



# APPENDIX **A**

## Hardware Specifications

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This appendix contains hardware and software specifications for the ONS 15454 ANSI and ETSI shelf assemblies and cards.



### Note

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Unless otherwise specified, “ONS 15454” refers to both ANSI and ETSI shelf assemblies.

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The following sections are included:

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- [A.2 General Card Specifications, page A-5](#)
- [A.3 Common Control Card Specifications, page A-8](#)
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## A.1 Shelf Specifications

This section provides specifications for shelf bandwidth; a list of topologies; Cisco Transport Controller (CTC) specifications; the LAN, Transaction Language One (TL1), modem, and alarm specifications; timing, power, and environmental specifications; and shelf dimensions.

## A.1.1 Bandwidth

The ONS 15454 has the following bandwidth specifications:

- Total bandwidth: 240 Gbps
- Data plane bandwidth: 160 Gbps
- SONET/SDH plane bandwidth: 80 Gbps

## A.1.2 Configurations

The ONS 15454 can be configured for the following dense wavelength division multiplexing (DWDM) topologies:

- Hubbed rings
- Multihubbed rings
- Point-to-point
- Linear
- Linear with optical add/drop multiplexing (OADM)
- Hybrid terminal node
- Hybrid OADM node
- Hybrid line amplifier node

## A.1.3 Cisco Transport Controller

CTC, the ONS 15454 craft interface software, has the following specifications:

- 10BaseT Ethernet
- TCC2/TCC2P card access: RJ-45 connector
- Backplane access: LAN pin field (ANSI only)
- Front Mount Electrical Connection (FMEC) access: LAN connector on MIC-C/T/P faceplate (ETSI only)

## A.1.4 External LAN Interface

The ONS 15454 external LAN interface has the following specifications:

- 10BaseT Ethernet
- Backplane access: LAN pin field (ANSI only)
- FMEC access: LAN connector on MIC-C/T/P faceplate (ETSI only)

## A.1.5 TL1 Craft Interface

The ONS 15454 TL1 craft interface has the following specifications:

- Speed: 9600 bps

- TCC2/TCC2P access: EIA/TIA-232 DB-9 type connector
- Backplane access: CRAFT pin field (ANSI only)

## A.1.6 Modem Interface

The ONS 15454 modem interface has the following specifications:

- Hardware flow control
- TCC2/TCC2P: EIA/TIA-232 DB-9 type connector

## A.1.7 Alarm Interface

The ONS 15454 alarm interface has the following specifications:

- ETSI
  - Visual: Critical, Major, Minor, Remote
  - Audible: Critical, Major, Minor, Remote
  - FMEC access: 62-Pin DB connector on MIC-A/P faceplate
  - Alarm inputs: Common 32-VDC output for all alarm-inputs, closed contact limited to 2 mA
  - Control outputs: Open contact maximum 60 VDC, closed contact maximum 100 mA
- ANSI
  - Visual: Critical, Major, Minor, Remote
  - Audible: Critical, Major, Minor, Remote
  - Backplane access: Alarm pin fields
  - Alarm contacts: 0.045 mm, –48 V, 50 mA

## A.1.8 EIA Interface (ANSI only)

The ONS 15454 electrical interface assembly (EIA) interface has the following specifications:

- SMB: AMP #415504-3 75-ohm, 4-leg connectors
- BNC: Trompeter #UCBJ224 75-ohm 4 leg connector (King or ITT are also compatible)
- AMP Champ: AMP#552246-1 with #552562-2 bail locks

## A.1.9 BITS Interface (ANSI only)

The ONS 15454 building integrated timing supply (BITS) interface has the following specifications:

- 2 DS-1 BITS inputs
- 2 derived DS-1 outputs
- Backplane access: BITS pin field

## A.1.10 System Timing

The ONS 15454 ANSI has the following system timing specifications:

- Stratum 3 per Telcordia GR-253-CORE
- Free running accuracy:  $\pm 4.6$  ppm
- Holdover stability:  $3.7 \times 10^{-7}$  per day, including temperature (< 255 slips in first 24 hours)
- Reference: External BITS, line, internal

The ONS 15454 ETSI has the following system timing specifications:

- Stratum 3E, per ITU-T G.813
- Free running accuracy:  $\pm 4.6$  ppm
- Holdover stability:  $3.7 \exp -7$  per day, including temperature (< 255 slips in first 24 hours)
- Reference: External BITS, line, internal

## A.1.11 System Power

The ONS 15454 ANSI has the following power specifications:

- Nominal Input Voltage:  $-48$  VDC
- Power consumption: Configuration dependent; 55 W (fan tray only)
- Power requirements:
  - Nominal:  $-48$  VDC
  - Input Voltage Range:  $-40.5$  to  $-57.0$  VDC
- Power terminals: #6 Lug
- ANSI shelf fusing: 100-A fuse panel (minimum 30 A fuse per shelf)  
HD shelf fusing: 100-A fuse panel (minimum 30 A fuse per shelf)

The ONS 15454 ETSI has the following power specifications:

- Nominal Input Voltage:  $-48$  VDC
- Power consumption: Configuration dependent; 53 W (fan tray only)
- Power requirements:
  - Nominal:  $-48$  VDC
  - Input Voltage Range:  $-40.5$  to  $-57.0$  VDC
- Power terminals: 3WK3 Combo-D power cable connector (MIC-A/P and MIC-C/T/P faceplates)
- Fusing: 100 A fuse panel; minimum 30 A fuse per shelf

## A.1.12 Fan Tray

[Table A-1](#) lists power requirements for the fan-tray assembly.

**Table A-1 Fan Tray Assembly Power Requirements**

Fan Tray Assembly	Watts	Amps	BTU/Hr
FTA2	53	1.21	198
FTA3 -T	86.4	1.8	295
15454E-CC-FTA/15454-CC-FTA	115	2.4	393

## A.1.13 System Environmental Specifications

The ONS 15454 ANSI has the following environmental specifications:

- Operating temperature:  
C-Temp: 32 to +131 degrees Fahrenheit (0 to +55 degrees Celsius)  
I-Temp: -40 to +139 degrees Fahrenheit (-40 to +65 degrees Celsius)
- Operating humidity: 5 to 95 percent, noncondensing

The ONS 15454 ETSI has the following environmental specifications:

- Operating temperature: 32 to 131 degrees Fahrenheit (0 to +55 degrees Celsius)
- Operating humidity: 5 to 95 percent, noncondensing

## A.1.14 Dimensions

The ONS 15454 ANSI shelf assembly has the following dimensions:

- Height: 18.5 in. (40.7 cm)
- Width: 19 or 23 in. (41.8 or 50.6 cm) with mounting ears attached
- Depth: 12 in. (26.4 cm) (5 in. or 12.7 cm projection from rack)
- Weight: 55 lb (24.947 kg) empty

The ONS 15454 ETSI shelf assembly has the following dimensions:

- Height: 616.5 mm (24.27 in.)
- Width: 535 mm (17 in.) without mounting ears attached
- Depth: 280 mm (11.02 in.)
- Weight: 26 kg empty (57.3 lb)

## A.2 General Card Specifications

This section provides power specifications and temperature ranges for all ONS 15454 cards.

### A.2.1 Power

[Table A-2](#) provides power consumption information for the ONS 15454 cards.

**Table A-2 Individual Card Power Requirements**

Card Type	Card Name	Maximum Power in Watts	Typical Power in Watts	Amperes at –48 V	BTU/Hr.
<b>Common Control Cards</b>	TCC2/TCC2P	30	19.2	0.54	89
	AIC-I	10	6	0.17	28
	AEP	-	-	(from +5 VDC from AIC-I)	10
	MIC-A/P	0.2	0.13	via TCC2/TCC2 P/TCC3	0.44
	MIC-C/T/P	0.5	0.38	via TCC2/TCC2 P/TCC3	1.29
	MS-ISC-100T	69	53	1.10	181.0
<b>Optical Service Channel Cards</b>	OSCM	26	23	0.48	79
	OSC-CSM	27	24	0.5	82
<b>Optical Amplifier Cards</b>	OPT-PRE	39	30	0.63	103
	OPT-BST	39	30	0.63	103
	OPT-BST-E	39	30	0.63	103
	OPT-BST-L	32	25	0.52	86
	OPT-AMP-L	40	32	0.67	110
	OPT-AMP-17-C	23	19	0.83	137
	OPT-AMP-C	30	23	0.83	137
	OPT-RAMP-C	55	44	1.04	171
	OPT-RAMP-CE	58	46	0.83	137
<b>PSM Card</b>	PSM	50	35	0.41	69
<b>Multiplexer and Demultiplexer Cards</b>	32MUX-O	25	16	0.33	55
	32DMX-O	25	16	0.33	55
	4MD-xx.x	25	17	0.35	58.0
<b>ROADM Cards</b>	32DMX	25	15	0.31	52
	32DMX-L	25	15	0.31	52
	32WSS	65	50	1.04	171
	32WSS-L	48	43	0.90	147
	40-MUX-C	39	35	0.73	120
	40-DMX-C	39	35	0.73	120
	40-DMX-CE	39	35	0.73	120
	40-WSS-C	79	63	1.53	250
	40-WSS-CE	79	63	1.53	250

**Table A-2 Individual Card Power Requirements**

Card Type	Card Name (continued)	Maximum Power in Watts	Typical Power in Watts	Amperes at –48 V	BTU/Hr.
ROADM Cards	40-WXC-C	40	20	0.63	103
	40-SMR1-C	60	30	0.73	120
	40-SMR2-C	70	35	0.83	137
	MMU	15	7	0.15	24
Optical Add/Drop Cards	AD-1C-xx.x	25	17	0.35	58.0
	AD-2C-xx.x	25	17	0.35	58.0
	AD-4C-xx.x	25	17	0.35	58.0
	AD-1B-xx.x	25	17	0.35	58.0
	AD-4B-xx.x	25	17	0.35	58.0
Transponder and Muxponder Cards	TXP_MR_10G	50	32.5	0.73	120
	TXP_MR_10E	50	32.5	1.05	171
	TXP_MR_10E_C	50	31.8	1.05	171
	TXP_MR_10E_L	50	31.8	1.05	171
	TXP_MR_10EX_C	53	34.4	0.88	144
	TXP_MR_2.5G	31	24.3	0.73	120
	TXPP_MR_2.5G	31	24.3	1.05	171
	MXP_2.5G_10G	60	43.6	1.05	171
	MXP_2.5G_10E	60	43.6	1.05	171
	MXP_2.5G_10E_C	60	43.6	1.05	171
	MXP_2.5G_10E_L	60	43.6	1.05	171
	MXP_2.5G_10EX_C	60	43.6	1.05	171
	MXP_MR_2.5G	60	43.6	1.05	171
	MXPP_MR_2.5G	60	43.6	1.05	171
	MXP_MR_10DME_C	71	53.4	1.25	205
	MXP_MR_10DME_L	71	53.4	1.25	205
	MXP_MR_10DMEX_C	74	56	1.25	205
	ADM-10G	160	135	2.81	461
	OTU2_XP	70	50.8	1.48	243
TDCU Cards	TDC-CC	12	11	0.17	28
	TDC-FC	12	11	0.17	28

## A.2.2 Temperature

- Operating temperature:
  - Long term: 0 to 40 degrees Celsius (32 to 104 degrees Fahrenheit)

- Short term: Functionality is guaranteed at -5 to 55 degrees Celsius (23 to 131 degrees Fahrenheit), according to GR-63 Issue 3

The indicated temperatures are the ambient ones in which the shelf can be placed.

## A.3 Common Control Card Specifications

This section provides specifications for the TCC2, TCC2P, AIC, and AIC-I cards, the alarm expansion panel (AEP), the MIC-A/P and MIC-C/T/P FMECs, and the MS-ISC-100T card.

For compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.

### A.3.1 TCC2 Card Specifications

The TCC2 card has the following specifications:

- CTC software
  - Interface: EIA/TIA-232 (local craft access, on TCC2 faceplate)
  - Interface: 10BaseT LAN (on TCC2 faceplate)
  - Interface: 10BaseT LAN (through the backplane)
- Synchronization
  - Stratum 3, per Telcordia GR-253-CORE
  - Free running access: Accuracy +/- 4.6 ppm
  - Holdover stability:  $3.7 \times 10^{-7}$  per day including temperature (< 255 slips in first 24 hours)
  - Reference: External BITS, line, internal
- Supply voltage monitoring
  - Both supply voltage inputs are monitored.
  - Normal operation: -40.5 to -56.7 V
  - Undervoltage: Major alarm
  - Overvoltage: Major alarm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 235 mm (9.250 in.)
  - Weight not including clam shell: 0.7 kg (1.5 lb)

### A.3.2 TCC2P Card Specifications

The TCC2P card has the following specifications:

- CTC software



- Interface: EIA/TIA-232 (local craft access, on TCC2P faceplate)
  - Interface: 10BaseT LAN (on TCC2P faceplate)
  - Interface: 10BaseT LAN (through the backplane)
- Synchronization
  - Stratum 3, per Telcordia GR-253-CORE
  - Free running access: Accuracy +/- 4.6 ppm
  - Holdover stability:  $3.7 \times 10^{-7}$  per day including temperature (< 255 slips in first 24 hours)
  - Reference: External BITS, line, internal
- Supply voltage monitoring
  - Both supply voltage inputs are monitored.
  - Normal operation: -40.5 to -56.7 V (in -48 VDC systems)
  - Undervoltage: Major alarm
  - Overvoltage: Major alarm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 1.5 lb (0.7 kg)

## A.3.3 AIC-I Card Specifications

The AIC-I card has the following specifications:

- Alarm inputs
  - Number of inputs: 12 without AEP, 32 with AEP
  - Opto-coupler isolated
  - Label customer provisionable
  - Severity customer provisionable
  - Common 32 V output for all alarm inputs
  - Each input limited to 2 mA
  - Termination: Wire-wrap on backplane without AEP, on AEP connectors with AEP
- Alarm outputs
  - Number of outputs: 4 (user configurable as inputs) without AEP, 16 with AEP
  - Switched by opto MOS (metal oxide semiconductor)
  - Triggered by definable alarm condition
  - Maximum allowed open circuit voltage: 60 VDC
  - Maximum allowed closed circuit current: 100 mA
  - Termination: Wire-wrap on backplane without AEP, on AEP connectors with AEP

- Express orderwire/local orderwire (EOW/LOW)
  - ITU-T G.711, ITU-T G.712, Telcordia GR-253-CORE
  - A-law, mu-law



**Note** Due to the nature of mixed coding, in a mixed-mode (A-law/mu-law) configuration, the orderwire is not ITU-T G.712 compliant.

- Orderwire party line
- Dual tone, multifrequency (DTMF) signaling
- User data channel (UDC)
  - Bit rate: 64 kbps, codirectional
  - ITU-T G.703
  - Input/output impedance: 120 ohm
  - Termination: RJ-11 connectors
- Data communications channel (DCC)
  - Bit rate: 576 kbps
  - EIA/TIA-485/V11
  - Input/output impedance: 120 ohm
  - Termination: RJ-45 connectors
- ACC connection for additional alarm interfaces
  - Connection to AEP
- Power monitoring alarming states:
  - Power failure (0 to –38 VDC)
  - Undervoltage (–38 to –40.5 VDC)
  - Overvoltage (beyond –56.7 VDC)
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Weight: 1.8 lb (0.82 kg)

## A.3.4 AEP Specifications (ANSI only)

The AEP has the following specifications:

- Alarm inputs
  - Number of inputs: 32
  - Optocoupler isolated
  - Label customer provisionable
  - Severity customer provisionable

- Common 32 V output for all alarm inputs
  - Each input limited to 2 mA
  - Termination: 50-pin AMP champ connector
- Alarm outputs
  - Number of outputs: 16
  - Switched by opto MOS
  - Triggered by definable alarm condition
  - Maximum allowed open circuit voltage: 60 VDC
  - Maximum allowed closed circuit current: 100 mA
  - Termination: 50-pin AMP champ connector
- Environmental
  - Overvoltage protection: as in ITU-T G.703 Annex B
- Dimensions of AEP board
  - Height: 20 mm (0.79 in.)
  - Width: 330 mm (13.0 in.)
  - Depth: 89 mm (3.5 in.)
  - Weight: 0.18 kg (0.4 lb)

## A.3.5 MIC-A/P FMEC Specifications (ETSI only)

The MIC-A/P FMEC card has the following specifications:

- Power supply input BATTERY B
  - System supply voltage: Nominal –48 VDC  
Tolerance limits: –40.5 to –57.0 VDC
  - Connector: 3WK3 Combo-D power cable connector
- Alarm outputs
  - Voltage (open contact): Maximum 60 VDC
  - Current (closed contact): Maximum 250 mA
  - Connector: 62-pin DB connector (common for inputs/outputs)
- Alarm inputs
  - Voltage (open contact): Maximum 60 VDC
  - Current (closed contact): Maximum 2 mA
  - Connector: 62-pin DB connector (common for inputs/outputs)
- Dimensions
  - Height: 182 mm (7.165 in.)
  - Width: 31.88 mm (1.255 in.)
  - Depth: 92 mm (3.62 in.)
  - Depth with backplane connector: 98 mm (3.87 in.)

- Weight not including clam shell: 0.2 kg (0.5 lb)

## A.3.6 MIC-C/T/P FMEC Specifications (ETSI only)

The MIC-C/T/P FMEC card has the following specifications:

- Power supply input BATTERY A
  - System supply voltage: Nominal –48 VDC  
Tolerance limits: –40.5 to –57.0 VDC
  - Connector: 3WK3 Combo-D power cable connector
- Timing connector
  - Frequency: 2.048 MHz +/-10 ppm
  - Signal level: 0.75 to 1.5 V
  - Impedance: 75 ohms +/-5 percent (switchable by jumper to high impedance > 3 kohms)




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**Note** 120 ohms balanced impedance is possible with external matching cable.

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- Cable attenuation: Up to 6 dB at 2 MHz
  - Connectors: 1.0/2.3 miniature coax connector
- System management serial port:
  - System management serial port craft interface
  - Modem port (for future use)
  - Connectors: 8-pin RJ-45
- System management LAN port connectors:
  - Signal: IEEE 802.3 10BaseT
  - Connectors: 8-pin RJ-45
- Dimensions
  - Height: 182 mm (7.165 in.)
  - Width: 31.88 mm (1.255 in.)
  - Depth: 92 mm (3.62 in.)
  - Depth with backplane connector: 98 mm (3.87 in.)
  - Weight not including clam shell: 0.2 kg (0.5 lb)

## A.3.7 MS-ISC-100T Card Specifications

The MS-ISC-100T card has the following specifications:

- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)

- Depth with backplane connector: 9.250 in. (235 mm)
- Weight not including clam shell: 2.3 lb (1.0 kg)

## A.4 Optical Service Channel Cards

This section provides specifications for the OSCM and OSC-CSM cards.

### A.4.1 OSCM Card Specifications

The OSCM card has the following specifications:

- Line
  - Bit rate: 155 Mbps
  - Code: Scrambled non-return to zero (NRZ)
  - Loopback modes: None
  - Connector: Duplex LC
- Transmitter optical service channel (OSC) signal
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –5 dBm
  - Nominal wavelength: 1510-nm +/-10 nm
  - Variable optical attenuator (VOA) necessary in the transmit path to adjust the in-fiber optical power level
- Receiver OSC signal
  - Maximum receiver level: –8 dBm at  $10^{-10}$  bit error rate (BER)
  - Minimum receiver level: –40 dBm at  $10^{-10}$  BER
  - Span budget: 40-dB span budget (about 150 km assuming fiber path loss equals 0.25 dB/km)
  - Jitter tolerance: Telcordia GR-253/G.823 compliant
- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

### A.4.2 OSC-CSM Card Specifications

The OSC-CSM card has the following specifications:

- Line
  - Bit rate: 155 Mbps
  - Code: Scrambled NRZ
  - Loopback modes: None

- Connector: Duplex LC
- Transmitter OSC signal
  - Maximum transmitter output power: –2 dBm
  - Minimum transmitter output power: –24 dBm
  - Nominal wavelength: 1510-nm +/-10 nm
  - VOA is necessary in the transmit path to adjust the in-fiber optical power level
- Receiver OSC signal
  - Maximum receiver level: –8 dBm at  $10^{-10}$  BER
  - Minimum receiver level: –40 dBm at  $10^{-10}$  BER
  - Span loss budget: 35-dB span budget (approximately 140 km assuming that the fiber path loss is equal to 0.25 dB/km)
  - Jitter tolerance: Telcordia GR-253/G.823 compliant
- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.5 Optical Amplifier Cards

This section provides specifications for the OPT-PRE amplifier, OPT-BST amplifier, OPT-BST-E amplifier, OPT-BST-L amplifier, OPT-AMP-L preamplifier (configurable as a preamplifier or booster amplifier), OPT-AMP-C amplifier (configurable as a preamplifier or booster amplifier), OPT-AMP-17-C, and OPT-RAMP-C amplifier cards.

### A.5.1 OPT-PRE Amplifier Card Specifications

The OPT-PRE amplifier card has the following specifications:

- Optical characteristics:
  - Total operating wavelength range: 1530 to 1561.3 nm
  - Gain ripple (peak to valley): 1.5 dB
  - Mid-access loss (MAL) range (for dispersion compensation unit [DCU]): 3 to 9 dB
  - Gain range: 5 to 38.5 dBm in constant power mode, 5 to 28 dBm in constant gain mode
  - Minimum gain (standard range): 5.0 dBm
  - Maximum gain (standard range with programmable gain tilt): 21 dBm
  - Maximum gain (extended range with uncontrolled gain tilt): 38.5 dBm
  - Gain and power regulation over/undershoot: 0.5 dB
  - Limited maximum output power: 17.5 dBm
  - Maximum output power (with full channel load): 17 dB
  - Minimum output power (with one channel): –2 dBm

- Input power (Pin) range at full channel load: –21.5 to 12 dBm
- Input power (Pin) range at single channel load: –39.5 to –6 dBm
- Noise figure at  $G^3$  21 dB = 6.5 dB
- OSC filter drop (channels) insertion loss maximum: 1 dB
- OSC filter drop (OSC) insertion loss maximum: 1.8 dB
- OSC filter add (OSC) insertion loss maximum: 1.3 dB
- Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (240 mm)

## A.5.2 OPT-BST Amplifier Card Specifications

The OPT-BST amplifier card has the following specifications:

- Optical characteristics:
  - Total operating wavelength range: 1530 to 1561.3 nm
  - Gain ripple (peak to valley): 1.5 dB
  - Gain range: 5 to 20 dBm with programmable gain tilt
  - Gain and power regulation over/undershoot: 0.5 dB
  - Limited maximum output power: 17.5 dBm
  - Maximum output power (with full channel load): 17 dB
  - Minimum output power (with one channel): –2 dBm
  - Input power (Pin) range at full channel load: –3 to 12 dBm
  - Input power (Pin) range at single channel load: –21 to –6 dBm
  - Noise figure at  $G^3$  20 dB = 6 dB
  - OSC filter drop (channels) insertion loss maximum: 1 dB
  - OSC filter drop (OSC) insertion loss maximum: 1.8 dB
  - OSC filter add (OSC) insertion loss maximum: 1.3 dB
  - Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (240 mm)

## A.5.3 OPT-BST-E Amplifier Card Specifications

The OPT-BST-E amplifier card has the following specifications:

- Optical characteristics:
  - Total operating wavelength range: 1530 to 1561.3 nm
  - Gain ripple (peak to valley): 1.8 dB
  - Gain range: 8 to 23 dB with programmable gain tilt
  - Extended gain range: 23 to 26 dB with gain tilt uncontrolled
  - Gain and power regulation over/undershoot: 0.5 dB
  - Limited maximum output power: 20.5 dBm
  - Maximum output power (with full channel load): 20 dB
  - Minimum output power (with one channel): –0 dBm
  - Input power (Pin) range at full channel load: –6 to 12 dBm
  - Input power (Pin) range at single channel load: –26 to –8 dBm
  - Noise figure at  $G^3$  23 dB = 6 dB
  - OSC filter drop (channels) insertion loss maximum: 1 dB
  - OSC filter drop (OSC) insertion loss maximum: 1.8 dB
  - OSC filter add (OSC) insertion loss maximum: 1.3 dB
  - Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (240 mm)

## A.5.4 OPT-BST-L Amplifier Card Specifications

The OPT-BST-L amplifier card has the following specifications:

- Optical characteristics:
  - Total operating wavelength range: 1570.0 to 1605.0 nm
  - Gain ripple (peak to valley): 1.5 dB
  - Gain range: 8 to 20 dB with programmable gain tilt
  - Extended gain range: 20 to 27 dB with gain tilt uncontrolled
  - Gain and power regulation over/undershoot: 0.5 dB
  - Limited maximum output power: 10 dBm
  - Maximum output power (with full channel load): 17 dB
  - Minimum output power (with one channel): –1 dBm
  - Input power (Pin) range at full channel load: –10 to 9 dBm
  - Input power (Pin) range at single channel load: –37 to –18 dBm
  - Noise figure at  $G^3$  20 dB = 7.5 dB
  - Insertion loss (Line RX to OSC TX): 0.3 to 1.8 dB
  - Insertion loss (Line RX to COM TX): 0.3 to 1.0 dB



- Insertion loss (OSC RX to LINE TX): 0.3 to 1.3 dB
  - Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (240 mm)

## A.5.5 OPT-AMP-L Preamplifier Card Specifications

The OPT-AMP-L card has the following specifications:

- Optical characteristics:
  - DWDM channel wavelength plan, 100 GHz, 4 skip 1, ITU-T wavelength grid channels 71 (1602.3 nm) to 90 (1570.4 nm)
  - DWDM channel wavelength plan, 50 GHz, 8 skip 2, ITU-T wavelength grid channels 70.5 (1602.7 nm) to 90 (1570.4 nm)
  - Channel spacing: 100 and 50 GHz
  - Total operating wavelength range 1570.0 - 1605.0 nm
  - Gain ripple (peak to valley): 1.5 dB
  - Standard gain range: 12 to 24 dB
  - Extended gain range (uncontrolled gain tilt): 24 to 35 dB
  - Gain and power regulation over/undershoot: 0.5 dB
  - Minimum output power (with one channel): +2 dBm
  - Maximum power output (standard or extended gain range): 20 dB
  - Input power range (full channel load): –15 to 8 dB
  - Input power range (single channel load): –40 to –17
  - Noise figure at  $G^3$  20 dB = 8.9 dB
  - Insertion loss (Line RX to OSC TX): 0.3 to 1.8 dB
  - Insertion loss (Line RX to COM TX): 0.3 to 1.0 dB
  - Insertion loss (OSC RX to LINE TX): 0.3 to 1.3 dB
  - Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (240 mm)

## A.5.6 OPT-AMP-17-C Amplifier Card Specifications

The OPT-AMP-17-C card has the following specifications:

- Optical characteristics:

- DWDM channel wavelength plan: 80 channels at 50 GHz spacing, 1530.33 nm to 1561.83 nm
- Channel spacing: 50 GHz
- Total operating wavelength range 1529.0 to 1562.5 nm
- Gain ripple (peak to valley): 1.5 dB
- Gain range: 14 to 23 dB
- Optimal gain (gain tilt = 0): 17 dB
- Gain and power regulation over/undershoot: 0.5 dB
- Minimum output power (with one channel): -2 dBm
- Maximum power output (standard or extended gain range): 17.5 dBm
- Input power range (full channel load): -6 to 3 dBm
- Input power range (single channel load): -28 to -19 dBm
- Noise figure at G=17dB = 6 dB maximum
- Insertion loss (Line RX to OSC TX): 0.3 to 1.8 dB
- Insertion loss (Line RX to COM TX): 0.3 to 1.0 dB
- Insertion loss (OSC RX to LINE TX): 0.3 to 1.3 dB
- Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.5.7 OPT-AMP-C Amplifier Card Specifications

The OPT-AMP-C amplifier card has the following specifications:

- Optical characteristics:
  - Total operating wavelength range: 1529.0 to 1562.5 nm
  - Gain ripple (peak to valley): 1.2 dB
  - Gain range: 12 to 24 dB with programmable gain tilt
  - Extended gain range: 24 to 35 dB with gain tilt uncontrolled
  - Gain and power regulation over/undershoot: 0.5 dB
  - Limited maximum output power: 20.5 dBm
  - Maximum output power (with full channel load): 20 dBm
  - Minimum output power (with one channel): -2 dBm
  - Input power (Pin) at full channel load: -15 dBm minimum
  - Input power (Pin) range at single channel load: -40 to -17 dBm
  - Noise figure at G3 20 dB: 7.6 dB
  - Insertion loss (Line RX to OSC TX): 0.3 to 1.8 dB
  - Insertion loss (Line RX to COM TX): 0.3 to 1.0 dB

- Insertion loss (OSC RX to LINE TX): 0.3 to 1.3 dB
- Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 8.66 in. (220.1 mm)

## A.5.8 OPT-RAMP-C Amplifier Card Specifications

The OPT-RAMP-C amplifier card has the following specifications:

- Raman pump
  - Raman pump 1 wavelength: 1425 nm
  - Raman pump 2 wavelength: 1452 nm
  - Total Raman Pump power - Line-RX port: 500 mW
  - Operating range Raman Pump power - Line-RX port: min 100 mW, max 450<sup>2</sup> mW
  - Raman pump laser class: 3B
- Embedded EDFA
  - Total operating signal wavelength range: 1529 to 1562.5 nm
  - EDFA nominal gain value (Line RX to DC-TX): 14 dB
  - EDFA gain settable range: 8 to 20 dB
  - EDFA Output Power range - DC-TX (Full Channel load): 17.5<sup>3</sup> dBm
  - VOA attenuation range: 0 to 25 dB
  - Gain and power regulation over/undershoot: 0.5 dB
  - EDFA laser class: 1M
  - Maximum EDFA output power: 17.5 dBm
  - Minimum output power (with one channel): –10 dBm
  - Input power (Pin) at full channel load: –3 dBm to +9 dBm
  - Input power (Pin) range at single channel load: –24dBm to –10 dBm
  - Noise figure at G 14 dB: 7.5 dB
  - Insertion loss (Line TX to OSC TX): 0.3 to 2.0 dB
  - Insertion loss (Line RX to COM TX): 0.3 to 1.0 dB
  - Insertion loss (OSC RX to LINE RX): 0.3 to 1.8 dB
  - Optical connectors: LC-UPC/2
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 8.665 in. (220.1 mm)

## A.5.9 OPT-RAMP-CE Amplifier Card Specifications

The OPT-RAMP-CE amplifier card has the following specifications:

- Raman pump
  - Raman pump 1 wavelength: 1425 nm
  - Raman pump 2 wavelength: 1452 nm
  - Total Raman pump power - LINE-RX port: 500 mW
  - Operating range Raman pump power - LINE-RX port: min 100 mW, max 450 mW
  - Raman pump laser class: 3B
- Embedded EDFA
  - Total operating signal wavelength range: 1529 to 1562.5 nm
  - EDFA nominal gain value (LINE-RX to DC-TX): 11 dB
  - EDFA gain settable range: 5 to 17 dB
  - EDFA Output power range - DC-TX (Full Channel load): 20.2 dBm
  - VOA attenuation range: 0 to 25 dB
  - Gain and power regulation over/undershoot: 0.5 dB
  - EDFA laser class: 1M
  - Maximum EDFA output power: 20.5 dBm
  - Minimum output power (with one channel): –10 dBm
  - Input power (Pin) at full channel load: 15 dBm (maximum)
  - Input power (Pin) range at single channel load: –27dBm (minimum)
  - Noise figure at G 11 dB: 7 dB
  - Insertion loss (LINE-RX to MON-RX): 22 to 26 dB
  - Insertion loss (LINE-TX to OSC-TX): 1.5 dB
  - Insertion loss (OSC-RX to LINE-RX): 0.7 to 1.7 dB
  - Insertion loss (LINE-TX to COM-RX): 0.6 to 1.0 dB
  - Insertion loss (LINE-TX to PD12): 1.7dB
  - Insertion loss (OSC-RX to LINE-RX): 0.7 to 1.7dB
  - Optical connectors: LC-UPC/2
- Dimensions
  - Height: 13.11 in. (333 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.88 in. (251 mm)

## A.6 PSM (Protection Switching Module) Card Specifications

The PSM card has the following specifications:

- Wavelength:

- Total operating signal wavelength range (C-band range): 1529.0 – 1562.5 nm
- OSC wavelength range: 1500 – 1520 nm
- L-band range: 1570 - 1605 nm
- Optical
  - Insertion loss:
    - COM-RX to W-TX and P-TX: 4.6 dB
    - W-RX and P-RX to COM-TX: 2.3 dB
  - Insertion loss ripple: 0.2 dB
  - Maximum optical input power: 300mW
  - Polarization dependent loss: 0.2 dB
  - Optical switches state setting time: 5 ms
  - VOA attenuation setting time in open loop: 20 ms
  - VOA attenuation setting time in closed loop: 500 ms (applicable to VOA in RX only)
  - VOA attenuation range: 0 - 15 dB
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 8.66 in. (220.1 mm)

## A.7 Multiplexer and Demultiplexer Cards

This section provides specifications for the 32MUX-O, 32DMX-O, and 4MD-xx.x cards.

### A.7.1 32MUX-O Card Specifications

The 32MUX-O card optical specifications are listed in [Table A-3](#).



#### Note

For power specifications, see [Table A-2 on page A-6](#).

**Table A-3** 32MUX-O Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
Transmit (Tx) filter shape (–1 dB bandwidth)	All standard operating procedures (SOP) and within whole operating temperature range	In 1/32—Out beginning of life (BOL)	+/-180	+/-300	pm
		In 1/32—Out end of life (EOL)	+/-160	+/-300	pm
Insertion loss	All SOP and within whole operating temperature range	In 1/32—Out BOL	4	8.0	dB
		In 1/32—Out EOL	4	8.5	dB
VOA dynamic range	—	—	25	—	dB

**Table A-3 32MUX-O Optical Specifications (continued)**

Parameter	Note	Condition	Min	Max	Unit
Optical monitor tap-splitting ratio on monitor port	Optical monitor port with respect to output port in multiplexer only	—	19	21	dB
Maximum optical input power	—	—	300	—	mW

The 32MUX-O card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.7.2 32DMX-O Card Specifications

The 32DMX-O card optical specifications are listed in [Table A-4](#).



### Note

For power specifications, see [Table A-2 on page A-6](#).

**Table A-4 32DMX-O Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Receive (Rx) filter shape (–1 dB bandwidth)	All SOP and within whole operating temperature range	In 1/32—Out BOL	+/-180	+/-300	pm
		In 1/32—Out EOL	+/-160	+/-300	pm
Insertion loss	All SOP and within whole operating temperature range	In 1/32—Out BOL	4	8.0	dB
		In 1/32—Out EOL	4	8.5	dB
VOA dynamic range	—	—	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 32DMX-O card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.7.3 4MD-xx.x Card Specifications

The 4MD-xx.x card optical specifications are listed in [Table A-5](#).



**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-5** 4MD-xx.x Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
Trx filter shape (−0.5 dB bandwidth TrxBW <sub>2</sub> )	All SOP and within whole operating temperature range	COM Rx—xx.xx Tx COM Rx—yy.yy Tx COM Rx—zz.zz Tx COM Rx—kk.kk Tx xx.xx Rx—COM Tx yy.yy Rx—COM Tx zz.zz Rx—COM Tx kk.kk Rx—COM Tx	+/−180	—	pm
Insertion loss demultiplexer section	All SOP and within whole operating temperature range	COM Rx—xx.xx Tx	—	1.9	dB
		COM Rx—yy.yy Tx	—	2.4	dB
		COM Rx—zz.zz Tx	—	2.8	dB
		COM Rx—kk.kk Tx	—	3.3	dB
Insertion loss multiplexer section	All SOP and within whole operating temperature range (two connectors included)	xx.xx Rx—COM Tx	—	3.6	dB
		yy.yy Rx—COM Tx	—	3.2	dB
		zz.zz Rx—COM Tx	—	3.0	dB
		kk.kk Rx—COM Tx	—	2.6	dB
VOA dynamic range	—	—	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 4MD-xx.x card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8 Reconfigurable Optical Add/Drop Cards

This section provides specifications for the 32DMX, 32DMX-L, 32WSS, 32WSS-L, 40-MUX-C, 40-DMX-C, 40-DMX-CE, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 40-SMR1-C, 40-SMR2-C, and MMU cards.

### A.8.1 32DMX Card Specifications

The 32DMX card optical specifications are listed in [Table A-6](#).


**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-6** 32DMX Optical Specifications

Parameter	Note	Condition	Min	Typical	Max	Units
-1 dB bandwidth	All SOP and within whole operating temperature range, connectors included, and for maximum VOA operating attenuation.	COM RX => TX 1, 32 (OUT)	+/-110	—	—	pm
-3 dB bandwidth			+/-200	—	—	pm
Insertion loss	All SOP, and within whole operating temperature range, connectors included.	COM RX => TX 1, 32	—	—	5.5	dB
VOA dynamic range	—	COM RX => TX 1, 32	25	—	—	dB
Maximum optical input power	—	—	300	—	—	mW

The 32DMX channel plan is shown in [Table A-7](#). All 32DMX client interfaces must comply with this plan.

**Table A-7** 32DMX Channel Plan

Channel Number	Band	Channel ID	Frequency (GHz)	Wavelength (nm)
1	1	30.3	195.9	1530.33
2		31.2	195.8	1531.12
3		31.9	195.7	1531.90
4		32.6	195.6	1532.68



**Table A-7 32DMX Channel Plan (continued)**

Channel Number	Band	Channel ID	Frequency (GHz)	Wavelength (nm)
5	2	34.2	195.4	1534.25
6		35.0	195.3	1535.04
7		35.8	195.2	1535.82
8		36.6	195.1	1536.61
9	3	38.1	194.9	1538.19
10		38.9	194.8	1538.98
11		39.7	194.7	1539.77
12		40.5	194.6	1540.56
13	4	42.1	194.4	1542.14
14		42.9	194.3	1542.94
15		43.7	194.2	1543.73
16		44.5	194.1	1544.53
17	5	46.1	193.9	1546.12
18		46.9	193.8	1546.92
19		47.7	193.7	1547.72
20		48.5	193.6	1548.51
21	6	50.1	193.4	1550.12
22		50.9	193.3	1550.92
23		51.7	193.2	1551.72
24		52.5	193.1	1552.52
25	7	54.1	192.9	1554.13
26		54.9	192.8	1554.94
27		55.7	192.7	1555.75
28		56.5	192.6	1556.55
29	8	58.1	192.4	1558.17
30		58.9	192.3	1558.98
31		59.7	192.2	1559.79
32		60.6	192.1	1560.61

The 32DMX card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8.2 32DMX-L Card Specifications

The 32DMX-L card optical specifications are listed in [Table A-6](#).


**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-8 32DMX-L Optical Specifications**

Parameter	Note	Condition	Min	Typical	Max	Units
-1 dB bandwidth	All SOP and within whole operating temperature range, connectors included, and for maximum VOA operating attenuation.	COM RX => TX 1, 32 (OUT)	+/-100	—	—	pm
-3 dB bandwidth			+/-199	—	—	pm
Insertion loss	All SOP, and within whole operating temperature range, connectors included.	COM RX => TX 1, 32	—	—	5.8	dB
VOA dynamic range	—	COM RX => TX 1, 32	25	—	—	dB
Maximum optical input power	—	—	300	—	—	mW

The 32DMX-L channel plan is shown in [Table A-9](#). All 32DMX-L client interfaces must comply with this plan.

**Table A-9 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 A-9 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

The 32DMX-L card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8.3 32WSS Card Specifications

The 32WSS card optical specifications are listed in [Table A-10](#).



### Note

For power specifications, see [Table A-2 on page A-6](#).

**Table A-10 32WSS Optical Specifications**

Parameter	Note	Condition	Min	Typical	Max	Units
-0.25 dB bandwidth	All SOP and within whole operating temperature range, connectors	EXP RX => COM TX	+/-95	—	—	pm
-0.5 dB bandwidth			+/-115	—	—	pm
-1.0 dB bandwidth			+/-135	—	—	pm
-0.25 dB bandwidth	included, and for maximum VOA operating attenuation.	Add 1, 32 => COM TX	+/-115	—	—	pm
-0.5 dB bandwidth			+/-135	—	—	pm
-1.0 dB bandwidth			+/-160	—	—	pm
Insertion loss	All SOP, any optical switch state, and within whole operating temperature range, connectors included.	EXP RX => COM TX	—	—	11.3	dB
	—	COM RX => EXP TX	—	—	1.5	dB
	—	Add 1, 32 => COM TX	—	—	7.6	dB
	—	COM RX => DROP TX	6	—	8.5	dB
VOA dynamic range	—	EXP RX => COM TX	20	—	—	dB
	—	Add 1, 32 => COM TX	25	—	—	dB
Maximum optical input power	—	—	300	—	—	mW

The 32WSS channel plan is shown in [Table A-11](#). All 32WSS client interfaces must comply with this plan.

**Table A-11 32WSS Channel Plan**

Channel Number	Band	Channel ID	Frequency (GHz)	Wavelength (nm)
1	1	30.3	195.9	1530.33
2		31.2	195.8	1531.12
3		31.9	195.7	1531.90
4		32.6	195.6	1532.68
5	2	34.2	195.4	1534.25
6		35.0	195.3	1535.04
7		35.8	195.2	1535.82
8		36.6	195.1	1536.61

**Table A-11 32WSS Channel Plan (continued)**

Channel Number	Band	Channel ID	Frequency (GHz)	Wavelength (nm)
9	3	38.1	194.9	1538.19
10		38.9	194.8	1538.98
11		39.7	194.7	1539.77
12		40.5	194.6	1540.56
13	4	42.1	194.4	1542.14
14		42.9	194.3	1542.94
15		43.7	194.2	1543.73
16		44.5	194.1	1544.53
17	5	46.1	193.9	1546.12
18		46.9	193.8	1546.92
19		47.7	193.7	1547.72
20		48.5	193.6	1548.51
21	6	50.1	193.4	1550.12
22		50.9	193.3	1550.92
23		51.7	193.2	1551.72
24		52.5	193.1	1552.52
25	7	54.1	192.9	1554.13
26		54.9	192.8	1554.94
27		55.7	192.7	1555.75
28		56.5	192.6	1556.55
29	8	58.1	192.4	1558.17
30		58.9	192.3	1558.98
31		59.7	192.2	1559.79
32		60.6	192.1	1560.61

The 32WSS card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8.4 32WSS-L Card Specifications

The 32WSS-L card optical specifications are listed in [Table A-12](#).

**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-12 32WSS-L Optical Specifications**

Parameter	Note	Condition	Min	Typical	Max	Units
-0.1 dB bandwidth	All SOP and within whole operating temperature range, connectors included, and for maximum VOA operating attenuation.	EXP RX => COM TX	—	+/-/57	—	pm
-0.25 dB bandwidth			+/-/61	+/-/89	—	
-0.5 dB bandwidth			+/-/91	+/-/116	—	
-1.0 dB bandwidth			+/-/135	+/-/149	—	
-0.1 dB bandwidth		Add 1, 32 => COM TX	+/-/32	+/-/69	—	
-0.25 dB bandwidth			+/-/98	+/-/129	—	
-0.5 dB bandwidth			+/-/135	+/-/161	—	
-1.0 dB bandwidth			+/-/160	+/-/201	—	
Insertion loss	All SOP, any optical switch state, and within whole operating temperature range, connectors included.	EXP RX => COM TX	—	9.7	11.3	dB
		COM RX => EXP TX	—	1.4	1.6	dB
		Add 1, 32 => COM TX	—	6.2	8.0	dB
		COM RX => DROP TX	6.0	8.0	8.5	dB
VOA dynamic range	—	EXP RX => COM TX	20	25	—	dB
	—	Add 1, 32 => COM TX	25	25	—	dB
Maximum optical input power	—	—	300	—	—	mW

The 32WSS-L channel plan is shown in [Table A-13](#). All 32WSS-L client interfaces must comply with this plan.

**Table A-13 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

**Table A-13 32WSS-L Channel Plan (continued)**

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
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	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

The 32WSS-L card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8.5 40-MUX-C Card Specifications

The 40-MUX-C card optical specifications are listed in [Table A-14](#).


**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-14 40-MUX-C Card Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Transmit (Tx) filter shape	All standard operating procedures (SOP) and within whole operating temperature range	–1 dB bandwidth, RX 1, 40 => COM TX	+/-100	—	pm
		–3 dB bandwidth, RX 1, 40 => COM TX	+/-199	—	pm
Insertion loss	All SOP and within whole operating temperature range	RX 1, 40 => COM TX		5.8	dB
VOA dynamic range	—	RX 1, 40 => COM TX	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 40-MUX-C card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8.6 40-DMX-C Card Specifications

The 40-DMX-C card optical specifications are listed in [Table A-15](#).


**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-15 40-DMX-C Card Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Receive (Rx) filter shape	All SOP and within whole operating temperature range	–1 dB bandwidth, COM RX => TX 1, 40 (OUT)	+/-100	—	pm
		–3 dB bandwidth, COM RX => TX 1, 40 (OUT)	+/-199	—	pm



**Table A-15 40-DMX-C Card Optical Specifications (continued)**

Parameter	Note	Condition	Min	Max	Unit
Insertion loss	All SOP and within whole operating temperature range	COM RX => TX 1, 40	—	5.8	dB
VOA dynamic range	—	COM RX => TX 1, 40	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 40-DMX-C card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm)

## A.8.7 40-DMX-CE Card Specifications

The 40-DMX-CE card optical specifications are listed in [Table A-16](#).



### Note

For power specifications, see [Table A-2 on page A-6](#).

**Table A-16 40-DMX-CE Card Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Receive (Rx) filter shape	All SOP and within whole operating temperature range	–1 dB bandwidth, COM RX => TX 1, 40 (OUT)	+/-100	—	pm
		–3 dB bandwidth, COM RX => TX 1, 40 (OUT)	+/-199	—	pm
Insertion loss	All SOP and within whole operating temperature range	COM RX => TX 1, 40	—	5.8	dB
VOA dynamic range	—	COM RX => TX 1, 40	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 40-DMX-CE card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)

- Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
- Depth: 9.00 in. (228.6 mm)

## A.8.8 40-WSS-C Card Specifications

The 40-WSS-C card optical specifications are listed in [Table A-17](#).



### Note

For power specifications, see [Table A-2 on page A-6](#).

**Table A-17** 40-WSS-C Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
Channel grid: -0.1 dB	All SOP and within whole operating temperature range	EXP_RX to COM_TX	—	—	pm
Channel grid: -0.25 dB			+/- 61	—	pm
Channel grid: -0.5 dB			+/- 91	—	pm
Channel grid: -1.0 dB			+/- 135	—	pm
Channel grid: -0.1 dB	All SOP and within whole operating temperature range	EXP_RX to COM_TX	+/- 32	—	pm
Channel grid: -0.25 dB			+/- 98	—	pm
Channel grid: -0.5 dB			+/- 135	—	pm
Channel grid: -1.0 dB			+/- 160	—	pm
Insertion loss	All SOP and within whole operating temperature range	EXP_RX to COM_TX	—	7.5	dB
		EXP_RX to COM_TX	—	2.3	dB
		EXP_RX to COM_TX	—	6.0	dB
		EXP_RX to COM_TX	—	6.8	dB
VOA dynamic range	—	EXP_RX to COM_TX	20	—	dB
		EXP_RX to COM_TX	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 40-WSS-C card channel grid is listed in [Table A-18](#).

**Table A-18 40-WSS-C Channel Grid**

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
	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	195.0	1537.4
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	194.0	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	193.0	1553.33
54.1	54.1	192.9	1544.13
	54.9	192.8	1544.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36

**Table A-18** 40-WSS-C Channel Grid (continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
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	192.0	1561.42

The 40-WSS-C card has the following additional specifications:

- Dimensions
  - Height: 8.66 in. (220 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 1.42 in. (36 mm)

## A.8.9 40-WSS-CE Card Specifications

The 40-WSS-CE card optical specifications are listed in [Table A-19](#).



### Note

For power specifications, see [Table A-2 on page A-6](#).

**Table A-19** 40-WSS-C Card Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
Channel grid: –0.1 dB	All SOP and within whole operating temperature range	EXP RX greater than or equal to COM TX	—	—	pm
Channel grid: –0.25 dB			+/- 61	—	pm
Channel grid: –0.5 dB			+/- 91	—	pm
Channel grid: –1.0 dB			+/- 135	—	pm
Channel grid: –0.1 dB	All SOP and within whole operating temperature range	Add 1, 40 greater than or equal to COM TX	+/- 32	—	pm
Channel grid: –0.25 dB			+/- 98	—	pm
Channel grid: –0.5 dB			+/- 135	—	pm
Channel grid: –1.0 dB			+/- 160	—	pm

**Table A-19 40-WSS-C Card Optical Specifications (continued)**

Parameter	Note	Condition	Min	Max	Unit
Insertion loss	All SOP and within whole operating temperature range	EXP RX greater than or equal to COM TX	—	7.5	dB
		COM RX greater than or equal to EXP TX	—	2.3	dB
		Add 1, 40 greater than or equal to COM TX	—	6.0	dB
		COM RX greater than or equal to DROP TX	—	6.8	dB
VOA dynamic range	—	EXP RX greater than COM TX	20	—	dB
		Add 1, 40 greater than or equal to COM TX	25	—	dB
Maximum optical input power	—	—	300	—	mW

The 40-WSS-CE card channel grid is listed in [Table A-20](#).

**Table A-20 40-WSS-C Card Channel Grid**

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B30.7	30.7	195.85	1530.72
	31.5	195.75	1531.51
	32.3	195.65	1532.29
	33.1	195.55	1533.07
	33.9	195.45	1533.86
B34.6	34.6	195.35	1534.64
	35.4	195.25	1535.43
	36.2	195.15	1536.22
	37.0	195.05	1537.00
	37.8	194.95	1537.79
B38.6	38.6	194.85	1538.58
	39.4	194.75	1539.37
	40.1	194.65	1540.16
	40.9	194.55	1540.95
	41.8	194.45	1541.75

**Table A-20** 40-WSS-C Card Channel Grid (continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B42.5	42.5	194.35	1542.54
	43.3	194.25	1543.33
	44.1	194.15	1544.13
	44.9	194.05	1544.92
	45.7	193.95	1545.72
B46.5	46.5	193.85	1546.52
	47.3	193.75	1547.32
	48.1	193.65	1548.11
	48.9	193.55	1548.91
	49.7	193.45	1549.72
B50.5	50.5	193.35	1550.52
	51.3	193.25	1551.32
	52.1	193.15	1552.12
	52.9	193.05	1552.93
	53.7	192.95	1553.73
B54.4	54.4	192.85	1554.54
	55.3	192.75	1555.34
	56.1	192.65	1556.15
	56.9	192.55	1556.96
	57.8	192.45	1557.77
B58.6	58.6	192.35	1558.58
	59.4	192.25	1559.39
	60.2	192.15	1560.20
	61.0	192.05	1561.01
	61.8	191.95	1561.83

The 40-WSS-CE card has the following additional specifications:

- Dimensions
  - Height: 8.66 in. (220 mm)
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 1.42 in. (36 mm)

## A.8.10 40-WXC-C Card Specifications

The 40-WXC-C card optical specifications are listed in [Table A-21](#).

**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-21 40-WXC-C Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Channel bandwidth: –0.25 dB	All SOP and within whole operating temperature range	All paths	—	—	GHz
Channel bandwidth: –0.5 dB			+/- 20.5	—	GHz
Channel bandwidth: –1.5 dB			—	—	GHz
Channel bandwidth: –03.0 dB			+/- 37.5	—	GHz
Insertion loss	All SOP and within whole operating temperature range	All paths	—	8.5	dB
VOA dynamic range	—	All paths	20	—	dB
Maximum optical input power	—	—	300	—	mW

The 40-WXC-C card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm) for a standard DWDM unit
  - Width: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.00 in. (228.6 mm) for a standard DWDM unit

## A.8.11 40-SMR1-C Card Specifications

The 40-SMR1-C card optical specifications are listed in [Table A-22](#).

**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-22 40-SMR1-C Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Channel bandwidth: -0.25 dB	All SOP and within whole operating temperature range, connectors included, and for maximum VOA operating attenuation	All WXC paths (ADD-RX to LINE-TX and EXP-RX to LINE-TX)	—	—	pm
Channel bandwidth: -0.5 dB			+/- 160	—	pm
Channel bandwidth: -1.5 dB			—	—	pm
Channel bandwidth: -3.0 dB			+/- 240	—	pm
Insertion loss	All SOP, any optical switch state, and within whole operating temperature range, connectors included	All WXC paths (ADD-RX to LINE-TX and EXP-RX to LINE-TX)	2.0	8.1	dB
	All SOP, within whole operating temperature range, connectors included	DROP-TX with respect to EXP-TX	—	5.3	dB
VOA dynamic range	—	All WXC paths (ADD-RX to LINE-TX and EXP-RX to LINE-TX)	20	—	dB
		DROP-TX	—	25	dB
Maximum optical input power	Total power sum of all ports	—	500	—	mW

The EDFA1 amplifier within the 40-SMR1-C card has the following specifications:

- Optical characteristics (specified from LINE-RX to EXP-TX)
  - Total operating wavelength range: 1530 to 1561.5 nm
  - Gain ripple (peak to valley): 1.2 dB
  - Mid-access loss (MAL) range (for dispersion compensation unit [DCU]): 0 to 9 dB
  - Gain range: 7 to 38 dB
  - Minimum gain (standard range): 7.0 dB
  - Maximum gain (standard range with programmable gain tilt): 21 dB
  - Maximum gain (extended range with uncontrolled gain tilt): 38 dB
  - Gain and power regulation over/undershoot: 0.5 dB
  - Maximum output power (with full channel load): 17 dBm
  - Minimum output power (with one channel): -5 dBm
  - Input power (pin) range at full channel load: -21 to 12 dBm



- Input power (pin) range at single channel load: -43 to -10 dBm
- Noise figure at  $G = 21$  dB = 7.5 dB

The OSC filter within the 40-SMR1-C card has the following specifications:

- OSC filter drop (OSC) insertion loss maximum: 1.8 dB
- OSC filter add (OSC) insertion loss maximum: 1.3 dB

The 40-SMR1-C card has the following additional specifications:

- Dimensions
  - Height: 13.11 in. (333 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.88 in. (251 mm)

## A.8.12 40-SMR2-C Card Specifications

The 40-SMR2-C card optical specifications are listed in [Table A-23](#).



**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-23 40-SMR2-C Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Channel bandwidth: -0.25 dB	All SOP and within whole operating temperature range, connectors included, and for maximum VOA operating attenuation	All WXC paths (ADD-RX to WXC output, EXP1-RX to WXC output, EXP2-RX to WXC output, and EXP3-RX to WXC output)	—	—	pm
Channel bandwidth: -0.5 dB			+/- 160	—	pm
Channel bandwidth: -1.5 dB			—	—	pm
Channel bandwidth: -3.0 dB			+/- 240	—	pm
Insertion loss	All SOP, any optical switch state, and within whole operating temperature range, connectors included	All WXC paths (ADD-RX to WXC output, EXP1-RX to WXC output, EXP2-RX to WXC output, and EXP3-RX to WXC output)	2.0	7	dB
	All SOP, within whole operating temperature range, connectors included	DROP-TX with respect to EXP-TX	—	5.3	dB

**Table A-23** 40-SMR2-C Optical Specifications (continued)

Parameter	Note	Condition	Min	Max	Unit
VOA dynamic range	—	All WXC paths (ADD-RX to WXC output, EXP1-RX to WXC output, EXP2-RX to WXC output, and EXP3-RX to WXC output)	20	—	dB
		DROP-TX	—	25	dB
Maximum optical input power	Total power sum of all ports	—	500	—	mW

The EDFA1 amplifier within the 40-SMR2-C card has the following specifications:

- Optical characteristics (specified from LINE-RX to EXP-TX)
  - Total operating wavelength range: 1530 to 1561.5 nm
  - Gain ripple (peak to valley): 1.2 dB
  - Mid-access loss (MAL) range (for dispersion compensation unit [DCU]): 0 to 9 dB
  - Gain range: 7 to 38 dBm in constant gain mode
  - Minimum gain (standard range): 7.0 dBm
  - Maximum gain (standard range with programmable gain tilt): 21 dBm
  - Maximum gain (extended range with uncontrolled gain tilt): 38 dBm
  - Gain and power regulation over/undershoot: 0.5 dB
  - Maximum output power (with full channel load): 17 dBm
  - Minimum output power (with one channel): -5 dBm
  - Input power (pin) range at full channel load: -21 to 12 dBm
  - Input power (pin) range at single channel load: -43 to -10 dBm
  - Noise figure at G= 21 dB = 7.5 dB

The EDFA2 amplifier within the 40-SMR2-C card has the following specifications:

- Optical characteristics (specified from WXC output to LINE-TX)
  - Total operating wavelength range 1530.0 to 1561.5 nm
  - Gain ripple (peak to valley): 1.2 dB
  - Gain range: 13 to 26 dB
  - Optimal gain (gain tilt = 0): 17 dB
  - Gain and power regulation over/undershoot: 0.5 dB
  - Minimum output power (with one channel): -5 dBm
  - Input power range (full channel load): -9 to 4 dBm
  - Input power range (single channel load): -31 to -18 dBm
  - Noise figure at G=17dB = 6 dB maximum

The OSC filter within the 40-SMR2-C card has the following specifications:

- OSC filter drop (OSC) insertion loss maximum: 1.8 dB
- OSC filter add (OSC) insertion loss maximum: 1.3 dB

The 40-SMR2-C card has the following additional specifications:

- Dimensions
  - Height: 13.11 in. (333 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.88 in. (251 mm)

## A.8.13 MMU Card Specifications

The MMU card optical specifications are listed in [Table A-24](#).



**Note**

For power specifications, see [Table A-2 on page A-6](#).

**Table A-24**      **MMU Optical Specifications**

Parameter	Note	Condition	Min	Typical	Max	Units
Operating bandwidth	All SOP, any optical switch state, and within whole operating temperature range, connectors included.	All paths	1500	—	1605	nm

**Table A-24** MMU Optical Specifications (continued)

Parameter	Note	Condition	Min	Typical	Max	Units
Insertion loss	All SOP, any optical switch state, and within whole operating temperature range, connectors included.	EXP RX => COM TX	—	—	7.0	dB
		EXP A RX => COM TX	—	—	2.3	dB
		COM RX => EXP TX	—	—	0.8	dB
		COM RX => EXP A TX	—	—	14.8	dB
Wavelength dependent losses	All SOP, any optical switch state, and within whole operating temperature range, connectors included.	C-band only	—	—	0.3	dB
		L-band only	—	—	0.3	dB
		C and L bands	—	—	0.5	dB
Polarization dependent loss (PDL)	—	C-band only	—	—	0.2	dB
	—	L-band only	—	—	0.2	dB
	—	C and L bands	—	—	0.3	dB
Chromatic dispersion		All paths	–20	—	+20	ps/nm
Polarization mode dispersion (PMD)	—	All paths	—	—	0.1	ps
Optical power reading resolution	—	All photodiodes (both real and virtual)	—	—	0.1	dB
Optical power reading precision	—		–0.1	—	0.1	dB
Directivity	All SOP, any optical switch state, and within whole operating temperature range, connectors included.	EXP RX => EXP A RX	40	—	—	dB
		EXP RX => EXP B RX	40	—	—	dB
		EXP A RX => EXP B RX	40	—	—	dB
Return loss	—	—	40	—	—	dB
Maximum optical input power	Maximum handling power	—	500	—	—	mW

The MMU card has the following additional specifications:

- Dimensions
  - Height: 12.65 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 8.66 in. (220.1 mm)

## A.9 Optical Add/Drop Cards

This section provides specifications for the AD-1C-xx.x, AD-2C-xx.x, AD-4C-xx.x, AD-1B-xx.x, and AD-4B-xx.x cards.

### A.9.1 AD-1C-xx.x Card Specifications

Table A-25 lists the AD-1C-xx.x optical specifications.

**Table A-25 AD-1C-xx.x Card Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Trx filter shape (−0.5 dB bandwidth) TrxBW <sub>2</sub>	All SOP and within whole operating temperature range	COM Rx—xx.xx Tx xx.xx Rx—COM Tx	+/−180	—	pm
Rfx filter shape (−0.5 dB bandwidth) RfxBW <sub>2</sub>	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	+/−180	—	pm
Insertion loss (drop section)	All SOP and within whole operating temperature range (two connectors included)	COM Rx—xx.xx Tx	—	2.0	dB
Insertion loss (express section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	COM Rx—Exp Tx Exp Rx—COM Tx	—	2.4 or 1.2	dB
Insertion loss (add section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	xx.xx Rx—COM Tx	—	2.6	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

The AD-1C-xx.x card optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See Table 8-3 on page 8-3 through Table 8-6 on page 8-5 for this information.

The AD-1C-xx.x card has the following additional specifications:

- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.0 in. (228.6 mm)

### A.9.2 AD-2C-xx.x Card Specifications

Table A-26 lists the AD-2C-xx.x optical specifications.

**Table A-26 AD-2C-xx.x Card Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Trx filter shape (−0.5 dB bandwidth) TrxBW <sub>2</sub>	All SOP and within whole operating temperature range	COM Rx—xx.xx Tx COM Rx—yy.yy Tx	+/−180	—	pm
		xx.xx Rx—COM Tx yy.yy Rx—COM Tx	+/−180	—	
Rfx filter shape (−0.5 dB bandwidth) RfxBW <sub>2</sub>	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	+/−180	—	pm
Insertion loss (drop section)	All SOP and within whole operating temperature range (two connectors included)	COM Rx—xx.xx Tx	—	2.0	dB
		COM Rx—yy.yy Tx	—	2.4	dB
Insertion loss (express section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	COM Rx—Exp Tx	—	2.7	dB
		Exp Rx—COM Tx	—	1.6	dB
Insertion loss (add section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	xx.xx Rx—COM Tx	—	3.1	dB
		yy.yy Rx—COM Tx	—	2.7	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

The AD-2C-xx.x card optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 8-3 on page 8-3](#) through [Table 8-6 on page 8-5](#) for this information.

The AD-2C-xx.x has the following additional specifications:

- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.0 in. (228.6 mm)

## A.9.3 AD-4C-xx.x Card Specifications

[Table A-27](#) lists the AD-4C-xx.x optical specifications.

**Table A-27 AD-4C-xx.x Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Channel grid	See <a href="#">Table A-28</a> . The channel plan for the AD-4C-xx.x card is identical to the channel plan for the AD-1B-xx.x card.	—	—	—	—
Trx filter shape (–0.5 dB bandwidth) TrxBW <sub>2</sub>	All SOP and within whole operating temperature range	COM Rx—xx.xx Tx COM Rx—yy.yy Tx COM Rx—zz.zz Tx COM Rx—kk.kk Tx xx.xx Rx—COM Tx yy.yy Rx—COM Tx	+/-180	—	pm
Rfx filter shape (–1 dB bandwidth) RfxBW <sub>2</sub>	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	—	—	pm
Insertion loss (drop section)	All SOP and within whole operating temperature range (two connectors included)	COM Rx—xx.xx Tx	—	5.5	dB
		COM Rx—yy.yy Tx	—	5.0	dB
		COM Rx—zz.zz Tx	—	4.5	dB
		COM Rx—kk.kk Tx	—	4.1	dB
Insertion loss (express section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	COM Rx—Exp Tx	—	2.7	dB
		Exp Rx—COM Tx	—	1.2	dB
Insertion loss (add section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	xx.xx Rx—COM Tx	—	3.9	dB
		yy.yy Rx—COM Tx	—	4.3	dB
		zz.zz Rx—COM Tx	—	4.5	dB
		kk.kk Rx—COM Tx	—	4.9	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

The AD-4C-xx.x card optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 8-3 on page 8-3](#) through [Table 8-6 on page 8-5](#) for this information.

The AD-4C-xx.x has the following additional specifications:

- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.0 in. (228.6 mm)

## A.9.4 AD-1B-xx.x Card Specifications

Table A-28 lists the unit names, band IDs, channel IDs, frequencies, and wavelengths assigned to the eight versions of the AD-1B-xx.x card.

**Table A-28** AD-1B-xx.x Channel Allocation Plan by Band

Unit Name	Band ID	Channel ID	Frequency (GHz)	Wavelength (nm)
AD-1B-30.3	B30.3	30.3	195.9	1530.33
		30.7	195.85	1530.72
		31.1	195.8	1531.12
		31.5	195.75	1531.51
		31.9	195.7	1531.90
		32.2	195.65	1532.29
		32.6	195.6	1532.68
		33.3	195.55	1533.07
AD-1B-34.2	B34.2	34.2	195.4	1534.25
		34.6	195.35	1534.64
		35.0	195.3	1535.04
		35.4	195.25	1535.43
		35.8	195.2	1535.82
		36.2	195.15	1536.22
		36.6	195.1	1536.61
		37.0	195.05	1537.00
AD-1B-38.1	B38.1	38.1	194.9	1538.19
		38.5	194.85	1538.58
		38.9	194.8	1538.98
		39.3	194.75	1539.37
		39.7	194.7	1539.77
		40.1	194.65	1540.16
		40.5	194.6	1540.56
		40.9	194.55	1540.95
AD-1B-42.2	B42.1	42.1	194.4	1542.14
		42.5	194.35	1542.54
		42.9	194.3	1542.94
		43.3	194.25	1543.33
		43.7	194.2	1543.73
		44.1	194.15	1544.13
		44.5	194.1	1544.53
		44.9	194.05	1544.92



**Table A-28 AD-1B-xx.x Channel Allocation Plan by Band (continued)**

Unit Name	Band ID	Channel ID	Frequency (GHz)	Wavelength (nm)
AD-1B-46.1	B46.1	46.1	193.9	1546.12
		46.5	193.85	1546.52
		46.9	193.8	1546.92
		47.3	193.75	1547.32
		47.7	193.7	1547.72
		48.1	193.65	1548.11
		48.5	193.6	1548.51
		48.9	193.55	1548.91
AD-1B-50.1	B50.1	50.1	193.4	1550.12
		50.5	193.35	1550.52
		50.9	193.3	1550.92
		51.3	193.25	1551.32
		51.7	193.2	1551.72
		52.1	193.15	1552.12
		52.5	193.1	1552.52
		52.9	193.05	1552.93
AD-1B-54.1	B54.1	54.1	192.9	1554.13
		54.5	192.85	1554.54
		54.9	192.8	1554.94
		55.3	192.75	1555.34
		55.7	192.7	1555.75
		56.1	192.65	1556.15
		56.5	192.6	1556.96
		56.9	192.55	1556.96
AD-1B-58.1	B58.1	58.1	192.4	1558.17
		58.5	192.35	1558.58
		58.9	192.3	1558.98
		59.3	192.25	1559.39
		59.7	192.2	1559.79
		60.2	192.15	1560.20
		60.6	192.1	1560.61
		61.0	192.05	1561.01

Table A-29 lists AD-1B-xx.x optical specifications.

**Table A-29** AD-1B-xx.x Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
–1 dB bandwidth	All SOP and within whole operating environmental range	COM Rx—Band Tx Band Rx—COM Tx	3.6	—	nm
–1 dB bandwidth	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	See <a href="#">Table A-30</a> .		nm
Insertion loss (drop section)	All SOP and within whole operating environmental range; two connectors included, VOA set at minimum attenuation	COM Rx—Band Tx	—	3.0	dB
Insertion loss (express section)	All SOP and within whole operating environmental range; two connectors included	Exp Rx—COM Tx	—	1.6	dB
	All SOP and within whole operating environmental range; two connectors included, VOA set at its minimum attenuation	COM Rx—Exp Tx	—	2.2	dB
Insertion loss (add section)	All SOP and within whole operating environmental range; two connectors included	Band Rx—COM Tx	—	2.2	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

[Table A-30](#) lists the range of wavelengths for the receive (express) band.

**Table A-30** AD-1B-xx.x Transmit and Receive Dropped Band Wavelength Ranges

Tx (Dropped) Band	Rx (Express) Band	
	Left Side (nm)	Right Side (nm)
B30.3	—	Wavelengths 1533.825 or higher
B34.2	Wavelengths 1533.395 or lower	Wavelengths 1537.765 or higher
B38.1	Wavelengths 1537.325 or lower	Wavelengths 1541.715 or higher
42.1	Wavelengths 1541.275 or lower	Wavelengths 1545.695 or higher
46.1	Wavelengths 1545.245 or lower	Wavelengths 1549.695 or higher
50.1	Wavelengths 1549.235 or lower	Wavelengths 1553.705 or higher
54.1	Wavelengths 1553.255 or lower	Wavelengths 1557.745 or higher
58.1	Wavelengths 1557.285 or lower	—

The AD-1B-xx.x card optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 8-3 on page 8-3](#) through [Table 8-6 on page 8-5](#) for this information.

The AD-1B-xx.x card has the following additional specifications:

- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.0 in. (228.6 mm)

## A.9.5 AD-4B-xx.x Card Specifications

[Table A-31](#) lists the unit names, band IDs, channel IDs, frequencies, and wavelengths assigned to the two versions of the card.

**Table A-31** AD-4B-xx.x Channel Allocation Plan by Band

Unit Name	Band ID	Channel ID	Frequency (GHz)	Wavelength (nm)
AD-4B-30.3	B30.3	30.3	195.9	1530.33
		30.7	195.85	1530.72
		31.1	195.8	1531.12
		31.5	195.75	1531.51
		31.9	195.7	1531.90
		32.2	195.65	1532.29
		32.6	195.6	1532.68
		33.3	195.55	1533.07
	B34.2	34.2	195.4	1534.25
		34.6	195.35	1534.64
		35.0	195.3	1535.04
		35.4	195.25	1535.43
		35.8	195.2	1535.82
		36.2	195.15	1536.22
		36.6	195.1	1536.61
		37.0	195.05	1537.00
	B38.1	38.1	194.9	1538.19
		38.5	194.85	1538.58
		38.9	194.8	1538.98
		39.3	194.75	1539.37
		39.7	194.7	1539.77
		40.1	194.65	1540.16
		40.5	194.6	1540.56
		40.9	194.55	1540.95
	B42.1	42.1	194.4	1542.14
		42.5	194.35	1542.54
		42.9	194.3	1542.94
		43.3	194.25	1543.33
		43.7	194.2	1543.73
		44.1	194.15	1544.13
		44.5	194.1	1544.53
		44.9	194.05	1544.92

**Table A-31** AD-4B-xx.x Channel Allocation Plan by Band (continued)

Unit Name	Band ID	Channel ID	Frequency (GHz)	Wavelength (nm)
AD-4B-46.1	B46.1	46.1	193.9	1546.12
		46.5	193.85	1546.52
		46.9	193.8	1546.92
		47.3	193.75	1547.32
		47.7	193.7	1547.72
		48.1	193.65	1548.11
		48.5	193.6	1548.51
		48.9	193.55	1548.91
	B50.1	50.1	193.4	1550.12
		50.5	193.35	1550.52
		50.9	193.3	1550.92
		51.3	193.25	1551.32
		51.7	193.2	1551.72
		52.1	193.15	1552.12
		52.5	193.1	1552.52
		52.9	193.05	1552.93
	B54.1	54.1	192.9	1554.13
		54.5	192.85	1554.54
		54.9	192.8	1554.94
		55.3	192.75	1555.34
		55.7	192.7	1555.75
		56.1	192.65	1556.15
		56.5	192.6	1556.96
		56.9	192.55	1556.96
	B58.1	58.1	192.4	1558.17
		58.5	192.35	1558.58
		58.9	192.3	1558.98
		59.3	192.25	1559.39
		59.7	192.2	1559.79
		60.2	192.15	1560.20
		60.6	192.1	1560.61
		61.0	192.05	1561.01

Table A-32 lists AD-4B-xx.x optical specifications.

**Table A-32** AD-4B-xx.x Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
–1 dB bandwidth	All SOP and within whole operating environmental range	COM Rx—Band Tx Band Rx—COM Tx	3.6	—	nm
–1 dB bandwidth	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	Refer to <a href="#">Table A-33</a> .		nm
Insertion loss (drop section)	All SOP and within whole operating environmental range; two connectors included, VOA set at minimum attenuation	COM Rx—Band Tx 30.3/46.1	—	2.9	dB
		COM Rx—Band Tx 34.2/50.1	—	3.3	dB
		COM Rx—Band Tx 38.1/54.1	—	3.8	dB
		COM Rx—Band Tx 42.1/58.1	—	4.5	dB
Insertion loss (express section)	All SOP and within whole operating environmental range; two connectors included	Exp Rx—COM Tx	—	4.9	dB
	All SOP and within whole operating environmental range; two connectors included, VOA set at its minimum attenuation	COM Rx—Exp Tx	—	3	dB
Insertion loss (add section)	All SOP and within whole operating environmental range; two connectors included	Band Rx 30.3/46.1—COM Tx	—	3.5	dB
		Band Rx 34.2/50.1—COM Tx	—	2.8	dB
		Band Rx 38.1/54.1—COM Tx	—	2.3	dB
		Band Rx 42.1/58.1—COM Tx	—	1.8	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

[Table A-33](#) lists the range of wavelengths for the receive (express) band.

**Table A-33** AD-4B-xx.x Transmit and Receive Dropped Band Wavelength Ranges

Tx (Dropped) Band	Rx (Express) Band	
	Left Side (nm)	Right Side (nm)
B30.3	—	Wavelengths 1533.825 or higher
B34.2	Wavelengths 1533.395 or lower	Wavelengths 1537.765 or higher
B38.1	Wavelengths 1537.325 or lower	Wavelengths 1541.715 or higher
B42.1	Wavelengths 1541.275 or lower	Wavelengths 1545.695 or higher

**Table A-33 AD-4B-xx.x Transmit and Receive Dropped Band Wavelength Ranges (continued)**

Tx (Dropped) Band	Rx (Express) Band	
	Left Side (nm)	Right Side (nm)
B46.1	Wavelengths 1545.245 or lower	Wavelengths 1549.695 or higher
B50.1	Wavelengths 1549.235 or lower	Wavelengths 1553.705 or higher
B54.1	Wavelengths 1553.255 or lower	Wavelengths 1557.745 or higher
B58.1	Wavelengths 1557.285 or lower	—

The AD-4B-xx.x card optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 8-3 on page 8-3](#) through [Table 8-6 on page 8-5](#) for this information.

The AD-4B-xx.x has the following additional specifications:

- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.0 in. (228.6 mm)

## A.10 Transponder and Muxponder Card Specifications

This section provides specifications for the TXP\_MR\_10G, MXP\_2.5G\_10G, TXP\_MR\_2.5G, TXPP\_MR\_2.5G, MXP\_MR\_2.5G, MXPP\_MR\_2.5G, MXP\_2.5G\_10E, MXP\_2.5G\_10E\_C, MXP\_2.5G\_10EX\_C, MXP\_2.5G\_10E, TXP\_MR\_10E, TXP\_MR\_10E\_C, TXP\_MR\_10E\_L, TXP\_MR\_10EX\_C, MXP\_MR\_10DME\_C, MXP\_MR\_10DME\_L, MXP\_MR\_10DMEX\_C, ADM-10G, and OTU2\_XP cards.

For compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.

### A.10.1 TXP\_MR\_10G Card Specifications

The TXP\_MR\_10G card has the following specifications:

- Line (trunk side)
  - Bit rate:
    - 9.95328 Gbps for OC-192/STM-64
    - 10.70923 Gbps with ITU-T G.709 Digital Wrapper/forward error correction (FEC)
    - 10.3125 Gbps for 10 Gigabit Ethernet (GE)
    - 11.095 Gbps with ITU-T G.709 Digital Wrapper/FEC over 10 GE
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: 1000 ps/nm
  - Loopback modes: Terminal and facility

**Caution**

You must use a 15-dB fiber attenuator (10 to 20 dB) when working with the TXP\_MR\_10G card in a loopback on the trunk port. Do not use direct fiber loopbacks with the TXP\_MR\_10G card. Using direct fiber loopbacks causes irreparable damage to the TXP\_MR\_10G card.

- Connectors: LC
- Compliance Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.691
- Transmitter (trunk side)
  - Maximum transmitter output power: +3.5 dBm
  - Minimum transmitter output power: +2.5 dBm
  - Transmitter: Lithium Niobate (LN) external modulator transmitter
  - Wavelength stability (drift):  $\pm 25$  picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is  $\pm 25$  pm.

- Currently available wavelengths and versions of TXP\_MR\_10G (16 card versions, each covering two wavelengths):
  - 1530.33 to 1531.12 nm (two wavelengths)
  - 1531.90 to 1532.68 nm (two wavelengths)
  - 1534.25 to 1535.04 nm (two wavelengths)
  - 1535.82 to 1536.61 nm (two wavelengths)
  - 1538.19 to 1538.98 nm (two wavelengths)
  - 1539.77 to 1540.56 nm (two wavelengths)
  - 1542.14 to 1542.94 nm (two wavelengths)
  - 1543.73 to 1544.53 nm (two wavelengths)
  - 1546.12 to 1546.92 nm (two wavelengths)
  - 1547.72 to 1548.51 nm (two wavelengths)
  - 1550.12 to 1550.92 nm (two wavelengths)
  - 1551.72 to 1552.52 nm (two wavelengths)
  - 1554.13 to 1554.94 nm (two wavelengths)
  - 1555.75 to 1556.55 nm (two wavelengths)
  - 1558.17 to 1558.98 nm (two wavelengths)
  - 1559.79 to 1560.61 nm (two wavelengths)
- Receiver (trunk side):
  - Receiver input power (no FEC, unamplified, 23 dB optical signal-to-noise ratio [OSNR], BER  $1 \times 10^{-12}$ ):  $-8$  to  $-21$  dBm
  - Receiver input power (no FEC, unamplified, 23 dB OSNR, at  $\pm 1000$  ps/nm BER  $1 \times 10^{-12}$ ):  $-8$  to  $-19$  dBm
  - Receiver input power (no FEC, amplified, 19 dB OSNR, BER  $1 \times 10^{-12}$ ):  $-8$  to  $-20$  dBm



- Receiver input power (no FEC, amplified, 19 dB OSNR, at  $\pm 1000$  ps/nm BER  $1 \times 10^{-12}$ ): –8 to –18 dBm
- Receiver input power (FEC, unamplified, 23 dB OSNR, BER  $8 \times 10^{-5}$ ): –8 to –24 dBm
- Receiver input power (FEC, unamplified, 23 dB OSNR, at  $\pm 1000$  ps/nm, BER  $8 \times 10^{-5}$ ): –8 to –22 dBm
- Receiver input power (FEC, amplified, 9 dB OSNR, BER  $8 \times 10^{-5}$ ): –8 to –18 dBm
- Receiver input power (FEC, unamplified, 11 dB OSNR, at  $\pm 800$  ps/nm, BER  $8 \times 10^{-5}$ ): –8 to –18 dBm
- Line (client side)
  - Bit rate: 9.95328 Gbps or 10.3125 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: Compliant with SR-1 specification for OC-192. In the case of 10 GE, the allowance is up to 10 km of single-mode fiber (SMF) dispersion.
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: 1290 to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: Distributed feedback (DFB) laser
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER  $1 \times 10^{-12}$
  - Minimum receiver level: –14 dBm at BER  $1 \times 10^{-12}$
  - Receiver: avalanche photodiode (APD)
  - Link loss budget: 8 dB minimum, at BER =  $1 \times 10^{-12}$
  - Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.2 MXP\_2.5G\_10G Card Specifications

The MXP\_2.5G\_10G card has the following specifications:

- Line (trunk side)

- Bit rate:  
9.95328 Gbps for OC-192/STM-64  
10.70923 Gbps with ITU-T G.709 Digital Wrapper/FEC
- Code: Scrambled NRZ
- Fiber: 1550-nm single-mode
- Maximum chromatic dispersion allowance: 1000 ps/nm
- Loopback modes: Terminal and facility

**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_2.5G\_10G card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_2.5G\_10G card. Using direct fiber loopbacks causes irreparable damage to the MXP\_2.5G\_10G card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +3.5 dBm
  - Minimum transmitter output power: +2.5 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of MXP\_2.5G\_10G (16 card versions, each covering two wavelengths):
  - 1530.33 to 1531.12 nm (two wavelengths)
  - 1531.90 to 1532.68 nm (two wavelengths)
  - 1534.25 to 1535.04 nm (two wavelengths)
  - 1535.82 to 1536.61 nm (two wavelengths)
  - 1538.19 to 1538.98 nm (two wavelengths)
  - 1539.77 to 1540.56 nm (two wavelengths)
  - 1542.14 to 1542.94 nm (two wavelengths)
  - 1543.73 to 1544.53 nm (two wavelengths)
  - 1546.12 to 1546.92 nm (two wavelengths)
  - 1547.72 to 1548.51 nm (two wavelengths)
  - 1550.12 to 1550.92 nm (two wavelengths)
  - 1551.72 to 1552.52 nm (two wavelengths)
  - 1554.13 to 1554.94 nm (two wavelengths)
  - 1555.75 to 1556.55 nm (two wavelengths)
  - 1558.17 to 1558.98 nm (two wavelengths)

- 1559.79 to 1560.61 nm (two wavelengths)
- Receiver (trunk side)
  - Receiver input power (no FEC, unamplified, 23 dB OSNR, BER  $1 * 10^{\exp - 12}$ ): –8 to –21 dBm
  - Receiver input power (no FEC, unamplified, 23 dB OSNR, at  $\pm 1000$  ps/nm BER  $1 * 10^{\exp - 12}$ ): –8 to –19 dBm
  - Receiver input power (no FEC, amplified, 19 dB OSNR, BER  $1 * 10^{\exp - 12}$ ): –8 to –20 dBm
  - Receiver input power (no FEC, amplified, 19 dB OSNR, at  $\pm 1000$  ps/nm BER  $1 * 10^{\exp - 12}$ ): –8 to –18 dBm
  - Receiver input power (FEC, unamplified, 23 dB OSNR, BER  $8 * 10^{\exp - 5}$ ): –8 to –24 dBm
  - Receiver input power (FEC, unamplified, 23 dB OSNR, at  $\pm 1000$  ps/nm, BER  $8 * 10^{\exp - 5}$ ): –8 to –22 dBm
  - Receiver input power (FEC, amplified, 9 dB OSNR, BER  $8 * 10^{\exp - 5}$ ): –8 to –18 dBm
  - Receiver input power (FEC, unamplified, 11 dB OSNR, at  $\pm 800$  ps/nm, BER  $8 * 10^{\exp - 5}$ ): –8 to –18 dBm
- Line (client side)
  - Bit rate: 2.48832 Gbps
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: Compliant with SR-1 specification for OC-192. In the case of 10 GE, allowance is up to 10 km of SMF fiber of dispersion.
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side): Depends on the Small Form-factor Pluggable (SFP) that is used.
- Receiver (client side): Depends on the SFP that is used.
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.3 TXP\_MR\_2.5G and TXPP\_MR\_2.5G Card Specifications

The TXP\_MR\_2.5G and TXPP\_MR\_2.5G cards have the following specifications:

- Line (trunk side)
  - Bit rate:
    - 2.488 Gbps for OC-48/STM-16
    - 2.66 Gbps with ITU-T G.709 Digital Wrapper/FEC
  - Code: Scrambled NRZ

- Fiber: 1550-nm single-mode
- Maximum chromatic dispersion allowance: 5400 ps/nm
- Loopback modes: Terminal and facility

**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the TXP\_MR\_2.5G and TXPP\_MR\_2.5G cards in a loopback on the trunk port. Do not use direct fiber loopbacks with the TXP\_MR\_2.5G and TXPP\_MR\_2.5G cards. Using direct fiber loopbacks causes irreparable damage to the TXP\_MR\_2.5G and TXPP\_MR\_2.5G cards.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +1 dBm
  - Minimum transmitter output power: –4.5 dBm
  - Transmitter: Direct modulated laser
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths of TXP\_MR\_2.5G and TXPP\_MR\_2.5G (eight card versions):  
ITU grid blue band: 1530.334 to 1544.526 nm (four card versions covering four wavelengths each)  
ITU grid red band: 1546.119 to 1560.606 nm (four card versions covering four wavelengths each)
- Receiver (trunk side, see [Table A-34](#))

**Table A-34** TXP\_MR\_2.5G/TXPP\_MR\_2.5G Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	Chromatic Dispersion Tolerance
22 dB	Off - 2R	< 10 exp – 12	N/A	– 9 to – 24 dBm	—
22 dB	Off - 2R	< 10 exp – 12	N/A	– 9 to – 21 dBm	+/- 3300ps/nm
21 dB	Off - 3R	< 10 exp – 12	N/A	– 9 to – 30 dBm	—
22 dB	Off - 3R	< 10 exp – 12	N/A	– 9 to – 30 dBm	+/- 1800ps/nm
23 dB	Off - 3R	< 10 exp – 12	N/A	– 9 to – 30 dBm	+/- 5400ps/nm
12 dB	Standard- 3R	< 10 exp – 5	< 10 exp – 15	– 9 to – 25 dBm	—
12 dB	Standard- 3R	< 10 exp – 5	< 10 exp – 15	– 9 to – 24 dBm	+/- 1800ps/nm
12 dB	Standard- 3R	< 10 exp – 5	< 10 exp – 15	– 9 to – 23 dBm	+/- 5400ps/nm
21 dB	Standard- 3R	< 10 exp – 5	< 10 exp – 15	– 9 to – 31 dBm	—

1. OSNR defined with 0.1 nm resolution bandwidth (RBW)

- Receiver: APD
- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at  
BER = 1 \* 10 exp – 12 including dispersion

- Line (client side)
  - Bit rate: 8 Mbps to 2.488 Gbps
  - Code: Scrambled NRZ
  - Fiber: Based on SFP (1310-nm single-mode or 850-nm multimode)
  - Maximum chromatic dispersion allowance: Based on SFP
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: Based on SFP
  - Nominal wavelength: Based on SFP
  - Transmitter: Based on SFP
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER  $1 \times 10^{-12}$
  - Minimum receiver level: –14 dBm at BER  $1 \times 10^{-12}$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at BER =  $1 \times 10^{-12}$
  - Receiver input wavelength range: 850nm to 1605 nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.4 MXP\_MR\_2.5G and MXPP\_MR\_2.5G Card Specifications

The MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards have the following specifications:

- Payload configuration
  - FC1G—Fibre Channel 1.06 Gbps
  - FC2G—Fibre Channel 2.125 Gbps
  - FICON1G—Fiber connectivity 1.06 Gbps (IBM signal)
  - FICON2G—Fiber connectivity 2.125 Gbps (IBM signal)
  - ESCON—Enterprise System Connection 200 Mbps
  - ONE\_GE—One Gigabit Ethernet 1.125 Gbps

- Mixed configurations up to maximum line rate of 2.5 Gbps (for example, if you have a port configured for FC2G, you cannot use another port at the same time). See the [“10.9 MXP\\_MR\\_2.5G and MXPP\\_MR\\_2.5G Cards” section on page 10-45](#) for more information on mixed-mode operation.
- Client ports: 8x SFP
- Performance monitoring (PM) for all interfaces
- Buffer-to-buffer credit management for distance extension
- Line (trunk side)
  - Bit rate: 2.488 Gbps for OC-48/STM-16
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: 6000 ps/nm
  - Loopback modes: Terminal and facility

**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards. Using direct fiber loopbacks causes irreparable damage to the MXP\_MR\_2.5G and MXPP\_MR\_2.5G cards.

- Connectors: LC
- Transmitter (trunk side)
  - Transmit power: +3 +/- 1 dBm with MXP\_MR\_2.5G card, and +/- 1 dBm with MXPP\_MR\_2.5G card
  - 50-GHz DWDM migration ready (the wavelength deviation is less than +/- 0.040 nm through wavelocker deployment)
  - Four-channel wavelength tunability at 100-GHz spacing
  - Transmitter maximum return reflectance: -27 dB
  - Chromatic dispersion allowance: 5400 ps/nm, giving an optical power penalty < 2.0 dB
  - Minimum side mode suppression ratio: 30 dB
  - Transmitter is a direct modulated laser
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths of the TXP\_MR\_2.5G and TXPP\_MR\_2.5G cards (eight card versions):
  - ITU grid blue band: 1530.334 to 1544.526 nm (four card versions, four wavelengths each)
  - ITU grid red band: 1546.119 to 1560.606 nm (four card versions, four wavelengths each)
- Receiver (trunk side, see [Table A-35](#))

**Table A-35 MXP\_MR\_2.5G/MXPP\_MR\_2.5G Card Receiver Trunk Side Specifications**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	Chromatic Dispersion Tolerance
17 dB	N/A	< 10 exp – 12	N/A	– 9 to – 23 dBm	—
17 dB	N/A	< 10 exp – 12	N/A	– 9 to – 22 dBm	+/- 1800 ps/nm
17 dB	N/A	< 10 exp – 12	N/A	– 9 to – 21 dBm	+/- 5400 ps/nm
18 dB	N/A	< 10 exp – 12	N/A	– 9 to – 23 dBm	+/- 1800 ps/nm
19 dB	N/A	< 10 exp – 12	N/A	– 9 to – 23 dBm	+/- 5400 ps/nm
21 dB	N/A	< 10 exp – 12	N/A	– 9 to – 30 dBm	—
21 dB	N/A	< 10 exp – 12	N/A	– 9 to – 29 dBm	+/- 1800 ps/nm
21 dB	N/A	< 10 exp – 12	N/A	– 9 to – 28 dBm	+/- 5400 ps/nm
22 dB	N/A	< 10 exp – 12	N/A	– 9 to – 30 dBm	+/- 1800 ps/nm
23 dB	N/A	< 10 exp – 12	N/A	– 9 to – 30 dBm	+/- 5400 ps/nm

1. OSNR defined with 0.1 nm RBW

- Receiver sensitivity –28 dBm, BER  $1 * 10 \text{ exp} - 12$
- Receiver overload is equal to or exceeds –8 dBm
- Receiver maximum reflectance of –27 dB
- Line (client side)
  - Bit rate: 200Mbps or 1.06 Gbps to 2.125 Gbps per client
  - Code: Scrambled NRZ
  - Fiber: Based on SFP (1310-nm single-mode or 850-nm multimode)
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: Based on SFP
  - Nominal wavelength: Based on SFP
  - Transmitter: Based on SFP
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER  $1 * 10 \text{ exp} - 12$
  - Minimum receiver level: –14 dBm at BER  $1 * 10 \text{ exp} - 12$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at BER =  $1 * 10 \text{ exp} - 12$
  - Receiver input wavelength range: 1290 to 1605 nm or 850nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)

- Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
- Depth: 9.000 in. (228.6 mm)
- Depth with backplane connector: 9.250 in. (235 mm)
- Weight not including clam shell: 2.25 lb (1.02 kg)

## A.10.5 MXP\_2.5G\_10E Card Specifications

The MXP\_2.5G\_10E card has the following specifications:

- Line (trunk side)
  - Bit rate: 10.70923 Gbps (in ITU-T G.709 Digital Wrapper/FEC mode)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance:  $\pm 1200$  ps/nm (specified penalty)
  - Loopback modes: Terminal and facility



### Caution

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_2.5G\_10E card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_2.5G\_10E card. Using direct fiber loopbacks causes irreparable damage to the MXP\_2.5G\_10E card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift):  $\pm 25$  picometers (pm)



### Note

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is  $\pm 25$  pm.

- Currently available wavelengths and versions of MXP\_2.5G\_10E (eight card versions):

ITU grid blue band:

- 1530.33 to 1533.07 nm (four channels)
- 1534.25 to 1537.00 nm (four channels)
- 1538.19 to 1540.95 nm (four channels)
- 1542.14 to 1544.92 nm (four channels)

ITU grid red band:

- 1546.12 to 1548.92 nm (four channels)
- 1550.12 to 1552.93 nm (four channels)
- 1554.13 to 1556.96 nm (four channels)
- 1558.17 to 1561.01 nm (four channels)



- Receiver (trunk side, see [Table A-36](#))
  - Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at  $BER = 1 \times 10^{-12}$  including dispersion

**Table A-36 MXP\_2.5G\_10E Card Receiver Trunk Side Specifications**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	$< 10 \times 10^{-12}$	N/A	– 8 to – 20 dBm	+/- 1200 ps/nm
26 dB	Off	$< 10 \times 10^{-12}$	N/A	– 8 to – 20 dBm	+/- 1000 ps/nm
26 dB	Off	$< 10 \times 10^{-12}$	N/A	– 8 to – 22 dBm	—
17 dB	Standard	$< 10 \times 10^{-5}$	$< 10 \times 10^{-15}$	– 8 to – 18 dBm	+/- 800 ps/nm
15 dB	Standard	$< 10 \times 10^{-5}$	$< 10 \times 10^{-15}$	– 8 to – 18 dBm	—
15 dB	Enhanced	$< 7 \times 10^{-4}$	$< 10 \times 10^{-15}$	– 8 to – 18 dBm	+/- 800 ps/nm
14 dB	Enhanced	$< 7 \times 10^{-4}$	$< 10 \times 10^{-15}$	– 8 to – 18 dBm	—

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth greater than or equal to 180 pm (at – 3 dBm)

- Line (client side)
  - Bit rate: 2.5 Gbps per port (OC-48/STM-16)
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 12 ps/nm (SR SFP version)
  - Loopback modes: Terminal and facility
  - Connectors: LC (optical)
- Transmitter (client side): Depends on the SFP that is used.
- Receiver (client side): Depends on the SFP that is used.
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.6 MXP\_2.5G\_10E\_C Card Specifications

The MXP\_2.5G\_10E\_C card has the following specifications:

- Line (trunk side)
  - Bit rate: 10.70923 Gbps (in ITU-T G.709 Digital Wrapper/FEC mode)

- Code: Scrambled NRZ
- Fiber: 1550-nm single-mode
- Maximum chromatic dispersion allowance: +/- 1200 ps/nm (specified penalty)
- Loopback modes: Terminal and facility

**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_2.5G\_10E\_C card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_2.5G\_10E\_C card. Using direct fiber loopbacks causes irreparable damage to the card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of MXP\_2.5G\_10E\_C card:

There is a single version of the MXP\_2.5G\_10E\_C card. It is tunable across 82 wavelengths in the C-band frequency plan, with channels on the ITU 50-GHz grid, as shown in [Table A-37](#).

**Table A-37 MXP\_2.5G\_10E\_C Card Trunk Wavelengths**

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
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

**Table A-37** MXP\_2.5G\_10E\_C Card Trunk Wavelengths (continued)

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

- Receiver (trunk side, see [Table A-38](#))

**Table A-38** MXP\_2.5G\_10E\_C Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	< 10 exp – 12	N/A	– 8 to – 18 dBm	+/- 1200 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 18 dBm	+/- 1000 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 18 dBm	—

**Table A-38** MXP\_2.5G\_10E\_C Card Receiver Trunk Side Specifications (continued)

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
17 dB	Standard	$< 10 \text{ exp} - 5$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	+/- 800 ps/nm
15.5 dB	Standard	$< 10 \text{ exp} - 5$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	—
14 dB	Enhanced	$< 7 \times 10 \text{ exp} - 4$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	+/- 800 ps/nm

**Table A-38 MXP\_2.5G\_10E\_C Card Receiver Trunk Side Specifications (continued)**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
12 dB	Enhanced	$< 7 \times 10^{-4}$	$< 10^{-15}$	- 8 to - 18 dBm	—

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth 32.5GHz (at - 3 dB)

- Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at  $BER = 1 \times 10^{-12}$  including dispersion
  - Receiver input wavelength range: 1529 to 1562 nm
- Line (client side)
  - Bit rate: 2.5 Gbps per port (OC-48/STM-16)
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 12 ps/nm (SR SFP version)
  - Loopback modes: Terminal and facility
  - Connectors: LC (optical)
- Transmitter (client side): Depends on the SFP that is used.
- Receiver (client side): Depends on the SFP that is used.
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.7 MXP\_2.5G\_10E\_L Card Specifications

The MXP\_2.5G\_10E\_L card has the following specifications:

- Line (trunk side)
  - Bit rate: 10.70923 Gbps (in ITU-T G.709 Digital Wrapper/FEC mode)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: +/- 1200 ps/nm (specified penalty)
  - Loopback modes: Terminal and facility

**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_2.5G\_10E\_L card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_2.5G\_10E\_L card. Using direct fiber loopbacks causes irreparable damage to the card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of MXP\_2.5G\_10E\_L card:  
There is a single version of the MXP\_2.5G\_10E\_L card. It is tunable across 80 wavelengths in the L band frequency plan, with channels on the ITU 50-GHz grid, as shown in [Table A-39](#).

**Table A-39 MXP\_2.5G\_10E\_L Card Trunk Wavelengths**

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

**Table A-39 MXP\_2.5G\_10E\_L Card Trunk Wavelengths (continued)**

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

- Receiver (trunk side, see [Table A-40](#))

**Table A-40 MXP\_2.5G\_10E\_L Card Receiver Trunk Side Specifications**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	< 10 exp – 12	N/A	– 8 to – 20 dBm	+/- 1200 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 20 dBm	+/- 1000 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 22 dBm	—
17 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 18 dBm	+/- 800 ps/nm
15.5 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 18 dBm	—
15 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 18 dBm	+/- 800 ps/nm

**Table A-40** MXP\_2.5G\_10E\_L Card Receiver Trunk Side Specifications (continued)

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
13 dB	Enhanced	$< 7 \times 10 \exp - 4$	$< 10 \exp - 15$	- 8 to - 18 dBm	—

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth greater than or equal to 180 pm (at - 3 dBm)

- Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER =  $1 \times 10 \exp - 12$  including dispersion
  - Receiver input wavelength range: 1570 to 1604 nm
- Line (client side)
  - Bit rate: 2.5 Gbps per port (OC-48/STM-16)
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 12 ps/nm (SR SFP version)
  - Loopback modes: Terminal and facility
  - Connectors: LC (optical)
- Transmitter (client side): Depends on the SFP that is used.
- Receiver (client side): Depends on the SFP that is used.
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.8 MXP\_2.5G\_10EX\_C Card Specifications

The MXP\_2.5G\_10EX\_C card has the following specifications:

- Line (trunk side)
  - Bit rate: 10.70923 Gbps (in ITU-T G.709 Digital Wrapper/FEC mode)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: +/- 1600 ps/nm (specified penalty)
  - Loopback modes: Terminal and facility



**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_2.5G\_10EX\_C card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_2.5G\_10EX\_C card. Using direct fiber loopbacks causes irreparable damage to the card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of MXP\_2.5G\_10EX\_C card:  
There is a single version of the MXP\_2.5G\_10EX\_C card. It is tunable across 82 wavelengths in the C-band frequency plan, with channels on the ITU 50-GHz grid, as shown in [Table A-37](#).

**Table A-41** MXP\_2.5G\_10EX\_C Card Trunk Wavelengths

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	1546.12
3	195.90	1530.334	44	193.85	1546.52
4	195.85	1530.725	45	193.80	1546.92
5	195.80	1531.116	46	193.75	1547.32
6	195.75	1531.507	47	193.70	1547.72
7	195.70	1531.898	48	193.65	1548.11
8	195.65	1532.290	49	193.60	1548.51
9	195.60	1532.681	50	193.55	1548.91
10	195.55	1533.073	51	193.50	1549.32
11	195.50	1533.47	52	193.45	1549.72
12	195.45	1533.86	53	193.40	1550.12
13	195.40	1534.250	54	193.35	1550.52
14	195.35	1534.643	55	193.30	1550.92
15	195.30	1535.036	56	193.25	1551.32
16	195.25	1535.429	57	193.20	1551.72
17	195.20	1535.822	58	193.15	1552.12
18	195.15	1536.216	59	193.10	1552.52

**Table A-41** MXP\_2.5G\_10EX\_C Card Trunk Wavelengths (continued)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
19	195.10	1536.609	60	193.05	1552.93
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	1554.13
23	194.90	1538.186	64	192.85	1554.54
24	194.85	1538.581	65	192.80	1554.94
25	194.80	1538.976	66	192.75	1555.34
26	194.75	1539.371	67	192.70	1555.75
27	194.70	1539.766	68	192.65	1556.15
28	194.65	1540.162	69	192.60	1556.55
29	194.60	1540.557	70	192.55	1556.96
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	1558.17
33	194.40	1542.142	74	192.35	1558.58
34	194.35	1542.539	75	192.30	1558.98
35	194.30	1542.936	76	192.25	1559.39
36	194.25	1543.333	77	192.20	1559.79
37	194.20	1543.730	78	192.15	1560.20
38	194.15	1544.128	79	192.10	1560.61
39	194.10	1544.526	80	192.05	1561.01
40	194.05	1544.924	81	192.00	1561.42
41	194.00	1545.32	82	191.95	1561.83

- Receiver (trunk side, see [Table A-42](#))

**Table A-42** TMXP\_2.5G\_10EX\_C Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance	PMD tolerance
16 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	+/- 1600 ps/nm	—
15 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	—	—
TBD	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	—	<sup>3</sup>
12.5 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	—	—

**Table A-42** *TMXP\_2.5G\_10EX\_C Card Receiver Trunk Side Specifications (continued)*

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance	PMD tolerance
17 dB	Enhanced	$< 7 \times 10 \exp - 4$	$< 10 \exp - 15$	- 8 to - 20 dBm	+/- 4000 ps/nm	—
15.2 dB	Enhanced	$< 7 \times 10 \exp - 4$	$< 10 \exp - 15$	- 8 to - 20 dBm	+/- 2500 ps/nm	—
17.4 dB	Enhanced	$< 7 \times 10 \exp - 4$	$< 10 \exp - 15$	- 8 to - 20 dBm		<sup>3</sup>

1. OSNR defined with 0.1 nm RBW
2. Receiver filter bandwidth 32.5GHz (at - 3 dBm)
3. PMD = 30 ps; DGD = 90 ps, hence PMD = 3000 ps<sup>2</sup>

- Receiver: APD
- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER =  $1 \times 10 \exp - 12$  including dispersion
- Receiver input wavelength range: 1529 to 1562 nm
- Line (client side)
  - Bit rate: 2.5 Gbps per port (OC-48/STM-16)
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 12 ps/nm (SR SFP version)
  - Loopback modes: Terminal and facility
  - Connectors: LC (optical)
- Transmitter (client side): Depends on the SFP that is used.
- Receiver (client side): Depends on the SFP that is used.
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.9 MXP\_MR\_10DME\_C Card Specifications

The MXP\_MR\_10DME\_C card has the following specifications:

- Payload configuration
  - FC1G—Fibre Channel 1.06 Gbps
  - FC2G—Fibre Channel 2.125 Gbps

- FC4G—Fibre Channel 4.25 Gbps
- FICON1G—Fiber connectivity 1.06 Gbps (IBM signal)
- FICON2G—Fiber connectivity 2.125 Gbps (IBM signal)
- FICON4G—Fiber connectivity 4.25 Gbps (IBM signal)
- ISC compatibility
- ISC peer 1G
- ISC peer 2G
- ONE\_GE—One Gigabit Ethernet 1.125 Gbps
- Mixed configurations up to maximum line rate of 10.0 Gbps. See the [“10.10 MXP\\_MR\\_10DME\\_C and MXP\\_MR\\_10DME\\_L Cards”](#) section on page 10-52 for more information on mixed-mode operation.
- Client ports: 8x SFP
- Line (trunk side)
  - Bit rate: 9.952 Gbps for OC-192/STM-64
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and facility

**Caution**

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_MR\_10DME\_C card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_MR\_10DME\_C cards. Using direct fiber loopbacks causes irreparable damage to the MXP\_MR\_10DME\_C cards.

- Connectors: LC
- Transmitter (trunk side)
  - Minimum output power: +3 dBm
  - Maximum output power: +6 dBm
  - Minimum Single-Mode Suppression Ratio (SMSR): 30 dB
  - Minimum optical extinction ratio: 10 dB
  - 41 wavelength tunability at 100-GHz spacing
  - Receiver maximum return reflectance (Rx return loss): -27 dB
  - Chromatic dispersion allowance: 5400 ps/nm, giving an optical power penalty < 2.0 dB
  - Minimum side mode suppression ratio: 30 dB
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- For available wavelengths for the MXP\_MR\_10DME\_C card, see [Table 10-29](#) on page 10-57.
- For the receiver trunk side, see [Table A-43](#):

**Table A-43 MXP\_MR\_10DME\_C Card Receiver Trunk Side Specifications**

FEC Applications	OSNR <sup>1</sup>	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	Chromatic Dispersion Tolerance	Power Penalty	OSNR Penalty
None	23 dB	< 10 exp – 12	—	–8 to –20 dBm	+/- 1200 ps/nm	2 dBm	—
	19 dB	< 10 exp – 12	—	–9 to –22 dBm	+/- 1000 ps/nm	2 dBm	—
FEC	10 dB	< 10 exp – 5	< 10 exp – 15	–8 to –18 dBm	+/- 800 ps/nm	—	1.5 dB
Enhanced FEC	19 dB	< 10 exp – 4	< 10 exp – 15	–8 to –26 dBm	+/- 800 ps/nm	2 dBm	2 dB
	8 dB	< 10 exp – 4	< 10 exp – 15	–8 to –18 dBm	+/- 800 ps/nm	2 dBm	1.5 dB

1. OSNR defined with 0.5 nm RBW

- Receiver: APD
- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER =  $1 * 10 \text{ exp} - 12$  including dispersion
- Receiver input wavelength range: 1529 to 1562 nm
- Line (client side)
  - Bit rate: 1.06 Gbps to 4.25 Gbps per client
  - Code: Scrambled NRZ
  - Fiber: Based on SFP (1310-nm single-mode or 850-nm multimode)
  - Maximum chromatic dispersion allowance: Based on SFP
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: Based on SFP
  - Nominal wavelength: Based on SFP
  - Transmitter: Based on SFP
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER  $1 * 10 \text{ exp} - 12$
  - Minimum receiver level: –14 dBm at BER  $1 * 10 \text{ exp} - 12$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at BER =  $1 * 10 \text{ exp} - 12$
  - Receiver input wavelength range: 1290 to 1605 nm or 850nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)

- Weight not including clam shell: 2.25 lb (1.02 kg)

## A.10.10 MXP\_MR\_10DME\_L Card Specifications

The MXP\_MR\_10DME\_L card has the following specifications:

- Payload configuration
  - FC1G—Fibre Channel 1.06 Gbps
  - FC2G—Fibre Channel 2.125 Gbps
  - FC4G—Fibre Channel 4.25 Gbps
  - FICON1G—Fiber connectivity 1.06 Gbps (IBM signal)
  - FICON2G—Fiber connectivity 2.125 Gbps (IBM signal)
  - FICON4G—Fiber connectivity 4.25 Gbps (IBM signal)
  - ISC compatibility
  - ISC peer 1G
  - ISC peer 2G
  - ONE\_GE—One Gigabit Ethernet 1.125 Gbps
  - Mixed configurations up to maximum line rate of 10.0 Gbps. See the [“10.10 MXP\\_MR\\_10DME\\_C and MXP\\_MR\\_10DME\\_L Cards”](#) section on page 10-52 for more information on mixed-mode operation.
- Client ports: 8x SFP
- Line (trunk side)
  - Bit rate: 9.952 Gbps for OC-192/STM-64
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and facility



### Caution

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_MR\_10DME\_L card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_MR\_10DME\_L cards. Using direct fiber loopbacks causes irreparable damage to the MXP\_MR\_10DME\_L cards.

- Connectors: LC
- Transmitter (trunk side)
  - Minimum output power: +3 dBm
  - Maximum output power: +6 dBm
  - Minimum SMSR: 30 dB
  - Minimum optical extinction ratio: 10.5 dB
  - 40 wavelength tunability at 100-GHz spacing, 80 wavelength tunability at 50-GHz spacing
  - Receiver maximum return reflectance (Rx return loss): –27 dB
  - Chromatic dispersion allowance: 5400 ps/nm, giving an optical power penalty < 2.0 dB

- Minimum side mode suppression ratio: 30 dB
- Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- For the currently available wavelengths for the MXP\_MR\_10DME\_L card, see [Table 10-30 on page 10-58](#).
- [Table A-44](#) provides the receiver trunk side specifications:

**Table A-44** MXP\_MR\_10DME\_L Card Receiver Trunk Side Specifications

FEC Applications	OSNR <sup>1</sup>	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	Chromatic Dispersion Tolerance	Power Penalty	OSNR Penalty
None	23 dB	< 10 exp – 12	—	–8 to –19 dBm	+/- 1200 ps/nm	2 dBm	—
	19 dB	< 10 exp – 12	—	–9 to –19 dBm	+/- 1000 ps/nm	2 dBm	—
FEC	10 dB	< 10 exp – 5	< 10 exp – 15	–8 to –18 dBm	+/- 800 ps/nm	—	1.5 dB
Enhanced FEC	19 dB	< 10 exp – 4	< 10 exp – 15	–8 to –26 dBm	+/- 800 ps/nm	—	2 dB
	8 dB	< 10 exp – 4	< 10 exp – 15	–8 to –18 dBm	+/- 800 ps/nm	—	1.5 dB

1. OSNR defined with 0.5 nm RBW

- Receiver: APD
- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = 1 \* 10 exp – 12 including dispersion
- Receiver input wavelength range: 1570 to 1604 nm
- Line (client side)
  - Bit rate: 1.06 Gbps to 4.25 Gbps per client
  - Code: Scrambled NRZ
  - Fiber: Based on SFP (1310-nm single-mode or 850-nm multimode)
  - Maximum chromatic dispersion allowance: Based on SFP
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: Based on SFP
  - Nominal wavelength: Based on SFP
  - Transmitter: Based on SFP
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER 1 \* 10 exp – 12
  - Minimum receiver level: –14 dBm at BER 1 \* 10 exp – 12

- Receiver: APD
- Link loss budget: 8 dB minimum, at  $BER = 1 * 10^{exp - 12}$
- Receiver input wavelength range: 1290 to 1605 nm or 850nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 2.25 lb (1.02 kg)

## A.10.11 MXP\_MR\_10DMEX\_C Card Specifications

The MXP\_MR\_10DMEX\_C card has the following specifications:

- Payload configuration
  - FC1G—Fibre Channel 1.06 Gbps
  - FC2G—Fibre Channel 2.125 Gbps
  - FC4G—Fibre Channel 4.25 Gbps
  - FICON1G—Fiber connectivity 1.06 Gbps (IBM signal)
  - FICON2G—Fiber connectivity 2.125 Gbps (IBM signal)
  - FICON4G—Fiber connectivity 4.25 Gbps (IBM signal)
  - ISC compatibility
  - ISC peer 1G
  - ISC peer 2G
  - ONE\_GE—One Gigabit Ethernet 1.125 Gbps
  - Mixed configurations up to maximum line rate of 10.0 Gbps.
- Client ports: 8x SFP
- Line (trunk side)
  - Bit rate: 9.952 Gbps for OC-192/STM-64
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Loopback modes: Terminal and facility



### Caution

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the MXP\_MR\_10DMEX\_C card in a loopback on the trunk port. Do not use direct fiber loopbacks with the MXP\_MR\_10DMEX\_C cards. Using direct fiber loopbacks causes irreparable damage to the MXP\_MR\_10DMEX\_C cards.

- Connectors: LC
- Transmitter (trunk side)



- Minimum output power: +3 dBm
- Maximum output power: +7 dBm
- Minimum Single-Mode Suppression Ratio (SMSR): 30 dB
- Minimum optical extinction ratio: 10 dB
- 41 wavelength tunability at 100-GHz spacing
- Receiver maximum return reflectance (Rx return loss): –27 dB
- Chromatic dispersion allowance: 5400 ps/nm, giving an optical power penalty < 2.0 dB
- Minimum side mode suppression ratio: 30 dB
- Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- For available wavelengths for the MXP\_MR\_10DMEX\_C card, see [Table 10-29 on page 10-57](#).
- For the receiver trunk side, see [Table A-45](#):

**Table A-45 MXP\_MR\_10DMEX\_C Card Receiver Trunk Side Specifications**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance	PMD tolerance
16 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	+/- 1600 ps/nm	—
15 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	—	—
TBD	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	—	<sup>3</sup>
12.5 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	—	—
17 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	+/- 4000 ps/nm	—
15.2 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	+/- 2500 ps/nm	—
17.4 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm		<sup>3</sup>

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth 32.5GHz (at - 3 dBm)

3. PMD = 30 ps; DGD = 90 ps, hence PMD = 3000 ps<sup>2</sup>

- Receiver: APD
- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = 1 \* 10 exp – 12 including dispersion
- Receiver input wavelength range: 1529 to 1562 nm
- Line (client side)
  - Bit rate: 1.06 Gbps to 4.25 Gbps per client

- Code: Scrambled NRZ
- Fiber: Based on SFP (1310-nm single-mode or 850-nm multimode)
- Maximum chromatic dispersion allowance: Based on SFP
- Loopback modes: Terminal and facility
- Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: Based on SFP
  - Nominal wavelength: Based on SFP
  - Transmitter: Based on SFP
- Receiver (client side)
  - Maximum receiver level: –1 dBm at BER  $1 \times 10^{-12}$
  - Minimum receiver level: –14 dBm at BER  $1 \times 10^{-12}$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at BER =  $1 \times 10^{-12}$
  - Receiver input wavelength range: 1290 to 1605 nm or 850nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 2.25 lb (1.02 kg)

## A.10.12 TXP\_MR\_10E Card Specifications

The TXP\_MR\_10E card has the following specifications:

- Line (trunk side)
  - Bit rate: OC-192/STM-64 (9.95328 Gbps), OTU2 (10.70923 Gbps), 10GE (10.3125 Gbps), 10GE into OTU2 (non-standard 11.0957 Gbps), 10G FC (10.51875 Gbps), or 10G FC into OTU2 (non-standard 11.31764 Gbps)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: +/- 1200 ps/nm (specified penalty)
  - Loopback modes: Terminal and facility



### Caution

You must use a 15-dB fiber attenuator (10 to 20 dB) when working with the TXP\_MR\_10E card in a loopback on the trunk port. Do not use direct fiber loopbacks with the TXP\_MR\_10E card. Using direct fiber loopbacks causes irreparable damage to the TXP\_MR\_10E card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm for C-band and +2 dBm for L-band
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift): +/- 25 picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of TXP\_MR\_10E:

C-band frequency plan (eight card versions, each with four tunable channels on the ITU 100-GHz grid):

- 1530.33 to 1533.07 nm (four channels)
- 1534.25 to 1537.00 nm (four channels)
- 1538.19 to 1540.95 nm (four channels)
- 1542.14 to 1544.92 nm (four channels)
- 1546.12 to 1548.92 nm (four channels)
- 1550.12 to 1552.93 nm (four channels)
- 1554.13 to 1556.96 nm (four channels)
- 1558.17 to 1561.01 nm (four channels)

L-band frequency plan (five card versions, each with eight tunable channels on the ITU 50-GHz grid):

- 1577.44 to 1580.35 nm (eight channels)
- 1580.77 to 1583.69 nm (eight channels)
- 1584.11 to 1587.04 nm (eight channels)
- 1587.46 to 1590.41 nm (eight channels)
- 1590.83 to 1593.79 nm (eight channels)

- Receiver (trunk side, see [Table A-46](#))

**Table A-46** TXP\_MR\_10E Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	< 10 exp – 12	N/A	– 8 to – 20 dBm	+/- 1200 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 20 dBm	+ – 1000 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 22 dBm	—
17 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 18 dBm	+/- 800 ps/nm
15 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 18 dBm	—

**Table A-46** TXP\_MR\_10E Card Receiver Trunk Side Specifications (continued)

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
15 dB	Enhanced	$< 7 \times 10 \text{ exp} - 4$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	+/- 800 ps/nm
14 dB	Enhanced	$< 7 \times 10 \text{ exp} - 4$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	—

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth greater than or equal to 180 pm (at - 3 dBm)

- Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER =  $1 \times 10 \text{ exp} - 12$  including dispersion
- Line (client side):
  - 10-Gigabit Small Form-factor Pluggable (XFP)-based SR
  - Bit rate: 10GE (10.3125 Gbps), 10G FC (10.51875 Gbps), or STM-64/OC-192
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 6.6 ps/nm
  - Loopback modes: Terminal and facility
  - Connectors: LC
  - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957, ITU-T G.691
- Transmitter (client side)
  - Maximum transmitter output power: -1 dBm
  - Minimum transmitter output power: -6 dBm
  - Center wavelength: 1290 to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: DFB laser
- Receiver (client side)
  - Maximum receiver level: -1 dBm at BER  $1 \times 10 \text{ exp} - 12$
  - Minimum receiver level: -14 dBm at BER  $1 \times 10 \text{ exp} - 12$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at BER =  $1 \times 10 \text{ exp} - 12$
  - Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.13 TXP\_MR\_10E\_C Card Specifications

The TXP\_MR\_10E\_C card has the following specifications:

- Line (trunk side)
  - Bit rate: OC-192/STM-64 (9.95328 Gbps), OTU2 (10.70923 Gbps), 10GE (10.3125 Gbps), 10GE into OTU2 (non-standard 11.0957 Gbps), 10G FC (10.51875 Gbps), or 10G FC into OTU2 (non-standard 11.31764 Gbps)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance:  $\pm 1200$  ps/nm (specified penalty)
  - Loopback modes: Terminal and facility



### Caution

You must use a 15-dB fiber attenuator (10 to 20 dB) when working with the TXP\_MR\_10E\_C card in a loopback on the trunk port. Do not use direct fiber loopbacks with the TXP\_MR\_10E\_C card. Using direct fiber loopbacks causes irreparable damage to the TXP\_MR\_10E\_C card.

- Connectors: LC
- Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957, and ITU-T G.709
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift):  $\pm 25$  picometers (pm)



### Note

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is  $\pm 25$  pm.

- Currently available wavelengths and versions of TXP\_MR\_10E\_C card:  
There is a single version of the TXP\_MR\_10E\_C card. It is tunable across 82 wavelengths in the C-band frequency plan, with channels on the ITU 50-GHz grid, as shown in [Table A-47](#).

**Table A-47** TXP\_MR\_10E\_C Card Trunk Wavelengths

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
5	195.80	1531.116	46	193.75	1547.316
6	195.75	1531.507	47	193.70	1547.715

**Table A-47** TXP\_MR\_10E\_C Card Trunk Wavelengths (continued)

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

- Receiver (trunk side, see [Table A-48](#))

**Table A-48 TXP\_MR\_10E\_C Card Receiver Trunk Side Specifications**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	$< 10 \text{ exp} - 12$	N/A	- 8 to - 18 dBm	+/- 1200 ps/nm
26 dB	Off	$< 10 \text{ exp} - 12$	N/A	- 8 to - 18 dBm	+ - 1000 ps/nm
26 dB	Off	$< 10 \text{ exp} - 12$	N/A	- 8 to - 18 dBm	—
17 dB	Standard	$< 10 \text{ exp} - 5$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	+/- 800 ps/nm
15.5 dB	Standard	$< 10 \text{ exp} - 5$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	—
14 dB	Enhanced	$< 7 \times 10 \text{ exp} - 4$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	+/- 800 ps/nm
12 dB	Enhanced	$< 7 \times 10 \text{ exp} - 4$	$< 10 \text{ exp} - 15$	- 8 to - 18 dBm	—

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth 32.5GHz (at - 3 dB)

- Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at  $\text{BER} = 1 * 10 \exp - 12$  including dispersion
  - Receiver input wavelength range: 1529 to 1562 nm
- Line (client side):
  - XFP-based SR
  - Bit rate: 10GE (10.3125 Gbps), 10G FC (10.51875 Gbps), or STM-64/OC-192
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 6.6 ps/nm
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: 1290 to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: DFB laser
- Receiver (client side)
  - Maximum receiver level: –1 dBm at  $\text{BER} = 1 * 10 \exp - 12$
  - Minimum receiver level: –14 dBm at  $\text{BER} = 1 * 10 \exp - 12$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at  $\text{BER} = 1 * 10 \exp - 12$
  - Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.14 TXP\_MR\_10E\_L Card Specifications

The TXP\_MR\_10E\_L card has the following specifications:

- Line (trunk side)
  - Bit rate: OC-192/STM-64 (9.95328 Gbps), OTU2 (10.70923 Gbps), 10GE (10.3125 Gbps), 10GE into OTU2 (non-standard 11.0957 Gbps), 10G FC (10.51875 Gbps), or 10G FC into OTU2 (non-standard 11.31764 Gbps)
  - Code: Scrambled NRZ



- Fiber: 1550-nm single-mode
- Maximum chromatic dispersion allowance:  $\pm 1200$  ps/nm (specified penalty)
- Loopback modes: Terminal and facility

**Caution**

You must use a 15-dB fiber attenuator (10 to 20 dB) when working with the TXP\_MR\_10E\_L card in a loopback on the trunk port. Do not use direct fiber loopbacks with the TXP\_MR\_10E\_L card. Using direct fiber loopbacks causes irreparable damage to the TXP\_MR\_10E\_L card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +2 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift):  $\pm 25$  picometers (pm)

**Note**

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is  $\pm 25$  pm.

- Currently available wavelengths and versions of TXP\_MR\_10E\_L card:

There is a single version of the TXP\_MR\_10E\_L card. It is tunable across 80 wavelengths in the L band frequency plan, with channels on the ITU 50-GHz grid, as shown in [Table A-49](#).

**Table A-49** TXP\_MR\_10E\_L Card Trunk Wavelengths

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

**Table A-49** TXP\_MR\_10E\_L Card Trunk Wavelengths (continued)

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

- Receiver (trunk side, see [Table A-50](#))

**Table A-50** TXP\_MR\_10E Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	< 10 exp – 12	N/A	– 8 to – 20 dBm	+/- 1200 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 20 dBm	+ – 1000 ps/nm
26 dB	Off	< 10 exp – 12	N/A	– 8 to – 22 dBm	—
17 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 18 dBm	+/- 800 ps/nm
15.5 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 18 dBm	—

**Table A-50** TXP\_MR\_10E Card Receiver Trunk Side Specifications (continued)

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
15 dB	Enhanced	$< 7 \times 10 \exp - 4$	$< 10 \exp - 15$	- 8 to - 18 dBm	+/- 800 ps/nm
13 dB	Enhanced	$< 7 \times 10 \exp - 4$	$< 10 \exp - 15$	- 8 to - 18 dBm	—

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth greater than or equal to 180 pm (at - 3 dBm)

- Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER =  $1 \times 10 \exp - 12$  including dispersion
  - Receiver input wavelength range: 1570 to 1604 nm
- Line (client side):
  - XFP-based SR
  - Bit rate: 10GE (10.3125 Gbps), 10G FC (10.51875 Gbps), or STM-64/OC-192
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 6.6 ps/nm
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: -1 dBm
  - Minimum transmitter output power: -6 dBm
  - Center wavelength: 1290 to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: DFB laser
- Receiver (client side)
  - Maximum receiver level: -1 dBm at BER  $1 \times 10 \exp - 12$
  - Minimum receiver level: -14 dBm at BER  $1 \times 10 \exp - 12$
  - Receiver: APD
  - Link loss budget: 8 dB minimum, at BER =  $1 \times 10 \exp - 12$
  - Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
  - Height: 12.650 in. (321.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.000 in. (228.6 mm)
  - Depth with backplane connector: 9.250 in. (235 mm)
  - Weight not including clam shell: 3.1 lb (1.3 kg)

## A.10.15 TXP\_MR\_10EX\_C Card Specifications

The TXP\_MR\_10EX\_C card has the following specifications:

- Line (trunk side)
  - Bit rate: OC-192/STM-64 (9.95328 Gbps), OTU2 (10.70923 Gbps), 10GE (10.3125 Gbps), 10GE into OTU2 (non-standard 11.0957 Gbps), 10G FC (10.51875 Gbps), or 10G FC into OTU2 (non-standard 11.31764 Gbps)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: +/- 1600 ps/nm (specified penalty)
  - Loopback modes: Terminal and facility



### Caution

You must use a 15-dB fiber attenuator (10 to 20 dB) when working with the TXP\_MR\_10EX\_C card in a loopback on the trunk port. Do not use direct fiber loopbacks with the TXP\_MR\_10EX\_C card. Using direct fiber loopbacks causes irreparable damage to the TXP\_MR\_10EX\_C card.

- Connectors: LC
- Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957, and ITU-T G.709
- Transmitter (trunk side)
  - Maximum transmitter output power: +6 dBm
  - Minimum transmitter output power: +3 dBm
  - Transmitter: LN external modulator transmitter
  - Wavelength stability (drift): +/- 25 picometers (pm)



### Note

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of TXP\_MR\_10EX\_C card:  
There is a single version of the TXP\_MR\_10EX\_C card. It is tunable across 82 wavelengths in the C-band frequency plan, with channels on the ITU 50-GHz grid, as shown in [Table A-51](#).

**Table A-51 TXP\_MR\_10EX\_C Card Trunk Wavelengths**

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	1546.12
3	195.90	1530.334	44	193.85	1546.52
4	195.85	1530.725	45	193.80	1546.92
5	195.80	1531.116	46	193.75	1547.32
6	195.75	1531.507	47	193.70	1547.72

**Table A-51** *TXP\_MR\_10EX\_C Card Trunk Wavelengths (continued)*

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
7	195.70	1531.898	48	193.65	1548.11
8	195.65	1532.290	49	193.60	1548.51
9	195.60	1532.681	50	193.55	1548.91
10	195.55	1533.073	51	193.50	1549.32
11	195.50	1533.47	52	193.45	1549.72
12	195.45	1533.86	53	193.40	1550.12
13	195.40	1534.250	54	193.35	1550.52
14	195.35	1534.643	55	193.30	1550.92
15	195.30	1535.036	56	193.25	1551.32
16	195.25	1535.429	57	193.20	1551.72
17	195.20	1535.822	58	193.15	1552.12
18	195.15	1536.216	59	193.10	1552.52
19	195.10	1536.609	60	193.05	1552.93
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	1554.13
23	194.90	1538.186	64	192.85	1554.54
24	194.85	1538.581	65	192.80	1554.94
25	194.80	1538.976	66	192.75	1555.34
26	194.75	1539.371	67	192.70	1555.75
27	194.70	1539.766	68	192.65	1556.15
28	194.65	1540.162	69	192.60	1556.55
29	194.60	1540.557	70	192.55	1556.96
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	1558.17
33	194.40	1542.142	74	192.35	1558.58
34	194.35	1542.539	75	192.30	1558.98
35	194.30	1542.936	76	192.25	1559.39
36	194.25	1543.333	77	192.20	1559.79
37	194.20	1543.730	78	192.15	1560.20
38	194.15	1544.128	79	192.10	1560.61
39	194.10	1544.526	80	192.05	1561.01
40	194.05	1544.924	81	192.00	1561.42
41	194.00	1545.32	82	191.95	1561.83

- Receiver (trunk side, see [Table A-48](#))

**Table A-52 TXP\_MR\_10E\_C Card Receiver Trunk Side Specifications**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance	PMD tolerance
16 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	+/- 1600 ps/nm	—
15 dB	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	—	—
TBD	Standard	< 10 exp – 5	< 10 exp – 15	– 8 to – 20 dBm	—	<sup>3</sup>
12.5 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	—	—
17 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	+/- 4000 ps/nm	—
15.2 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm	+/- 2500 ps/nm	—
17.4 dB	Enhanced	< 7 x 10 exp – 4	< 10 exp – 15	– 8 to – 20 dBm		<sup>3</sup>

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth 32.5GHz (at - 3 dBm)

3. PMD = 30 ps; DGD = 90 ps, hence PMD = 3000 ps<sup>2</sup>

- Receiver: APD
- Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = 1 \* 10 exp – 12 including dispersion
- Receiver input wavelength range: 1529 to 1562 nm
- Line (client side):
  - XFP-based SR
  - Bit rate: 10GE (10.3125 Gbps), 10G FC (10.51875 Gbps), or STM-64/OC-192
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode
  - Maximum chromatic dispersion allowance: 6.6 ps/nm
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (client side)
  - Maximum transmitter output power: –1 dBm
  - Minimum transmitter output power: –6 dBm
  - Center wavelength: 1290 to 1330 nm
  - Nominal wavelength: 1310 nm
  - Transmitter: DFB laser
- Receiver (client side)

- Maximum receiver level:  $-1 \text{ dBm}$  at  $\text{BER } 1 * 10^{\text{exp } -12}$
  - Minimum receiver level:  $-14 \text{ dBm}$  at  $\text{BER } 1 * 10^{\text{exp } -12}$
  - Receiver: APD
  - Link loss budget:  $8 \text{ dB}$  minimum, at  $\text{BER } = 1 * 10^{\text{exp } -12}$
  - Receiver input wavelength range:  $1290$  to  $1605 \text{ nm}$
- Dimensions
  - Height:  $12.650 \text{ in. (321.3 mm)}$
  - Width:  $0.921 \text{ in. (23.4 mm)}$  (The dimension of the finger gasket is not included)
  - Depth:  $9.000 \text{ in. (228.6 mm)}$
  - Depth with backplane connector:  $9.250 \text{ in. (235 mm)}$
  - Weight not including clam shell:  $3.1 \text{ lb (1.3 kg)}$

## A.10.16 ADM-10G Card Specifications

The ADM-10G card has the following specifications:

- Line
  - Bit rate: OC-3/STM-1 ( $155.520 \text{ Mb/s}$ ); OC-12/STM-3 ( $622.08 \text{ Mb/s}$ ); OC-48/STM-16 ( $2488.32 \text{ Mb/s}$ ); OC-192/STM-64 ( $9.95328 \text{ Gbps}$ )
  - Code: Scrambled NRZ
  - Fiber:  $1310\text{-nm}$  single-mode for ONS-XC-10GS1 XFP or  $1530.33$  to  $1554.94\text{-nm}$  single-mode for ONS-XC-10G-xx.x XFP
  - Maximum chromatic dispersion allowance: up to  $3600 \text{ ps/nm}$
  - Loopback modes: Terminal, facility, and cross-connect
  - Connectors: LC
- Transmitter (trunk side)
  - Transmitter: LN external modulator transmitter
  - Maximum transmitter output power: Depends on XFP that is used
  - Minimum transmitter output power: Depends on XFP that is used
  - Wavelength stability (drift):  $\pm 25 \text{ picometers (pm)}$
- Receiver (trunk side)
  - Receiver: APD
  - Receiver input wavelength range: Depends on XFP that is used
  - Receiver sensitivity: depends on XFP that is used
  - Link loss budget:  $24 \text{ dB}$  minimum, with no dispersion or  $22 \text{ dB}$  optical path loss at  $\text{BER } = 1 * 10^{\text{exp } -12}$  including dispersion
- Dimensions
  - Height:  $12.65 \text{ in. (321.3 mm)}$
  - Width:  $1.866 \text{ in. (47.4 mm)}$  (The dimension of the finger gasket is not included)
  - Depth:  $9.00 \text{ in. (228.6 mm)}$

- Depth with backplane connector: 9.250 in. (235 mm)
- Weight not including clam shell: 5.07 lb (2.3 kg)

## A.10.17 GE\_XP, 10GE\_XP, GE\_XPE, and 10GE\_XPE Card Specifications

The GE\_XP, 10GE\_XP, GE\_XPE, and 10GE\_XPE cards have the following specifications:

- Line (trunk side)
  - Bit rate: 11.1 Gbps (in ITU-T G.709 Digital Wrapper/FEC mode) or 10.3125 Gbps (in ITU-T G.709 Digital Wrapper/FEC mode disabled)
  - Code: Scrambled NRZ
  - Fiber: 1550-nm single-mode
  - Maximum chromatic dispersion allowance: – 500 to 1600 ps/nm (specified penalty)
  - Loopback modes: Terminal and facility



### Caution

You must use a 20-dB fiber attenuator (15 to 25 dB) when working with the GE\_XP and GE\_XPE card in a loopback on the trunk port. Do not use direct fiber loopbacks with the GE\_XP and GE\_XPE card. Using direct fiber loopbacks causes irreparable damage to the GE\_XP and GE\_XPE card.

- Connectors: LC
- Transmitter (trunk side)
  - Maximum transmitter output power: +3 dBm
  - Minimum transmitter output power: -1 dBm
  - Transmitter: EML laser
  - Wavelength stability (drift): +/- 100 picometers (pm)



### Note

An optical device on the card keeps the laser wavelength locked as closely as possible to the ITU nominal value. The allowed drift is +/- 25 pm.

- Currently available wavelengths and versions of GE\_XP, 10GE\_XP, GE\_XPE, and 10GE\_XPE: C Band, 100 GHz spacing.
- Receiver (trunk side, see [Table A-53](#))
  - Receiver: APD
  - Link loss budget: 24 dB minimum, with no dispersion or 22 dB optical path loss at BER = 1 \* 10 exp – 12 including dispersion

**Table A-53** GE\_XP and GE\_XPE Card Receiver Trunk Side Specifications

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
30 dB	Off	1.00E – 12	N/A	– 7 to – 23 dBm	—
30 dB	Off	1.00E – 12	N/A	– 7 to – 20 dBm	– 500 to 1600 ps/nm
24 dB	Off	1.00E – 12	N/A	– 7 to – 18 dBm	—



**Table A-53 GE\_XP and GE\_XPE Card Receiver Trunk Side Specifications (continued)**

OSNR <sup>1</sup>	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity <sup>2</sup>	Chromatic Dispersion Tolerance
27 dB	Off	1.00E – 12	N/A	– 7 to – 18 dBm	– 500 to 1600 ps/nm
18 dB	Standard	1.00E – 05	1.00E – 15	– 7 to – 18 dBm	—
19 dB	Standard	1.00E – 05	1.00E – 15	– 7 to – 18 dBm	– 500 to 1600 ps/nm
30 dB	Enhanced	1.00E – 04	1.00E – 15	– 7 to – 27 dBm	—
30 dB	Enhanced	1.00E – 04	1.00E – 15	– 7 to – 24 dBm	– 500 to 1600 ps/nm
15 dB	Enhanced	1.00E – 04	1.00E – 15	– 7 to – 18 dBm	—
15 dB	Enhanced	1.00E – 04	1.00E – 15	– 7 to – 18 dBm	– 500 to 1600 ps/nm

1. OSNR defined with 0.1 nm RBW

2. Receiver filter bandwidth greater than or equal to 180 pm (at – 3 dBm)

- Line (client side)
  - Bit rate: 1.125Gbps (GE) or 10.3125Gbps (10GE)
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode or 850-nm multimode
  - Maximum chromatic dispersion allowance: 12 ps/nm (SR SFP version)
  - Loopback modes: Terminal and facility
  - Connectors: LC (optical)
- Transmitter (client side): Depends on the SFP that is used.
- Receiver (client side): Depends on the SFP that is used.
- Environmental
  - Power consumption: 95.00 W (maximum), 2 A at -48 V for GE\_XP and GE\_XPE cards
  - Power consumption: 80.00 W (maximum), 1.67 A at -48 V for 10GE\_XP and 10GE\_XPE cards
- Dimensions
  - Height: 12.992 in. (330 mm)
  - Width: 10GE\_XP and 10GE\_XPE: 0.921 in. (23.4 mm)  
GE\_XP and GE\_XPE: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.448 in. (240 mm)
  - Weight not including clam shell: 10GE\_XP and 10GE\_XPE, 1.04 kg;  
GE\_XP and GE\_XPE, 1.36 kg.

## A.10.18 OTU2\_XP Card Specifications

The OTU2\_XP card has the following specifications:

- Line
  - Bit rate: OC-192/STM-64 (9.95328 Gbps), 10GE (10.3125 Gbps), or 10G FC (10.51875 Gbps)
  - Code: Scrambled NRZ

- Fiber: 1310-nm single-mode for ONS-XC-10GS1 XFP or 1530.33-nm to 1561.42-nm single-mode for ONS-XC-10G-xx.x XFP
  - Maximum chromatic dispersion allowance: Depends on the XFP that is used
  - Loopback modes: Terminal and facility
  - Connectors: LC
- Transmitter (trunk side)
  - Transmitter: EML
  - Maximum transmitter output power: Depends on the XFP that is used
  - Minimum transmitter output power: Depends on the XFP that is used
  - Wavelength stability (drift): Depends on the XFP that is used
- Receiver (trunk side)
  - Receiver: APD
  - Receiver input wavelength range: Depends on XFP that is used
  - Receiver sensitivity: Depends on XFP that is used
  - Link loss budget: Depends on XFP that is used
- Dimensions
  - Height: 13.043 in. (331.3 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 9.413 in. (239.1 mm)
  - Depth with backplane connector: 9.909 in. (251.7 mm)
  - Weight not including clam shell: 2.38 lb (1.08 kg)

## A.11 TDC-CC and TDC-FC Card Specifications

The TDC-CC and TDC-FC card specifications are as follows:

- Wavelength
  - Total operating signal wavelength range (C-band range): 1529.0 - 1562.5 nm
- Optical
  - Insertion loss — DC-RX to DC-TX: Maximum 12.5 for TDC-CC and 9.5 for TDC-FC @ 1545.32 nm at room temperature
  - Wavelength dependant loss: 0.8 dB max
  - Maximum optical input power: 200mW
  - Polarization dependent loss: 0.2 dB max
- Dimensions
  - Height: 12.65 in. (332 mm)
  - Width: 0.921 in. (23.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 8.66 in. (220.1 mm)
  - Depth with backplane connector: 235 mm (9.250 in)

- Weight not including clam shell:
  - TDC-CC—1.26 Kg
  - TDC-FC—1.14 Kg
  - The TDC-CC and TDC-FC tunable CD values are listed in [Table A-54](#).

**Table A-54 TDC-CC and TDC-FC Tunable CD Value**

Unit Configuration	TDC-CC [ps/nm]	TDC-FC [ps/nm]
0	0 <sup>1</sup>	0 <sup>2</sup>
1	-110	-45
2	-220	-90
3	-330	-135
4	-440	-180
5	-550	-225
6	-660	-270
7	-770	-315
8	-880	-360
9	-990	-405
10	-1100	-450
11	-1210	-495
12	-1320	-540
13	-1430	-585
14	-1540	-630
15	-1650	-675

1. The default value of the TDC-CC CD value for Coarse Unit is 0.
2. The default value of the TDC-FC value for Fine Unit is 0.

## A.12 Mesh Patch Panel Specifications

This section provides specifications for the PP-MESH-4, PP-MESH-8, and 15454-PP-4-SMR patch panels.

### A.12.1 PP-MESH-4 Patch Panel Specifications

The PP-MESH-4 patch panel optical specifications are listed in [Table A-55](#).

**Table A-55** *PP-MESH-4 Patch Panel Optical Specifications*

Parameter	Note	Condition	Min	Max	Unit
Wavelength range	—	—	1530	1570	nm
Insertion loss <sup>1 2</sup>	—	In all the wavelength ranges  (local ADD or test access RX to EXP TX, COM RX to EXP TX, COM RX to test access TX)	—	7.5	dB
Insertion Loss Uniformity <sup>1 2</sup>	—	In all the wavelength ranges	—	0.9	dB
Polarization dispersion loss (PDL) <sup>1</sup>	—	—	—	0.3	dB
Polarization mode dispersion (PMD) <sup>1</sup>	—	—	—	0.1	dB
Optical Return Loss <sup>1</sup>	—	—	50	—	dB
Directivity <sup>1</sup>	—	—	50	—	dB

1. Under all SOPs and all operating environmental conditions

2. Values are referenced with connector loss (LC=0.3 dB, MPO=0.5dB)

The PP-MESH-4 patch panel has the following additional specifications:

- Environmental
  - Operating temperature: +23 to +149 degrees Fahrenheit (–5 to +65 degrees Celsius)
  - Operating humidity: 5 to 95 percent, noncondensing
- Dimensions
  - Height: 17.42 in. (442.5 mm)
  - Width: 3.457 in. (87.8 mm)
  - Depth: 11.025 in. (280 mm)

## A.12.2 PP-MESH-8 Patch Panel Specifications

The PP-MESH-8 patch panel optical specifications are listed in [Table A-56](#).

**Table A-56** *PP-MESH-8 Patch Panel Optical Specifications*

Parameter	Note	Condition	Min	Max	Unit
Wavelength range	—	—	1530	1570	nm
Insertion loss <sup>1 2</sup>	—	In all the wavelength ranges  (local ADD or test access RX to EXP TX, COM RX to EXP TX, COM RX to test access TX)	—	10.6	dB
Insertion loss uniformity <sup>1 2</sup>	—	In all the wavelength ranges	—	1.3	dB
PDL <sup>1</sup>	—	—	—	0.5	dB
PMD <sup>1</sup>	—	—	—	0.1	dB
Optical Return Loss <sup>1</sup>	—	—	50	—	dB
Directivity <sup>1</sup>	—	—	50	—	dB

1. Under all SOPs and all operating environmental conditions

2. Values are referenced with connector loss (LC=0.3 dB, MPO=0.5dB)

The PP-MESH-8 patch panel has the following additional specifications:

- Environmental
  - Operating temperature: +23 to +149 degrees Fahrenheit (–5 to +65 degrees Celsius)
  - Operating humidity: 5 to 95 percent, noncondensing
- Dimensions
  - Height: 17.42 in. (442.5 mm)
  - Width: 3.457 in. (87.8 mm)
  - Depth: 11.025 in. (280 mm)

## A.12.3 15454-PP-4-SMR Patch Panel Specifications

The 15454-PP-4-SMR patch panel optical specifications are listed in [Table A-57](#).

**Table A-57** *15454-PP-4-SMR Patch Panel Optical Specifications*

Parameter	Note	Condition	Min	Max	Unit
Wavelength range	All SOP within operating temperature range	—	1520	1570	nm

**Table A-57 15454-PP-4-SMR Patch Panel Optical Specifications (continued)**

Parameter	Note	Condition	Min	Max	Unit
Insertion loss	All SOP within operating temperature range, wavelength range, from each input port of any MPO connector to any output port including two MPO connections	—	5.5	7.5	dB
Insertion loss uniformity <sup>1</sup>		—	—	0.5	dB
Insertion loss ripple		—	—	0.2	dB
Chromatic dispersion		—	—	+/- 5	ps/nm
PDL		—	—	0.1	dB
PMD		—	—	0.1	dB
Optical return loss		—	50	—	dB
Directivity		—	50.0	—	dB

1. Defined as the difference between the insertion loss values of any of the four branches of each 1x4 coupler.

The 15454-PP-4-SMR patch panel has the following additional specifications:

- Environmental
  - Operating temperature: +23 to +149 degrees Fahrenheit (–5 to +65 degrees Celsius)

## A.13 SFP and XFP Specifications



### Note

The CC-FTA fan tray is mandatory if CWDM SFPs and DWDM SFPs are used on MSTP units.



### Note

Use hardware version 2.0 DWDM SFP for MSTP units.

See the [Installing the GBIC, SFP, SFP+, XFP, CXP, and CFP Optical Modules in Cisco ONS Platforms](#) for SFP and XFP specifications.

## A.14 Patch Panel Specifications

For information on 15216 40-Channel Mux/Demux Patch Panel specifications, refer to the “Patch Panel Specifications” section in the *“Installing Cisco ONS 15216 40-Channel Mux/Demux Patch Panel”* guide.

For information on 15454-PP-4-SMR Patch Panel specifications, refer to the “Patch Panel Specifications” section in the *“Installing Cisco ONS 15454-PP-4-SMR Patch Panel”* guide.