Provisioning Multiplexer and Demultiplexer Cards

This chapter describes legacy multiplexer and demultiplexer cards used in Cisco ONS 15454 dense wavelength division multiplexing (DWDM) networks and related procedures.

For card safety and compliance information, refer to the Regulatory Compliance and Safety Information for Cisco NCS Platforms document.

Card Compatibility

The table below lists the software compatibility for the respective cards.

Table 1: Software Compatibility for Multiplexer and Demultiplexer Cards in Cisco NCS

Card Name	R10.0	R10.1	R10.3	R10.5
4MD-xx.x				

Optical Performance Parameters

The following table lists the optical performance parameters for 40-Gbps cards that provide signal input to multiplexer and demultiplexer cards.

Table 2: 40-Gbps Interface Optical Performance

Parameter	Class A		Class B		Class I	
Type	**Power Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**
Maximum bit rate	40 Gbps		40 Gbps		40 Gbps	
Regeneration	3R		3R		3R	
FEC	Yes		No		Yes (E-FEC)	
Threshold	Optimum		Average		Optimum	
Maximum BER	10–15		10–12		10–15	
OSNR sensitivity	23 dB	9 dB	23 dB	19 dB	20 dB	8 dB
Power sensitivity	–24 dBm	–18 dBm	–21 dBm	–20 dBm	–26 dBm	–18 dBm
Power overload	–8 dBm		–8 dBm		–8 dBm	
Transmitted Power Range						
40-Gbps multirate transponder/40-Gbps EC transponder (40E-TXP-C and 40ME-TXP-C)	+2.5 to 3.5 dBm		+2.5 to 3.5 dBm		—	
OC-192 LR ITU	—		—		—	
Dispersion compensation tolerance	+/–800 ps/nm		+/–1,000 ps/nm		+/–800 ps/nm	

Note

- OSNR = optical signal-to-noise ratio
- BER = bit error rate
- Transmitted Power Range values decreased by patchcord and connector losses, are also the input power values for the OADM cards.

The following table lists the optical performance parameters that provide signal input for the 40-Gbps multiplexer and demultiplexer cards.

Table 3: 10-Gbps Interface Optical Performance Parameters

Parameter	**Class A**		**Class B**		**Class C**	**Class I**	
Type	**Power Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**
Maximum bit rate	10 Gbps		10 Gbps		10 Gbps	10 Gbps	
Regeneration	3R		3R		3R	3R	
FEC	Yes		No		No	Yes (E-FEC)	
Threshold	Optimum		Average		Average	Optimum	
Maximum BER	10–15		10–12		10–12	10–15	
OSNR sensitivity	23 dB	9 dB	23 dB	19 dB	19 dB	20 dB	8 dB
Power sensitivity	–24 dBm	–18 dBm	–21 dBm	–20 dBm	–22 dBm	–26 dBm	–18 dBm
Power overload	–8 dBm		–8 dBm		–9 dBm	–8 dBm	
Transmitted Power Range							
10-Gbps multirate transponder/10-Gbps FEC transponder (TXP_MR_10G)	+2.5 to 3.5 dBm		+2.5 to 3.5 dBm		—	—	
OC-192 LR ITU	—		—		+3.0 to 6.0 dBm	—	
10-Gbps multirate transponder/10-Gbps FEC transponder (TXP_MR_10E)	+3.0 to 6.0 dBm		+3.0 to 6.0 dBm		—	+3.0 to 6.0 dBm	
Dispersion compensation tolerance	+/–800 ps/nm		+/–1,000 ps/nm		+/–1,000 ps/nm	+/–800 ps/nm	

Note

- OSNR = optical signal-to-noise ratio
- BER = bit error rate
- Transmitted Power Range values decreased by patchcord and connector losses, are also the input power values for the OADM cards.

The following table lists the optical interface performance parameters for 2.5-Gbps cards that provide signal input to multiplexer and demultiplexer cards.

Table 4: 2.5-Gbps Interface Optical Performance

Parameter	Class D		Class E		Class F	Class G		Class H		Class J
Type	**Power Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**	**Power Limited**	**OSNR Limited**	**Power Limited**
Maximum bit rate	2.5 Gbps		2.5 Gbps		2.5 Gbps	2.5 Gbps		1.25 Gbps		2.5 Gbps
Regeneration	3R		3R		2R	3R		3R		3R
FEC	Yes		No		No	No		No		No
Threshold	Average		Average		Average	Average		Average		Average
Maximum BER	10–15		10–12		10–12	10–12		10–12		10–12
OSNR sensitivity	14 dB	6 dB	14 dB	10 dB	15 dB	14 dB	11 dB	13 dB	8 dB	12 dB
Power sensitivity	–31 dBm	–25 dBm	–30 dBm	–23 dBm	–24 dBm	–27 dBm	–33 dBm	–28 dBm	–18 dBm	–26 dBm
Power overload	–9 dBm		–9 dBm		–9 dBm	–9 dBm		–7 dBm		–17dBm
Transmitted Power Range										
TXP_MR_2.5G	–1.0 to 1.0 dBm		–1.0 to 1.0 dBm		–1.0 to 1.0 dBm	–2.0 to 0 dBm				
TXPP_MR_2.5G	–4.5 to –2.5 dBm		–4.5 to –2.5 dBm		–4.5 to –2.5dBm					
MXP_MR_2.5G	—		+2.0 to +4.0 dBm		—					
MXPP_MR_2.5G	—		–1.5 to +0.5 dBm		—					

Parameter	Class D		Class E		Class F	Class G		Class H		Class J
Type	Power Limited	OSNR Limited	Power Limited	OSNR Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited
2/4 port GbE Transponder (GBIC WDM 100GHz)								+2.5 to 3.5 dBm		—
Dispersion compensation tolerance	–1200 to +5400 ps/nm		–1200 to +5400 ps/nm		–1200 to +3300 ps/nm	–1200 to +3300 ps/nm		–1000 to +3600 ps/nm		–1000 to +3200 ps/nm

Note Transmitted Power Range values decreased by patchcord and connector losses, are also the input power values for the OADM cards.

DWDM Channel Allocation Plan

ONS 15454 DWDM multiplexer and demultiplexer cards are designed for use with specific channels in the C band and L band. In most cases, the channels for these cards are either numbered (for example, 1 to 32 or 1 to 40) or delimited (odd or even). Client interfaces must comply with these channel assignments to be compatible with the ONS 15454 system.

Table 5: DWDM Channel Allocation Plan (C Band) lists the channel IDs and wavelengths assigned to the C-band DWDM channels.

Note In some cases, a card uses only one of the bands (C band or L band) and some or all of the channels listed in a band. Also, some cards use channels on the 100-GHz ITU grid while others use channels on the 50-GHz ITU grid. See the specific card description or the "Hardware Specifications" document for more details.

Table 5: DWDM Channel Allocation Plan (C Band)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
1	196.00	1529.55	42	193.95	1545.72
2	195.95	1529.94	43	193.90	1546.119
3	195.90	1530.334	44	193.85	1546.518
4	195.85	1530.725	45	193.80	1546.917

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
5	195.80	1531.116	46	193.75	1547.316
6	195.75	1531.507	47	193.70	1547.715
7	195.70	1531.898	48	193.65	1548.115
8	195.65	1532.290	49	193.60	1548.515
9	195.60	1532.681	50	193.55	1548.915
10	195.55	1533.073	51	193.50	1549.32
11	195.50	1533.47	52	193.45	1549.71
12	195.45	1533.86	53	193.40	1550.116
13	195.40	1534.250	54	193.35	1550.517
14	195.35	1534.643	55	193.30	1550.918
15	195.30	1535.036	56	193.25	1551.319
16	195.25	1535.429	57	193.20	1551.721
17	195.20	1535.822	58	193.15	1552.122
18	195.15	1536.216	59	193.10	1552.524
19	195.10	1536.609	60	193.05	1552.926
20	195.05	1537.003	61	193.00	1553.33
21	195.00	1537.40	62	192.95	1553.73
22	194.95	1537.79	63	192.90	1554.134
23	194.90	1538.186	64	192.85	1554.537
24	194.85	1538.581	65	192.80	1554.940
25	194.80	1538.976	66	192.75	1555.343
26	194.75	1539.371	67	192.70	1555.747
27	194.70	1539.766	68	192.65	1556.151
28	194.65	1540.162	69	192.60	1556.555

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
29	194.60	1540.557	70	192.55	1556.959
30	194.55	1540.953	71	192.50	1557.36
31	194.50	1541.35	72	192.45	1557.77
32	194.45	1541.75	73	192.40	1558.173
33	194.40	1542.142	74	192.35	1558.578
34	194.35	1542.539	75	192.30	1558.983
35	194.30	1542.936	76	192.25	1559.389
36	194.25	1543.333	77	192.20	1559.794
37	194.20	1543.730	78	192.15	1560.200
38	194.15	1544.128	79	192.10	1560.606
39	194.10	1544.526	80	192.05	1561.013
40	194.05	1544.924	81	192.00	1561.42
41	194.00	1545.32	82	191.95	1561.83

The following table lists the channel IDs and wavelengths assigned to the L-band channels.

Table 6: DWDM Channel Allocation Plan (L Band)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
1	190.85	1570.83	41	188.85	1587.46
2	190.8	1571.24	42	188.8	1587.88
3	190.75	1571.65	43	188.75	1588.30
4	190.7	1572.06	44	188.7	1588.73
5	190.65	1572.48	45	188.65	1589.15
6	190.6	1572.89	46	188.6	1589.57
7	190.55	1573.30	47	188.55	1589.99

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
8	190.5	1573.71	48	188.5	1590.41
9	190.45	1574.13	49	188.45	1590.83
10	190.4	1574.54	50	188.4	1591.26
11	190.35	1574.95	51	188.35	1591.68
12	190.3	1575.37	52	188.3	1592.10
13	190.25	1575.78	53	188.25	1592.52
14	190.2	1576.20	54	188.2	1592.95
15	190.15	1576.61	55	188.15	1593.37
16	190.1	1577.03	56	188.1	1593.79
17	190.05	1577.44	57	188.05	1594.22
18	190	1577.86	58	188	1594.64
19	189.95	1578.27	59	187.95	1595.06
20	189.9	1578.69	60	187.9	1595.49
21	189.85	1579.10	61	187.85	1595.91
22	189.8	1579.52	62	187.8	1596.34
23	189.75	1579.93	63	187.75	1596.76
24	189.7	1580.35	64	187.7	1597.19
25	189.65	1580.77	65	187.65	1597.62
26	189.6	1581.18	66	187.6	1598.04
27	189.55	1581.60	67	187.55	1598.47
28	189.5	1582.02	68	187.5	1598.89
29	189.45	1582.44	69	187.45	1599.32
30	189.4	1582.85	70	187.4	1599.75
31	189.35	1583.27	71	187.35	1600.17

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
32	189.3	1583.69	72	187.3	1600.60
33	189.25	1584.11	73	187.25	1601.03
34	189.2	1584.53	74	187.2	1601.46
35	189.15	1584.95	75	187.15	1601.88
36	189.1	1585.36	76	187.1	1602.31
37	189.05	1585.78	77	187.05	1602.74
38	189	1586.20	78	187	1603.17
39	188.95	1586.62	79	186.95	1603.60
40	188.9	1587.04	80	186.9	1604.03

4MD-xx.x Card

Note For 4MD-xx.x card specifications, see the section "4MD-xx.x Card Specifications" section in the Hardware Specifications document.

The 4-Channel Multiplexer/Demultiplexer (4MD-xx.x) card multiplexes and demultiplexes four 100-GHz-spaced channels identified in the channel plan.

The card is bidirectional. The demultiplexer and multiplexer functions are implemented in two different sections of the same card. In this way, the same card can manage signals flowing in opposite directions.

There are eight versions of this card that correspond with the eight sub-bands specified in Table 7: 4MD-xx.x Channel Sets. The 4MD-xx.x can be installed in Slots 1 to 6 and 12 to 17.

4MD-xx.x Card Functions

The 4MD-xx.x has the following functions implemented inside a plug-in optical module:

- Passive cascade of interferential filters perform the channel multiplex/demultiplex function.
- Software-controlled VOAs at every port of the multiplex section regulate the optical power of each multiplexed channel.
- Software-monitored photodiodes at the input and output multiplexer and demultiplexer ports for power control and safety purposes.

- Software-monitored virtual photodiodes at the common DWDM output and input ports. A virtual photodiode is a firmware calculation of the optical power at that port. This calculation is based on the single channel photodiode reading and insertion losses of the appropriated paths.

Port-Level Indicators for the 4MD-xx.x Cards

The 4MD-xx.x card has five sets of ports located on the faceplate. COM RX is the line input. COM TX is the line output. The 15xx.x TX ports represent demultiplexed channel outputs 1 to 4. The 15xx.x RX ports represent multiplexed channel inputs 1 to 4.

Wavelength Pairs

The following table shows the band IDs and the add/drop channel IDs for the 4MD-xx.x card.

Table 7: 4MD-xx.x Channel Sets

Band ID	Add/Drop Channel IDs
Band 30.3 (A)	30.3, 31.2, 31.9, 32.6
Band 34.2 (B)	34.2, 35.0, 35.8, 36.6
Band 38.1 (C)	38.1, 38.9, 39.7, 40.5
Band 42.1 (D)	42.1, 42.9, 43.7, 44.5
Band 46.1 (E)	46.1, 46.9, 47.7, 48.5
Band 50.1 (F)	50.1, 50.9, 51.7, 52.5
Band 54.1 (G)	54.1, 54.9, 55.7, 56.5
Band 58.1 (H)	58.1, 58.9, 59.7, 60.6

Power Monitoring

Physical photodiodes P1 through P8 and virtual photodiodes V1 and V2 monitor the power for the 4MD-xx.x card. The returned power level values are calibrated to the ports as shown in the following table.

Table 8: 4MD-xx.x Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P4	ADD	COM TX
P5–P8	DROP	DROP TX

Photodiode	CTC Type Name	Calibrated to Port
V1	OUT COM	COM TX
V2	IN COM	COM RX

For information on the associated TL1 AIDs for the optical power monitoring points, refer the “CTC Port Numbers and TL1 Aids” section in *Cisco ONS SONET TL1 Command Guide, Release 9.2.1*.

Related Procedures for the 4MD-xx.x Card

The following is the list of procedures and tasks related to the configuration of the 4MD-xx.x card:

- DLP-G353 Preprovisioning a Slot
- NTP-G30 Installing the DWDM Cards
- NTP-G143 Importing the Cisco Transport Planner NE Update Configuration File
- NTP-G49 Performing the Active OADM Node Acceptance Test on a Symmetric Node with OSC-CSM Cards
- DLP-G94 Verifying Add and Drop Connections on an OADM Node with OSC-CSM Cards
- NTP-G34 Installing Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G140 Installing Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes
- DLP-G315 Installing Fiber-Optic Cables From the 32WSS/32DMX Cards to the Standard Patch Panel Tray
- DLP-G356 Installing Fiber-Optic Cables from the 32WSS/32DMX and 32MUX-O/32DMX-O Cards to the Deep Patch Panel Tray
- NTP-G44 Performing the Anti-ASE Hub Node Acceptance Test
- DLP-G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 16-WXC-FS, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G175 Modifying Line Card Settings and PM Thresholds for Multiplexer and Demultiplexer Cards
- DLP-G414 Changing Optical Line Settings for Multiplexer and Demultiplexer Cards
- DLP-G415 Changing Optical Line Threshold Settings for Multiplexer and Demultiplexer Cards
- DLP-G416 Changing Optical Channel Settings for Multiplexer and Demultiplexer Cards
- DLP-G417 Changing Optical Channel Threshold Settings for Multiplexer and Demultiplexer Cards
-

12-AD-FS Card

The 12-AD-FS card is a single slot add/drop card that provides colorless, contentionless, omnidirectional, and flex spectrum capability on 12 channels over four ROADM directions. The card receives same wavelength from transponder cards and forwards to different ROADM nodes without collision. This capability is achieved using multicast switches.

Each add/drop port pair in the card is:

- Colorless - forwards any wavelength on a specific port
- Contentionless - adds/drops the same wavelength from the same add/drop section to different directions
- Omnidirectional - connects to both the add and drop directions

The 12-AD-FS card can be installed in any service slots in the Cisco NCS 2006 and NCS 2015 chassis. The 12-AD-FS card work only in the Cisco NCS Flex node.

Key Features

- Integrates three independent add/drop sections that individually supports add/drop of up to four channels over four ROADM directions. The channels can be forwarded to the direction only within the same section.
- Each add/drop section has a 4 channel multiplexer and a 4 channel demultiplexer.
- Monitors optical power on the input ports through optical photo diodes and raises alarms when the threshold exceeds.
- Supports tone detection on the input ports in the add direction.
- The multicast switch does not block any wavelength and does not have any optical filtering element.

For more information about the 12-AD-FS card such as the block diagram and the specifications, see the data sheet.

16-AD-FS Card

The 16-AD-FS card is a single slot add/drop card that provides colorless, contentionless, omnidirectional, and flex spectrum capability on 16 channels over four ROADM directions. The card receives same wavelength from 16 transponder cards and forwards to different ROADM nodes without collision. This capability is achieved using multicast switches. Two or three 16-AD-FS cards can be connected using upgrade ports to provide the add/drop capability on 16 channels over 8 or 12 ROADM directions respectively.

Each add/drop port pair in the card is:

- Colorless - forwards any wavelength on a specific port
- Contentionless - adds/drops the same wavelength from the same add/drop section to different directions
- Omnidirectional - connects to both the add and drop directions

The 16-AD-FS card can be installed in any service slots in the Cisco NCS 2006 and NCS 2015 chassis. The 16-AD-FS card work only in the Cisco NCS Flex node.

Key Features

- Has a 16x4 multiplexer and a 4x16 demultiplexer.
- Monitors optical power on the input ports through optical photo diodes and raises alarms when the threshold exceeds.
- Supports tone detection on the input ports in the add direction.
- The multicast switch does not block any wavelength and does not have any optical filtering element.
- Has fixed gain EDFA amplifiers in the add/drop directions to compensate the high optical insertion loss. The gain is -1 dB in the drop direction and -2 dB in the add direction.

For more information about the 16-AD-FS card such as the block diagram and the specifications, see the data sheet.

Related Procedures for the 12-AD-FS and 16-AD-FS Cards

The following is the list of procedures and tasks related to the configuration of the 12-AD-FS and 16-AD-FS cards:

- DLP-G414 Changing Optical Line Settings for Multiplexer and Demultiplexer Cards
- DLP-G415 Changing Optical Line Threshold Settings for Multiplexer and Demultiplexer Cards
- DLP-G Switching the Channels for 12-AD-FS and 16-AD-FS Cards