
# Hardware Specifications

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

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

## 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: +/– 4.6 ppm
- Holdover stability: 3.7 x $10^{-7}$ 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: +/– 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:

- Input power: –48 VDC
- Power consumption: Configuration dependent; 55 W (fan tray only)

- Power requirements: –40.5 to –57 VDC
- Power terminals: #6 Lug
- ANSI shelf: 100-A fuse panel (minimum 30 A fuse per shelf)
  HD shelf: 100-A fuse panel (minimum 30 A fuse per shelf)

The ONS 15454 ETSI has the following power specifications:

- Input voltage: –48 VDC
- Power consumption: Configuration dependent, 53 W (fan tray only)
- Power requirements:
  - Nominal: –48 VDC
  - Tolerance limits: –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 System Environmental Specifications

The ONS 15454 ANSI has the following environmental specifications:

- Operating temperature:

  C-Temp: 32 to +131 degrees Farenheit (0 to +55 degrees Celsius)

  I-Temp: –40 to +139 degrees Farenheit (–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 104 degrees Fahrenheit (0 to +40 degrees Celsius)
- Operating humidity: 5 to 95 percent, noncondensing

## A.1.13 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

<Xref_Color>Table A-1 provides power consumption information for the ONS 15454 cards.

*Table A-1 Individual Card Power Requirements*

| Card Type | Card Name | Maximum Power in Watts | Typical Power in Watts | Amperes at –48 V | BTU/Hr. |
|---|---|---|---|---|---|
| **Common Control Cards** | 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/TCC2P/ TCC3 | 0.44 |
| | MIC-C/T/P | 0.5 | 0.38 | via TCC2/TCC2P/ TCC3 | 1.29 |
| | MS-ISC-100T | 69 | 53 | 1.10 | 181.0 |
| **Optical Service Channel Cards** | OSCM | 26 | 23 | 0.48 | 79 |
| | OSC-CSM | 27 | 24 | 0.5 | 82 |
| **Optical Amplifier Cards** | 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 |
| **Multiplexer and Demultiplexer Cards** | 32MUX-O | 25 | 16 | 0.33 | 55 |
| | 32DMX-O | 25 | 16 | 0.33 | 55 |
| | 4MD-xx.x | 25 | 17 | 0.35 | 58.0 |
| **ROADM Cards** | 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 |
| | MMU | 15 | 7 | 0.15 | 24 |

*Table A-1 Individual Card Power Requirements*

| Card Type | Card Name (continued) | Maximum Power in Watts | Typical Power in Watts | Amperes at –48 V | BTU/Hr. |
|---|---|---|---|---|---|
| **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_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_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 |

## 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 x $10^{-7}$ 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 * 10 exp – 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)

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

  - 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 DWDM Card Specifications

This section provides specifications for the OSCM, OSC-CSM, 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), 32MUX-O, 32DMX-O, 32DMX, 32DMX-L, 4MD-xx.x, AD-IC-xx.x, AD-2C-xx.x, AD-4C-xx.x, AD-1B-xx.x, AD-4B-xx.x, 32WSS, 32WSS-L, and MMU cards.

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

## 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.4.3 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): –1 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.4.4 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): –1 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.4.5 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): –1 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.4.6 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): –10 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.4.7 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
  - 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.4.8 32MUX-O Card Specifications

The 32MUX-O card optical specifications are listed in <Xref_Color>Table A-2.

Note For power specifications, refer to the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-2 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 |

*Table A-2 32MUX-O Optical Specifications (continued)*

| Parameter | Note | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| VOA dynamic range | — | — | 25 | — | dB |
| 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.4.9 32DMX-O Card Specifications

The 32DMX-O card optical specifications are listed in <Xref_Color>Table A-3.

Note For power specifications, see the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-3 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.4.10 32DMX Card Specifications

The 32DMX card optical specifications are listed in <Xref_Color>Table A-4.

Note For power specifications, see the <Xref_Color>"2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes" section on page 2-7.

*Table A-4 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 <Xref_Color>Table A-5. All 32DMX client interfaces must comply with this plan.

*Table A-5 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 |
| 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 |

*Table A-5 32DMX Channel Plan (continued)*

| Channel Number | Band | Channel ID | Frequency (GHz) | Wavelength (nm) |
|---|---|---|---|---|
| 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.4.11 32DMX-L Card Specifications

The 32DMX-L card optical specifications are listed in <Xref_Color>Table A-4.

Note For power specifications, see the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-6 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 <Xref_Color>Table A-7. All 32DMX-L client interfaces must comply with this plan.

*Table A-7 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 |
| 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 |

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

| Band ID | Channel Label | Frequency (THz) | Wavelength (nm) |
|---|---|---|---|
| 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.4.12 4MD-xx.x Card Specifications

The 4MD-xx.x card optical specifications are listed in <Xref_Color>Table A-8.

Note For power specifications, see the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-8 4MD-xx.x Optical Specifications*

| Parameter | Note | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Trx filter shape (–0.5 dB bandwidth $TrxBW_2$) | All SOP and within whole operating temperature range | COM Rx—xx.xx Tx<br>COM Rx—yy.yy Tx<br>COM Rx—zz.zz Tx<br>COM Rx—kk.kk Tx<br>xx.xx Rx—COM Tx<br>yy.yy Rx—COM Tx<br>zz.zz Rx—COM Tx<br>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.4.13 AD-1C-xx.x Card Specifications

<Xref_Color>Table A-9 lists the AD-1C-xx.x optical specifications.

*Table A-9 AD-1C-xx.x Card Optical Specifications*

| Parameter | Note | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Trx filter shape (–0.5 dB bandwidth) $TrxBW_2$ | 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) $RfxBW_2$ | 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 <Xref_Color>Table 2-3 on page 2-8 through <Xref_Color>Table 2-5 on page 2-9 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.4.14 AD-2C-xx.x Card Specifications

<Xref_Color>Table A-10 lists the AD-2C-xx.x optical specifications.

*Table A-10 AD-2C-xx.x Card Optical Specifications*

| Parameter | Note | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Trx filter shape (–0.5 dB bandwidth) $TrxBW_2$ | 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 | — | |

*Table A-10 AD-2C-xx.x Card Optical Specifications (continued)*

| Parameter | Note | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Rfx filter shape (–0.5 dB bandwidth) $RfxBW_2$ | All SOP and within whole operating temperature range | COM Rx—Exp Tx<br>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 <Xref_Color>Table 2-3 on page 2-8 through <Xref_Color>Table 2-5 on page 2-9 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.4.15 AD-4C-xx.x Card Specifications

<Xref_Color>Table A-11 lists the AD-4C-xx.x optical specifications.

*Table A-11 AD-4C-xx.x Optical Specifications*

| Parameter | Note | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Channel grid | See <Xref_Color>Table A-12. 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) $TrxBW_2$ | All SOP and within whole operating temperature range | COM Rx—xx.xx Tx<br>COM Rx—yy.yy Tx<br>COM Rx—zz.zz Tx<br>COM Rx—kk.kk Tx<br>xx.xx Rx—COM Tx<br>yy.yy Rx—COM Tx | +/–180 | — | pm |
| Rfx filter shape (–1 dB bandwidth) $RfxBW_2$ | All SOP and within whole operating temperature range | COM Rx—Exp Tx<br>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 <Xref_Color>Table 2-3 on page 2-8 through <Xref_Color>Table 2-5 on page 2-9 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.4.16 AD-1B-xx.x Card Specifications

<Xref_Color>Table A-12 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-12 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-12 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 |

<Xref_Color>Table A-13 lists AD-1B-xx.x optical specifications.

*Table A-13 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<br>Band Rx—COM Tx | 3.6 | — | nm |
| –1 dB bandwidth | All SOP and within whole operating temperature range | COM Rx—Exp Tx<br>Exp Rx—COM Tx | Refer to <Xref_Color >Table A-14 . | | 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 |

<Xref_Color>Table A-14 lists the range of wavelengths for the receive (express) band.

*Table A-14 AD-1B-xx.x Transmit and Receive Dropped Band Wavelength Ranges*

| | Rx (Express) Band | |
|---|---|---|
| Tx (Dropped) 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 <Xref_Color>Table 2-3 on page 2-8 through <Xref_Color>Table 2-5 on page 2-9 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.4.17 AD-4B-xx.x Card Specifications

<Xref_Color>Table A-15 lists the unit names, band IDs, channel IDs, frequencies, and wavelengths assigned to the two versions of the card.

*Table A-15 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-15 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 |

<Xref_Color>Table A-16 lists AD-4B-xx.x optical specifications.

*Table A-16 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<br>Band Rx—COM Tx | 3.6 | — | nm |
| –1 dB bandwidth | All SOP and within whole operating temperature range | COM Rx—Exp Tx<br>Exp Rx—COM Tx | Refer to <Xref_Color >Table A-17. | | 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 |

<Xref_Color>Table A-17 lists the range of wavelengths for the receive (express) band.

*Table A-17 AD-4B-xx.x Transmit and Receive Dropped Band Wavelength Ranges*

| | Rx (Express) Band | |
|---|---|---|
| Tx (Dropped) 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 |

*Table A-17 AD-4B-xx.x Transmit and Receive Dropped Band Wavelength Ranges (continued)*

| | Rx (Express) Band | |
|---|---|---|
| **Tx (Dropped) Band** | **Left Side (nm)** | **Right Side (nm)** |
| B42.1 | Wavelengths 1541.275 or lower | Wavelengths 1545.695 or higher |
| 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 <Xref_Color>Table 2-3 on page 2-8 through <Xref_Color>Table 2-5 on page 2-9 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.4.18 32WSS Card Specifications

The 32WSS card optical specifications are listed in <Xref_Color>Table A-18.

Note For power specifications, see the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-18 32WSS Optical Specifications*

| Parameter | Note | Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| –0.25 dB bandwidth | All SOP and within whole operating temperature range, connectors included, and for maximum VOA operating attenuation. | EXP RX => COM TX | +/–/95 | — | — | pm |
| –0.5 dB bandwidth | | | +/–115 | — | — | pm |
| –1.0 dB bandwidth | | | +/–135 | — | — | pm |
| –0.25 dB bandwidth | | Add 1, 32 => COM TX | +/–115 | — | — | pm |
| –0.5 dB bandwidth | | | +/–135 | — | — | pm |
| –1.0 dB bandwidth | | | +/–160 | — | — | pm |

*Table A-18 32WSS 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 | — | — | 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 <Xref_Color>Table A-19. All 32WSS client interfaces must comply with this plan.

*Table A-19 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 |
| 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 |

*Table A-19 32WSS Channel Plan (continued)*

| Channel Number | Band | Channel ID | Frequency (GHz) | Wavelength (nm) |
|---|---|---|---|---|
| 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.4.19 32WSS-L Card Specifications

The 32WSS-L card optical specifications are listed in <Xref_Color>Table A-20.

Note For power specifications, see the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-20 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 <Xref_Color>Table A-21. All 32WSS-L client interfaces must comply with this plan.

*Table A-21 32WSS-L Channel Plan*

| Band ID | Channel Label | Frequency (THz) | Wavelength (nm) |
|---|---|---|---|
| B77.8 | 77.8 | 190 | 1577.86 |
| | 78.6 | 189.9 | 1578.69 |
| | 79.5 | 189.8 | 1579.52 |
| | 80.3 | 189.7 | 1580.35 |
| B81.1 | 81.1 | 189.6 | 1581.18 |
| | 82.0 | 189.5 | 1582.02 |
| | 82.8 | 189.4 | 1582.85 |
| | 83.6 | 189.3 | 1583.69 |

*Table A-21 32WSS-L Channel Plan (continued)*

| Band ID | Channel Label | Frequency (THz) | Wavelength (nm) |
|---|---|---|---|
| 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.4.20 MMU Card Specifications

The MMU card optical specifications are listed in <Xref_Color>Table A-22.

Note For power specifications, see the <Xref_Color>“2.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes” section on page 2-7.

*Table A-22 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 |
| 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 |

*Table A-22 MMU Optical Specifications (continued)*

| Parameter | Note | Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| 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: 1.866 in. (47.4 mm) (The dimension of the finger gasket is not included)
  - Depth: 8.66 in. (220.1 mm)

# A.5 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_10E_E, TXP_MR_10E, TXP_MR_10E_C, TXP_MR_10E_L, MXP_MR_10DME_C, and MXP_MR_10DME_L cards.

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

## A.5.1 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): +/– 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_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 * 10 exp – 12): –8 to –21 dBm
  - Receiver input power (no FEC, unamplified, 23 dB OSNR, at +/– 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 +/– 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 +/– 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 +/– 800 ps/nm, BER 8 * 10 exp – 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 * 10 exp – 12
  - Minimum receiver level: –14 dBm at BER 1 * 10 exp – 12
  - Receiver: avalanche photodiode (APD)
  - Link loss budget: 8 dB minimum, at 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.5.2 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 +/– 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 +/– 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 +/– 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 +/– 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.5.3 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 <Xref_Color>Table A-23)

***Table A-23 TXP_MR_2.5G/TXPP_MR_2.5G Card Receiver Trunk Side Specifications***

| OSNR[1] | 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 * 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: 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.5.4 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 <Xref_Color>“2.9.8 MXP_MR_2.5G and MXPP_MR_2.5G Cards” section on page 2-156 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 <Xref_Color>Table A-24)

*Table A-24 MXP_MR_2.5G/MXPP_MR_2.5G Card Receiver Trunk Side Specifications*

| OSNR[1] | 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 |

*Table A-24 MXP_MR_2.5G/MXPP_MR_2.5G Card Receiver Trunk Side Specifications (continued)*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity | Chromatic Dispersion Tolerance |
|---|---|---|---|---|---|
| 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 exp – 12
  - Receiver overload is equal to or exceeds –8 dBm
  - Receiver maximum reflectance of –27 dB
- Line (client side)
  - Bit rate: 200 Mbps or 1.06 Gbps to 2.125 Gbps per client
  - Code: Scrambled NRZ
  - Fiber: 1310-nm single-mode or 850-nm multimode
  - Maximum chromatic dispersion allowance: 1600 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: 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
- 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.5.5 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: +/– 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): +/– 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 (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 <Xref_Color>Table A-25))
  - 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-25 MXP_2.5G_10E Card Receiver Trunk Side Specifications*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | 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 | — |
| 15 dB | Enhanced | < 7 x 10 exp – 4 | < 10 exp – 15 | – 8 to – 18 dBm | +/– 800 ps/nm |
| 14 dB | Enhanced | < 7 x 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)

- 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.5.6 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 <Xref_Color>Table A-26.

***Table A-26 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 |
| 15 | 195.30 | 1535.036 | 56 | 193.25 | 1551.319 |
| 16 | 195.25 | 1535.429 | 57 | 193.20 | 1551.721 |

*Table A-26 MXP_2.5G_10E_C Card Trunk Wavelengths (continued)*

| Channel Number | Frequency (THz) | Wavelength (nm) | Channel Number | Frequency (THz) | Wavelength (nm) |
|---|---|---|---|---|---|
| 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 <Xref_Color>Table A-27)

*Table A-27 MXP_2.5G_10E_C Card Receiver Trunk Side Specifications*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | 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-27 MXP_2.5G_10E_C Card Receiver Trunk Side Specifications (continued)*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | Chromatic Dispersion Tolerance |
|---|---|---|---|---|---|
| 14 dB | Enhanced | < 7 x 10 exp – 4 | < 10 exp – 15 | – 8 to – 18 dBm | +/– 800 ps/nm |
| 12 dB | Enhanced | < 7 x 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 * 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.5.7 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 <Xref_Color>Table A-28.

***Table A-28 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-28 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 <Xref_Color>Table A-29)

*Table A-29 MXP_2.5G_10E_L Card Receiver Trunk Side Specifications*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | 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 |
| 13 dB | Enhanced | < 7 x 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 * 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.5.8 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)
  - ONE_GE—One Gigabit Ethernet 1.125 Gbps
  - Mixed configurations up to maximum line rate of 10.0 Gbps. See the <Xref_Color>“2.9.9 MXP_MR_10DME_C and MXP_MR_10DME_L Cards” section on page 2-161 for more information on mixed-mode operation.
- Client ports: 8x SFP
- Line (trunk side)
  - Bit rate: 2.488 Gbps for OC-48/STM-16, 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
  - Maximum chromatic dispersion allowance: +/- 1200 ps/nm (specified penalty)
  - 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.

  - Currently available wavelengths for the MXP_MR_10DME_C card: See <Xref_Color>Table 2-92 on page 2-167
- Receiver (trunk side, see <Xref_Color>Table A-30)

***Table A-30 MXP_MR_10DME_C Card Receiver Trunk Side Specifications***

| FEC Applications | OSNR[1] | 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 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 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.5.9 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)
  - ONE_GE—One Gigabit Ethernet 1.125 Gbps

  - Mixed configurations up to maximum line rate of 10.0 Gbps. See the <Xref_Color>“2.9.9 MXP_MR_10DME_C and MXP_MR_10DME_L Cards” section on page 2-161 for more information on mixed-mode operation.

- Client ports: 8x SFP
- Line (trunk side)
  - Bit rate: 2.488 Gbps for OC-48/STM-16, 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
  - Maximum chromatic dispersion allowance: +/- 1200 ps/nm (specified penalty)
  - 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.

  - Currently available wavelengths for the MXP_MR_10DME_L card: See <Xref_Color>Table 2-92 on page 2-167
- Receiver (trunk side, see <Xref_Color>Table A-31)

*Table A-31 MXP_MR_10DME_L Card Receiver Trunk Side Specifications*

| FEC Applications | OSNR[1] | 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 |

*Table A-31 MXP_MR_10DME_L Card Receiver Trunk Side Specifications (continued)*

| FEC Applications | OSNR[1] | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity | Chromatic Dispersion Tolerance | Power Penalty | OSNR Penalty |
|---|---|---|---|---|---|---|---|
| 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.5.10 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 <Xref_Color>Table A-32)

*Table A-32 TXP_MR_10E Card Receiver Trunk Side Specifications*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | 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 | — |
| 15 dB | Enhanced | < 7 x 10 exp – 4 | < 10 exp – 15 | – 8 to – 18 dBm | +/– 800 ps/nm |
| 14 dB | Enhanced | < 7 x 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 * 10 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 * 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
- 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.5.11 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: +/– 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): +/– 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 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 <Xref_Color>Table A-33.

*Table A-33 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 |
| 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 |

*Table A-33 TXP_MR_10E_C Card Trunk Wavelengths (continued)*

| Channel Number | Frequency (THz) | Wavelength (nm) | Channel Number | Frequency (THz) | Wavelength (nm) |
|---|---|---|---|---|---|
| 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 <Xref_Color>Table A-34)

*Table A-34 TXP_MR_10E _C Card Receiver Trunk Side Specifications*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | 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 | — |
| 14 dB | Enhanced | < 7 x 10 exp – 4 | < 10 exp – 15 | – 8 to – 18 dBm | +/– 800 ps/nm |
| 12 dB | Enhanced | < 7 x 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 * 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 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
- 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.5.12 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: +/– 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): +/– 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_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 <Xref_Color>Table A-35.

***Table A-35 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 |
| 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 |

*Table A-35 TXP_MR_10E_L Card Trunk Wavelengths (continued)*

| Channel Number | Frequency (THz) | Wavelength (nm) | Channel Number | Frequency (THz) | Wavelength (nm) |
|---|---|---|---|---|---|
| 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 <Xref_Color>Table A-36)

*Table A-36 TXP_MR_10E Card Receiver Trunk Side Specifications*

| OSNR[1] | FEC Type | Pre-FEC BER | Post-FEC BER | Input Power Sensitivity[2] | 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 |
| 13 dB | Enhanced | < 7 x 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 * 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 * 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
- 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.6 SFP and XFP Specifications

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