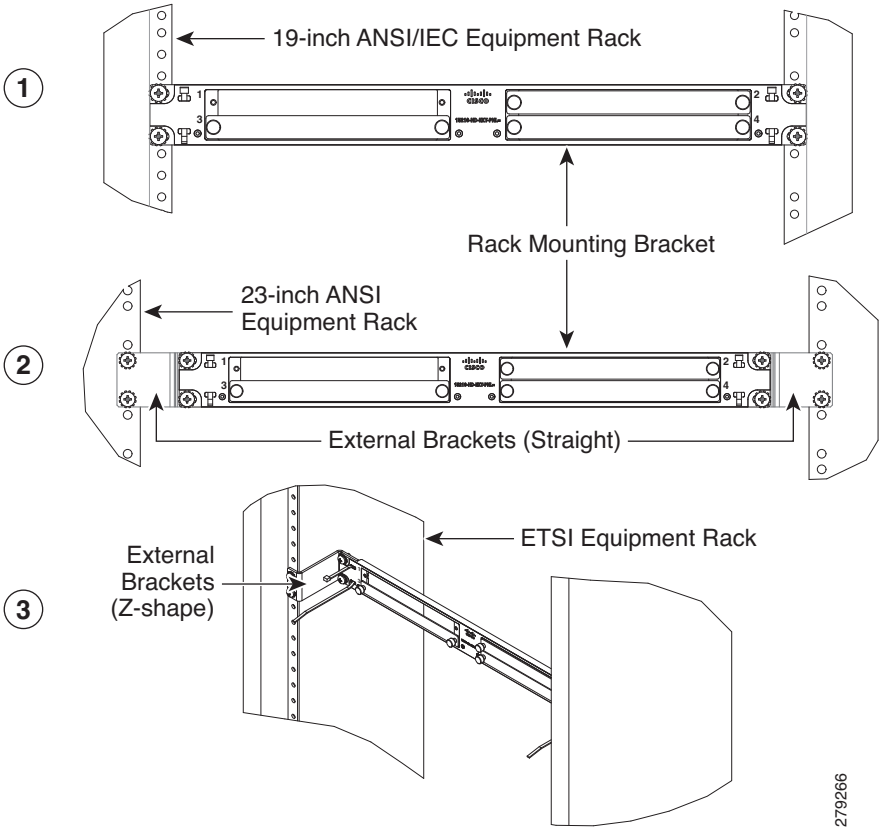
The rack mounting bracket has two slots. In each of these slots, either two single-slot units (4-Channel DWDM Add/Drop module, OSC Combiner/Splitter module, or 2-way Optical Isolator module) or one double-slot unit (8-Channel CWDM Mux/Demux module or 9-way Optical Isolator module) can be inserted. If the slots are empty, they can be covered by a blank-slot filler panel.

Diagram 1 in Figure 1 indicates the rack mounting bracket installed on a 19-inch ANSI or IEC equipment rack.

Diagram 2 in Figure 1 indicates the rack mounting bracket installed on a 23-inch ANSI equipment rack.

Diagram 3 in Figure 1 indicates the rack mounting bracket installed on an ETSI equipment rack.

Figure 1 Rack Mounting Bracket



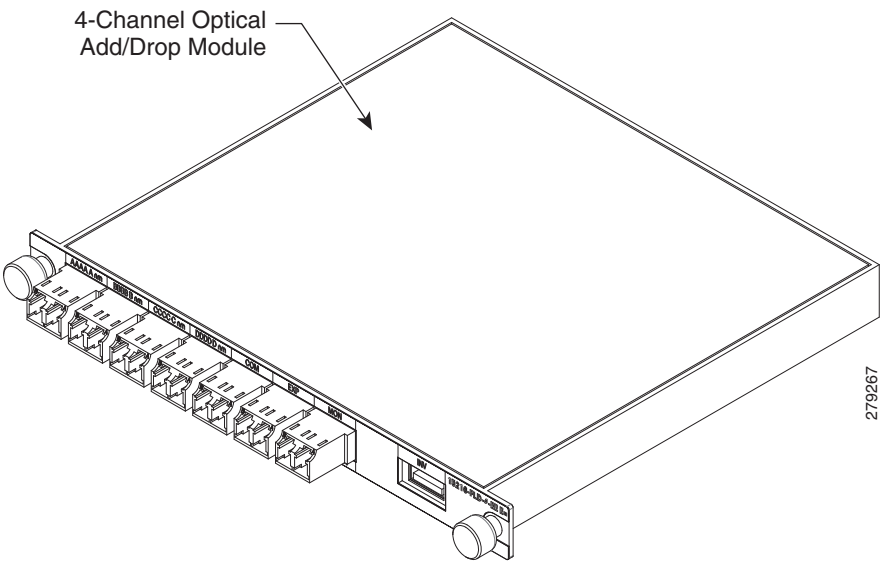
Cisco ONS 15216 4-Channel 100-GHz Add/Drop Module

The Cisco ONS 15216 4-Channel 100-GHz Optical Add/Drop module (15216-FLD-4-XX.X=) is a passive unit that has eight channel filters. A single Cisco ONS 15216 4-Channel 100-GHz Optical Add/Drop module occupies a single-slot in the rack mounting bracket. Based on the wavelength supported, there are ten variants of the Cisco ONS 15216 4-Channel 100-GHz Optical Add/Drop module:

- 15216-FLD-4-30.3
- 15216-FLD-4-33.4
- 15216-FLD-4-36.6
- 15216-FLD-4-39.7
- 15216-FLD-4-42.9
- 15216-FLD-4-46.1
- 15216-FLD-4-49.3
- 15216-FLD-4-52.5
- 15216-FLD-4-55.7
- 15216-FLD-4-58.9

Figure 2 shows the Cisco ONS 15216 4-Channel 100-GHz Optical Add/Drop module.

Figure 2 Cisco ONS 15216 4-Channel 100-GHz Optical Add/Drop Module



This section contains details of the Cisco ONS 15216 4-Channel Add/Drop module:

- "Features" section on page 6
- "Functional Description" section on page 7
- "Channel Wavelength Allocation" section on page 9
- "Port Label Description" section on page 11
- "Channel Identification Label" section on page 12
- "Optical Specifications" section on page 12

Features

The operating features of the Cisco ONS 15216 4-Channel Add/Drop module include:

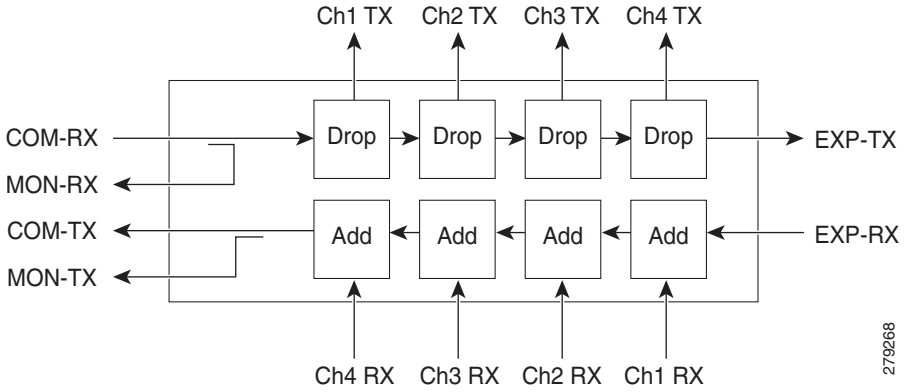
- Low dispersion
- Low insertion loss
- High channel isolation
- Wide clear bandwidth
- Full C-band coverage
- Multiplex and demultiplex 4-channels
- Athermal design

Functional Description

The 8-channel filters of the Cisco ONS 15216 4-Channel Add/Drop module are used to:

- Add 4-channel wavelengths from Ch*i*-RX input ports with the DWDM aggregated signal coming from the EXP-RX port and direct the combined signal towards the COM-TX port. An integrated tap-coupler splits one percent of the combined signal towards the MON-TX port that is used for monitoring purpose.
- Drop 4-channel wavelengths from the DWDM aggregated signal coming from the COM-RX input port towards the Ch*i*-TX ports, and route the remaining DWDM wavelengths towards the EXP-TX port. An integrated tap-coupler splits one percent of the aggregated signal coming from COM-RX port towards the MON-RX port that is used for monitoring purpose.

Figure 3 Optical Block Diagram of the Cisco ONS 15216 4-Channel Add/Drop Module



Ten ONS 15216 4-Channel Add/Drop modules can combine to form a 40-channel C-band wavelength plan. The Cisco ONS 15216 4-Channel Add/Drop module connects independent fibers from the channel ports (Ch*i* ports) to the fiber facilities of the carrier, through the common ports (COM ports).

Each ONS 15216 4-Channel Add/Drop module has two optical monitoring ports (MON-TX and MON-RX) and express ports (EXP-RX and EXP-TX). The monitoring ports are used for monitoring purpose and the express ports are used to cascade more than one ONS 15216 4-Channel Add/Drop modules.

Channel Wavelength Allocation

Table 1 describes the C-band channel wavelength plan for the Cisco ONS 15216 4-Channel Add/Drop modules.

Table 1 C-band Channel Wavelength Plan

Cisco ONS 15216 4-Channel Add/Drop Module (15216-FLD-4-EE.E)	Channel	Frequency (THz)	Wavelength (nm)	Port Label
15216-FLD-4-30.3	A	195.9	1530.33	1530.3
	B	195.8	1531.12	1531.1
	C	195.7	1531.90	1531.9
	D	195.6	1532.68	1532.6
15216-FLD-4-33.4	A	195.5	1533.47	1533.4
	B	195.4	1534.25	1534.2
	C	195.3	1535.04	1535.0
	D	195.2	1535.82	1535.8
15216-FLD-4-36.6	A	195.1	1536.61	1536.6
	B	195	1537.40	1537.4
	C	194.9	1538.19	1538.1
	D	194.8	1538.98	1538.9
15216-FLD-4-39.7	A	194.7	1539.77	1539.7
	B	194.6	1540.56	1540.5
	C	194.5	1541.35	1541.3
	D	194.4	1542.14	1542.1
15216-FLD-4-42.9	A	194.3	1542.94	1542.9
	B	194.2	1543.73	1543.7
	C	194.1	1544.53	1544.5
	D	194	1545.32	1545.3

Table 1 C-band Channel Wavelength Plan

Cisco ONS 15216 4-Channel Add/Drop Module (15216-FLD-4-EE.E)	Channel	Frequency (THz)	Wavelength (nm)	Port Label
15216-FLD-4-46.1	A	193.9	1546.12	1546.1
	B	193.8	1546.92	1546.9
	C	193.7	1547.72	1547.7
	D	193.6	1548.51	1548.5
15216-FLD-4-49.3	A	193.5	1549.32	1549.3
	B	193.4	1550.12	1550.1
	C	193.3	1550.92	1550.9
	D	193.2	1551.72	1551.7
15216-FLD-4-52.5	A	193.1	1552.52	1552.5
	B	193	1553.33	1553.3
	C	192.9	1554.13	1554.1
	D	192.8	1554.94	1554.9
15216-FLD-4-55.7	A	192.7	1555.75	1555.7
	B	192.6	1556.55	1556.5
	C	192.5	1557.36	1557.3
	D	192.4	1558.17	1558.1
15216-FLD-4-58.9	A	192.3	1558.98	1558.9
	B	192.2	1559.79	1559.7
	C	192.1	1560.61	1560.6
	D	192	1561.42	1561.4

Port Label Description

Table 2 lists the connection ports, description, and the type of connectors used for each port. All ports are on the module faceplate, which is equipped with optical LC adapters and one USB Type A receptacle connector.

Table 2 Port Label Description of the Cisco ONS 15216 4-Channel Add/Drop Module

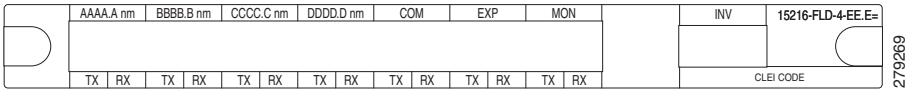
Port Label	Description	Type of Connector
COM-RX	Common input	LC-UPC II
COM-TX	Common output	LC-UPC II
AAAA.A-TX	Channel output	LC-UPC II
BBBB.B-TX		
CCCC.C-TX		
DDDD.D-TX		
AAAA.A-RX	Channel input	LC-UPC II
BBBB.B-RX		
CCCC.C-RX		
DDDD.D-RX		
MON-TX	Monitoring port of the COM-TX port	LC-UPC II
MON-RX	Monitoring port of the COM-RX port	LC-UPC II
EXP-RX	Express input	LC-UPC II
EXP-TX	Express output	LC-UPC II
INV	USB inventory port	USB Type A receptacle connector

Channel Identification Label

The channel identification label provides port identification of the ONS 15216 4-Channel Add/Drop module. The channel ID label is placed on the faceplate of the ONS 15216 4-Channel Add/Drop module.

Figure 4 shows an example of the Channel ID label placed on the ONS 15216 4-Channel Add/Drop module. This label does not represent the actual channel identification.

Figure 4 Cisco ONS 15216 4-Channel Add/Drop Module Label



Optical Specifications

The following tables provide the optical specifications of the ONS 15216 4-Channel Add/Drop module.

Table 3 Cisco ONS 15216 4-Channel Add/Drop Module Optical Specifications

Parameter	Condition	Min	Max	Units
COM-EXP Path Frequency/Wavelength Range	Within operative temperature range	1500	1565	nm
C-band Frequency/Wavelength Range		1528	1565	nm
OSC Frequency/Wavelength Range		1500	1520	nm

Parameter	Condition	Min	Max	Units
Channel Spacing	Within operative temperature range	100		GHz
-0.50 dB Clear Bandwidth	• Any state of polarization (SOP) and within operative temperature range • Around ITU center wavelength	-17	+17	GHz
Return Loss	—	45.0	—	
Directivity	—	50.0	—	dB
Monitor Attenuation RX[1]	—	17.5	+21.5	dB
Monitor Attenuation TX[2]	—	17.5	+21.5	dB

1. COM-RX to MON-RX path attenuation. The typical value is 19.5 dB with a variation of +/- 1 dB .
2. COM-TX to MON-TX relative attenuation. The typical value is 19.5 dB with a variation of +/- 1 dB.

Parameter	Condition	Min	Max	Units
The following specifications refer to Standard Operating Bandwidth				
Standard Operating Bandwidth	—	-15	+15	GHz
Insertion Loss[1] Add/Drop Path	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Including connectors	1.0	2.5	dB
Insertion Loss EXP Path (within C-band)		0.5	1.7	dB
Insertion Loss EXP Path (within OSC-band)		0.5	1.7	dB

Parameter	Condition	Min	Max	Units
Adjacent Channel Isolation[2] Add/Drop Path	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth	25.0	—	dB
Non-Adjacent Channel Isolation[3] Add/Drop Path		40.0	—	dB
Isolation[2] EXP Path		15.0	—	dB
Chromatic Dispersion Add/Drop Path[4]	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Including connectors	-40.0	+40.0	ps/nm
Polarization Dependent Loss (PDL)[5]	—	—	0.2	dB
Polarization Mode Dispersion (PMD)[6]	—	—	0.1	ps

1. The insertion loss values are measured as the maximum IL inside the operating and extended wavelength bandwidth.
2. Adjacent Channel Isolation is defined as the difference between the maximum IL in the 100 GHz transmitted channel bandwidth and the minimum IL measured over the operating wavelength bandwidth of both the adjacent 100 GHz channels.
3. Non-adjacent Channel Isolation is defined as the difference between the maximum IL in the 100 GHz transmitted channel bandwidth and the minimum IL measured over the operating wavelength bandwidth of both the non-adjacent 100 GHz channels.
4. Chromatic Dispersion is defined as the maximum derivative of the group delay versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating and extended wavelength bandwidth).
5. PDL is defined as the difference between the maximum and minimum IL in the 100 GHz transmitted channel bandwidth (operating and extended wavelength bandwidth) evaluated at all SOP, measured at a given wavelength.
6. PMD is defined as the maximum of the differential group delay (DGD) versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating and extended wavelength bandwidth).

Parameter	Condition	Min	Max	Units
The following specifications refer to Extended Operating Bandwidth				
Extended Operating Bandwidth	—	-26	+26	GHz
Insertion Loss[1] Add/Drop Path	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Including connectors	1.0	4.0	dB
Insertion Loss EXP Path (within C-band)		0.5	2.7	dB
Insertion Loss EXP Path (within OSC-band)		0.5	1.7	dB
Adjacent Channel Isolation[2] Add/Drop Path	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth	25.0	—	dB
Non-Adjacent Channel Isolation[3] Add/Drop Path		40.0	—	dB
Isolation[2] EXP Path		10.0	—	dB
Chromatic Dispersion Add/Drop Path[4]	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Including connectors	-70.0	+70.0	ps/nm
Return Loss	—	45.0	—	
Directivity	—	50.0	—	dB
Polarization Dependent Loss (PDL)[5]	—	—	1.0	dB
Polarization Mode Dispersion (PMD)[6]	—	—	0.9	ps

1. The insertion loss values are measured as the maximum IL inside the operating and extended wavelength bandwidth.

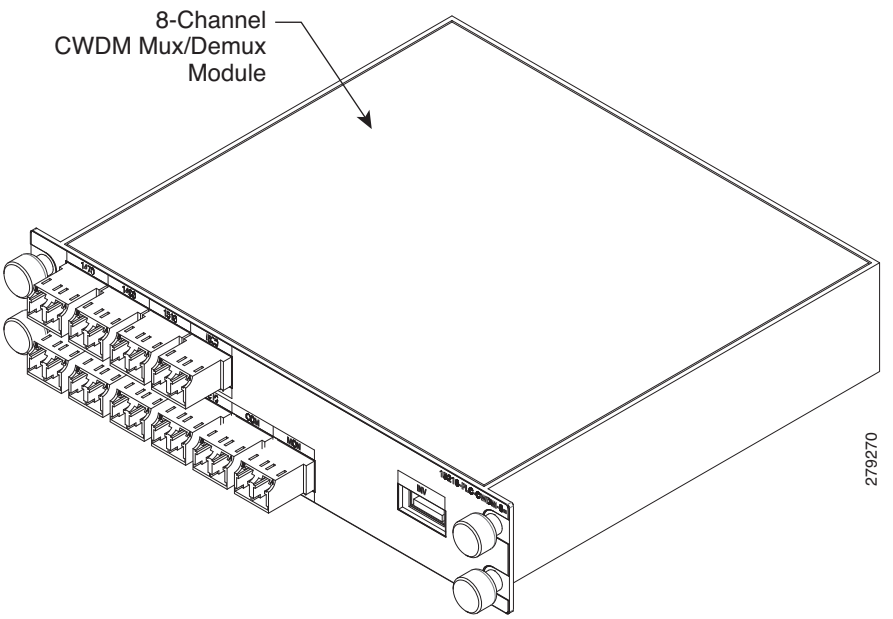
2. Adjacent Channel Isolation is defined as the difference between the maximum IL in the 100 GHz transmitted channel bandwidth and the minimum IL measured over the operating wavelength bandwidth of both the adjacent 100 GHz channels.
3. Non-adjacent Channel Isolation is defined as the difference between the maximum IL in the 100 GHz transmitted channel bandwidth and the minimum IL measured over the operating wavelength bandwidth of both the non-adjacent 100 GHz channels.
4. Chromatic Dispersion is defined as the maximum derivative of the group delay versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating and extended wavelength bandwidth).
5. PDL is defined as the difference between the maximum and minimum IL in the 100 GHz transmitted channel bandwidth (operating and extended wavelength bandwidth) evaluated at all SOP, measured at a given wavelength.
6. PMD is defined as the maximum of the differential group delay (DGD) versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating and extended wavelength bandwidth).

Cisco ONS 15216 8-Channel CWDM Mux/Demux Module

The Cisco ONS 15216 8-Channel Optical CWDM Mux/Demux module (15216-FLC-CWDM-8=) is a passive unit that has 16 channel filters. The 8-Channel CWDM Mux/Demux module can combine 8-channels of ITU wavelengths to an aggregated CWDM signal and separate the aggregated signal to 8-channels of ITU wavelengths. A single Cisco ONS 15216 8-Channel Optical CWDM Mux/Demux module occupies a double-slot in the rack mounting bracket.

Figure 5 shows the Cisco ONS 15216 8-Channel CWDM Mux/Demux module.

Figure 5 Cisco ONS 15216 8-Channel CWDM Mux/Demux Module



This section contains details of the
Cisco ONS 15216 8-Channel CWDM Mux/Demux module:

- "Features" section on page 17
- "Functional Description" section on page 18
- "Channel Wavelength Allocation" section on page 19
- "Port Label Description" section on page 20
- "Channel Identification Label" section on page 21
- "Optical Specifications" section on page 21

Features

The operating features of the Cisco ONS 15216 8-Channel CWDM Mux/Demux module include:

- Low dispersion

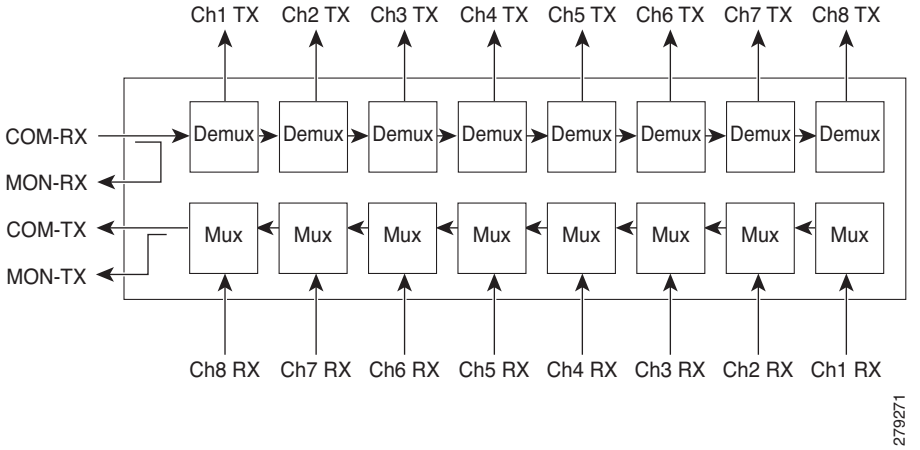
- Low insertion loss
- High channel isolation
- Wide clear bandwidth
- Full CWDM-band coverage
- Multiplex and demultiplex 8-channels
- Athermal design

Functional Description

The 16-channel filters of the Cisco ONS 15216 8-Channel CWDM Mux/Demux module are used to:

- Multiplex 8-channel wavelengths from Ch*i*-RX input ports and direct the composite signal towards the COM-TX output port. An integrated tap-coupler splits one percent of the combined signal towards the MON-TX port that is used for monitoring purpose.
- Demultiplex 8-channel wavelengths from the CWDM composite signal coming from the COM-RX input port towards the Ch*i*-TX output ports. An integrated tap-coupler splits one percent of the aggregated signal coming from the COM-RX port towards the MON-RX port that is used for monitoring purpose.

Figure 6 Optical Block Diagram of the Cisco ONS 15216 8-Channel CWDM Mux/Demux Module



The Cisco ONS 15216 8-Channel CWDM Mux/Demux module connects independent fibers from the channel ports (Ch*i* ports) to the fiber facilities of the carrier, through the common ports (COM ports).

Each Cisco ONS 15216 8-Channel CWDM Mux/Demux module has two optical monitoring ports (MON-TX and MON-RX) used for monitoring purpose

Channel Wavelength Allocation

Table 4 describes the channel wavelength plan for the Cisco ONS 15216 8-Channel CWDM Mux/Demux module.

Table 4 Channel Wavelength Plan

Channel Number	Wavelength (nm)	Port Label
1	1470.0	1470
2	1490.0	1490
3	1510.0	1510
4	1530.0	1530

Table 4 Channel Wavelength Plan

Channel Number	Wavelength (nm)	Port Label
5	1550.0	1550
6	1570.0	1570
7	1590.0	1590
8	1610.0	1610

Port Label Description

Table 5 lists the connection ports, description, and the type of connectors used for each port. All ports are on the module faceplate, which is equipped with optical LC adapters and one USB Type A receptacle connector.

Table 5 Port Label Description of the 8-Channel CWDM Mux/Demux Module

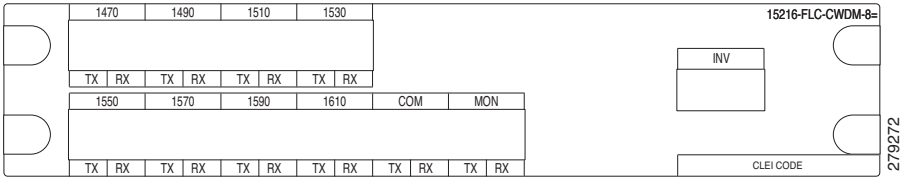
Port Label	Description	Type of Connector
COM-RX	Common input	LC-UPC II
Ch*i*_RX	Channel input	LC-UPC II
Ch*i*_TX	Channel output	LC-UPC II
COM-TX	Common output	LC-UPC II
MON-TX	Monitoring port of the COM-TX port	LC-UPC II
MON-RX	Monitoring port of the COM-RX port	LC-UPC II
INV	USB inventory port	USB Type A receptacle connector

Channel Identification Label

The channel identification label provides port identification of the Cisco ONS 15216 8-Channel CWDM Mux/Demux module. The channel ID label is placed on the faceplate of the Cisco ONS 15216 8-Channel CWDM Mux/Demux module.

Figure 7 shows the Channel ID label placed on the Cisco ONS 15216 8-Channel CWDM Mux/Demux module.

Figure 7 Cisco ONS 15216 8-Channel CWDM Mux/Demux Module Label



Optical Specifications

Table 6 provides the optical specifications of the Cisco ONS 15216 8-Channel CWDM Mux/Demux module.

Table 6 Optical Specifications of the 8-Channel CWDM Mux/Demux Module

Parameter	Condition	Min	Max	Units
Channel Spacing	Within operative temperature range	20		nm
Operating Bandwidth		-7	+7	nm

Parameter	Condition	Min	Max	Units
-0.50 dB Clear Bandwidth	• Any state of polarization (SOP) and within operative temperature range • Around ITU center wavelength	-7	+7	GHz
Insertion Loss[1] Mux/Demux	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth	0.8	3.5	dB
Mux/Demux Maximum Loss Uniformity	—	—	1	dB
Adjacent Channel Isolation[2]	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth	30.0	—	dB
Non-Adjacent Channel Isolation[3]		45.0	—	dB

Parameter	Condition	Min	Max	Units
Chromatic Dispersion[4]	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Includes connectors	-10.0	+10.0	ps/nm
Return Loss		45.0	—	
Directivity		50.0	—	dB
Polarization Dependent Loss (PDL)[5]		—	0.15	dB
Polarization Mode Dispersion (PMD)[6]		—	0.1	ps
Monitor Attenuation RX[7]	—	17.5	+21.5	dB
Monitor Attenuation TX[8]	—	17.5	+21.5	dB

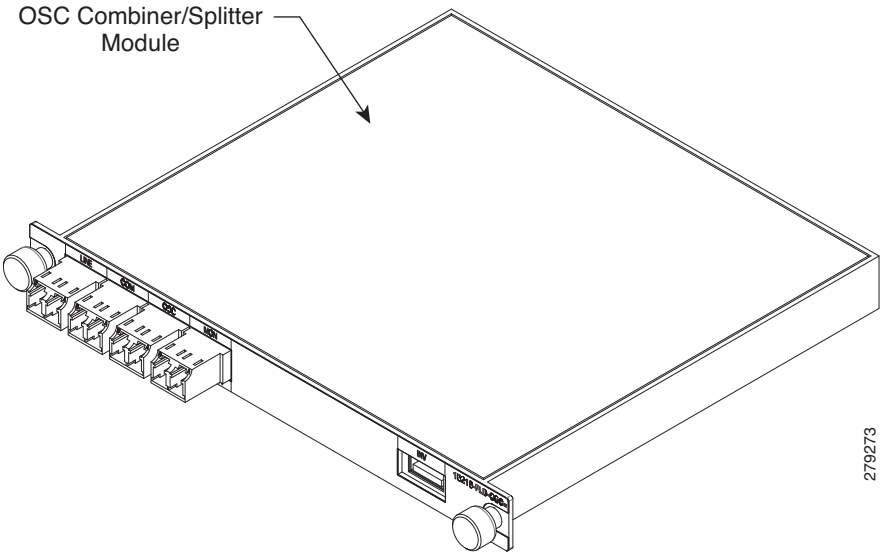
1. The insertion loss values are measured as the maximum IL inside the operating wavelength bandwidth (± 80 pm, centered on each ITU wavelength of the channel).
2. Adjacent Channel Isolation is defined as the difference between the maximum IL in the transmitted channel Bandwidth (ITU ± 80 pm) and the minimum IL measured over the operating wavelength bandwidth of both the adjacent channels.
3. Non-Adjacent Channel Isolation is defined as the difference between the maximum IL in the transmitted channel bandwidth (ITU ± 80 pm) and the minimum IL measured over the operating wavelength bandwidth of both the non-adjacent channels.
4. Chromatic Dispersion is defined as the maximum of derivative of the group delay versus the wavelength curve in the transmitted channel bandwidth (operating wavelength bandwidth)
5. PDL is defined as the difference between the maximum and minimum IL in the transmitted channel bandwidth (operating wavelength bandwidth) evaluated at all SOP, measured at a given wavelength.
6. PMD is defined as the maximum of the differential group delay (DGD) versus the wavelength curve in the transmitted channel bandwidth (operating wavelength bandwidth).
7. COM-RX to MON-RX path attenuation
8. COM-TX to MON-TX relative attenuation

Cisco ONS 15216 OSC Combiner/Splitter Module

The Cisco ONS 15216 OSC Combiner/Splitter module (15216-FLD-OSC=) is a passive unit used to combine the optical service channel (OSC) wavelengths to form the DWDM aggregated signal, or split the OSC wavelengths from the DWDM aggregated signal. A single OSC Combiner/Splitter module occupies a single-slot in the rack mounting bracket.

Figure 8 shows the Cisco ONS 15216 OSC Combiner/Splitter module.

Figure 8 Cisco ONS 15216 OSC Combiner/Splitter Module



This section contains details of the Cisco ONS 15216 OSC Combiner/Splitter module:

- "Features" section on page 25
- "Functional Description" section on page 25
- "Port Label Description" section on page 26
- "Channel Identification Label" section on page 27
- "Optical Specifications" section on page 28

Features

The operating features of the Cisco ONS 15216 OSC Combiner/Splitter module include:

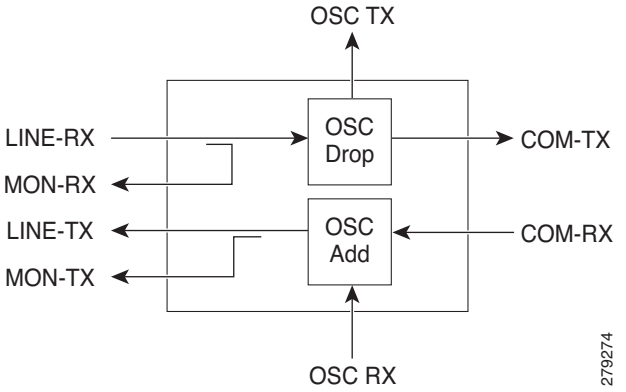
- Low dispersion
- Low insertion loss
- Full C-band coverage
- Athermal design

Functional Description

The Cisco ONS 15216 OSC Combiner/Splitter module:

- Combines the DWDM signal from the COM-RX input port with the OSC signal from the OSC-RX input port and directs the combined signal towards the LINE-TX output port. An integrated tap-coupler splits one percent of the aggregated signal towards the MON-TX port that is used for monitoring purpose.
- Splits the DWDM signal and the OSC signal from the LINE-RX input port and directs the OSC signal to the OSC-TX output port, while the remaining DWDM signal is directed to the COM-TX output port. An integrated tap-coupler splits one percent of the aggregated signal coming from the LINE-RX port towards the MON-RX port that is used for monitoring purpose.

Figure 9 Optical Block Diagram of the Cisco ONS 15216 OSC Combiner/Splitter Module



The Cisco ONS 15216 OSC Add/Drop module connects independent fibers from the line and OSC ports to the fiber facilities of the carrier, through the common ports (COM ports).

Each Cisco ONS 15216 OSC Add/Drop module has two optical monitoring ports (MON-TX and MON-RX) used for monitoring purpose.

Port Label Description

Table 7 lists the connection ports, description, and the type of connectors used for each port. All ports are on the module faceplate, which is equipped with optical LC adapters and one USB Type A receptacle connector.

Table 7 Port Label Description of the Cisco ONS 15216 OSC Combiner/Splitter Module

Port Label	Description	Type of Connector
LINE-RX	Line input	LC-UPC II
LINE-TX	Line output	LC-UPC II
COM-RX	Common input	LC-UPC II
COM-TX	Common output	LC-UPC II

Port Label	Description	Type of Connector
OSC-RX	Optical Service Channel input	LC-UPC II
OSC-TX	Optical Service Channel output	LC-UPC II
MON-TX	Monitoring port of the COM-TX port	LC-UPC II
MON-RX	Monitoring port of the COM-RX port	LC-UPC II
INV	USB inventory port	USB Type A receptacle connector

Channel Identification Label

The port identification label provides port identification of the Cisco ONS 15216 OSC Combiner/Splitter module. The port label is placed on the faceplate of the Cisco ONS 15216 OSC Combiner/Splitter module.

Figure 10 shows the port identification label placed on the Cisco ONS 15216 OSC Combiner/Splitter module.

Figure 10 Cisco ONS 15216 OSC Combiner/Splitter



Optical Specifications

Table 8 provides the optical specifications of the Cisco ONS 15216 OSC Combiner/Splitter module.

Table 8 Cisco ONS 15216 OSC Combiner/Splitter Module Optical Specifications

Parameter	Condition	Min	Max	Units
COM-LINE Path Frequency/Wavelength Range	Within operative temperature range	1528	1565	nm
OSC Add/Drop Frequency/Wavelength Range		1500	1520	nm
Insertion Loss[1] Add/Drop Path	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Includes connectors	0.5	1.5	dB
Insertion Loss EXP Path		0.5	1	dB
In-Band Ripple[2]		—	0.5	dB
Isolation[3] COM-RX/TX to LINE-RX/TX	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth	15.0	—	dB
Isolation OSC-RX/TX to LINE-RX/TX		40.0	—	dB

Parameter	Condition	Min	Max	Units
Chromatic Dispersion Add/Drop Path[4]	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Includes connectors	-10.0	+10.0	ps/nm
Return Loss		45.0	—	
Directivity		50.0	—	dB
Polarization Dependent Loss (PDL)[5]		—	0.2	dB
Polarization Mode Dispersion (PMD)[6]		—	0.1	ps
Monitor Attenuation RX[7]	—	17.5	+21.5	dB
Monitor Attenuation TX[8]	—	17.5	+21.5	dB

1. The insertion loss values are measured as the maximum IL inside the operating wavelength bandwidth (± 80 pm, centered on each ITU wavelength of the channel).
2. In-Band Ripple is the maximum peak-to-peak loss variation within the wavelength range.
3. Optical Isolation is the difference between the insertion loss (either C-band or OSC-band) and the minimum attenuation of the filter at the isolated band (OSC-band or C-band respectively).
4. Chromatic Dispersion is defined as the maximum of derivative of the Group Delay versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating wavelength bandwidth)
5. PDL is defined as the difference between the maximum and minimum IL in the 100 GHz transmitted channel bandwidth (operating wavelength bandwidth) evaluated at all SOP, measured at a given wavelength.
6. PMD is defined as the maximum of the differential group delay (DGD) versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating wavelength bandwidth).
7. LINE-RX to MON-RX path attenuation.
8. LINE-TX to MON-TX relative attenuation.

Cisco ONS 15216 Optical Isolator Module

The Cisco ONS 15216 Optical Isolator module (15216-FLD-2-ISO= or 15216-FLD-9-ISO=) integrates multiple independent isolators into a single module.The Cisco ONS 15216 Optical Isolator module is used to improve the directivity of the optical interconnections when there is excessive back reflection.

There are two variants of the Cisco ONS 15216 Optical Isolator:

- Cisco ONS 15216-FLD-2-ISO Module—This module is a passive unit that contains two dual-stage optical isolators and occupies a single-slot in the rack mounting bracket.
- Cisco ONS 15216-FLD-9-ISO Module—This module is a passive unit that contains nine dual-stage optical isolators and occupies a double-slot in the rack mounting bracket.

  Figure 11 shows the Cisco ONS 15216 Isolator module (2-way).

  Figure 12 shows the Cisco ONS 15216 Isolator module (9-way).

Figure 11 Cisco ONS 15216 Optical Isolator Module (2-way)

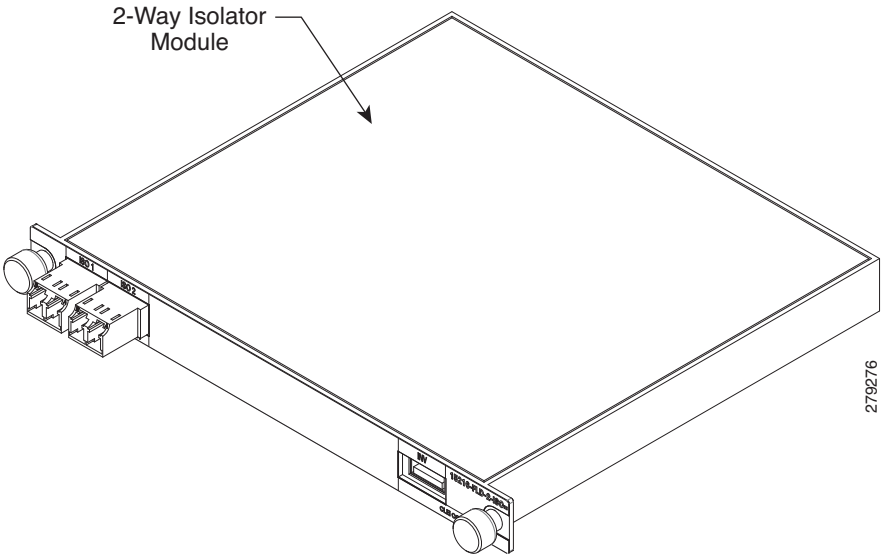
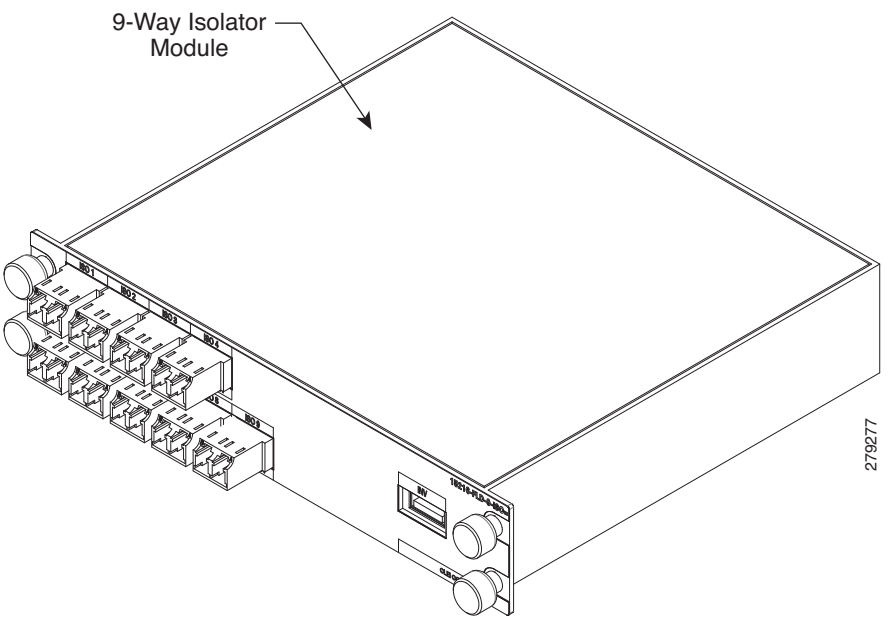


Figure 12 Cisco ONS 15216 Optical Isolator Module (9-way)



This section contains details of the Cisco ONS 15216 Optical Isolator module module:

- "Features" section on page 31
- "Functional Description" section on page 32
- "Port Label Description" section on page 33
- "Channel Identification Labels" section on page 34
- "Optical Specifications" section on page 35

Features

The operating features of the Cisco ONS 15216 Optical Isolator module include:

- Low dispersion
- Low insertion loss
- High channel isolation

- Full C-band coverage
- Athermal design

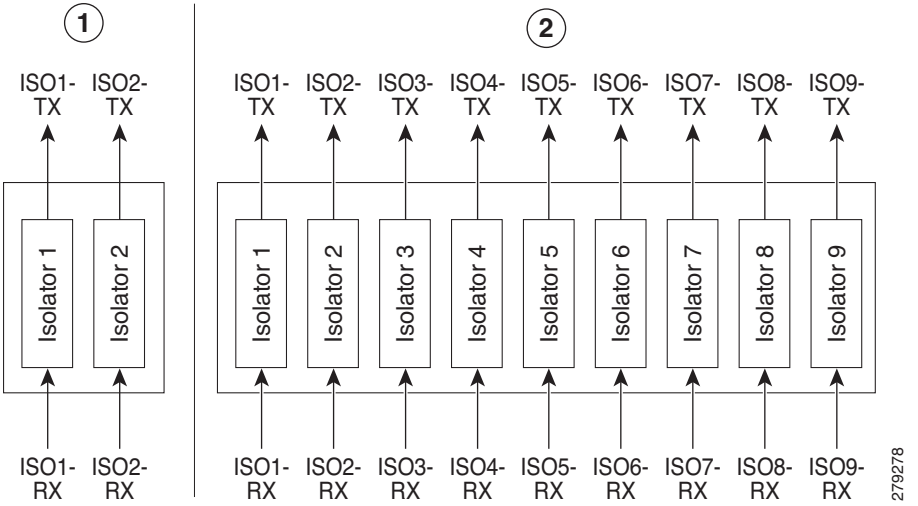
Functional Description

The optical isolator minimizes optical back reflection. Back reflection is a small amount of light that is reflected back towards the transmitting optical component. The optical isolator absorbs this reflected light so that the transmitting optical component operates with minimal interference. Optical back reflection is common in fiber-based transmissions.

Diagram 1 in Figure 13 shows the optical block diagram of the Cisco ONS 15216-FLD-2-ISO module.

Diagram 2 in Figure 13 shows the optical block diagram of the Cisco ONS 15216-FLD-9-ISO module.

Figure 13 Optical Block Diagram of Cisco ONS 15216-FLD-2-ISO and Cisco ONS 15216-FLD-9-ISO Modules



Port Label Description

Table 9 lists the connection ports, description, and the type of connectors used for each port. All ports are on the module faceplate, which is equipped with optical LC adapters and one USB Type A receptacle connector.

Table 9 Port Label Description of the Optical Isolator Module

Port Label	Description	Type of Connector
ISO 1- RX	Isolator input	LC-UPC II
ISO 1- TX	Isolator output	
ISO 2- RX	Isolator input	
ISO 2- TX	Isolator output	
ISO 3- RX	Isolator input	
ISO 3- TX	Isolator output	
ISO 4- RX	Isolator input	
ISO 4- TX	Isolator output	
ISO 5- RX	Isolator input	
ISO 5- TX	Isolator output	
ISO 6- RX	Isolator input	
ISO 6- TX	Isolator output	
ISO 7- RX	Isolator input	
ISO 7- TX	Isolator output	
ISO 8- RX	Isolator input	
ISO 8- TX	Isolator output	
ISO 9- RX	Isolator input	
ISO 9- TX	Isolator output	
INV	USB inventory port	USB Type A receptacle connector

Channel Identification Labels

The channel identification label provides port identification of the Cisco ONS 15216 Optical Isolator module. The port label is placed on the faceplate of the Cisco ONS 15216 Optical Isolator module.

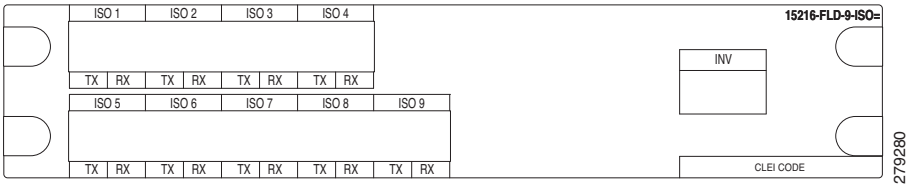
Figure 14 shows the port identification label placed on the 2-way Cisco ONS 15216 Optical Isolator module.

Figure 14 Cisco 15216-FLD-2-ISO Module Label



Figure 15 shows the port identification label placed on the 9-way Cisco ONS 15216 Optical Isolator module.

Figure 15 Cisco 15216-FLD-9-ISO Module Label



Optical Specifications

Table 10 provides the optical specifications for the Cisco ONS 15216 Optical Isolator module.

Table 10 Cisco ONS 15216 Optical Isolator Module Optical Specifications

Parameter	Condition	Min	Max	Units
Operating Wavelength Range	—	1500	1600	nm
Insertion Loss[1]	Within operative temperature range	0.5	1.0	dB
Isolation	Any optical path in the C-band range: 1528 nm and 1565 nm	40	—	dB
	Any optical path between the range 1500 nm and 1600 nm	32	—	dB
Wavelength Dependent Loss	—	—	0.2	dB

Parameter	Condition	Min	Max	Units
Group Delay Ripple[2] (GDR)	• Any state of polarization (SOP) and within operative temperature range • Within operating bandwidth • Includes connectors	—	10	ps
Chromatic Dispersion		-5	+5	ps/nm
Return Loss		45.0	—	
Polarization Dependent Loss (PDL)[3]		—	0.10	dB
Polarization Mode Dispersion (PMD)[4]		—	0.05	ps

1. The insertion loss values are measured as the maximum IL inside the operating wavelength bandwidth (± 80 pm, centered on each ITU wavelength of the channel).
2. The difference between the maximum and minimum group delay in the operating wavelength bandwidth of each channel evaluated at all SOP.
3. PDL is defined as the difference between the maximum and minimum IL in the 100 GHz transmitted channel bandwidth (operating wavelength bandwidth) evaluated at all SOP, measured at a given wavelength.
4. PMD is defined as the maximum of the differential group delay (DGD) versus the wavelength curve in the 100 GHz transmitted channel bandwidth (operating wavelength bandwidth).

Cisco ONS 15216 DWDM and CWDM Passive Optical Module Specifications

This section contains the environmental and mechanical specifications of the Cisco ONS 15216 DWDM and CWDM passive optical modules.

Environmental Performance Specifications

Table 11 provides the environmental performance specifications of the Cisco ONS 15216 DWDM and CWDM passive optical modules.

Table 11 Environmental Performance Specifications

Environmental Condition	Min	Max	Units
Continuous Operative Temperature Range (OTR)	-5	65	Celsius
	23	149	Fahrenheit
Power Handling for the Optical Port	300	—	mW
Power Handling for the USB Port	400	600	mW

Mechanical Specifications

Table 12 provides the mechanical dimensions of the Cisco ONS 15216 DWDM and CWDM passive optical modules.

Table 12 Mechanical Specifications

Parameter	Condition	Specification
Connector Type	All optical ports	LC/UPC II
	USB inventory port	USB Type A Receptacle Connector

Parameter	Condition	Specification
Optical Adapter Type	All optical ports	LC
Cisco 15216-FLD-4-XX.X	—	The Cisco ONS 15216 4-Channel Add/Drop module measures 17 mm high, 160 mm wide, and 146.5 mm deep
Cisco 15216-FLC-CWDM-8	—	The Cisco ONS 15216 8-Channel CWDM Mux/Demux module measures 35.2 mm high, 160 mm wide, and 146.5 mm deep
Cisco 15216-FLD-OSC	—	The Cisco ONS 15216 OSC Add/Drop module measures 17 mm high, 160 mm wide, and 146.5 mm deep
Cisco 15216-FLD-2-ISO	—	The Cisco ONS 15216 Optical Isolator (2-way) module measures 17 mm high, 160 mm wide, and 146.5 mm deep
Cisco 15216-FLD-9-ISO	—	The Cisco ONS 15216 Optical Isolator (9-way) module measures 35.2 mm high, 160 mm wide, and 146.5 mm deep

Installation

This section explains how to:

- Unpack and Verify the Rack Mounting Bracket and Optical Modules
- Install the Rack Mounting Bracket
- Install the Optical Module

Unpack and Verify the Rack Mounting Bracket and Optical Modules

The rack mounting bracket and the optical modules are shipped in separate packages. This procedure describes the steps for unpacking and verifying both the components.

Step 1 Unpack and inspect the rack mounting bracket and optical modules.

The rack mounting bracket package should include these components with the quantity of the item (specified in parentheses), included in the package.

- 19-inch ANSI/IEC rack mounting bracket assembled with 3 filler panels
- Straight external brackets for 23-inch ANSI installation (2)
- Z-shaped external brackets for ETSI installation (2)
- #12-24 x 0.50 pan-head Phillips screws (4)
- #12 lock washers (8)
- M6 x12 pan-head Phillips screws (12)
- Lock washers for M6 screws (8)
- Velcro strips for fiber management (4)
- Tie-wraps for locking the inventory USB plug cable (2)
- Production test report form showing the part number and serial number of the manufacturer, Cisco product part number, date, and device description
- Packing slip

The optical module package should include the following components:

- Optical modules
- Production test report form showing the part number and serial number of the manufacturer, Cisco product part number, date, and device description
- Packing slip

Step 2 Compare the equipment received with the packing slip and the equipment list that customer service provided. If there are any discrepancies, notify the Customer Service Center.

Step 3 Check for external damage. Visually check all components and immediately report any shipping damage to your customer service representative. Have this information ready:

- Invoice number of shipper (see packing slip)
- Model and serial number of the damaged unit
- Description of damage
- Effect of damage on the installation
- Packing slip

Install the Rack Mounting Bracket

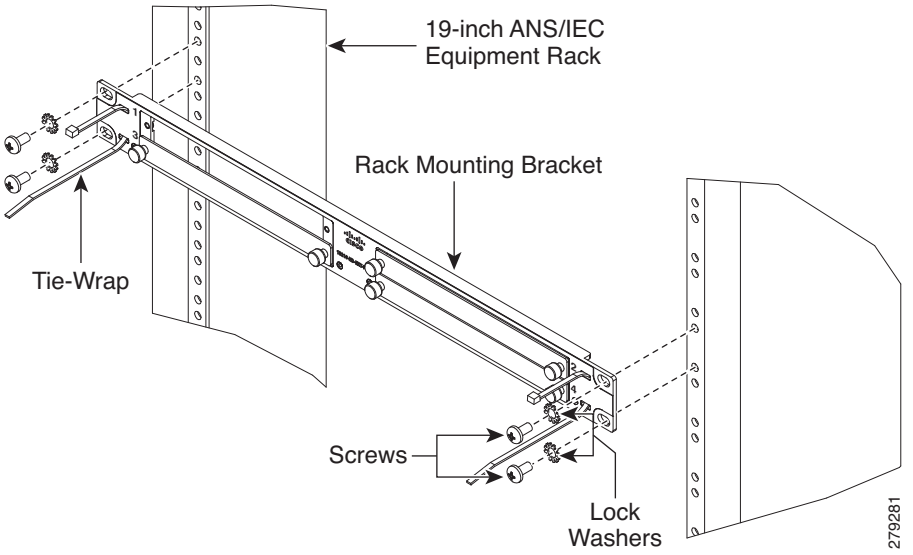
This procedure explains how to install the rack mounting bracket to the ANSI, IEC, or ETSI standard equipment rack.

Step 1 Insert the tie-wraps on both sides of the rack mounting bracket.

Step 2 To mount the rack mounting bracket to the standard equipment rack:

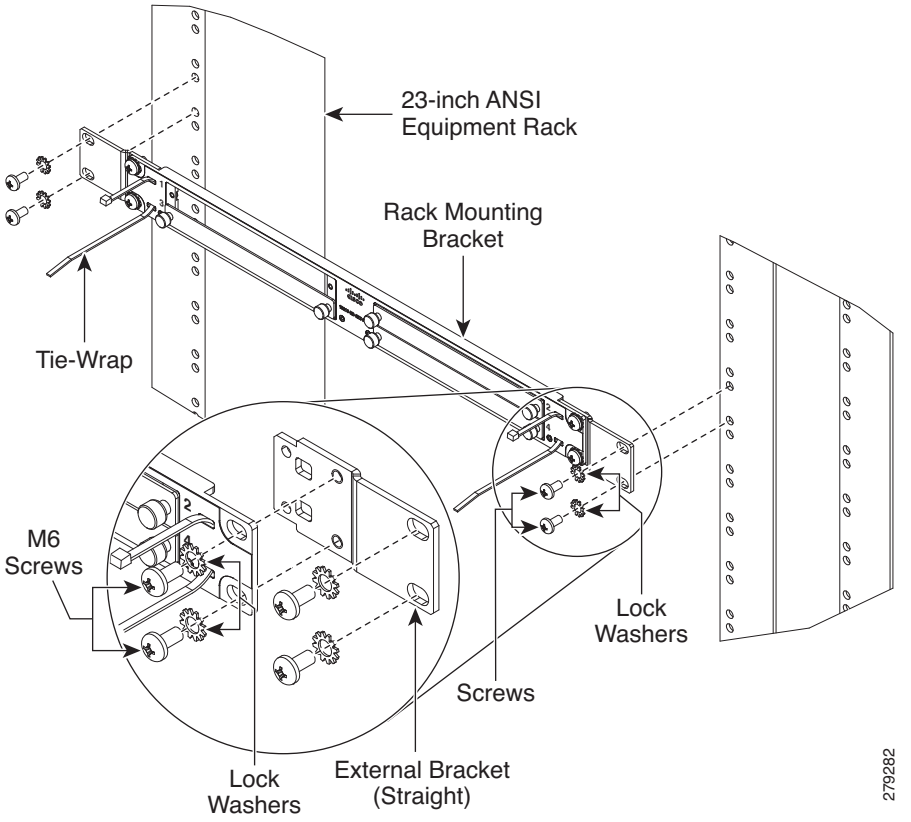
- For a 19-inch (482.6-mm) ANSI or IEC configuration, align the rack mounting bracket screw holes against the equipment rack screw holes (see Figure 16).

Figure 16 Installing the Rack Mounting Bracket on a 19-inch Equipment Rack



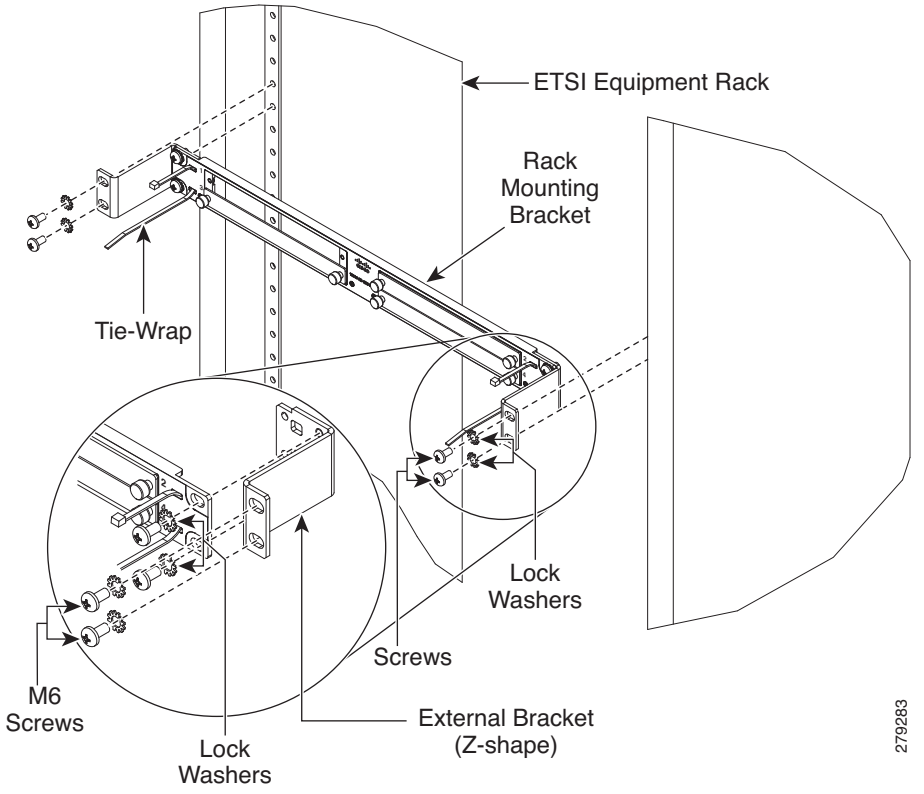
- For a 23-inch (584.2-mm) ANSI configuration:
  - Align the straight external bracket screw holes against the rack mounting bracket screw holes (see Figure 17).
  - Insert the M6 screws along with the lock washers and tighten them.
  - Align the extended rack mounting bracket screw holes against the equipment rack screw holes (see Figure 17).

Figure 17 Installing the Rack Mounting Bracket on a 23-inch Equipment Rack



- For an ETSI configuration:
  - Align the Z-shaped external bracket screw holes against the rack mounting bracket screw holes (see Figure 18).
  - Insert the M6 screws along with the lock washers and tighten them.
  - Align the extended rack mounting bracket screw holes against the equipment rack screw holes (see Figure 18).

Figure 18 Installing the Rack Mounting Bracket on an ETSI Equipment Rack



Step 3 Insert the screws along with the lock washers and tighten them.

Install the Optical Module

This procedure explains how to install the optical module into the rack mounting bracket.

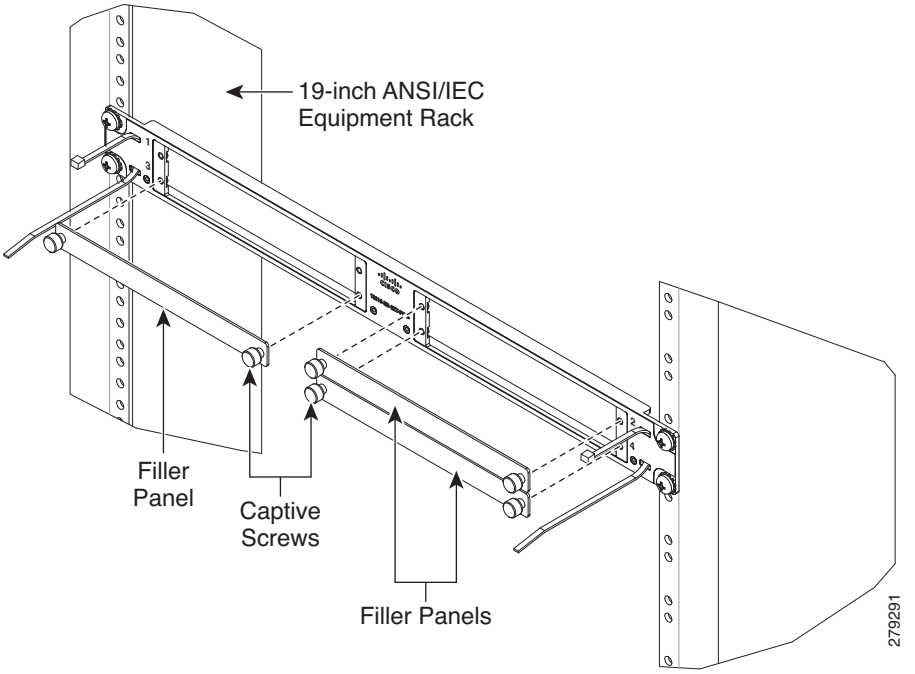
Step 1 Install the rack mounting bracket on the equipment rack by following the steps described in the "Install the Rack Mounting Bracket" section on page 40.

Step 2 Identify the slot in the rack mounting bracket to install the optical module.

Note A single-slot (left or right) can accommodate a 4-Channel DWDM Add/Drop module, or an OSC Combiner/Splitter module, or a 2-way Optical Isolator module. A double-slot (left or right) can accommodate one 8-Channel CWDM Mux/Demux module or a 9-way Optical Isolator module.

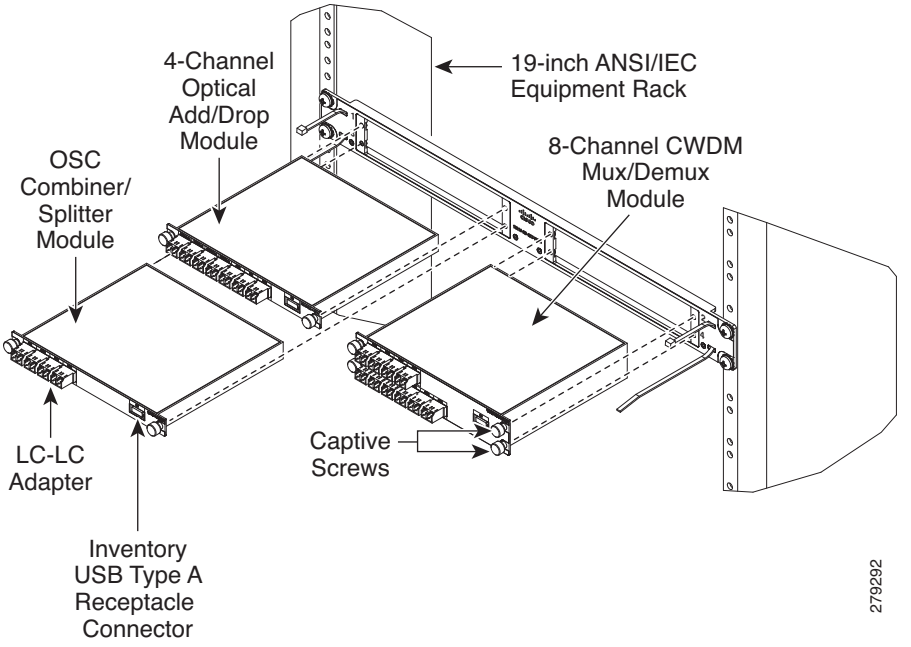
Step 3 Loosen the captive screws to remove the filler panel from the rack mounting bracket (see Figure 19).

Figure 19 Removing the Filler Panel from the Rack Mounting Bracket



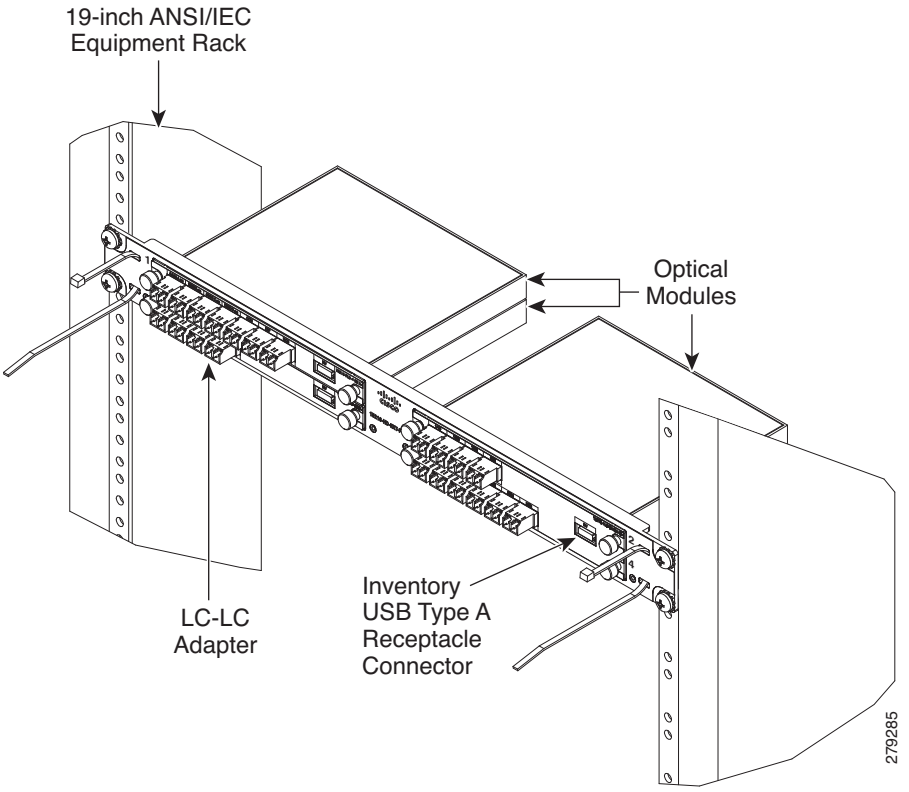
Step 4 Insert the optical module into the empty slot (see Figure 20).

Figure 20 Installing the Optical Module into the Rack Mounting Bracket



Step 5 Tighten the captive screws of the optical module to fix them into the rack mounting bracket (see Figure 21).

Figure 21 Optical Modules Installed



Step 6 To connect the fibers as appropriate:

a. Remove the LC dust cap from the LC-LC adapter of the optical module.

b. Route the optical patch cords with the LC connectors to the optical module.

Refer to the port label description and channel identification port information of the optical module. For fibering instructions, see the "Fiber-Optic Connector Cleaning and Maintenance" section on page 50 and the "Install and Route Fiber-Optic Cables" section on page 52.

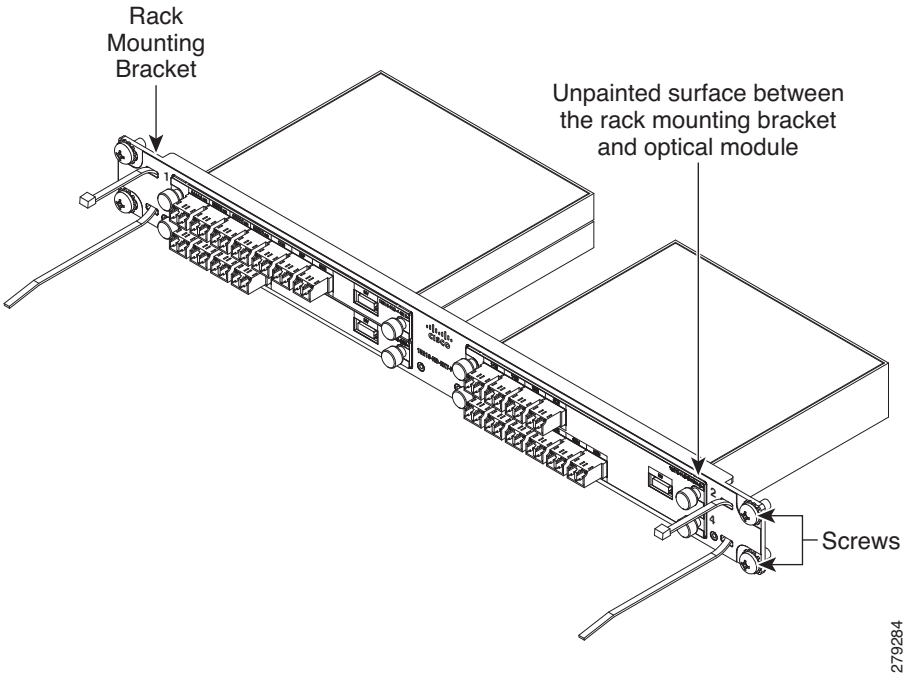
Step 7 Connect the inventory USB Type A plug connector to the inventory USB Type A receptacle connector (see Figure 21) present on the optical module. To secure the USB cable, lock it with the tie-wrap.

Note The fibers and the USB cable can also be connected to the optical modules before installing them in the rack mounting bracket. This is more suitable in an ETSI environment or when there are other modules preinstalled in the equipment rack.

Ground Description

The unpainted surface between the rack mounting bracket and optical modules, and screws ensure proper grounding of the Cisco ONS 15216 DWDM and CWDM passive unit (see Figure 22). The rack mounting bracket, the straight external brackets, and the Z-shaped external brackets are unpainted and treated with conductive finishing.

Figure 22 Grounding of the Cisco ONS 15216 DWDM and CWDM Passive Optical Unit



Note When mounting the Cisco ONS 15216 passive optical modules in a frame or rack with a nonconductive coating (such as paint, lacquer, or enamel), either use the thread-forming screws, or remove the coating from the threads to ensure electrical continuity and establish a metal-to-metal contact. Remove any paint or other non-conductive coatings on the surfaces between the mounting hardware and the rack. Clean the surfaces and apply an appropriate antioxidant before installation.

Fiber-Optic Connector Cleaning and Maintenance

Connector cleaning is required to maintain the performance of fiber-optic circuits. It is important that both the LC/UPC connector at the end of the fiber-optic cable and the mating bulkhead adapter on the front panel of the optical modules are clean before the connection is made.



Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

The following warning applies to disposal of chemicals and other materials used to clean connectors and adapters:



Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040

Before installing the fiber-optic cable, always perform the cleaning procedure for cable connectors described in the following section. Whenever possible, inspect each connector before connecting it to the mating bulkhead adapter on the front panel.

The LC bulkhead adapters on the optical modules are less likely to get dirty if they are capped when not in use. Because the procedure for a thorough cleaning of these adapters is complicated, we recommend that you use a commercially available cleaning kit and closely follow the instructions included with the kit.

Customer Supplied Cleaning Materials

The Type A fiber-optic connector cleaners (for example, CLETOP reel) are recommended to clean the cable connectors, but are not supplied with the Cisco ONS 15216 DWDM and CWDM passive optical modules.

When cleaning a paired cable connector (bulkhead mating adapter), always clean the mating adapter first.

If properly maintained (only used with clean, defect-free fiber connectors and capped when not in use), the mating adapter would not require cleaning. However, if you suspect the adapter is dirty, clean it by using the CLETOP stick swab.

Note For multi-fiber cable assemblies, use specific cleaning tools or materials designed for the assembly type.

Clean the Bulkhead Mating Adapters

This procedure explains how to clean the bulkhead mating adapters.

Step 1 Read the manufacturer (cleaning cartridge) instructions to insert the cartridge cleaning tip into the mating adapter.

Step 2 Slide the lever on the cartridge to swipe the mating surface.

Note Always keep unused adapter ports and fiber connectors capped with a clean dust cap.

Clean Fiber-Optic Cable Connectors

The tools required to clean fiber-optic cable connectors are:

- Inspection microscope
- Type A fiber-optic connector cleaner (CLETOP reel)
- Optical swab
- Optical receiver cleaning stick

Step 1 Using an inspection microscope, inspect each fiber connector for dirt, cracks, or scratches.

Step 2 Replace any damaged fiber connectors.

Note Replace all dust caps whenever the equipment is unused for 30 minutes or more.

Note Do not reuse optical swabs. Keep unused swabs away from work surfaces.

Step 3 Clean the fiber connectors with CLETOP reel:

a. Remove the dust cap from the fiber connector.

b. Press the lever down to open the shutter door. Each time you press the lever, you expose a clean wiping surface.

c. Insert the connector into the CLETOP cleaning cassette slot, rotate one quarter turn, and gently swipe downwards.

d. Use an inspection microscope to inspect each fiber connector for dirt, cracks, or scratches. If the connector is not clean, repeat Steps a to b.

e. Insert the fiber connector into the applicable adapter or attach a dust cap to the fiber connector.

Note If you must replace a dust cap on a connector, first verify that the dust cap is clean. To clean the dust cap, wipe the outside of the cap using a dry lint-free wipe and the inside of it using a CLETOP stick swab (14100400).

Install and Route Fiber-Optic Cables

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Caution When connecting an optical fiber patch cord between the optical module and the optical card ports in the Cisco ONS 15454, use the electrostatic discharge wristband supplied with the Cisco ONS 15454. Plug the wristband into the ESD jack on the lower right front side of the Cisco ONS 15454.

Note Always clean all fiber connectors thoroughly before making the connection with the mating adapter. Very small particles can permanently damage the end of the mating fiber inside the optical module, which makes regular cleaning imperative. For cleaning instructions see "Fiber-Optic Connector Cleaning and Maintenance" section on page 50.

Note The optical modules feature LC/UPC bulkhead adapters. Always use fiber-optic cables equipped with the corresponding (LC/UPC) connector type. Using any other type of connector results in damage to the connector or adapter, or both.

This procedure explains how to install and route fiber-optic cables.

Step 1 Place the LC/UPC cable connector in front of the corresponding bulkhead adapter on the front panel of the optical modules.

Step 2 Align the keyed ridge of the cable connector with the slot in the receiving adapter.

Step 3 Gently push the cable connector into the adapter until you hear a click, which indicates that the latching system is engaged.

Step 4 Route the fiber cables through the left or right side.

Performance Monitoring

The optical modules use Optical Test Access Port (TAP) devices to enable monitoring in the fiber-optic network. The optical monitor ports (MON-TX and MON-RX) split a part of the optical signal from the main output ports of the

optical module for monitoring purpose. An OSA (Optical Spectrum Analyzer (OSA) or PM (Power Meter) can be used for optical power monitoring and optical analysis.

Table 13 shows the manufacturer-specified TAP split ratios for the TAP coupler optical power in the optical module. The split ratio denotes the ratio of the TAP input signal to the output signal.

Table 13 Manufacturer-Specified TAP Split Ratio

Parameter	Min	Max	Units
Monitor Attenuation RX	17.5	+21.5	dB
Monitor Attenuation TX	17.5	+21.5	dB

Uninstalling the Module

This procedure describes the steps for removing the optical modules from the rack.

Step 1 Remove the fibers and the cable from the optical modules.

Step 2 Disconnect the inventory USB cable from the USB receptacle.

Step 3 Loosen the captive screws of the optical modules.

Step 4 Extract the optical modules from the rack mounting bracket.

Step 5 Loosen the screws of the rack mounting bracket.

Step 6 Remove the rack mounting bracket from the equipment rack.

Related Documentation

Use the *Installing the Cisco ONS 15216 DWDM and CWDM Passive Optical Modules* document in conjunction with the following referenced publications:

- *Cisco ONS 15454 DWDM Reference Manual*
- *Cisco ONS 15454 DWDM Procedure Guide*

- *Cisco ONS 15454 DWDM Troubleshooting Guide*

Visit the End-of-Life and End-of-Sale Notices page for EOL and EOS announcements.

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