CHAPTER 7

Reconfigurable Optical Add/Drop Cards

This chapter describes the Cisco ONS 15454 cards deployed in reconfigurable optical add/drop (ROADM) networks. For installation and card turn-up procedures, refer to the *Cisco ONS 15454 DWDM Procedure Guide*. For card safety and compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.

Note Unless otherwise specified, "ONS 15454" refers to both ANSI and ETSI shelf assemblies.

Chapter topics include:

- 7.1 Card Overview, page 7-1
- 7.2 Safety Labels for Class 1M Laser Product Cards, page 7-9
- 7.3 32WSS Card, page 7-11
- 7.4 32WSS-L Card, page 7-18
- 7.5 32DMX Card, page 7-25
- 7.6 32DMX-L Card, page 7-30
- 7.7 40-DMX-C Card, page 7-35
- 7.8 40-MUX-C Card, page 7-40
- 7.9 40-WSS-C Card, page 7-45
- 7.10 40-WXC-C Card, page 7-51
- 7.11 MMU Card, page 7-58

Note This chapter contains information about cards that perform mesh topology functions. Multiplexer and demultiplexer cards that do not perform these functions are described in Chapter 5, "Multiplexer and Demultiplexer Cards."

7.1 Card Overview

The ROADM cards include six add drop cards utilized in the C band (32WSS, 32DMX, 32DMX-C, 40-MUX-C, 40-WXC-C, and MMU) and two add drop cards utilized for the L band (32WSS-L, and 32DMX-L).

This section provides card summary, compatibility, channel allocation, and safety information.

Note Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 shelf assembly. The cards are then installed into slots that have the same symbols. See the "1.16.1 Card Slot Requirements" section on page 1-59 for a list of slots and symbols.

7.1.1 Card Summary

Table 7-1 lists and summarizes information about each ROADM card.

Table 7-1   ROADM Card Summary

Card	Port Description	For Additional Information
32WSS	The 32WSS card has seven sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "7.3 32WSS Card" section on page 7-11
32WSS-L	The 32WSS-L card has seven sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "7.4 32WSS-L Card" section on page 7-18
32DMX	The 32DMX has five sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "7.5 32DMX Card" section on page 7-25
32DMX-L	The 32DMX-L has five sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "7.6 32DMX-L Card" section on page 7-30
40-DMX-C	The 40-DMX-C has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "7.7 40-DMX-C Card" section on page 7-35
40-MUX-C	The 40-MUX-C has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "7.8 40-MUX-C Card" section on page 7-40.
40-WSS-C	The 40-WSS-C card has eight sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "7.9 40-WSS-C Card" section on page 7-45
40-WXC-C	The 40-WXC-C card has five sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "7.10 40-WXC-C Card" section on page 7-51
MMU	The MMU card has six sets of ports located on the faceplate, It operates in Slots 1 to 6 and 12 to 17.	See the "7.11 MMU Card" section on page 7-58

7.1.2 Card Compatibility

Table 7-2 lists the Cisco Transport Controller (CTC) software compatibility for the ROADM cards.

Table 7-2   Software Release Compatibility for ROADM Cards

Card Name	R4.5	R4.6	R4.7	R5.0	R6.0	R7.0	R7.2	R8.0
32WSS	No	No	Yes	Yes	Yes	Yes	Yes	Yes
32WSS-L	No	No	No	No	No	Yes	Yes	Yes
40-WSS-C	No	No	No	No	No	No	No	Yes
32DMX	No	No	Yes	Yes	Yes	Yes	Yes	Yes
32DMX-L	No	No	No	No	No	Yes	Yes	Yes
40-DMX-C	No	No	No	No	No	No	No	Yes
40-MUX-C	No	No	No	No	No	No	No	Yes
40-WXC-C	No	No	No	No	No	No	No	Yes
MMU	No	No	No	No	No	Yes	Yes	Yes

7.1.3 Interface Classes

The 40-MUX-C, 32DMX, 32DMX-L, 40-DMX-C, 32WSS, and 32WSS-L cards have different input and output optical channel signals depending on the interface card originating the input signal. The input interface cards have been grouped in classes listed in Table 7-3. The subsequent tables list the optical performance and output power of each interface class.

Table 7-3   Cisco ONS 15454 Card Interfaces Assigned to Input Power Classes

Input Power Class	Card
A	10-Gbps multirate transponder cards (TXP_MR_10G, TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L) with forward error correction (FEC) enabled and 10-Gbps muxponder cards (MXP_2.5G_10G, MXP_2.5G_10E, MXP_MR_10DME_C, MXP_MR_10DME_L, MXP_2.5G_10E_C, and MXP_2.5G_10E_L) with FEC enabled
B	10-Gbps multirate transponder card (TXP_MR_10G) without FEC, 10-Gbps muxponder cards (MXP_2.5G_10G, MXP_MR_10DME_C, and MXP_MR_10DME_L), and ADM-10G cards with FEC disabled
C	OC-192 LR ITU cards (TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L) without FEC
D	2.5-Gbps multirate transponder card (TXP_MR_2.5G), both protected and unprotected, with FEC enabled
E	OC-48 100-GHz dense wavelength division multiplexing (DWDM) muxponder card (MXP_MR_2.5G) and 2.5-Gbps multirate transponder card (TXP_MR_2.5G), protected or unprotected; FEC disabled; and retime, reshape, and regenerate (3R) mode enabled
F	2.5-Gbps multirate transponder card (TXP_MR_2.5G), protected or unprotected, in regenerate and reshape (2R) mode
G	OC-48 ELR 100 GHz card

Table 7-3 Cisco ONS 15454 Card Interfaces Assigned to Input Power Classes (continued)

Input Power Class	Card
H	2/4 port GbE transponder (GBIC WDM 100GHz)
I	TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L cards with enhanced FEC (E-FEC) and the MXP_2.5G_10E, MXP_2.5G_10E_C, MXP_2.5G_10E_L, MXP_MR_10DME_C, and MXP_MR_10DME_L cards with E-FEC enabled

Table 7-4 lists the optical performance parameters for the following 10-Gbps cards that provide signal to the following multiplexer cards and demultiplexer cards:

- 32DMX
- 32DMX-L
- 32DMX-O
- 32MUX-O1
- 40-DMX-C
- 40-MUX-C
- 40-WSS-C
- 40-WXC-C
- 4MD-xx.x

Table 7-4 10-Gbps Interface Optical Performance

Parameter	Class A		Class B		Class C	Class I	
Type	Power Limited	OSNR[1] 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[2]	10^{-15}		10^{-12}		10^{-12}	10^{-15}	
OSNR[1] 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[3]							
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	—	

Table 7-4 **10-Gbps Interface Optical Performance (continued)**

Parameter	Class A		Class B		Class C	Class I	
Type	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited	OSNR Limited	Power Limited	OSNR Limited
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	

1. OSNR = optical signal-to-noise ratio

2. BER = bit error rate

3. These values, decreased by patchcord and connector losses, are also the input power values for the optical add drop multiplexer (OADM) cards.

- Table 7-5 lists the optical interface performance parameters for 2.5-Gbps cards that provide signal input to the following multiplexer and demultiplexer cards:
- 32DMX
- 32DMX-L
- 32DMX-O
- 32MUX-O1
- 40-DMX-C
- 40-MUX-C
- 40-WSS-C
- 40-WXC-C
- 4MD-xx.x

Table 7-5 **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

Table 7-5   *2.5-Gbps Interface Optical Performance (continued)*

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
Transmitted Power Range[1]										
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 –2.5 dBm					
MXP_MR_2.5G	—		+2.0 to +4.0 dBm		—					
MXPP_MR_2.5G	—		–1.5 to +0.5 dBm		—					
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

1. These values, decreased by patchcord and connector losses, are also the input power values for the OADM cards.

7.1.4 Channel Allocation Plans

ONS 15454 DWDM ROADM 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.

. The following cards operate in the C band:

- 32WSS
- 32DMX
- 32DMX-C
- 40-MUX-C
- 40-WXC-C
- MMU

Table 7-6 lists the C band channel IDs and wavelengths at ITU-T 50-GHz intervals. This is a comprehensive C band channel table that encompasses future card capability as well as present capabilities.

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Table 7-6   *DWDM C[1] Band Channel Allocation Plan with 50-GHz Spacing*

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

Table 7-6 **DWDM C[1] Band Channel Allocation Plan with 50-GHz Spacing (continued)**

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
4	195.85	1530.725	45	193.80	1546.917
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
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

Table 7-6   DWDM C[1] Band Channel Allocation Plan with 50-GHz Spacing (continued)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
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

1.   Channels on the C band are 4-skip-1, starting at 1530.33 nm.

The following add drop cards utilize the L band DWDM channels:

- 32WSS-L
- 2DMX-L

Table 7-7 lists the L band channel IDs and wavelengths at ITU-T 50-GHz intervals. This is a comprehensive L band channel table that encompasses future card capability as well as present capabilities.

Table 7-7   DWDM L Band[1] Channel Allocation Plan at 50 GHz Spacing

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
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

Table 7-7   DWDM L Band[1] Channel Allocation Plan at 50 GHz Spacing (continued)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
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
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

1. Channels on the L band are contiguous, starting at 1577.86 nm. The channels listed in this table begin with 1570.83 nm for backward compatibility with other ONS products.

7.2 Safety Labels for Class 1M Laser Product Cards

This section explains the significance of the safety labels attached to some of the cards. The card faceplates are clearly labeled with warnings about the laser radiation levels. You must understand all warning labels before working on these cards.

The 32DMX, 32DMX-L, 40-MUX-C, 40-DMX-C, 32WSS, 32WSS-L, 40-WSS-C, and 40-WXC-C cards have Class IM lasers. The labels that appear on these cards are described in the following subsections.

7.2.1 Class 1M Laser Product Label

Figure 7-1 shows the Class 1M Laser Product label.

Figure 7-1   Class 1M Laser Product Label

Class 1M lasers are products that produce either a highly divergent beam or a large diameter beam. Therefore, only a small part of the whole laser beam can enter the eye. However, these laser products can be harmful to the eye if the beam is viewed using magnifying optical instruments.

7.2.2 Hazard Level 1M Label

Figure 7-2 shows the Hazard Level 1M label. The Hazard Level label warns users against exposure to laser radiation by Class 1 limits calculated in accordance with IEC60825-1 Ed.1.2.

Figure 7-2   Hazard Level Label

7.2.3 Laser Source Connector Label

Figure 7-3 shows the Laser Source Connector label. This label indicates that a laser source is present at the optical connector where the label is located.

Figure 7-3   Laser Source Connector Label

7.2.4 FDA Statement Label

Figure 7-4 shows the FDA Statement label. This label shows compliance to FDA standards and indicates that the hazard level classification is in accordance with IEC60825-1 Am.2 or Ed.1.2.

Figure 7-4   *FDA Statement Label*

```
COMPLIES WITH 21 CFR 1040.10
   AND 1040.11 EXCEPT FOR
  DEVIATIONS PURSUANT TO
    LASER NOTICE NO.50,
    DATED JULY 26, 2001        96634
```
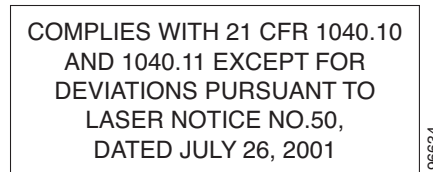
7.2.5 Shock Hazard Label

Figure 7-5 shows the Shock Hazard label. This label alerts you to electrical hazards within a card. A shock hazard exists when you remove adjacent cards during maintenance, or when you touch exposed electrical circuitry on the card itself.

Figure 7-5   *Shock Hazard Label*

7.3 32WSS Card

Note See the "A.7.3 32WSS Card Specifications" section on page A-24 for hardware specifications.

Note For information 32WSS card safety labels, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The two-slot 32-Channel Wavelength Selective Switch (32WSS) card performs channel add/drop processing within the ONS 15454 DWDM node. The 32WSS card can be installed in the following pairs of slots:

- Slots 1 and 2
- Slots 3 and 4

- Slots 5 and 6
- Slots 12 and 13
- Slots 14 and 15
- Slots 16 and 17

7.3.1 32WSS Faceplate Ports

The 32WSS has six types of ports:

- ADD RX ports (1 to 32): These ports are used for adding channels (listed in Table 7-9 on page 7-17). Each add channel is associated with an individual switch element that selects whether that channel is added. Each add port has optical power regulation provided by a variable optical attenuator (VOA). The 32WSS has four physical receive connectors that accept multifiber push-on (MPO) cables on its front panel for the client input interfaces.Each MPO cable breaks out into eight separate cables.

- EXP RX port: The EXP RX port receives an optical signal from another 32WSS card in the same network element (NE).

- EXP TX port: The EXP TX port sends an optical signal to the other 32WSS card within the NE.

- COM TX port: The COM TX (line input) port sends an aggregate optical signal to a booster amplifier card (for example, OPT-BST) for transmission outside of the NE.

- COM RX port: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.

- DROP TX port: The DROP TX port sends the split-off optical signal containing drop channels to the 32DMX card, where the channels are further processed and dropped.

Figure 7-6 shows the 32WSS card front panel and identifies the traffic flow through the ports.
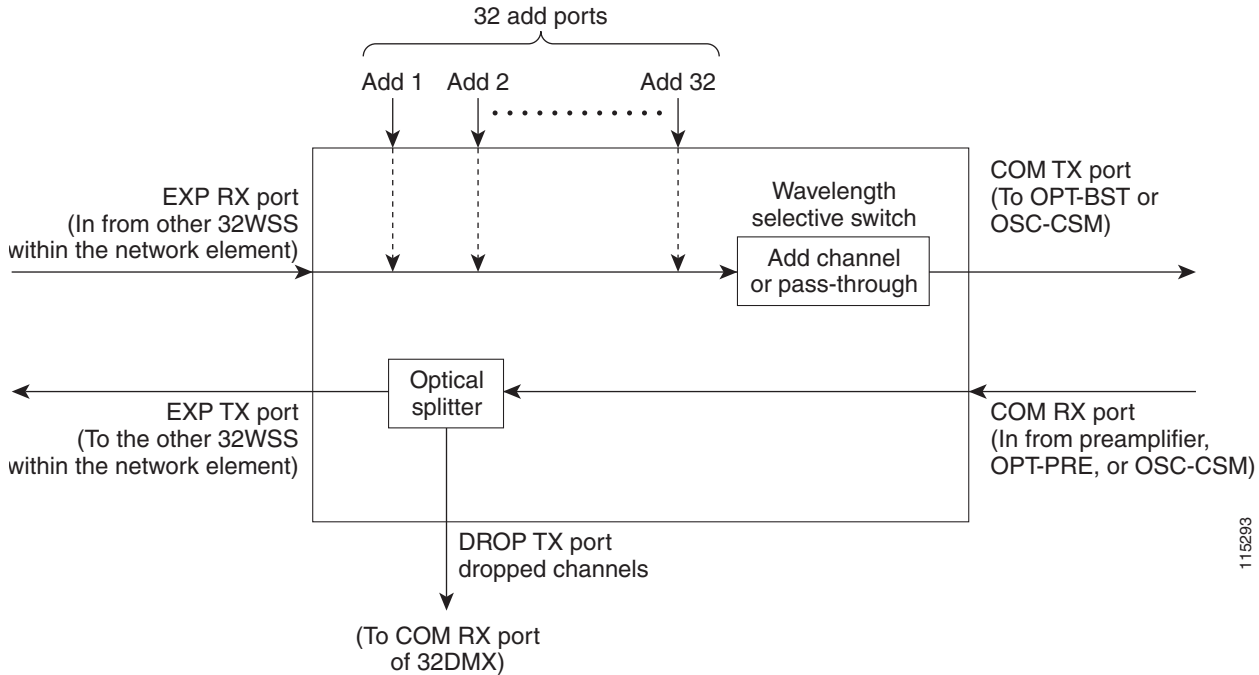
Figure 7-6   32WSS Faceplate and Ports
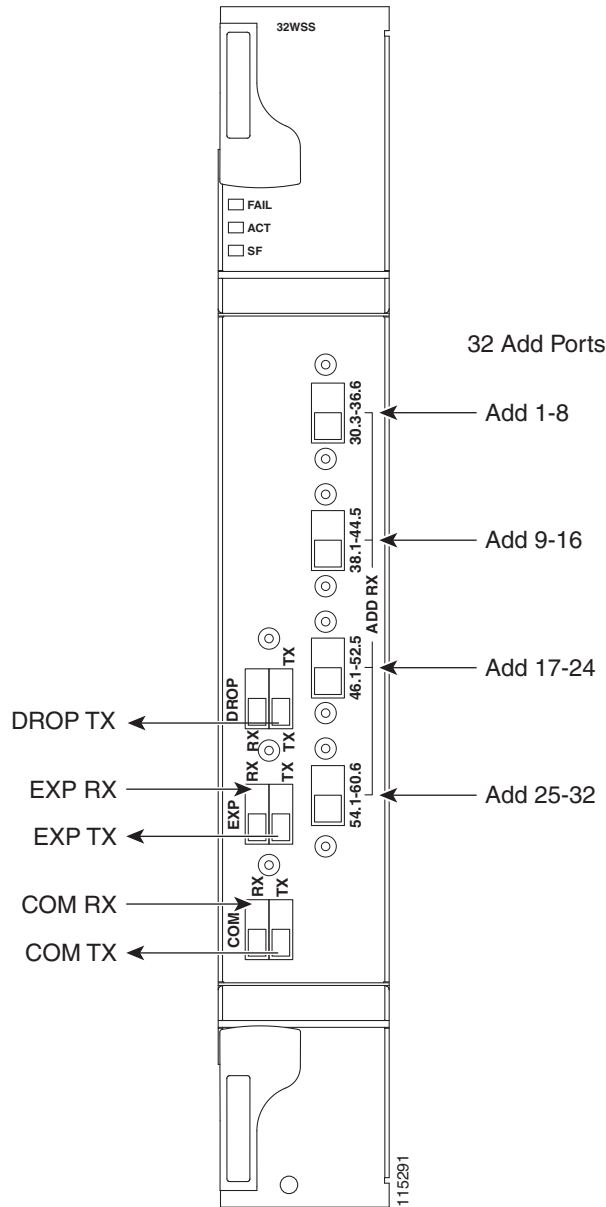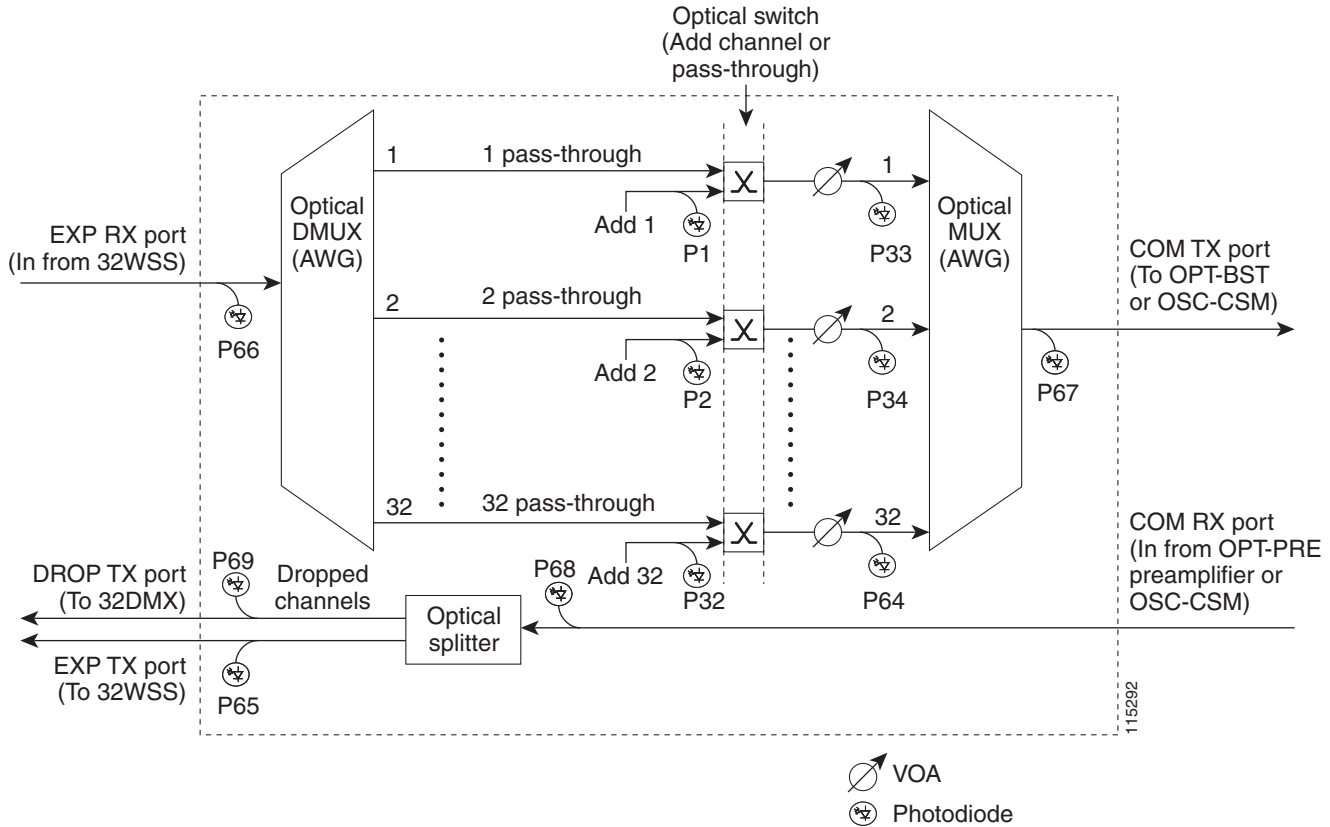

7.3.2 32WSS Block Diagram

Figure 7-7 provides a high-level functional block diagram of the 32WSS card and Figure 7-8 on page 7-15 shows how optical signals are processed on the EXP RX and COM RX ports.

Figure 7-7   ***32WSS Block Diagram***

Aggregate optical signals that enter the EXP RX and COM RX port are processed in two ways: Add channel/pass-through and optical splitter processing. The optical processing stages are shown in Figure 7-8, which provides a detailed optical functional diagram of the 32WSS card.

Figure 7-8   *32WSS Optical Block Diagram*

The EXP RX PORT and COM RX PORT operate as follows:

- EXP RX Port Add Channel/Pass-through Processing

    The incoming optical signal is received at the EXP RX port from the other 32WSS card within the NE. The incoming aggregate optical signal is demultiplexed into 32 individual wavelengths, or channels. Each channel is then individually processed by the optical switch, which performs add/pass-through processing. By using software controls, the switch either selects the optical channel coming in from the demultiplexer (that is, the pass-through channel) or it selects the external ADD channel. If the ADD port channel is selected this channel is transmitted and the optical signal coming from the demultiplexer is blocked.

    After the optical switch stage, all of the channels are multiplexed into an aggregate optical signal, which is sent out on the COM TX port. The output is typically connected to an OPT-BST or OPT-BST-E card (in the event a booster amplifier is needed) or to an OSC-CSM card (if no amplification is needed).

- COM RX Port Optical Splitter Processing

    The COM RX port receives the incoming optical signal and directs it to the 32WSS card's optical splitter. The splitter optically diverts channels that are designated to be dropped to the DROP TX port. The DROP TX port is typically connected to the COM RX port of the 32DMX where the drop channels are being dropped. Channels that are not dropped pass through the optical splitter and flow out of the 32WSS card EXP TX port. Typically, this optical signal is connected to the other 32WSS module within the NE.

- COM TX Port Monitoring

  The COM-TX Value can be measured by either a physical or a virtual photodiode of the 15454-32WSS card. If the vendor ID of the 15454-32WSS card is between 1024 (0x400) and 2047 (0x800), the COM-TX value is measured by physical photodiode. If the vendor ID of the 15454-32WSS card is greater than 2048 (0x800), the COM-TX value is measured by the virtual photodiode.

  For COM-TX values measured by virtual photodiode, check the values at the RX port in the downstream of the COM-TX port (COM-RX port on OPT-BST or OSC-CSM card).

7.3.3 32WSS ROADM Functionality

The 32WSS card works in combination with the 32DMX card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco MetroPlanner, and Cisco Transport Manager (CTM). ROADM functionality using the 32WSS card requires two 32DMX single-slot cards and two 32WSS double-slot cards (totalling six slots needed in the ONS 15454 chassis).

For other cards' ROADM functionality, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "9.1.4 ROADM Node" section on page 9-12.

Note A terminal site can be configured using only a 32WSS card and a 32DMX card plugged into the east or west side of the shelf.

7.3.4 32WSS Power Monitoring

Physical photodiodes P1 through P69 monitor the power for the 32WSS card. Table 7-8 shows how the returned power level values are calibrated to each port.

Table 7-8   32WSS Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	ADD (Power ADD)	ADD RX
P33–P64[1]	PASS THROUGH	COM TX
	ADD (Power)	COM TX
P65	OUT EXP	EXP TX
P66	IN EXP	EXP RX
P67	OUT COM	COM TX
P68	IN COM	COM RX
P69	DROP	DROP TX

1. P33–P64 monitor either ADD or PASSTHROUGH power, depending on the state of the optical switch

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 8.0.

7.3.5 32WSS Channel Allocation Plan

The 32WSS Card's channel labels, frequencies, and wavelengths are listed in Table 7-9.

Table 7-9   *32WSS Channel Allocation Plan*

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.1	195.1	1536.61
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.87
	39.7	194.7	1539.77
	40.5	194.6	1540.46
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61

7.3.6 32WSS Card-Level Indicators

Table 7-10 describes the three card-level LED indicators on the 32WSS card.

Table 7-10   32WSS Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that there is an internal hardware failure. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 32WSS card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.3.7 32WSS Port-Level Indicators

You can find the alarm status of the 32WSS card's ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.4 32WSS-L Card

Note   See the "A.7.4 32WSS-L Card Specifications" section on page A-26 for hardware specifications.

Note   For 32WSS-L safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The two-slot 32-Channel Wavelength Selective Switch L-Band (32WSS-L) card performs channel add/drop processing within the ONS 15454 DWDM node. The 32WSS-L card is particularly well suited for use in networks that employ DS fiber or SMF-28 single-mode fiber.The 32WSS-L card can be installed in the following pairs of slots:

- Slots 1 and 2
- Slots 3 and 4
- Slots 5 and 6
- Slots 12 and 13
- Slots 14 and 15
- Slots16 and 17

7.4.1 32WSS-L Faceplate Ports

The 32WSS-L card faceplate has six types of ports:

- ADD RX ports (1 to 32): These ports are used for adding channels (which are listed in Table 7-12 on page 7-24). Each add channel is associated with an individual switch element that selects whether the channel is added. Each add port has optical power regulation provided by a VOA.

- EXP RX port: The EXP RX port receives an optical signal from another 32WSS-L card in the same NE.

- EXP TX port: The EXP TX port sends an optical signal to the other 32WSS-L card within the NE.

- COM TX port: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.

- COM RX port: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.

- DROP TX port: The DROP TX port sends the split-off optical signal with drop channels to the 32DMX-L card, where the channels are further processed and dropped.

Figure 7-9 shows the 32WSS-L module front panel and identifies the traffic flow through the ports.

Figure 7-9 **32WSS-L Faceplate and Ports**
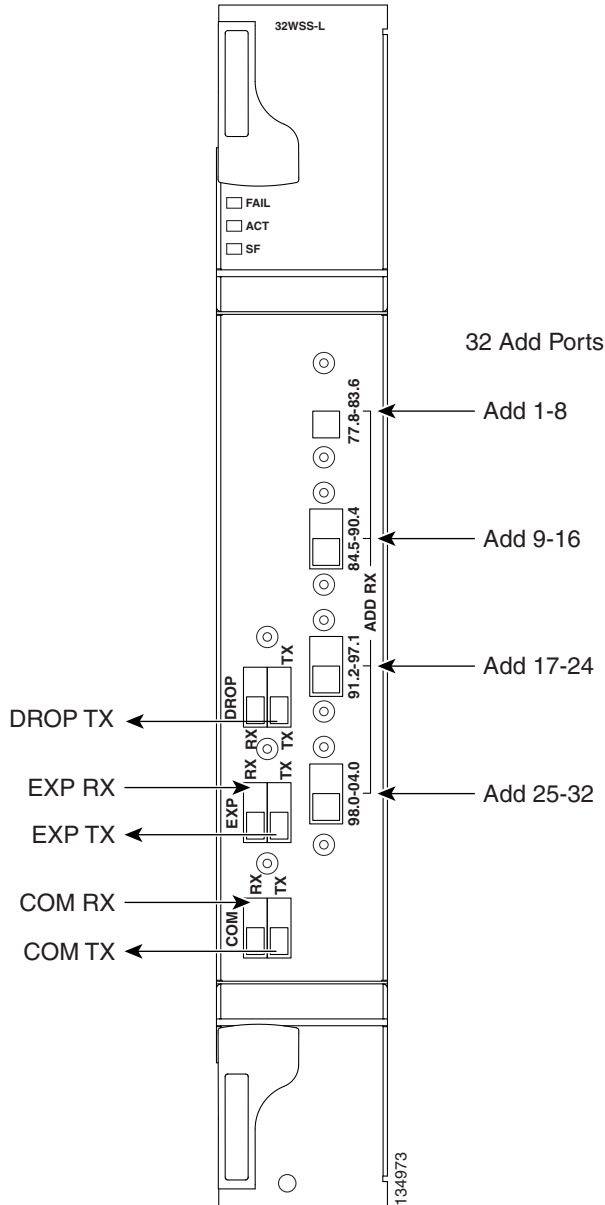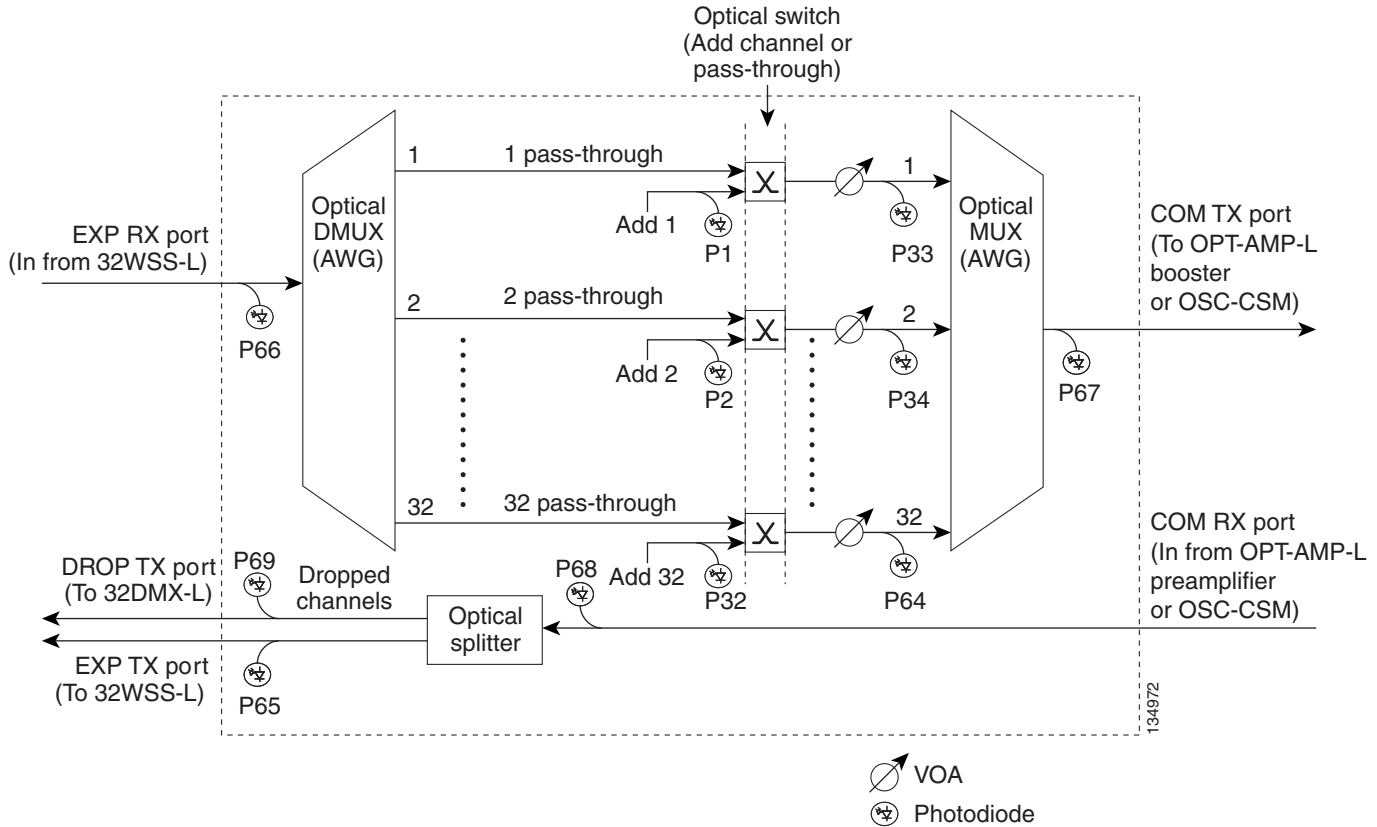

7.4.2 32WSS-L Block Diagram

Figure 7-10 provides a high-level functional block diagram of the 32WSS-L card and Figure 7-11 on page 7-22 shows how optical signals are processed on the EXP RX and COM RX ports.

Figure 7-10   32WSS-L Block Diagram
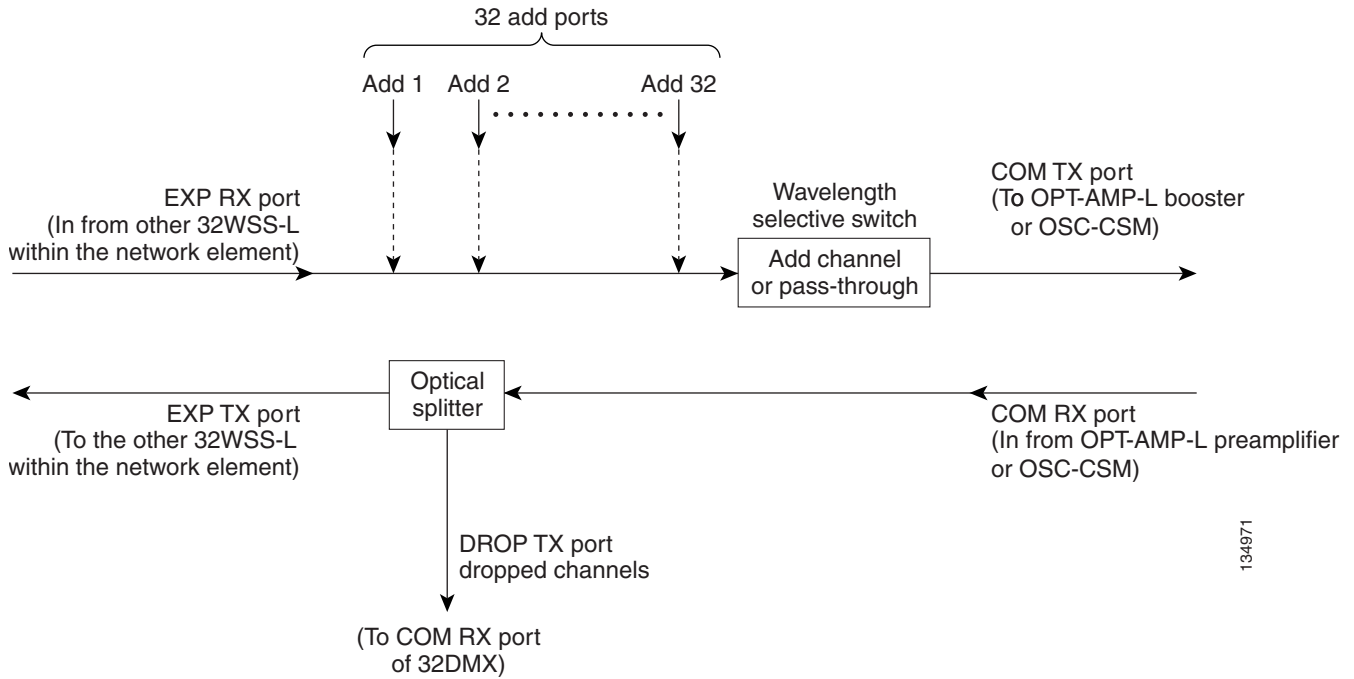
Aggregate optical signals that enter the EXP RX and COM RX ports are processed in two ways: add channel/pass-through and optical splitter processing. The optical processing stages are shown in Figure 7-11, which provides a detailed optical functional diagram of the 32WSS-L card.

Figure 7-11 **32WSS-L Optical Block Diagram**

The EXP RX PORT and COM RX PORT operate as follows:

- EXP RX Port Add Channel/Pass-through Processing

  The incoming optical signal is received at the EXP RX port from the other 32WSS-L card within the NE. The incoming aggregate optical signal is demultiplexed into 32 individual wavelengths, or channels. Each channel is then individually processed by the optical switch, which performs add/pass-through processing. By using software controls, the switch either selects the optical channel coming in from the demultiplexer (that is, the pass-through channel) or it selects the external ADD channel. If the ADD port channel is selected this channel is transmitted and the optical signal coming from the demultiplexer is blocked.

  After the optical switch stage, all of the channels are multiplexed into an aggregate optical signal, which is sent out on the COM TX port. The output is typically connected to an OPT-AMP-L or OPT-BST-E card (in the event a booster amplifier is needed) or to an OSC-CSM card (if no amplification is needed).

- COM RX Port Optical Splitter Processing

  The COM RX port receives the incoming optical signal and directs it to the 32WSS-L card's optical splitter. The splitter optically diverts channels that are designated to be dropped to the DROP TX port. The DROP TX port is typically connected to the COM RX port of the 32DMX-L where the drop channels are being dropped. Channels that are not dropped pass through the optical splitter and flow out of the 32WSS-L card EXP TX port. Typically, this optical signal is connected to the other 32WS-L module within the NE.

7.4.3 32WSS-L ROADM Functionality

The 32WSS-L works in combination with the 32DMX-L to implement L band (1570 to 1620 nm) functionality. As a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco MetroPlanner, and CTM. ROADM functionality using the 32WSS-L card requires two 32DMX-L single-slot cards and two 32WSS-L double-slot cards (totalling six slots needed in the ONS 15454 chassis).

For other cards' ROADM functionality, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "9.1.4 ROADM Node" section on page 9-12.

> **Note** A terminal site can be configured using a 32WSS-L card and a 32DMX-L card plugged into the east or west side of the shelf.

7.4.4 32WSS-L Power Monitoring

Physical photodiodes P1 through P69 monitor the power for the 32WSS-L card. Table 7-11 shows the returned power level values calibrated to each port.

Table 7-11   32WSS-L Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	ADD (Power ADD)	ADD RX
P33–P64[1]	PASS THROUGH	COM TX
	ADD (Power)	COM TX
P65	OUT EXP	EXP TX
P66	IN EXP	EXP RX
P67	OUT COM	COM TX
P68	IN COM	COM RX
P69	DROP	DROP TX

1. P33–P64 monitor either ADD or PASSTHROUGH power, depending on the state of the optical switch

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 8.0.

7.4.5 32WSS-L Channel Plan

The 32WSS-L card uses 32 banded channels on the ITU-T 100-GHz grid, as shown in Table 7-12.

Table 7-12   32WSS-L Channel Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B77.8	77.8	190	1577.86
	78.6	189.9	1578.69
	79.5	189.8	1579.52
	80.3	189.7	1580.35
B81.1	81.1	189.6	1581.18
	82.0	189.5	1582.02
	82.8	189.4	1582.85
	83.6	189.3	1583.69
B84.5	84.5	189.2	1584.53
	85.3	189.1	1585.36
	86.2	189	1586.20
	87.0	188.9	1587.04
B87.8	87.8	188.8	1587.88
	88.7	188.7	1588.73
	89.5	188.6	1589.57
	90.4	188.5	1590.41
B91.2	91.2	188.4	591.26
	92.1	188.3	1592.10
	92.9	188.2	1592.95
	93.7	188.1	1593.79
B94.6	94.6	188	1594.64
	95.4	187.9	1595.49
	96.3	187.8	1596.34
	97.1	187.7	1597.19
B98.0	98.0	187.6	1598.04
	98.8	187.5	1598.89
	99.7	187.4	1599.75
	00.6	187.3	1600.60
B01.4	01.4	187.2	1601.46
	02.3	187.1	1602.31
	03.1	187	1603.17
	04.0	186.9	1604.03

7.4.6 32WSS-L Card-Level Indicators

Table 7-13 describes the three card-level LED indicators on the 32WSS-L card.

Table 7-13   32WSS-L Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 32WSS-L card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.5 32DMX Card

Note See the "A.7.1 32DMX Card Specifications" section on page A-20 for hardware specifications.

Note For 32DMX card safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The single-slot 32-Channel Demultiplexer (32DMX) card is an optical demultiplexer. The card receives an aggregate optical signal on its COM RX port and demultiplexes it into to (32) ITU-T 100-GHz-spaced channels. The 32DMX card can be installed in Slots 1 to 6 and in Slots 12 to 17.

7.5.1 32DMX Faceplate Ports

The 32DMX card has two types of ports:

- COM RX port: COM RX is the input port for the aggregate optical signal being demultiplexed. This port is supported by a VOA for optical power regulation and a photodiode for optical power monitoring.

- DROP TX ports (1 to 32): On its output, the 32DMX provides 32 drop ports (listed in Table 7-15 on page 7-28) that are typically used for dropping channels within the ROADM node. These ports are connected using four 8-fiber MPO ribbon connectors. The incoming optical signal to the demultiplexer comes into the COM RX port. This input port is connected using a single LC duplex optical connector.Each drop port has a photodiode for optical power monitoring. Unlike the two-slot 32DMX-O demultiplexer, the drop ports on the 32DMX do not have a VOA per channel for optical power regulation. For a description of the 32DMX-O card, see the "5.4 32DMX-O Card" section on page 5-15.

Figure 7-12 shows the 32DMX card front panel and the basic traffic flow through the ports.

Figure 7-12   32DMX Faceplate and Ports
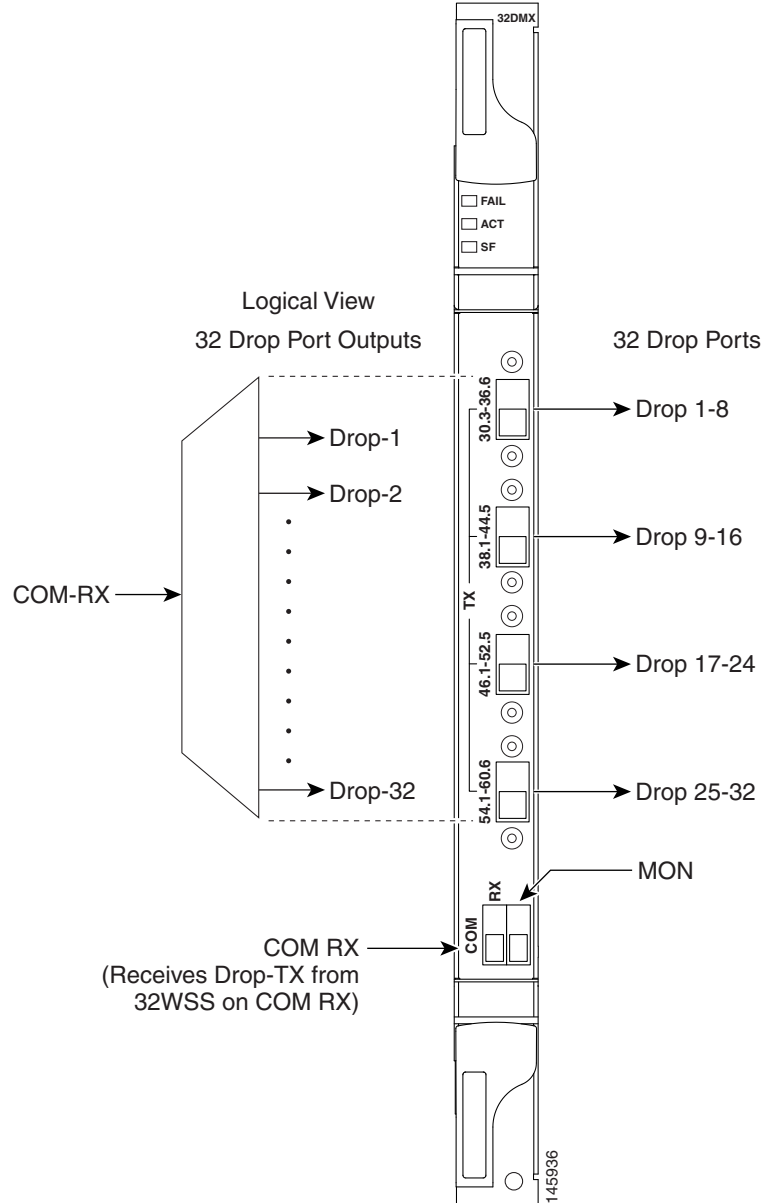
7.5.2 32DMX Block Diagram

A block diagram of the 32DMX card is shown in Figure 7-13.

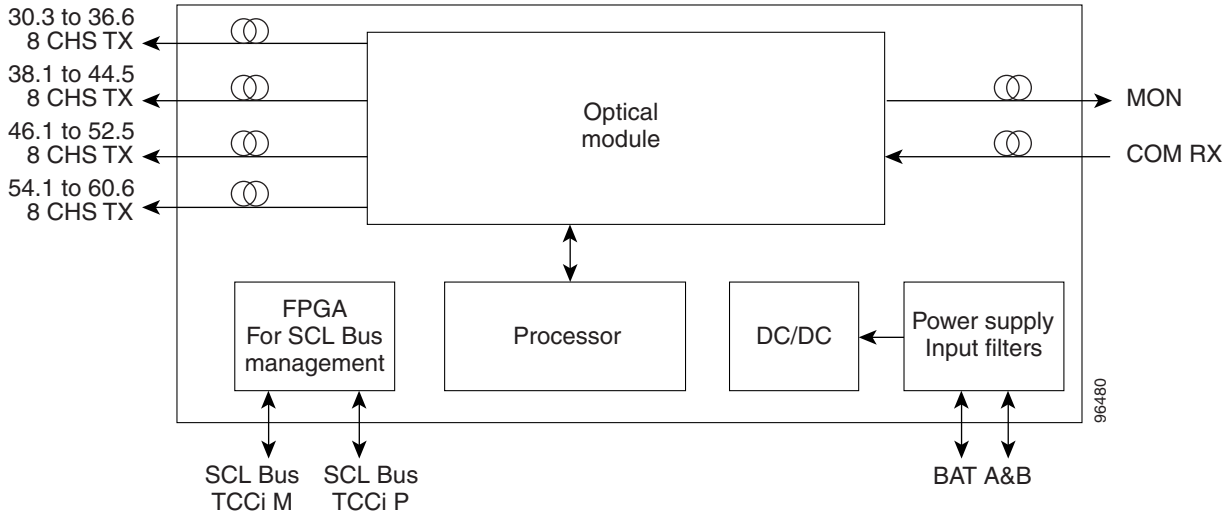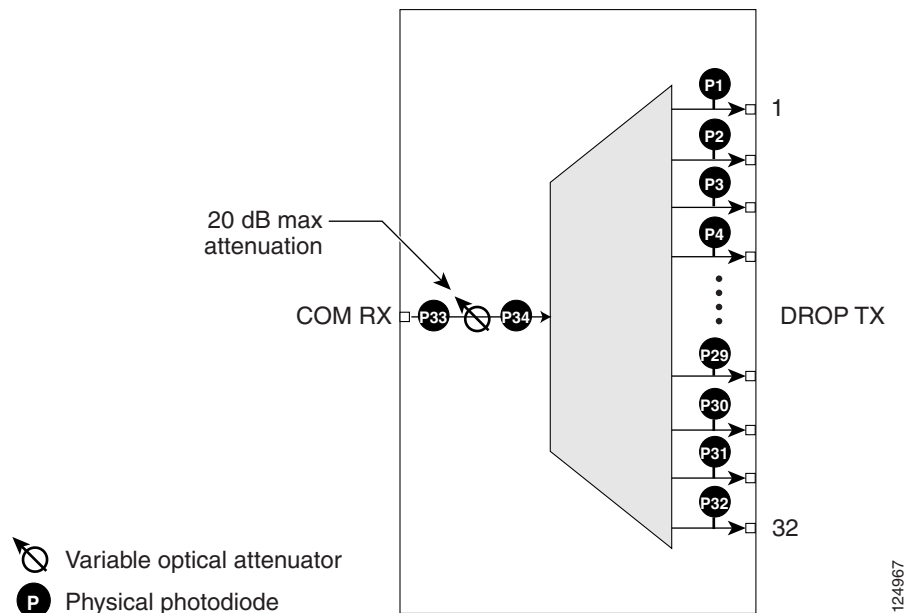*Figure 7-13*   *32DMX Block Diagram*

Figure 7-14 shows the 32DMX optical module functional block diagram.

Figure 7-14   *32DMX Optical Module Functional Block Diagram*

7.5.3 32DMX ROADM Functionality

The 32DMX card works in combination with the 32WSS card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco MetroPlanner, and CTM. ROADM functionality using the 32DMX card requires two 32DMX single-slot cards and two 32WSS double-slot cards (for six slots total in the ONS 15454 chassis).

For information about the ROADM functionality for other cards, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "9.1.4 ROADM Node" section on page 9-12.

Note A terminal site can be configured using only a 32WSS card and a 32DMX card plugged into the east or west side of the shelf.

7.5.4 32DMX Power Monitoring

Physical photodiodes P1 through P33 monitor the power for the 32DMX card. The returned power level values are calibrated to the ports as shown in Table 7-14.

Table 7-14   32DMX Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	DROP	DROP TX
P33	INPUT 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 8.0.

7.5.5 32DMX Channel Allocation Plan

The 32DMX card's channel labels, frequencies, and wavelengths are listed in Table 7-15.

Table 7-15   32DMX Channel Allocation Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.1	195.1	1536.61
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.87
	39.7	194.7	1539.77
	40.5	194.6	1540.46

Table 7-15   32DMX Channel Allocation Plan (continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61

7.5.6 32DMX Card-Level Indicators

Table 7-16 describes the three card-level LED indicators on the 32DMX card.

Table 7-16   32DMX Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 32DMX card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.5.7 32DMX Port-Level Indicators

You can find the alarm status of the 32DMX card's ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.6 32DMX-L Card

Note See the "A.7.2 32DMX-L Card Specifications" section on page A-22 for hardware specifications.

Note For 32DMX-L safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The single-slot 32-Channel Demultiplexer L-Band card (32DMX-L) is an L band optical demultiplexer. The card receives an aggregate optical signal on its COM RX port and demultiplexes it into to (32) 100-GHz-spaced channels. The 32DMX-L card is particularly well suited for use in networks that employ DS fiber or SMF-28 single-mode fiber. The 32DMX-L card can be installed in Slots 1 to 6 and in Slots 12 to 17.

7.6.1 32DMX-L Faceplate Ports

The 32DMX-L card has two types of ports:

- COM RX port: COM RX is the input port for the aggregate optical signal being demultiplexed. This port is supported by both a VOA for optical power regulation and a photodiode for optical power monitoring.

- DROP TX ports (1 to 32): On its output, the 32DMX-L card provides 32 drop ports (listed in Table 7-21 on page 7-38) that are typically used for dropping channels within the ROADM node. These ports are connected using four 8-fiber MPO ribbon connectors. Each drop port has a photodiode for optical power monitoring. Unlike the two-slot 32DMX-O demultiplexer, the drop ports on the 32DMX-L do not have a VOA per channel for optical power regulation. For a description of the 32DMX-O card, see the "5.4 32DMX-O Card" section on page 5-15.

Figure 7-15 shows the 32DMX-L card front panel and the basic traffic flow through the ports.

Figure 7-15   32DMX-L Faceplate and Ports
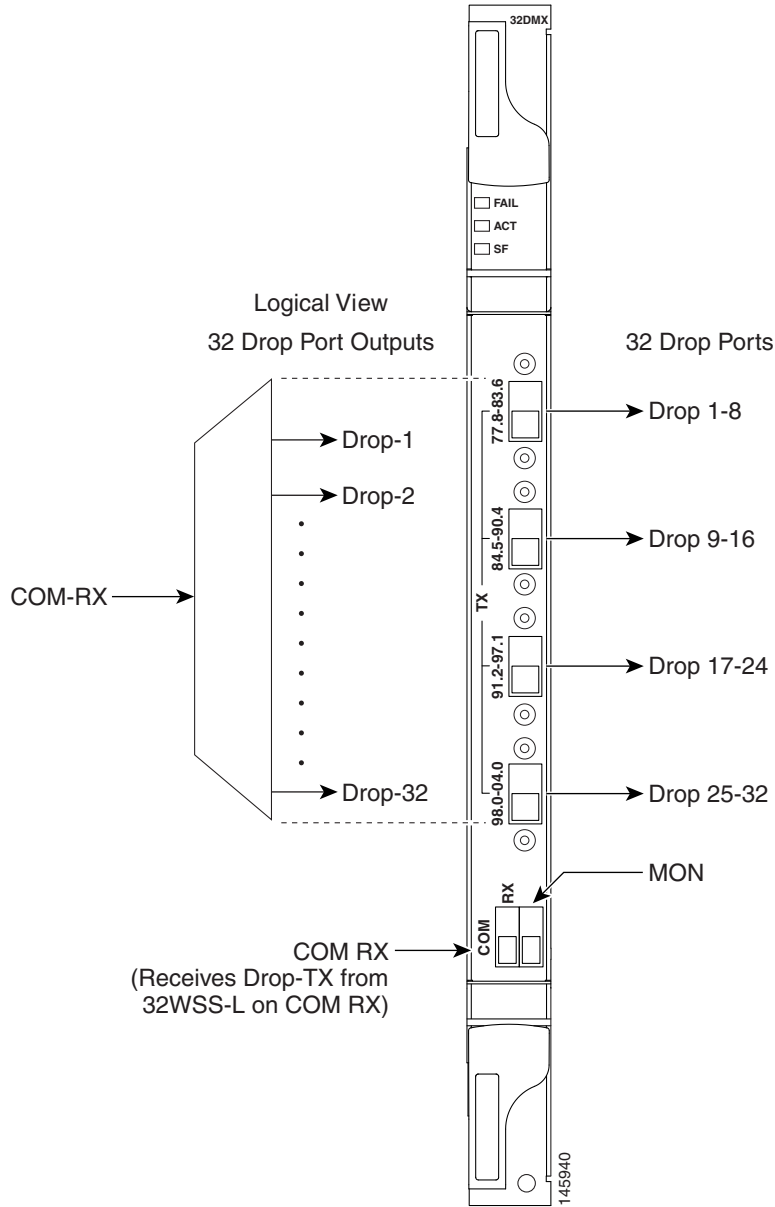
7.6.2 32DMX-L Block Diagram

Figure 7-16 shows a block diagram of the 32DMX-L card.
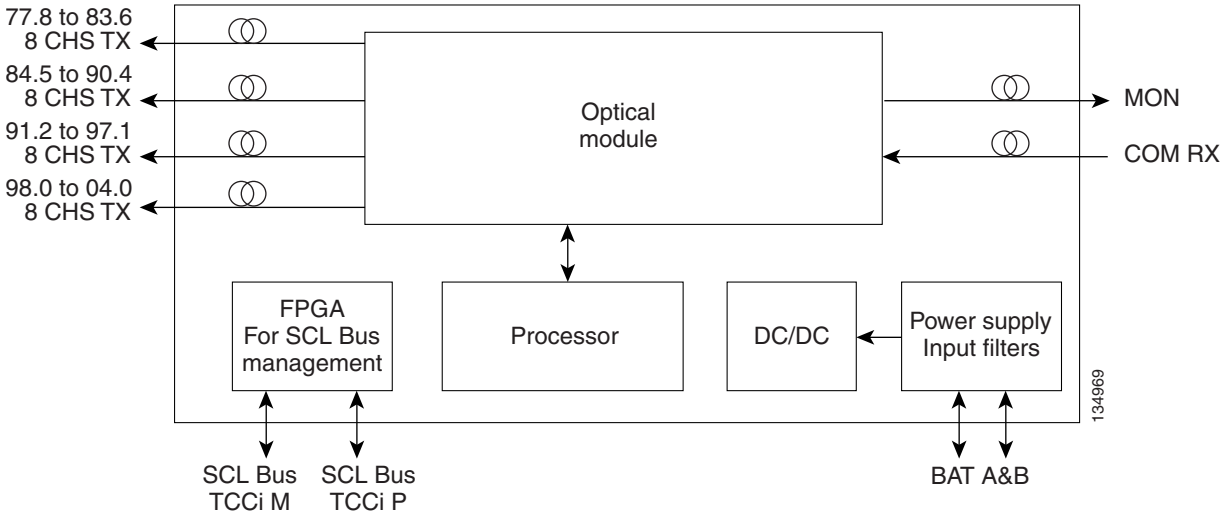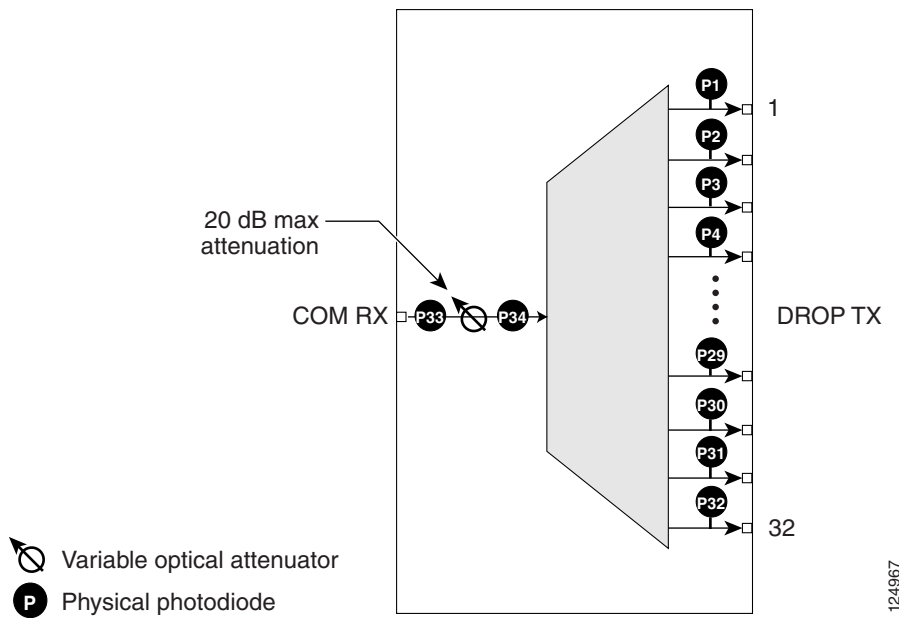
Figure 7-16   ***32DMX-L Block Diagram***

Figure 7-17 shows the 32DMX-L optical module functional block diagram.

Figure 7-17   ***32DMX-L Optical Module Functional Block Diagram***

7.6.3 32DMX-L ROADM Functionality

The 32DMX-L card works in combination with the 32WSS-L card to implement ROADM functionality. AS a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco MetroPlanner, and CTM. ROADM functionality using the 32DMX-L card requires two 32DMX-L single-slot cards and two 32WSS-L double-slot cards (for a total of six slots in the ONS 15454 chassis).

For information about ROADM functionality for other cards, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "9.1.4 ROADM Node" section on page 9-12.

> **Note** A terminal site can be configured using only a 32WSS-L card and a 32DMX-L card plugged into the east or west side of the shelf.

7.6.4 32DMX-L Power Monitoring

Physical photodiodes P1 through P33 monitor the power for the 32DMX-L card. The returned power level values are calibrated to the ports as shown in Table 7-17.

Table 7-17   32DMX-L Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	DROP	DROP TX
P33	INPUT 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 8.0.

7.6.5 32DMX-L Channel Plan

The 32DMX-L card uses 32 banded channels on the ITU-T 100-GHz grid, as shown in Table 7-18.

Table 7-18   32DMX-L Channel Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B77.8	77.8	190	1577.86
	78.6	189.9	1578.69
	79.5	189.8	1579.52
	80.3	189.7	1580.35
B81.1	81.1	189.6	1581.18
	82.0	189.5	1582.02
	82.8	189.4	1582.85
	83.6	189.3	1583.69
B84.5	84.5	189.2	1584.53
	85.3	189.1	1585.36
	86.2	189	1586.20
	87.0	188.9	1587.04

Table 7-18   32DMX-L Channel Plan (continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B87.8	87.8	188.8	1587.88
	88.7	188.7	1588.73
	89.5	188.6	1589.57
	90.4	188.5	1590.41
B91.2	91.2	188.4	1591.26
	92.1	188.3	1592.10
	92.9	188.2	1592.95
	93.7	188.1	1593.79
B94.6	94.6	188	1594.64
	95.4	187.9	1595.49
	96.3	187.8	1596.34
	97.1	187.7	1597.19
B98.0	98.0	187.6	1598.04
	98.8	187.5	1598.89
	99.7	187.4	1599.75
	00.6	187.3	1600.60
B01.4	01.4	187.2	1601.46
	02.3	187.1	1602.31
	03.1	187	1603.17
	04.0	186.9	1604.03

7.6.6 32DMX-L Card-Level Indicators

Table 7-19 describes the three card-level LED indicators on the 32DMX-L card.

Table 7-19   32DMX-L Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 32DMX-L card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.6.7 32DMX-L Port-Level Indicators

You can find the alarm status of the 32DMX-L card's ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.7 40-DMX-C Card

Note See the "A.7.6 40-DMX-C Card Specifications" section on page A-29 for hardware specifications.

Note For 40-DMX-C safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The single-slot 40-Channel Demultiplexer C-band (40-DMX-C) card demultiplexes 40 100-GHz-spaced channels identified in the channel plan (Table 7-21 on page 7-38), and sends them to dedicated output ports. The overall optical power can be adjusted using a single VOA that is common to all channels. The 40-DMX-C card is unidirectional, optically passive, and can be installed in Slots 1 to 6 and 12 to 17.

7.7.1 40-DMX-C Faceplate Ports

The 40-DMX-C has two types of ports:

- COM RX port: COM RX is the line input port for the aggregate optical signal being demultiplexed. This port is supported by a VOA for optical power regulation and a photodiode for per-channel optical power monitoring.

  Note By default, the VOA is set to its maximum attenuation for safety purposes (for example, electrical power failure). A manual VOA setting is also available.

- DROP TX ports (1 to 40): On its output, the 40-DMX-C card provides 40 drop ports that are typically used for dropping channels within the ROADM node. These ports are connected using five physical connectors on the front panel that accept MPO client input cables. (MPO cables break out into eight separate cables.) The 40-DMX-C card also has one LC-PC-II optical connector for the main input.

Figure 7-18 shows the 40-DMX-C card faceplate.

Figure 7-18   40-DMX-C Faceplate
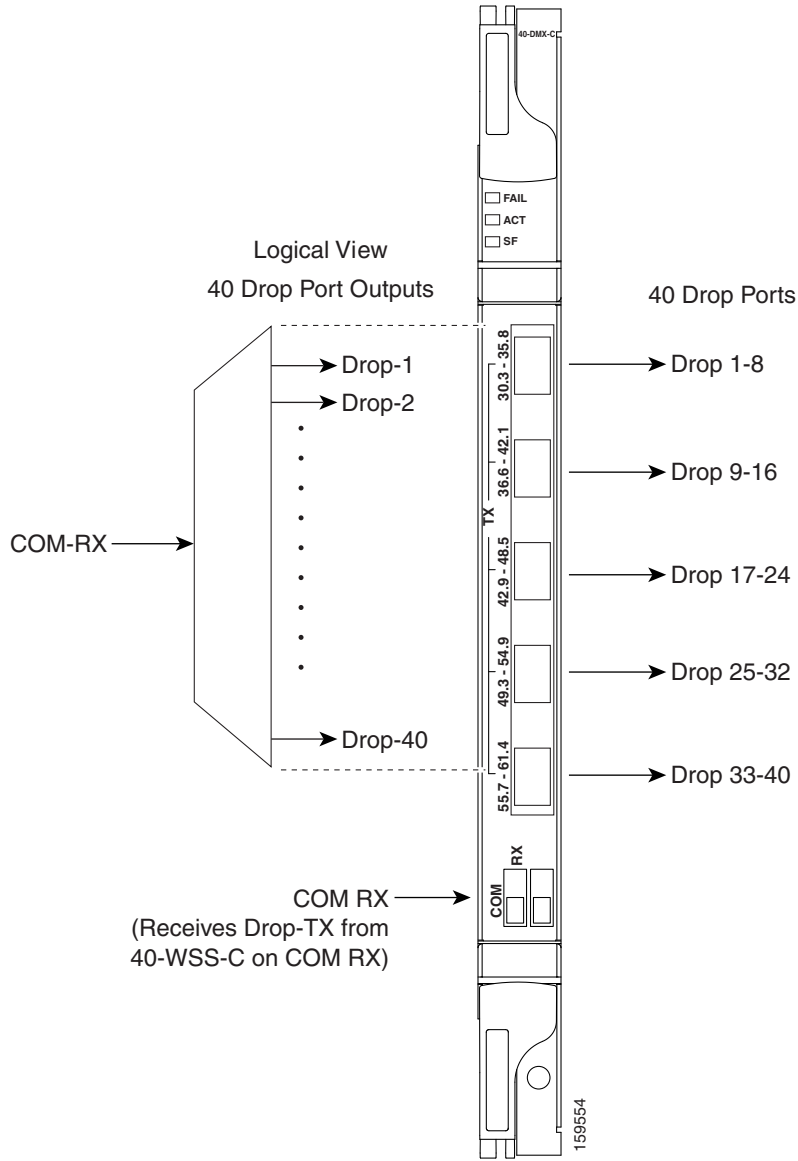
7.7.2 40-DMX-C Block Diagram

Figure 7-19 shows a block diagram of the 40-DMX-C card.
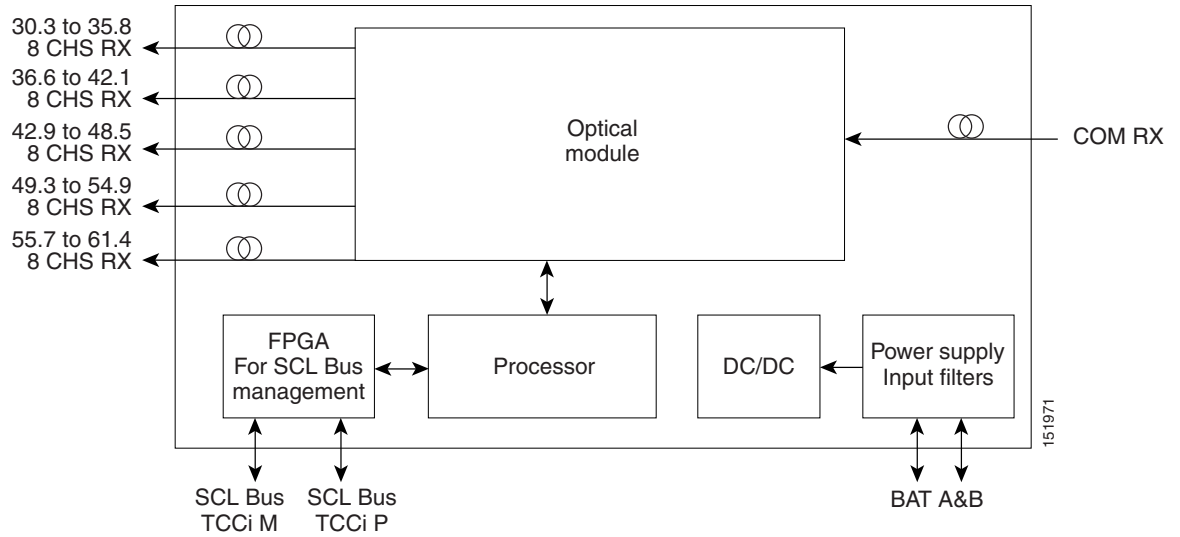
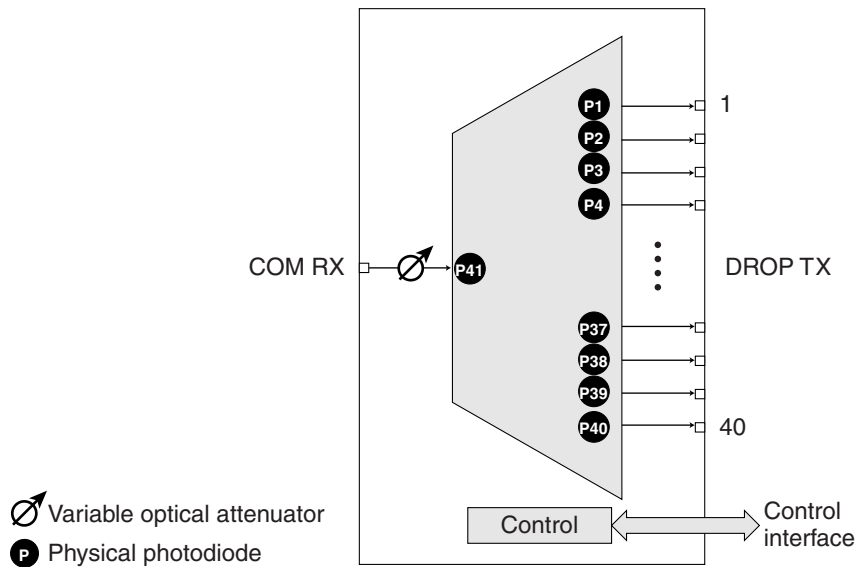*Figure 7-19*   *40-DMX-C Block Diagram*

Figure 7-20 shows the 40-DMX-C optical module functional block diagram.

Figure 7-20   *40-DMX-C Optical Module Functional Block Diagram*

7.7.3 40-DMX-C ROADM Functionality

The 40-DMX-C card works in combination with the 40-WSS-C card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured at the optical channel level using CTC, Cisco MetroPlanner, and CTM. ROADM functionality using the 40-DMX-C card requires two single-slot 40-DMX-C cards and two 40-WSS-C double-slot cards (for a total of six slots in the ONS 15454 chassis).

For other cards' ROADM functionality, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "9.1.4 ROADM Node" section on page 9-12.

7.7.4 40-DMX-C Power Monitoring

Physical photodiodes P1 through P40 monitor the power at the outputs of the 40-DMX-C card. P41 monitors the total multiplexed power at the input, calibrated to the COM-RX port. Table 7-20 shows the returned power level values calibrated to each port.

Table 7-20   40-DMX-C Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P40	DROP	DROP TX
P41	INPUT 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 8.0.

7.7.5 40-DMX-C Channel Plan

Table 7-21 shows the 40 ITU-T 100-GHz-spaced, C band channels (wavelengths) that are demultiplexed by the 40-DMX-C card.

Table 7-21   40-DMX-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35

Table 7-21 **40-DMX-C Channel Plan (continued)**

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

7.7.6 40-DMX-C Card-Level Indicators

The 40-DMX-C card has three card-level LED indicators, described in Table 7-22.

Table 7-22   40-DMX-C Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 40-DMX-C is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.7.7 40-DMX-C Port-Level Indicators

You can find the alarm status of the 40-DMX-C card ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.8 40-MUX-C Card

Note   See the "A.7.5 40-MUX-C Card Specifications" section on page A-28 for hardware specifications.

Note   For 40-MUX-C safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The single-slot 40-Channel Multiplexer C-band (40-MUX-C) card multiplexes forty ITU-T 100-GHz-spaced channels identified in the channel plan in Table 7-21 on page 7-38. The 40-MUX-C card can be installed in Slots 1 to 6 and 12 to 17. The 40-MUX-C card is typically used in hub nodes.

7.8.1 40-MUX-C Faceplate Ports

The 40-MUX-C has two types of ports:

- COM TX port: COM TX is the line output port for the aggregate optical signal being multiplexed. This port is supported by both a VOA for optical power regulation and a photodiode for per-channel optical power monitoring.

    Note   By default, the VOA is set to its maximum attenuation for safety purposes (for example, electrical power failure). A manual VOA setting is also available.

- DROP RX ports (1 to 40): The 40-MUX-C card provides 40 input optical channels. These ports are connected using five physical receive connectors on the card's front panel that accept MPO cables for the client input interfaces. MPO cables break out into eight separate cables. The 40-DMX-C card also has one LC-PC-II optical connector for the main output. For the wavelength range, see Table 7-21 on page 7-38.

Figure 7-21 shows the 40-MUX-C card faceplate.

Figure 7-21   *40-MUX-C Card Faceplate*
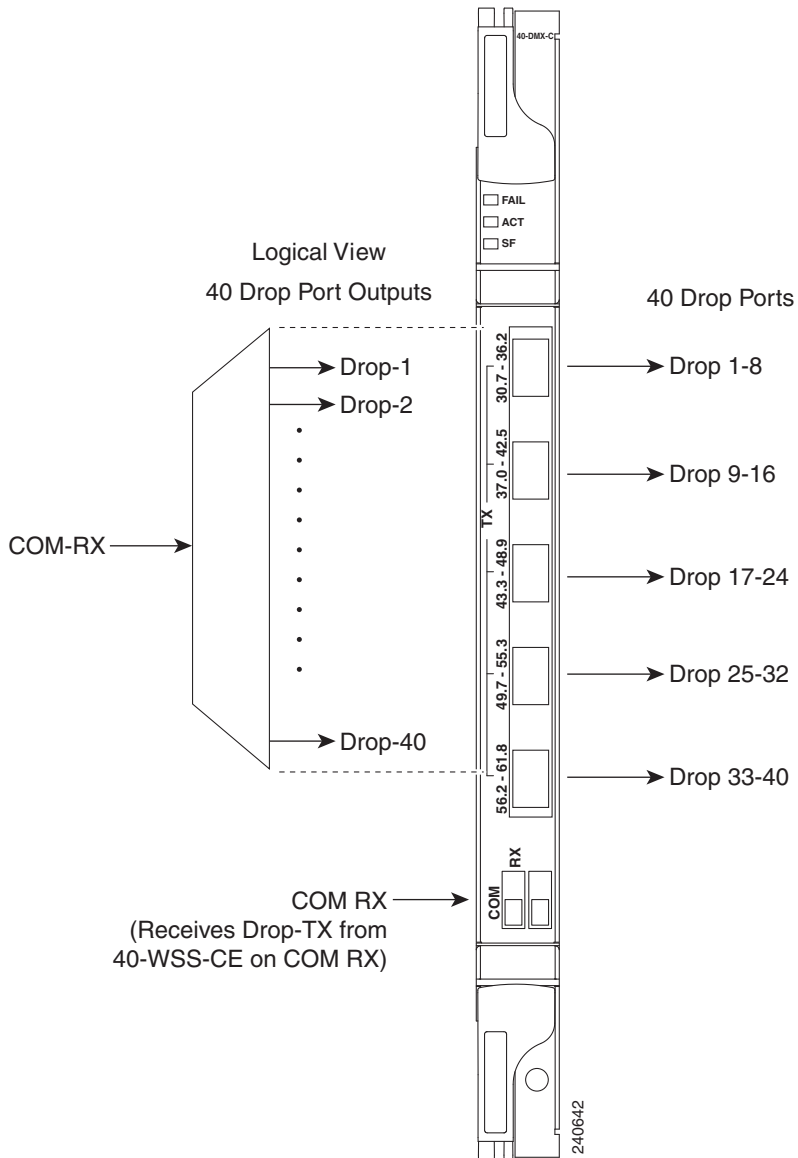
7.8.2 40-MUX-C Block Diagram

Figure 7-22 shows a block diagram of the 40-MUX-C card.

Figure 7-22   **40-MUX-C Block Diagram**
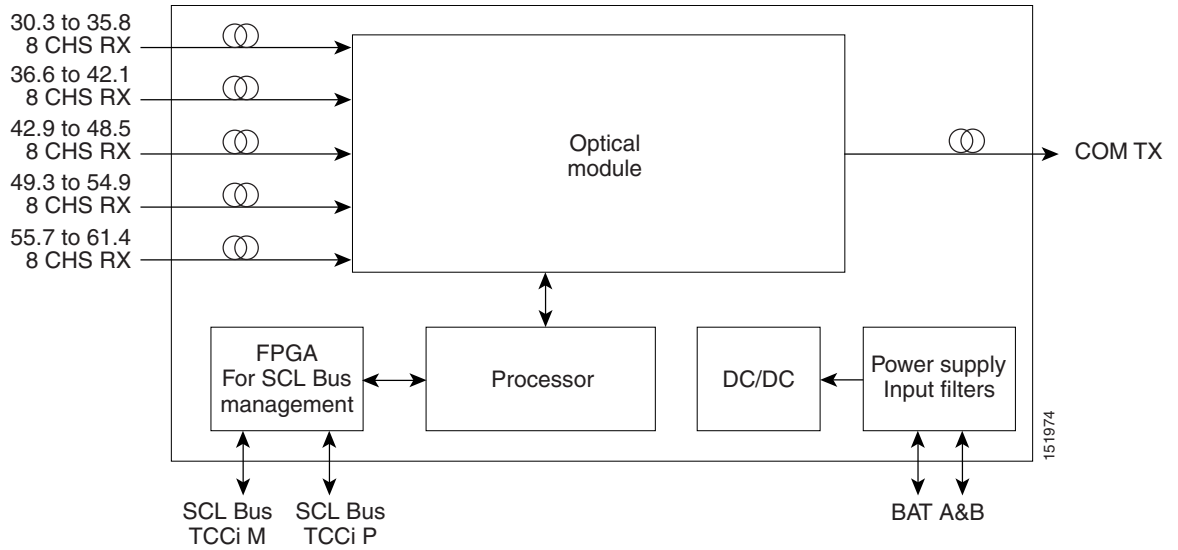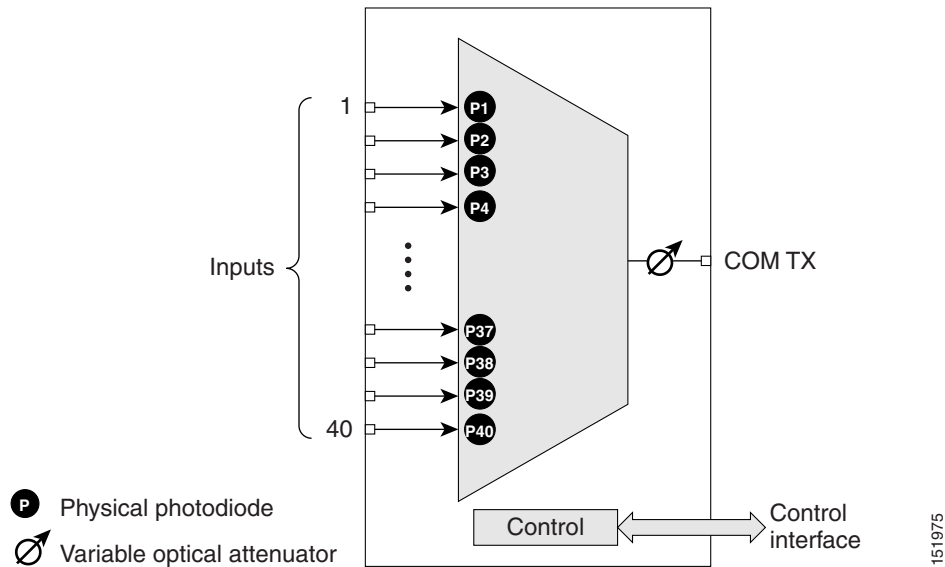

Figure 7-23 shows the 40-MUX-C optical module functional block diagram.

Figure 7-23   **40-MUX-C Optical Module Functional Block Diagram**

7.8.3 40-MUX-C Power Monitoring

Physical photodiodes P1 through P40 monitor the power of the individual input ports to the 40-MUX-C card. P41 monitors the total multiplexed output power, calibrated to the COM-TX port. Table 7-23 shows the returned power level values calibrated to each port.

Table 7-23 **40-MUX-C Port Calibration**

Photodiode	CTC Type Name	Calibrated to Port
P1–P40	ADD	ADD RX
P41	OUTPUT COM	COM-TX

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 8.0.

7.8.4 40-MUX-C Channel Plan

Table 7-24 shows the 40 ITU-T 100-GHz-spaced, C band channels (wavelengths) that are multiplexed by the 40-MUX-C card.

Table 7-24 **40-MUX-C Channel Plan**

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32

Table 7-24   40-MUX-C Channel Plan (continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

7.8.5 40-MUX-C Card-Level Indicators

The 40-MUX-C card has three card-level LED indicators, described in Table 7-25.

Table 7-25   40-MUX-C Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 40-MUX-C card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.8.6 40-MUX-C Port-Level Indicators

You can find the alarm status of the 40-MUX-C card ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.9 40-WSS-C Card

Note   See the "A.7.7 40-WSS-C Card Specifications" section on page A-30 for hardware specifications.

Note   For 40-WSS-C safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The double-slot 40-channel Wavelength Selective Switch C-Band (40-WSS-C) card switches 40 ITU-T 100-GHz-spaced channels identified in the channel plan (Table 7-21 on page 7-38) and sends them to dedicated output ports. The 40-WSS-C card is bidirectional and optically passive. The card can be installed in Slots 1 to 6 and 12 to 17

The 40-WSS-C features include:

- Receipt of an aggregate DWDM signal into 40 output optical channels from the Line receive port (EXP RX) in one direction and from the COM-RX port in the other direction.

- Per-channel optical power monitoring using photodiodes.

- Signal splitting in a 70%-to-30% ratio, sent to the 40-DMX-C for dropping signals, then to the other 40-WSS-C card.

- Aggregate DWDM signal monitoring and control through a variable optical attenuator (VOA). In the case of electrical power failure, the VOA is set to its maximum attenuation for safety purposes. A manual VOA setting is also available.

Within the 40-WSS-C card, the first AWG opens the spectrum and each wavelength is directed to one of the ports of a 1x2 optical switch. The same wavelength can be passed through or stopped. If the pass-through wavelength is stopped, a new channel can be added at the ADD port. The card's second AWG multiplexes all of the wavelengths, and the aggregate signal is output through the COM-TX port.

7.9.1 40-WSS-C Faceplate Ports

The 40-WSS-C has eight types of ports:

- ADD RX ports (1 to 40): These ports are used for adding channels. Each add channel is associated with an individual switch element that selects whether an individual channel is added. Each add port has optical power regulation provided by a VOA. The five connectors on the card faceplate accept MPO cables for the client input interfaces. MPO cables break out into eight separate cables. The 40-WSS-C card also has one LC-PC-II optical connector for the main input.

- COM RX: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.

- COM TX: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.

- EXP RX port: The EXP RX port receives an optical signal from another 40-WSS-C card in the same NE.

- EXP TX: The EXP TX port sends an optical signal to the other 40-WSS-C card within the NE.

- DROP TX port: The DROP TX port sends the split off optical signal that contains drop channels to the 40-DMX-C card, where the channels are further processed and dropped.

Figure 7-24 shows the 40-WSS-C card faceplate.

Figure 7-24   40-WSS-C Faceplate
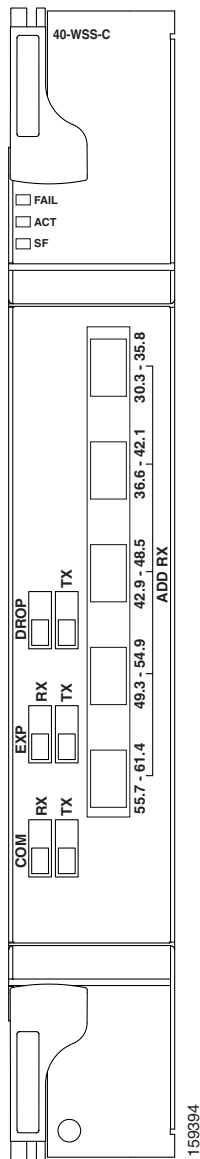
7.9.2 40-WSS-C Block Diagram

Figure 7-25 shows a block diagram of the 40-WSS-C card.

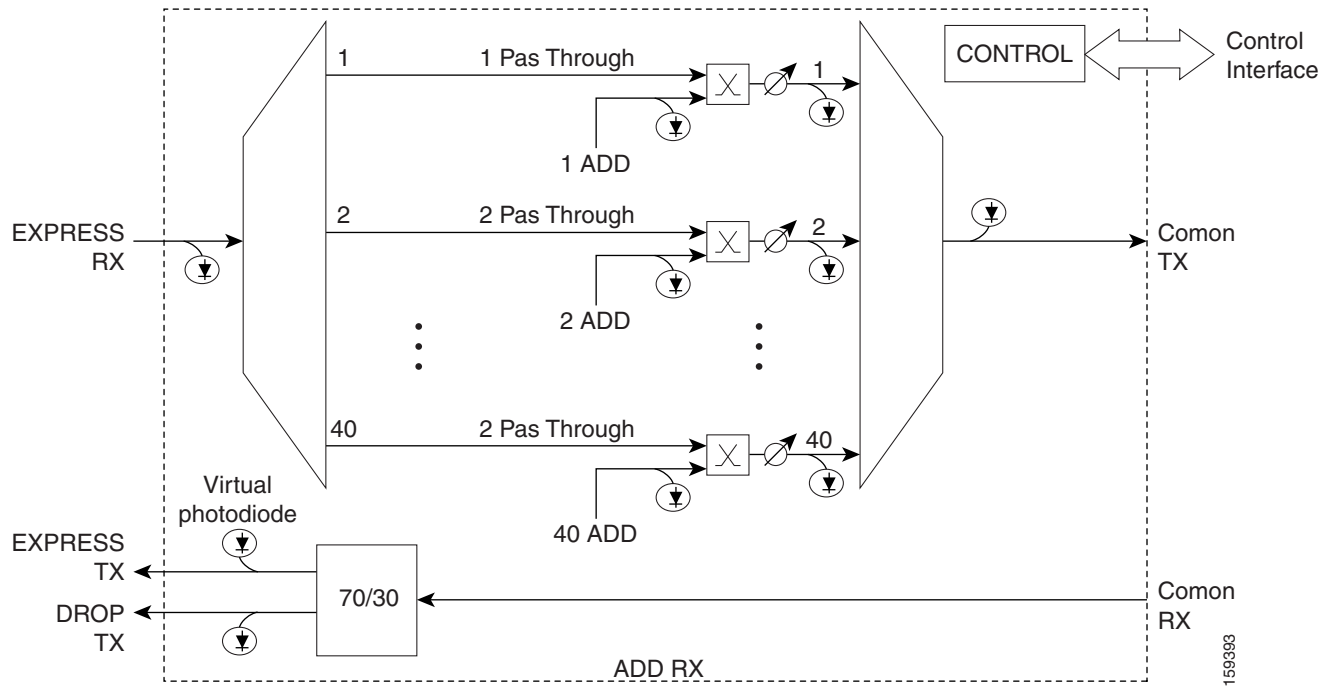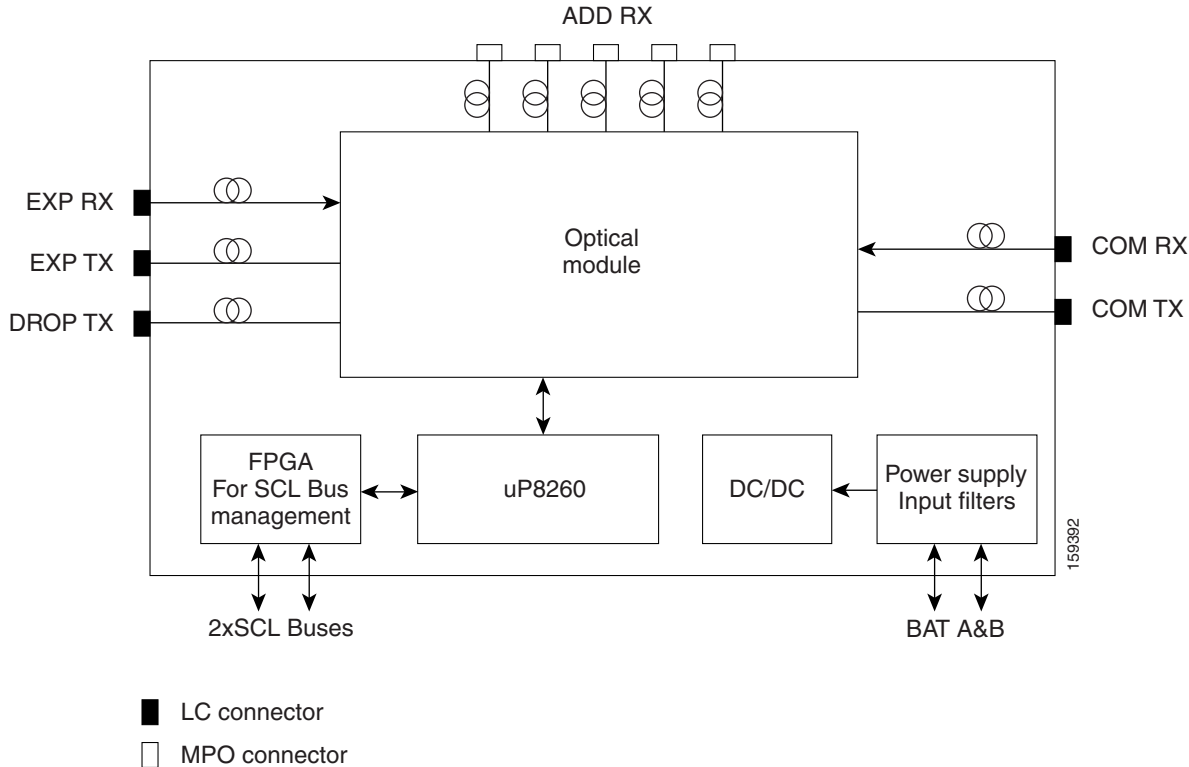*Figure 7-25*   *40-WSS-C Block Diagram*

Figure 7-26 shows the 40-WSS-C optical module functional block diagram.

Figure 7-26 40-WSS-C Optical Module Functional Block Diagram

7.9.3 40-WSS-C ROADM Functionality

The 40-WSS-C card works in combination with the 40-DMX-C card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured at the optical channel level using CTC, Cisco MetroPlanner, and CTM. ROADM functionality using the 40-WSS-C card requires two 40-WSS-C double-slot cards and two 40-DMX-C single-slot cards (for a total of six slots in the ONS 15454 chassis).

For information about ROADM functionality for other cards, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the .

7.9.4 40-WSS-C Power Monitoring

The 40-WSS-C has 83 physical diodes (P1 through P40) that monitor power at the outputs of the card. Table 7-26 lists the physical diode descriptions.

Table 7-26 40-WSS-C Physical Photodiode Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
P1	DROP	DROP TX
P2	EXP	EXP RX

Table 7-26   40-WSS-C Physical Photodiode Port Calibration (continued)

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
PD*i*3[1]	RX	Add *i* RX ports (that is, channel input Add *i* RX power), up to 40 ports and therefore 40 PDs[1]
PD*i*4[1]	TX	COM TX port (that is, per-channel output COM TX power) up to 40 channels and therefore 40 PDs
PD5	COM	COM TX port (that is, total output COM TX power)

1.   *i* indicates any channel from 01 through 40.

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 8.0.

Additionally, the 40-WSS-C has two virtual diodes. Virtual diodes are monitor points for each physical photodiode; they are identified with a physical diode relative to the way that the physical diode is identified with one of the two interlink (ILK) ports. Table 7-27 lists the virtual diodes.

Table 7-27   40-WSS-C Virtual Photodiode Port Calibration

Virtual Photodiode	CTC Type Name	Calibrated to Port(s)
VPD1	COM	COM RX port (total input COM RX power)
VPD2	EXP	EXP TX port (total output EXP TX power)

7.9.5 40-WSS-C Channel Plan

Table 7-28 shows the 40 ITU-T 100-GHz-spaced, C band channels (wavelengths) that are switched by the 40-WSS-C card.

Table 7-28   40-WSS-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40

Table 7-28   *40-WSS-C Channel Plan (continued)*

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

7.9.6 40-WSS-C Card-Level Indicators

The 40-WSS-C card has three card-level LED indicators, described in Table 7-29.

Table 7-29   40-WSS-C Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 40-WSS-C is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.9.7 40-WSS-C Port-Level Indicators

You can find the alarm status of the 40-WSS-C card ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.10 40-WXC-C Card

Note See the "A.7.8 40-WXC-C Card Specifications" section on page A-32 or hardware specifications.

Note For 40-WXC-C safety label information, see the "7.2 Safety Labels for Class 1M Laser Product Cards" section on page 7-9.

The double-slot 40-channel Wavelength Cross-Connect C Band (40-WXC-C) card selectively sends any wavelength combination coming from nine input ports to a common output port. The device can manage up to 41 channels spaced at 100GHz on each port according to the channel grid in Table 7-6 on page 7-6. Each channel can be selected from any input. The card is optically passive and provides bidirectional capability. It can be installed in Slots 1 to 6 and 12 to 17.

.The 40-WXC-C card provides the following features:

- Demultiplexing, selection, and multiplexing of DWDM aggregate signal from input ports to common output port.
- Aggregate DWDM signal monitoring and control through a VOA.
- VOAs are deployed in every channel path in order to regulate the channel's optical power. In the case of an electrical power failure, VOAs are set to their maximum attenuation value, or to a fixed and configurable one. The VOA can also be set manually.
- Per-channel optical power monitoring using photodiodes.

The 40-WXC-C card acts as a selector element with the following characteristics:

- It is able to select a wavelength from one input port and pass the wavelength through to the common out port. Simultaneously, the card can block the same wavelength coming from the other eight input ports.

- It is able to stop wavelengths from all nine inputs.

- It is able to monitor optical power and control path attenuation using per-channel VOA independently of the wavelength input-to-out port connection.

7.10.1 40-WXC-C Faceplate Ports

The 40-WXC-C card has six types of ports:

- COM RX: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.

- COM TX: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.

- EXP TX: The EXP TX port sends an optical signal to the other 40-WXC-C card within the NE.

- MON TX: The optical service channel (OSC) monitor.

- ADD/DROP RX: The 40-WXC-C card provides 40 input optical channels. These ports are connected using five physical receive connectors on the card's front panel that accept MPO cables for the client input interfaces. MPO cables break out into eight separate cables. For the wavelength range, see Table 7-32 on page 7-56.

- ADD/DROP TX: The DROP TX port sends the split off optical signal that contains drop channels to the 40-WXC-C card, where the channels are further processed and dropped.
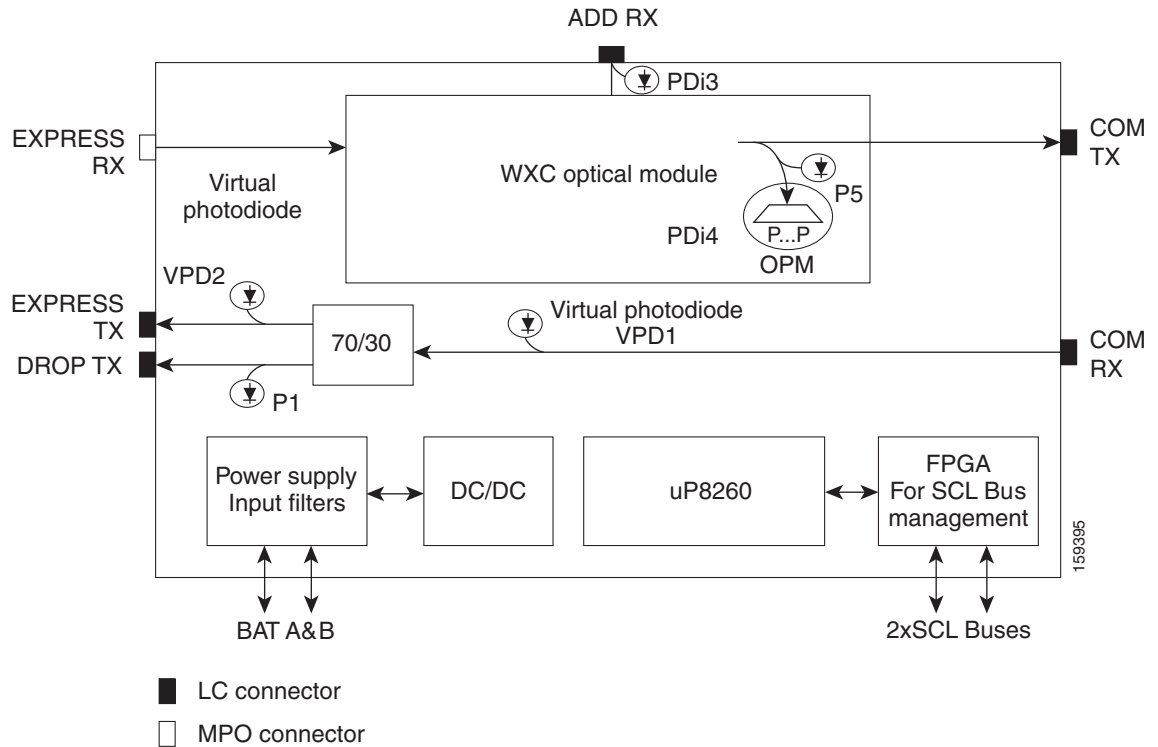
Figure 7-27 shows the 40-WXC-C card faceplate.

Figure 7-27 **40-WXC-C Faceplate**
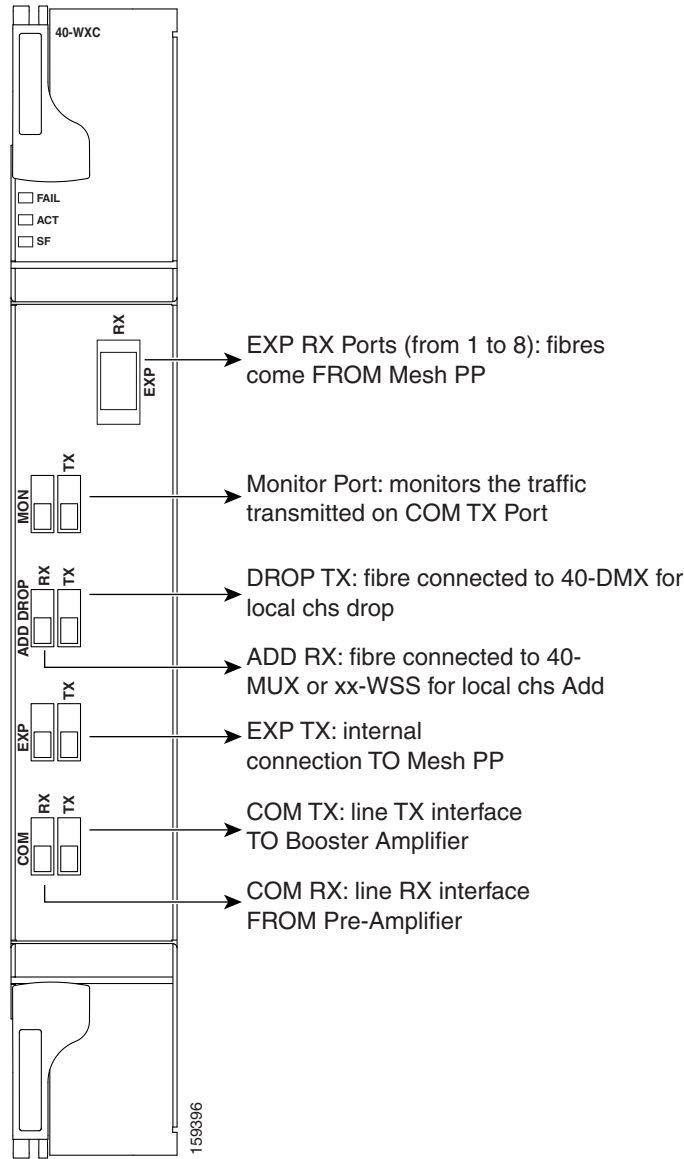
7.10.2 40-WXC-C Block Diagram

Figure 7-28 shows the 40-WXC-C optical module functional block diagram.

Figure 7-28   40-WXC-C Optical Module Functional Block Diagram

7.10.3 40-WXC-C Power Monitoring

The 40-WXC-C has 83 physical diodes (P1 through P40) that monitor power at the outputs of the card. Table 7-30 describes the physical diodes.

Table 7-30   40-WXC-C Physical Photodiode Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
P1	DROP	DROP TX
PD*i*3[1]	RX	Add *i* RX ports (that is, channel input Add *i* RX power), up to 40 ports and therefore 40 PDs[1]
PD*i*4[1]	TX	COM TX port (that is, per-channel output COM TX power) up to 40 channels and therefore 40 PDs
PD5	COM	COM TX port (that is, total output COM TX power)

1. *i* indicates any channel from 01 through 40.

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 8.0.

Additionally, the 40-WXC-C has two virtual diodes. Virtual diodes are monitor points for each physical photodiode; they are identified with a physical diode relative to the way that the physical diode is identified with one of the two interlink (ILK) ports. Table 7-31 lists the virtual diodes.

Table 7-31   40-WXC-C Virtual Photodiode Port Calibration

Virtual Photodiode	CTC Type Name	Calibrated to Port(s)
VPD1	COM	COM RX port (total input COM RX power)
VPD2	EXP	EXP TX port (total output EXP TX power)

The usage of WXC and mesh PP power readings to troubleshoot a LOS-P in WXC COM TX port in Side A is described in the following example. The example is explained assuming a single wavelength 1558.17 in the setup that comes from Side H to Side A. If there is more than one wavelength, then there is a risk of dropping traffic when pulling common fibers. The example is explained below:

When the wavelength from side H is 1558.17, you can check the power reading at WXC EXP TX port of the WXC card and verify the consistency with side H pre output power and WXC COMRX-EXPTX port loss. You can also check with a power meter connected to the 8th fiber (since it is from side H) of an MPO-FC (or LC) cable connected to the TAP-TX port of the MESH-PP. This value should be consistent with the previous reading, less than the insertion loss of the installed PP-MESH. If it is consistent, the issue is with the MPO between side A WXC and PP-MESH. If it is not consistent, the issue is with the PP-MESH or the LC-LC from side H. With only the PP-MESH already tested during installation, the only issue can be with the patch cord b.

You can check if the 1558.17 wavelength from side H is unequalized (that is, if the channel is not aligned with the linear fit of the power values of the other channels) by keeping the DMX COM-RX port of side H in maintenance, and checking both the signal and ASE levels of CHAN-TX ports of the DMX card. If the channel is equalized (that is, if the channel is aligned with the linear fit of the power values of the other channels), then the issue is in the WXC side A that cannot properly regulate the VOA for such channel. If the channel is unequalized, then the issue is on a remote node.

Note   With an OSA or a spare 40 DMX , you can see the light coming from all the sides from TAP-TX of the PP-MESH.

7.10.4 40-WXC-C Channel Plan

Table 7-32 shows the 40 ITU-T 100-GHz-spaced, C band channels (wavelengths) that are cross connected by the 40-WXC-C card.

Table 7-32   *40-WXC-C Channel Plan*

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
Ch. 0[1]	29.5	196	1529.55
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33

Table 7-32   40-WXC-C Channel Plan (continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

1.   This channel is unused by the 40-WXC-C

7.10.5 40-WXC-C Card-Level Indicators

The 40-WXC-C card has three card-level LED indicators described in Table 7-33.

Table 7-33   40-WXC-C Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that an internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the 40-WXC-C is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.10.6 40-WXC-C Port-Level Indicators

You can find the alarm status of the 40-WXC-C card ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.11 MMU Card

The single-slot Mesh Multi-Ring Upgrade Module (MMU) card supports multiring and mesh upgrades for ROADM nodes in both the C band and the L band. Mesh/multiring upgrade is the capability to optically bypass a given wavelength from one section of the network or ring to another one without requiring 3R regeneration. In each node, you need to install one east MMU and one west MMU. The card can be installed in Slots 1 through 6 and 12 through 17.

7.11.1 MMU Faceplate Ports

The MMU has six types of ports:

- EXP RX port: The EXP RX port receives the optical signal from the ROADM section available on the NE.
- EXP TX port: The EXP TX port sends the optical signal to the ROADM section available on the NE.
- EXP-A RX port: The EXP-A RX port receives the optical signal from the ROADM section available on other NEs or rings.
- EXP-A TX port: The EXP-A TX port sends the optical signal to the ROADM section available on other NEs or rings.
- COM TX port: The COM TX port sends the optical signal to the fiber stage section.
- COM RX port: The COM RX port receives the optical signal from the fiber stage section.
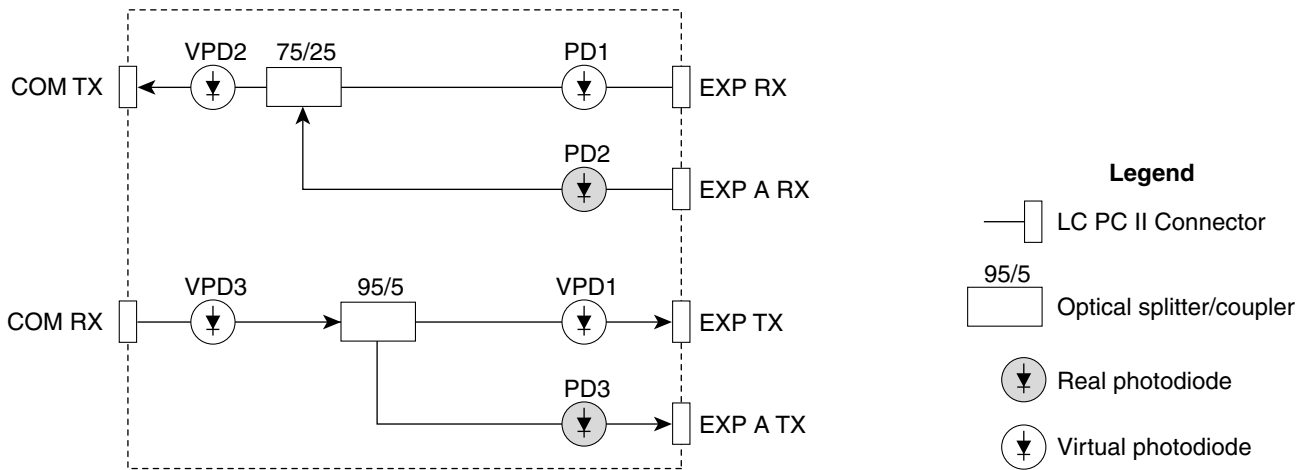
Figure 7-29 shows the MMU card faceplate.

Figure 7-29   MMU Faceplate and Ports
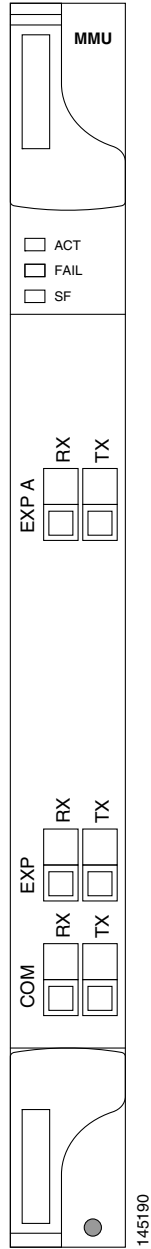
7.11.2 MMU Block Diagram

Figure 7-30 provides a high-level functional block diagram of the MMU card.

Figure 7-30 MMU Block Diagram

7.11.3 MMU Power Monitoring

Physical photodiodes P1 through P3 monitor the power for the MMU card. The returned power level values are calibrated to the ports as shown in Table 7-34. VP1 to VP3 are virtual photodiodes that have been created by adding (by software computation) the relevant path insertion losses of the optical splitters (stored in the module) to the real photodiode (P1 to P3) measurement.

Table 7-34 MMU Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1	1 (EXP-RX)	EXP RX
P2	5 (EXP A-RX)	EXP A RX
P3	6 (EXP A-TX)	EXP A TX
VP1	2 (EXP-TX)	EXP TX
VP2	4 (COM-TX)	COM TX
VP3	3 (COM-RX)	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 8.0.

7.11.4 MMU Card-Level Indicators

Table 7-35 describes the three card-level LED indicators on the MMU card.

Table 7-35   *MMU Card-Level Indicators*

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that n internal hardware failure occurred. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the MMU card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure on one or more of the card's ports. The amber SF LED also turns on when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

7.11.5 MMU Port-Level Indicators

You can find the alarm status of the MMU card's ports using the LCD screen on the ONS 15454 fan-tray assembly. The screen displays the number and severity of alarms on a given port or slot. For the procedure to view these counts, refer to "Manage Alarms" in the *Cisco ONS 15454 DWDM Procedure Guide*.

7.11.5 MMU Port-Level Indicators