



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.

B.1 Shelf Specifications

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

B.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

B.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)

B.1.3 Cisco Transport Controller

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

- 10BaseT
- Advanced Timing, Communications, and Control (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)

B.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)

B.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)

B.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

B.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

B.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

B.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

B.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: 3.7×10^{-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: 3.7×10^{-7} per day, including temperature (< 255 slips in first 24 hours)
- Reference: External BITS, line, internal

B.1.11 System Power

The ONS 15454 ANSI has the following power specifications:

- Input power: –48 VDC
- Power consumption: 55 W (fan tray only); 650 W (maximum draw with cards)
- 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 35 A fuse per shelf)

The ONS 15454 ETSI has the following power specifications:

- Input voltage: –48 VDC
- Power consumption: Configuration dependent, 53 W for fan tray; 650 W (maximum draw with cards)
- 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

B.1.12 System Environmental Specifications

The ONS 15454 ANSI has the following environmental specifications:

- Operating temperature: 32 to +131 degrees Fahrenheit (0 to +55 degrees Celsius); -40 to +139 degrees Fahrenheit (–40 to +65 degrees Celsius) with industrial temperature rated cards
- 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

B.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)

B.2 General Card Specifications

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

B.2.1 Power

Table 1-1 provides power consumption information for the ONS 15454 cards.

Table 1-1 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
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
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
	32WSS	65	50	1.04	171
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_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_MR_2.5G	60	43.6	1.05	171
	MXPP_MR_2.5G	60	43.6	1.05	171

B.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.

B.3 Common Control Card Specifications

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

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

B.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: 3.7×10^{-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)
 - 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)

B.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^{-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)
 - 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)

B.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)

B.3.4 AEP Specifications (ANSI only)

- 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)
 - Depth: 9.000 in. (228.6 mm)
 - Weight: 1.8 lb (0.82 kg)

B.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)

B.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: 32 mm (1.25 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)

B.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: 32 mm (1.25 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)

B.4 DWDM Card Specifications

This section provides specifications for the OSCM, OSC-CSM, OPT-PRE amplifier, OPT-BST amplifier, OPT-BST-E amplifier, 32MUX-O, 32DMX-O, 32DMX, 4MD-xx.x, AD-IC-xx.x, AD-2C-xx.x, AD-4C-xx.x, AD-1B-xx.x, AD-4B-xx.x, and 32WSS cards.

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

B.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
 - Compliance: Telcordia GR-253-CORE, ITU-T G.957
- 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: 0.92 in. (23.4 mm)
 - Depth: 9.00 in. (228.6 mm)

B.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
- Compliance: Telcordia GR-253-CORE, ITU-T G.957
- 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: 0.92 in. (23.4 mm)
 - Depth: 9.00 in. (228.6 mm)

B.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: 0.92 in. (24 mm)
 - Depth: 9.00 in. (240 mm)

B.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: 0.92 in. (24 mm)
 - Depth: 9.00 in. (240 mm)

B.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

B.4.6 32MUX-O Card Specifications

- 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: 0.92 in. (24 mm)
 - Depth: 9.00 in. (240 mm)

B.4.6 32MUX-O Card Specifications

The 32 MUX-O card optical specifications are listed in [Table B-2](#).


Note

For power specifications, refer to the “[16.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes](#)” section on page 16-6.

Table B-2 **32MUX-O Optical Specifications**

Parameter	Note	Condition	Min	Max	Unit
Tx filter shape (–1 dB bandwidth)	All standard operating procedures (SOP) and within whole operating temperature range	In 1/32—Out beginning of life (BOL)	+/–180	+/–300	pm
		In 1/32—Out end of life (EOL)	+/–160	+/–300	pm
Insertion loss	All SOP and within whole operating temperature range	In 1/32—Out BOL	4	8.0	dB
		In 1/32—Out EOL	4	8.5	dB
VOA dynamic range	—	—	25	—	dB
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: 1.84 in. (46.8 mm)
 - Depth: 9.00 in. (228.6 mm)

B.4.7 32DMX-O Card Specifications

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



Note

For power specifications, see the “[16.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes](#)” section on page 16-6.

Table B-3 32DMX-O Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
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: 1.84 in. (46.8 mm)
 - Depth: 9.00 in. (228.6 mm)

B.4.8 32DMX Card Specifications

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



Note

For power specifications, see the “[16.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes](#)” section on page 16-6.

Table B-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 [Table B-5](#). All 32DMX client interfaces must comply with this plan.

Table B-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
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

Table B-5 32DMX Channel Plan (continued)

Channel Number	Band	Channel ID	Frequency (GHz)	Wavelength (nm)
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: 0.92 in. (23.4 mm)
 - Depth: 9.00 in. (228.6 mm)

B.4.9 4MD-xx.x Card Specifications

The 4MD-xx.x card optical specifications are listed in [Table B-6](#).



Note

For power specifications, see the “[16.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes](#)” section on page 16-6.

Table B-6 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 COM Rx—yy.yy Tx COM Rx—zz.zz Tx COM Rx—kk.kk Tx xx.xx Rx—COM Tx yy.yy Rx—COM Tx zz.zz Rx—COM Tx kk.kk Rx—COM Tx	+/-180	—	pm
Insertion loss demultiplexer section	All SOP and within whole operating temperature range	COM Rx—xx.xx Tx	—	1.9	dB
		COM Rx—yy.yy Tx	—	2.4	dB
		COM Rx—zz.zz Tx	—	2.8	dB
		COM Rx—kk.kk Tx	—	3.3	dB
Insertion loss multiplexer section	All SOP and within whole operating temperature range (two connectors included)	xx.xx Rx—COM Tx	—	3.6	dB
		yy.yy Rx—COM Tx	—	3.2	dB
		zz.zz Rx—COM Tx	—	3.0	dB
		kk.kk Rx—COM Tx	—	2.6	dB
VOA dynamic range	—	—	25	—	dB
Maximum optical input power	—	—	300	—	mW

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

- Dimensions
 - Height: 12.65 in. (321.3 mm)
 - Width: 0.92 in. (23.4 mm)
 - Depth: 9.00 in. (228.6 mm)

B.4.10 AD-1C-xx.x Card Specifications

Table B-7 lists the AD-1C-xx.x optical specifications.

Table B-7 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

AD-1C-xx.x optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 16-3 on page 16-6](#) through [Table 16-5 on page 16-8](#) for this information.

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

- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.92 in. (23.4 mm)
 - Depth: 9.0 in. (228.6 mm)

B.4.11 AD-2C-xx.x Card Specifications

[Table B-8](#) lists the AD-2C-xx.x optical specifications.

Table B-8 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 B-8 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 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

AD-2C-xx.x optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 16-3 on page 16-6](#) through [Table 16-5 on page 16-8](#) for this information.

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

- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.92 in. (23.4 mm)
 - Depth: 9.0 in. (228.6 mm)

B.4.12 AD-4C-xx.x Card Specifications

[Table B-9](#) lists the AD-4C-xx.x optical specifications.

Table B-9 AD-4C-xx.x Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
Channel grid	See Table B-10 . 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 COM Rx—yy.yy Tx COM Rx—zz.zz Tx COM Rx—kk.kk Tx xx.xx Rx—COM Tx yy.yy Rx—COM Tx	+/-180	—	pm
Rfx filter shape (–1 dB bandwidth) RfxBW ₂	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	—	—	pm
Insertion loss (drop section)	All SOP and within whole operating temperature range (two connectors included)	COM Rx—xx.xx Tx	—	5.5	dB
		COM Rx—yy.yy Tx	—	5.0	dB
		COM Rx—zz.zz Tx	—	4.5	dB
		COM Rx—kk.kk Tx	—	4.1	dB
Insertion loss (express section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	COM Rx—Exp Tx	—	2.7	dB
		Exp Rx—COM Tx	—	1.2	dB
Insertion loss (add section)	VOA at minimum attenuation; all SOP and within whole operating temperature range (two connectors included)	xx.xx Rx—COM Tx	—	3.9	dB
		yy.yy Rx—COM Tx	—	4.3	dB
		zz.zz Rx—COM Tx	—	4.5	dB
		kk.kk Rx—COM Tx	—	4.9	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

AD-4C-xx.x optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 16-3 on page 16-6](#) through [Table 16-5 on page 16-8](#) for this information.

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

- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.92 in. (23.4 mm)
 - Depth: 9.0 in. (228.6 mm)

B.4.13 AD-1B-xx.x Card Specifications

Table B-10 lists the unit names, band IDs, channel IDs, frequencies, and wavelengths assigned to the eight versions of the AD-1B-xx.x card.

Table B-10 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 B-10 AD-1B-xx.x Channel Allocation Plan by Band (continued)

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

Table B-11 lists AD-1B-xx.x optical specifications.

Table B-11 AD-1B-xx.x Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
–1 dB bandwidth	All SOP and within whole operating environmental range	COM Rx—Band Tx Band Rx—COM Tx	3.6	—	nm
–1 dB bandwidth	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	Refer to Table B-12 .		nm
Insertion loss (drop section)	All SOP and within whole operating environmental range; two connectors included, VOA set at minimum attenuation	COM Rx—Band Tx	—	3.0	dB
Insertion loss (express section)	All SOP and within whole operating environmental range; two connectors included	Exp Rx—COM Tx	—	1.6	dB
	All SOP and within whole operating environmental range; two connectors included, VOA set at its minimum attenuation	COM Rx—Exp Tx	—	2.2	dB
Insertion loss (add section)	All SOP and within whole operating environmental range; two connectors included	Band Rx—COM Tx	—	2.2	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

[Table B-12](#) lists the range of wavelengths for the receive (express) band.

Table B-12 AD-1B-xx.x Transmit and Receive Dropped Band Wavelength Ranges

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

AD-1B-xx.x optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 16-3 on page 16-6](#) through [Table 16-5 on page 16-8](#) for this information.

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

- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.92 in. (23.4 mm)
 - Depth: 9.0 in. (228.6 mm)

B.4.14 AD-4B-xx.x Card Specifications

[Table B-13](#) lists the unit names, band IDs, channel IDs, frequencies, and wavelengths assigned to the two versions of the card.

Table B-13 *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 B-13 AD-4B-xx.x Channel Allocation Plan by Band (continued)

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

Table B-14 lists AD-4B-xx.x optical specifications.

Table B-14 AD-4B-xx.x Optical Specifications

Parameter	Note	Condition	Min	Max	Unit
–1 dB bandwidth	All SOP and within whole operating environmental range	COM Rx—Band Tx Band Rx—COM Tx	3.6	—	nm
–1 dB bandwidth	All SOP and within whole operating temperature range	COM Rx—Exp Tx Exp Rx—COM Tx	Refer to Table B-15 .		nm
Insertion loss (drop section)	All SOP and within whole operating environmental range; two connectors included, VOA set at minimum attenuation	COM Rx—Band Tx 30.3/46.1	—	2.9	dB
		COM Rx—Band Tx 34.2/50.1	—	3.3	dB
		COM Rx—Band Tx 38.1/54.1	—	3.8	dB
		COM Rx—Band Tx 42.1/58.1	—	4.5	dB
Insertion loss (express section)	All SOP and within whole operating environmental range; two connectors included	Exp Rx—COM Tx	—	4.9	dB
	All SOP and within whole operating environmental range; two connectors included, VOA set at its minimum attenuation	COM Rx—Exp Tx	—	3	dB
Insertion loss (add section)	All SOP and within whole operating environmental range; two connectors included	Band Rx 30.3/46.1—COM Tx	—	3.5	dB
		Band Rx 34.2/50.1—COM Tx	—	2.8	dB
		Band Rx 38.1/54.1—COM Tx	—	2.3	dB
		Band Rx 42.1/58.1—COM Tx	—	1.8	dB
VOA dynamic range	—	—	30	—	dB
Maximum optical input power	—	—	300	—	mW

[Table B-15](#) lists the range of wavelengths for the receive (express) band.

Table B-15 AD-4B-xx.x Transmit and Receive Dropped Band Wavelength Ranges

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

Table B-15 AD-4B-xx.x Transmit and Receive Dropped Band Wavelength Ranges (continued)

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

AD-4B-xx.x optical input and output power varies with amplifier output levels and the class of transponder interfaces used. See [Table 16-3 on page 16-6](#) through [Table 16-5 on page 16-8](#) for this information.

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

- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.92 in. (23.4 mm)
 - Depth: 9.0 in. (228.6 mm)

B.4.15 32WSS Card Specifications

The 32WSS card optical specifications are listed in [Table B-16](#).



Note

For power specifications, see the “[16.1.7 Multiplexer, Demultiplexer, and OADM Card Interface Classes](#)” section on [page 16-6](#).

Table B-16 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 B-16 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 [Table B-17](#). All 32WSS client interfaces must comply with this plan.

Table B-17 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 B-17 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: 1.84 in. (46.8 mm)
 - Depth: 9.00 in. (228.6 mm)

B.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, and TXP_MR_2.5G cards.

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

B.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 $1 * 10^{\text{exp} - 12}$): –8 to –21 dBm
 - Receiver input power (no FEC, unamplified, 23 dB OSNR, at ± 1000 ps/nm BER $1 * 10^{\text{exp} - 12}$): –8 to –19 dBm
 - Receiver input power (no FEC, amplified, 19 dB OSNR, BER $1 * 10^{\text{exp} - 12}$): –8 to –20 dBm
 - Receiver input power (no FEC, amplified, 19 dB OSNR, at ± 1000 ps/nm BER $1 * 10^{\text{exp} - 12}$): –8 to –18 dBm
 - Receiver input power (FEC, unamplified, 23 dB OSNR, BER $8 * 10^{\text{exp} - 5}$): –8 to –24 dBm
 - Receiver input power (FEC, unamplified, 23 dB OSNR, at ± 1000 ps/nm, BER $8 * 10^{\text{exp} - 5}$): –8 to –22 dBm
 - Receiver input power (FEC, amplified, 9 dB OSNR, BER $8 * 10^{\text{exp} - 5}$): –8 to –18 dBm
 - Receiver input power (FEC, unamplified, 11 dB OSNR, at ± 800 ps/nm, BER $8 * 10^{\text{exp} - 5}$): –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
 - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.697, 10GBase-LR
- 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 $1 * 10^{\text{exp} - 12}$
 - Minimum receiver level: –14 dBm at BER $1 * 10^{\text{exp} - 12}$

- Receiver: avalanche photodiode (APD)
- Link loss budget: 8 dB minimum, at $\text{BER} = 1 \times 10^{-12}$
- Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.921 in. (23.4 mm)
 - 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)

B.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
- 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: 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 $1 * 10^{-12}$): -8 to -21 dBm
 - Receiver input power (no FEC, unamplified, 23 dB OSNR, at +/- 1000 ps/nm BER $1 * 10^{-12}$): -8 to -19 dBm
 - Receiver input power (no FEC, amplified, 19 dB OSNR, BER $1 * 10^{-12}$): -8 to -20 dBm
 - Receiver input power (no FEC, amplified, 19 dB OSNR, at +/- 1000 ps/nm BER $1 * 10^{-12}$): -8 to -18 dBm
 - Receiver input power (FEC, unamplified, 23 dB OSNR, BER $8 * 10^{-5}$): -8 to -24 dBm
 - Receiver input power (FEC, unamplified, 23 dB OSNR, at +/- 1000 ps/nm, BER $8 * 10^{-5}$): -8 to -22 dBm
 - Receiver input power (FEC, amplified, 9 dB OSNR, BER $8 * 10^{-5}$): -8 to -18 dBm
 - Receiver input power (FEC, unamplified, 11 dB OSNR, at +/- 800 ps/nm, BER $8 * 10^{-5}$): -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

- Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- 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)
 - 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)

B.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
- Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- 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)

Table B-18 *TXP_MR_2.5G/TXPP_MR_2.5G 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. Optical Signal-to-Noise ratio (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 = $1 * 10 \text{ exp} - 12$ including dispersion
- Receiver input wavelength range: 1290 to 1605 nm
- Line (client side)
 - Bit rate: 8 Mbps to 2.488 Gbps
 - Code: Scrambled NRZ
 - Fiber: 1310-nm single-mode
 - Maximum chromatic dispersion allowance: 1600 ps/nm
 - Loopback modes: Terminal and facility
 - Connectors: LC
 - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- 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 $1 * 10 \text{ exp} - 12$
 - Minimum receiver level: –14 dBm at BER $1 * 10 \text{ exp} - 12$
 - Receiver: APD

- Link loss budget: 8 dB minimum, at $BER = 1 * 10^{exp - 12}$
- Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.921 in. (23.4 mm)
 - 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)

B.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—Fiber Channel 1.06 Gbps
 - FC2G—Fiber Channel 2.125 Gbps
 - FICON1G—Fiber CON 1.06 Gbps (IBM signal)
 - FICON2G—Fiber CON 2.125 Gbps (IBM signal)
 - ONE_GE—One Gigabit Ethernet 1.125 Gbps
 - Mixed configurations up to maximum line rate (for example, if you have a port configured for 2G FC, you cannot use another port at the same time)
- 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
- Compliance: Telcordia GR-253-CORE, Telcordia GR-2918-CORE, Issue 2, ITU-T G.957, and ITU-T 100-GHz grid standard G.692
- 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)

Table B-19 MXP_MR_2.5G/MXPP_MR_2.5G 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
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. Optical Signal-to-Noise ratio (OSNR) defined with 0.1 nm Resolution Bandwidth (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: 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
- Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- 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)
 - 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)

B.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

- Compliance: ITU-T G.707, ITU-T G.709, ITU-T G.957, and Telcordia GR-253-CORE
- 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)

Table B-20 MXP_2.5G_10E 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. Optical Signal-to-Noise ratio (OSNR) defined with 0.1 nm Resolution Bandwidth (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: 1290 to 1605 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)
 - Compliance: Telcordia GR-253-CORE, ITU-T G.707, ITU-T G.957
- 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)
 - 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)

B.5.6 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
- 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 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)

Table B-21 TXP_MR_10E Receiver Trunk Side Specifications

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

1. Optical Signal-to-Noise ratio (OSNR) defined with 0.1 nm Resolution Bandwidth (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 $\text{BER} = 1 \times 10^{-12}$ including dispersion

- Receiver input wavelength range: 1290 to 1605 nm
- 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^{-12}
 - Minimum receiver level: –14 dBm at BER 1×10^{-12}
 - Receiver: APD
 - Link loss budget: 8 dB minimum, at BER = 1×10^{-12}
 - Receiver input wavelength range: 1290 to 1605 nm
- Dimensions
 - Height: 12.650 in. (321.3 mm)
 - Width: 0.921 in. (23.4 mm)
 - 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)

B.6 SFP Specifications

Table B-22 lists the specifications for available SFPs.

Table B-22 SFP Specifications

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
15454-SFP3-1-IR=	OC-3	–15 to –8	–23 to –8
15454E-SFP-L.1.1=	STM-1	–15 to –8	–34 to –10

Table B-22 SFP Specifications (continued)

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
15454-SFP12-4-IR=	OC-12, D1 Video	-15 to -8	-28 to -7
15454E-SFP-L.4.1=	STM-4, D1 Video	-15 to -8	-28 to -8
15454-SFP-OC48-IR=	OC-48, DV6000 (C-Cor)	-5 to +0	-18 to +0
ONS-SE-2G-S1=	OC-48, STM-16	-10 to -3	-18 to -3
15454E-SFP-L.16.1=	STM-16, DV6000 (C-Cor)	-5 to +0	-18 to 0
15454-SFP-200/ 15454E-SFP-200	ESCON ¹	-8 to -4	-28 to -3
15454-SFP-GEFC-SX=/ 15454E-SFP-GEFC-S=	Fibre Channel (1 and 2 Gbps), FICON ² , GE	-10 to -3.5	-17 to 0 (1FC and 1GE) -15 to 0 (2FC)
15454-SFP-GE+-LX=/ 15454E-SFP-GE+-LX=	Fibre Channel (1 and 2 Gbps), FICON, GE, HDTV ³	-9.5 to -3.0	-20 to -3 (1FC, 1GE, and 2FC)
ONS-SE-2G-L2	OC-48, STM-16	-2 to 3	-28 to -9

1. ESCON = Enterprise System Connection

2. FICON = fiber connectivity

3. HDTV = high-definition television

SFP Port Cabling Specifications

Table B-23 provides cabling specifications for the single-mode fiber (SMF) SFPs and Table B-24 provides cabling specifications for multimode fiber (MMF) SFPs that you install into Ethernet cards. The ports of the listed SFPs have LC-type connectors.

Table B-23 Single-Mode Fiber SFP Port Cabling Specifications

SFP Product ID	Wavelength ¹	Fiber Type	Cable Distance
15454-SFP3-1-IR= Intermediate Reach	1310 nm	9 micron SMF	15 km (9.3 miles)
15454E-SFP-L.1.1= Short Haul	1310 nm	9 micron SMF	15 km (9.3 miles)
15454-SFP12-4-IR= Intermediate Reach	1310 nm	9 micron SMF	15 km (9.3 miles)
15454E-SFP-L.4.1= Short Haul	1310 nm	9 micron SMF	15 km (9.3 miles)
15454-SFP-OC48-IR= Intermediate Reach	1310 nm	9 micron SMF	15 km (9.3 miles)
ONS-SE-2G-S1= Short Reach	1310 nm	9 micron SMF	2 km (1.2 miles)

Table B-23 Single-Mode Fiber SFP Port Cabling Specifications (continued)

SFP Product ID	Wavelength ¹	Fiber Type	Cable Distance
15454E-SFP-L.16.1= Short Haul	1310 nm	9 micron SMF	15 km (9.3 miles)
15454-SFP-GE+-LX=/ 15454E-SFP-GE+-LX= Long Reach	1310 nm	9 micron SMF	10 km (6.2 miles) for FC 1G, FC 2G, and GE 5 km (3.1 miles) for HDTV

1. Typical loss on a 1310 nm wavelength is 0.6 dB/km.

Table B-24 Multimode Fiber SFP Port Cabling Specifications

SFP Product ID	Wavelength	Fiber Type	Cable Distance
15454-SFP-200/ 15454E-SFP-200 Long Reach	1310 nm	62.5 micron MMF	2 km (1.2 miles)
15454-SFP-GEFC-SX/ 15454E-SFP-GEFC-S Short Reach	850 nm	62.5 micron MMF	300 m (984 ft) for FC 1 Gbps and 1.2 Gbps GE 150 m (492 ft) for FC 2 Gbps
		50.0 micron MMF	550 m (1804 ft) for FC 1 Gbps and 1.2 Gbps GE 300 m (984 ft) for FC 2 Gbps

B.7 XFP Specifications

Table B-25 lists the specifications for available XFPs.

Table B-25 XFP Specifications

XFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
ONS-XC-10G-S1	10 Gigabit Ethernet, OC-192, STM-64, 10Gbps Fibre Channel	-1 to -11	0.5

B.7.1 XFP Port Cabling Specifications

Table B-26 provides cabling specifications for the SMF XFPs. The ports of the listed XFPs have LC-type connectors.

Table B-26 Single-Mode Fiber XFP Port Cabling Specifications

XFP Product ID	Wavelength ¹	Fiber Type	Cable Distance
ONS-XC-10G-S1	1310 nm	SMF	10 km (6.2 miles)

1. Typical loss on a 1310 nm wavelength is 0.6 dB/km.

